BUSINESS, ECONOMICS AND SUSTAINABLE DEVELOPMENT

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THE EMERGING ISSUES

Editors

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Contents

Preface

Manipadma Datta
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Background

Research on the role of business and economics for sustainable development has grown rapidly in the past five decades. The business case for sustainability, both at macro-level and firm-level macro, is gradually being acknowledged and discussed in the literature (Hart and Milstein, 2003; Sen and Bhattacharya, 2001; Porter and Kramer, 2006, 2011; Henderson, 2014 and so on). Researchers (Eccles, 2013; Bhattacharya, 2018) have empirically tested and proposed that at a firm level embracing sustainability increases profitability, especially in the long-run. Studies range from historical reviews to empirical researches examining the rationale for sustainability, role of stakeholders, implementation plans, regulations, constraints and so on. But the principles and practices of sustainability are still not completely integrated in majority and mainstream economic and business models. One of the reasons is the usage of the term sustainability for ideas like perpetual growth, profitability, or competitive advantage (Bansal and Mark, 2014). Another reason is the lack of awareness and understanding required for realization of a huge macro-ambition like sustainable development through micro-level tasks and activities. Although some literature on different frameworks and models for sustainable development at a societal level is available, but understanding of operationalization of sustainable development especially at an organizational and individual level is very limited. For instance, in common business contexts, sustainability is considered to be corporate social responsibility (CSR), or creation of shared value, or just managing environmental impacts. Some work like the European Corporate Sustainability Framework (Marrewijk and Hardjono, 2002) or Benn et al.'s (2006) Integrated Phase Model also exists, and there have been surveys and reports by organizations like the Network for Business Sustainability[1] and the Globe Scan[2], but there

[1] https://www.nbs.net/

[2] https://globescan.com/

still a long way to go in the transition towards sustainable organizations. In policy making, efforts have received impetus and reinforcement because of the Paris Agreement[3] and the Sustainable Development Goals (SDGs)[4]. The regulations are changing; awareness levels are increasing and thus, it is an appropriate time to discuss various issues ranging from abstractness in the concept of sustainability, lack of governance models and mechanisms, absence of policies or poor implementation, mixed evidence on returns from business sustainability, difficulty in changing mindsets, behaviors or lifestyles, lack of synergy between organizational strategies and SDGs, financial barriers, social and cultural constraints and so on, to meet the mammoth challenge of sustainable development.

In this backdrop, TERI School of Advanced Studies (TERI SAS), the pioneer institution of international importance in sustainability research, has resolved to provide a platform to the likeminded researchers by hosting its annual international conference – *The International Conference on Business Economics and Sustainable Development (ICBESD)*. The conference aims to bring together stakeholders including academia, industry, government, to discuss the need, challenges, and roadmap to approach long-term viability of economy and business without compromising on profitability, competitiveness, and sustainable development.

The first and the second ICBESD were held on February 22-23, 2018 and January 17-18, 2019 respectively at the TERI SAS at its Vasant Kunj Campus in New Delhi, India. The third conference in this series has been jointly announced by TERI SAS and the National Institute of Securities Management (NISM), a public trust established by the Securities and Exchange Board of India (SEBI) in 2006, at NISM's campus in Patalganga near Mumbai in Maharashtra, India.

The first ICBESD was a grand success with active participation and patronage all over the globe and sponsorship provided by organizations like Amar Ujala, Swayam, Container Corporation of India, Indian Oil Corporation Ltd. and others. The conference was inaugurated by Pinaki Misra, President, National Green Tribunal Bar Association and Member of Parliament; Professor Sunita Singh Sengupta, the Head and Dean, Faculty of Management Studies, Delhi University; and Subhash Chandra Vashist, Director, Swayam. More than 160 papers were received; authors being from different nations including the UK, the USA, Mexico, Canada, Spain, Italy, Kuwait, Bangladesh, Bahrain, Malaysia, Nigeria and the like.

[3] https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

[4] Ibid.

Within the country, submissions were received from the Indian Institutes of Management (IIMs), Indian Institutes of Technology (IITs), business schools like Management Development Institute, Institute of Management and Technology, Symbiosis Institute of Business Management, Central Universities of Kashmir, Haryana, Rajasthan, Jawahar Lal Nehru University, Aligarh Muslim University, University of Delhi, University of Calcutta, Indian Railways as well as corporate organizations like EY, PwC, Adani Port and SEZ Ltd. and so on. It was a grand gathering of scholars with plenary sessions' speakers from among the best in academia and industry. Selected papers presented in the conference were published in the Special Issue of a Scopus indexed journal – the International Journal of Management Practice.

The second ICBESD-2019 was organized by the TERI SAS on January 17-18, 2019 in collaboration with Government of India Rooftop Solar Technical Assistance Program supported by World Bank. Along with other usual tracks, there was a special focus was on solar energy. Research papers were invited on the broad theme of 'Emerging Horizons in Business, Economics and Sustainable Development; in different areas including accounting and finance, new and renewable energy, rooftop solar energy, operations management, corporate governance, CSR and ethics, strategic management, economics of sustainable development, human resource management, marketing, infrastructure accounting and management and others. An overwhelming response of 150 papers was received under various themes in line with the SDGs like circular economy, health finance, solar rooftop systems, solar rooftop policies, climate change, economics of sustainable development, banking and finance for sustainability, corporate governance, CSR and ethics, creating shared value, SDGs and India's preparedness, infrastructure and sustainable development, marketing and sustainability, sustainable business strategies, sustainable human resource development, sustainability reporting, etc. The conference comprised three panel discussions on emerging themes of health finance, circular economy, and solar rooftop systems and 16 parallel paper presentation sessions chaired by eminent academicians, corporate leaders and policy-makers. The conference was inaugurated by Mr. Gopal Krishna Gupta, Joint Secretary, Ministry of New and Renewable Energy, Government of India and witnessed the presence of eminent international and national speakers. Participants and paper presenters were from the IIMs, IITs, and other premier institutions like National Institute of Financial Management, Jamia Millia Islamia University, Rajiv Gandhi University, Symbiosis Institute of International Business, Jawahar Lal Nehru University, Lal Bahadur Shastri Institute of Management, to name a few. Overall the conference was a

platform for faculty, researchers, corporate leaders, students, and other stakeholders to deliberate on the emerging horizons and the road ahead to create a systemic change for sustainable development.

About the Book

Sustainability is gradually becoming the new imperative for managing economies and organizations in the long-run. With sustainability becoming increasingly important for various economic, social, political and legal reasons, this book is a small endeavour to disseminate research in the area of Business, Economics, and Sustainable Development. It is a collection of selected papers; accepted after a double blind peer review process spanning approximately ten months. It comprises 17 conceptual and empirical studies covering diverse and significant themes like renewable energy, sustainable consumption, corporate governance, green finance, agriculture, education, health, and economics of sustainable development. Apart from 13 papers presented at the ICBESD-2019, four papers were specially invited by the editors (chapter 13-16).

About the Chapters

Chapter 1 titled *Diffusion of Residential RT Solar: Global Learnings-Indian Context* written by Ashwini K Aggarwal, Asif Ali Syed, and Sandeep Garg is a comprehensive review of peer-reviewed research to identify behavioral factors affecting purchase intentions of solar rooftop consumers. The authors have scanned global literature including key theoretical frameworks and popular consumer behavior model and tracked the role of other contextual, moderating and mediating variables like geographical context, demographics, and awareness levels. The research provides insights for policy-makers to improve acceptance and diffusion of rooftop technology, and gaps for researchers related to scope and potential factors to develop new/improved consumer behavior models.

Chapter 2 titled *Solar energy: A Study of Efficiency in G20 Nations* written by Abhignya Baru analyzes the efficiency of solar energy production in G20 nations and performance of India with respect to other nations in this group using data envelopment analysis (DEA). Secondary data on installed capacity and sunshine hours (inputs and electricity generated) and reduced emissions (outputs) for the year 2016 has been analyzed using DEAP 2.1 software. Their results show that 11 of the G20 countries have been efficient; the primary reasons being innovative technology and respective country level initiatives.

Chapter 3 titled *Financial Challenges and Solutions in Indian Renewable Energy Projects* written by Shashi. K. Agrawal explores and reports key financial challenges and risks associated with renewable energy projects in India. Strategies for dealing with the challenges are also discussed. In particular, against the backdrop of the need to increase investments in renewable energy, the author analyzes the challenging environment for new investments in renewable energy in India and ways to increase investment for achieving the ambitious target of 227 GW.

Chapter 4 titled *Understanding the Intention to Adopt Commercial Carsharing Service: TAM Approach* written by Pooja Goel and Piyali Haldar proposes a conceptual framework comprising concern for environment, perceived ease of use and perceived usefulness in accordance with the technology acceptance model (TAM) to survey the intention of consumers to adopt car sharing services. They test the framework based on data collected from 291 commuters in north India using structural equation modelling. The authors present key insights for marketers and civic authorities by concluding that concern for environment and perceived usefulness are the major factors influencing commuters' attitudes, which further affect their intention to adopt commercial car-sharing service.

Chapter 5 titled *Consumption and Disposal of Saris by Housemaids- An Exploratory Study* written by Swati and Charu Gupta presents findings of a questionnaire survey conducted with 100 housemaids in the broad age group of 25-80 years in south Delhi contacted through convenience sampling. The authors report that the respondents' affinity for saris is still growing although the frequency of wearing such attires is decreasing. Further, for the supply chain of the second hand cloth market, household maids are a very important stakeholder. The saris discarded by these workers, mostly of polyester fabric, are sold to *bartan walis* (utensil sellers) of Wagdi community of Gujarat in exchange for new utensils; who sell these in the second-hand cloth market of Raghubir Nagar in the price range of INR 50-100 per piece.

Chapter 6 titled *Failure of Corporate Governance or Business Ethics? The Case of ICICI bank* written by Shinu Vig and Manipadma Datta presents the recent case of ICICI Bank on the issue of conflict of interest; wherein it was alleged that ICICI Bank granted loans of INR 3250 crores to Videocon with which Mr. Deepak Kochhar (husband of Ms Chanda Kochhar, CEO and MD of ICICI Bank) had business dealings. Although, ICICI bank denied any conflict of interest throughout the controversy, Ms. Kochhar eventually resigned. The case explores the meaning of conflict of interest and the duties of directors in such cases where their personal interests interfere with the interests of the public limited company. The paper discusses important

questions with regard to governance practices and business ethics in this regard.

Chapter 7 titled *Exploring Green Investment on the Dynamics of Behavioral Finance and Stock Performance* written by Soma Panja and Abhijit Ranjan Das investigated the impact of demographic, psychological and financial factors pertaining to individuals on their Investment Personalities in Socially Responsible Investment (IPSRI). This information is particularly helpful in improving understanding of green individual investment behavior. The paper also analyzes whether it really makes sense to go for SRI in comparison to Non-SRI investments purely in terms of performance parameters.

Chapter 8 titled *Food Processing in India- A New Horizon in Agribusiness Entrepreneurship* written by Rakesh Rathore and Aditi Mathur analyzes growth and entrepreneurship opportunities in the food processing industry in India. The authors report that although India is the second largest producer of fruits and vegetables in the world, yet 30 % of the production is wasted because of poor post-harvest management practices. The authors propose a vast scope for encouraging food processing agribusiness ventures in the country to boost the rural and urban economy. The paper, based on secondary data, discusses the present status of food processing industry in India, prospects of agribusiness opportunities in this industry, associated challenges and recommendations.

Chapter 9 titled *Impact of Green Revolution on Price Sensitivity of Agriculture in India* written by Prerona Baruah examines the impact of green revolution on market orientation in Indian agriculture by estimating the responsiveness of the non-food grain sector post GR to changes in the real relative prices over a period of 33 years from 1976-77 to 2009-10 using Nerlovian framework. The author concludes that there is no evidence suggesting improved price elasticity. Further, the author completed a panel regression with random effects specification on four states- Punjab, Haryana, Kerala and Tamil Nadu to compare the price-responsiveness for states where GR is considered to be more successful in relative terms. However, no evidence was found even in the latter case. The findings indicate possibility of non-price factors as constraints for the farmers to respond to market signals and raise questions on price-based policies being promoted to deal with India's agricultural crisis.

Chapter 10 titled *Quantifying Perception of MBA (Finance) Graduates towards Sustainable Development: An Application of FAHP* written by Soma Panja explores the perception of graduates studying finance as specialization in management programmes about sustainable development using fuzzy analytic hierarchy process. The findings present an understanding of the

evolving mindsets of would-be finance managers and the matrices they use to develop ideas about sustainable development.

Chapter 11 titled *Barriers to Institutional Education for Refugees: A Case Study of Rohingya Community in Bangladesh* written by Erina Mahmud and Nalifa Mehelin explores barriers to institutional education, particularly primary education from grade I to V, for refugees or people who have been forced to flee their country because of persecution, war or violence. The paper discusses the case of Rohingya community refugees in Bangladesh. The authors, through secondary data, classify the barriers as - financial condition of the refugees, language and curriculum barriers, and current refugee education policies.

Chapter 12 titled *Discourse on Ambulatory Healthcare in Uttar Pradesh, India: A Study Based on NSS Data* written by Sabitri Dutta, Montu Bose and Ruchika Rungta analyses socio-economic barriers to ambulatory healthcare in Uttar Pradesh, a state in northern India, based on National Sample Survey 71st round (2014) unit-level data on Social consumption: Health. The authors report significant differences in access to health care services across socio-economic classes in the State. They found that income and gender are the two major barriers, and intra-household discrimination against women is very strong in the urban sector. Further, they propose that the utilization rate in the sector can improve and out of pocket expenditure in both the sectors can reduce by focusing on availability of services and medicines in public institutions.

Chapter 13 titled *Predatory Pricing and the Notion of Multi-Market Dominance: A Case of the Indian Telecom* written by Soumendu Sarkar and Sumedha Shukla analyzes the Indian Telecom sector, particularly the case of Reliance Group of Industries that captured significant market share in the high end telecommunication segment through a combination of bundling and predatory pricing strategies. The authors put forth 'deep pocket argument' as the explanation for the market dominance of a cash-rich company like Reliance diversifying into unrelated markets. They propose that although such corporate strategies benefit the consumers and shareholders of the concerned company in the short-run, yet these may not be sustainable for the company and detrimental to the stability of the market in the long-run.

Chapter 14 titled *Happiness: Driven by Economic Factors? A study of Happiness Index with some Economic Indicators* written by Kausik Lahiri and Tanusree Mondal discusses the changing narrative of satisfaction, happiness, and development in the field economics and seeks to find the relation between the indicators of development including the human development

index. The rationale proposed by the authors is that if happiness is not related to development indicators, there might be confusion, as the government policies will not focus on economic development if people are happy irrespective of the state of economic development.

Chapter 15 titled *Inter-linkage between Credit and Housing Prices in India: Some Preliminary Findings* written by Priti Mendiratta Arora, Ananya Ghosh Dastidar and Mausumi Das explores recent developments and relationship between credit and housing prices in the Indian markets. Evidence on credit and housing prices using data for 13 cities has been examined by the authors using panel causality tests. They conclude that causality from house price to credit is more prominent and lending by banks is influenced by real estate prices.

Chapter 16 titled *Demographic Dividend in India: A State-Level Analysis* written by Varun Bhushan and Sonam analyzes the relationship between demographic variables and various facets of social development and policy environment using balanced panel data set from 2006 to 2015 for 19 states of India. The authors conclude a paradox of demographic dividend among different Indian States, wherein in the states in the south and west are at an advantage while others have not been able to capitalize and sustain the benefits. However, they suggest that the window of opportunity is closing for states in the south as their population is ageing and opening for states like Bihar, Uttar Pradesh Rajasthan, Jharkhand, and Haryana.

Chapter 17 titled *Analyzing Fiscal Sustainability in Jharkhand Economy* written by Madhuri Pal_assesses the fiscal sustainability of Jharkhand at a micro-level using the Domar Stability framework for the period from 2001-02 to 2010-11, which is ten years after the formation of Jharkhand in 2000. The study offers significant insights as fiscal sustainability is crucial in determining a government's ability to survive and service its debt obligations; it is an important pre-condition for pursuing budgetary policies.

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Renewable Energy

Diffusion of Residential Roof Top Solar: Global Learnings – The Indian Context

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Abstract

India's National Solar Mission targets 100GW Solar PV (SPV) by 2022, of which 40GW is to be realised from Roof Top Solar PV (RT SPV). RT SPV in India has grown to 4.4 GW by the end of March 2019 but it's still underperforming versus RT SPV target of 40GW(BridgetoIndia, 2019). A study of the factors influencing the purchase intent of the RT SPV consumers will enable policymakers to improve the penetration of this new and promising green technology.

This paper scans the key theoretical models and peer-research across the globe in the context of diffusion of RT SPV technology. It does a quick comparison of the popular consumer behaviour models used by researchers in the field. A case is built for applying the Unified Theory of Acceptance and Use of Technology 2 to model factors driving the purchase intent of a domestic RT SPV buyer.

Numerous studies have mapped the impact of environmental concerns/green beliefs on the purchase intention of the consumer. Will influencing the price value beliefs relating to RT SPV have a greater impact on the consumers' purchase intention? Or, is there a third, more potent trigger of the purchase intention of the RT SPV as far as the Indian domestic consumer is concerned? The global literature scan brings out several independent behavioural factors that impact the purchase intent of RT consumers. Potential interplay from contextual variables (like city/geographical context), moderating variables (demographics), and mediating variables (awareness, prior ownership) is also tracked.

Based on the literature review of consumer research in the diffusion of renewables in the residential sector, research gaps are identified relating to the scope, potential factors, and behaviour models for improved fits. Understanding of prior work in this area and its scope/limitation helps in building the case for an improved modelling of the consumer purchase intent/diffusion of residential RT SPV in the Indian context.

Keywords: *Rooftop solar India, Factors of purchase intent for RT SPV, UTAUT2 model, SPV, Consumer behaviour models for RT SPV.*

Introduction

In 2017, the overall global renewable energy grew by 5 per cent, solar energy grew by 35 per cent to reach 437 TWh globally (IRenA, 2019). Solar has become an integral part of the energy portfolio of most nations.

In India, this initiative is driven by the Government of India via the Ministry of New and Renewable Energy (MNRE) (Ministry of New & Renewable Energy, 2013). The MNRE initiative is captured in its policy document Jawaharlal Nehru National Solar Mission (JNNSM) Phase II. JNNSM Phase II sets a target of 100 GW SPV by 2022. Out of this 100 GW plan, 40GW is targeted from RT SPV(Ministry of New & Renewable Energy, 2015).

Both these objectives set a measurable goal with industry, academia, and government aligning on the vision of solarising India. Dr. Ashok Jhunjhunwalain in his paper 'Targeting 50% of Indian Electricity Needs Through Solar by 2030' at the Ministry of Science and Technology's National Conference on 'Accelerating Technology Innovation for Inclusive and Sustainable Growth' outlined potential technology/paths to the goal (Jhunjhunwala, 2013).

There is a dramatic evolution of the SPV technology with increasing conversion efficiencies and lower costs/watt. Moreover, new business models are evolving in the RT SPV markets that offer tailor-made OPEX/CAPEX offerings to the end-customers. Key trends are positive and seen as a harbinger of the solar era. However, despite these enablers of grid parity and obvious political and societal compulsions for solar, the actual RT SPV installation capacity is only 4.4GW as of 31 March 2019 (BridgetoIndia, 2019).

Clearly, the achievement of solar targets will finally depend on the social acceptance of solar technologies. If the national goal of 100GW of SPV in the National Solar Mission is to be realised, it is relevant to understand the triggers of purchase intent of the RT SPV in the Indian domestic households that are homeowners.

This paper scans the literature of prior contextual work done globally and has been structured to:

- Understand the diffusion of solar renewable as per prior research;
- Understand the models of consumer behaviour;
- Collate a comprehensive list of relevant factors influencing purchase intent of RT SPV from the literature scan;
- Analyse the work done in the Indian context; and
- Identify potential research gaps in the diffusion of RT SPV in the Indian context.

Diffusion of Innovation and Renewable Energy Technologies

Renewable energy technologies, like solar and wind, are relatively new concepts for consumers who are currently used to fossil fuel-based

economies/centralised electricity generation. The adoption of these new concepts by a community is a function of the social influence and beliefs relating to these new technologies.

The origins of social influence in the diffusion of new products/concepts are found in the ground-breaking work in opinion leadership in sociology and diffusion of innovation theory. Rogers and other investigators indicate five characteristics are associated with the success of a new product (Table 1).

Table 1: Characteristics of a Successful New Product (Rogers's Parameters)

1	Relative Advantage	Customers should perceive the new product to be at a relative advantage over the existing products that they substitute—usually expressed as an economic benefit or safety, or convenience or prestige.
2	Compatibility	Customers should believe that the product is delivering the same value as the previous product and will deliver a similar experience.
3	Complexity	Does the customer believe that the product is difficult to understand and use? Customer's acceptance of a new product can be constrained by the perceived risks relating to technical complexity, social rejection, and physical and rapid obsolescence.
4	Trialability	Can the customer try a product before adoption without a major commitment towards it?
5	Observability	How easily can the customer observe or perceive the product and its benefits?

Source: Rogers, 2003 (5th ed)/1962.

Strictly speaking, change is a very gradual process for human nature and different people can make a change at a different pace depending on their circumstances, backgrounds, and psyche. Rogers developed a classification of adopters by the time of adoption (Rogers, 2003/1962). It concluded after researching that there are five classes or categories of adopters distributed as mentioned in Table 2 and Figure 1.

Table 2: Adopter Categories and Percentage of Market/Category

Adopters	*Percentage of Total*	*Life Cycle*
Innovators	2.5	Introduction
Early Adopters	13.5	Growth
Early Majority	34.0	Growth-Maturity
Late Majority	34.0	Maturity
Laggards	16	Decline
Total	100	

Source: Rogers, 2003 (5th ed)/1962.

Geoffrey Moore's book *Crossing the Chasm: Marketing and Selling Technology Products* in 1991 added depth to the Theory of Diffusion by further segmenting the innovators into techno-maniacs, visionaries, and pragmatists (Moore, 1991). Techno-maniacs were technology product buyers who were primarily motivated by new product technology. These were classically people who would buy the latest Intel processor super computer while their work would be handled by a simpler, inexpensive computer. Visionaries would be motivated by a potential application of that product/technology. In most cases, the visionary would build that application in the first place. Both the techno-maniacs and visionaries would pay a price for their first-mover motivation. The next buyer, the pragmatist, would take the technology and applications established by the techno-maniacs and the visionaries and establish if it met a required ROI or was cost-effective.

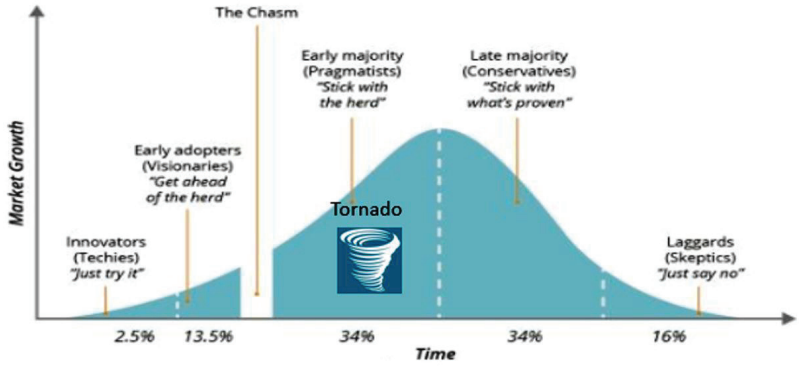

Fig. 1: Technology Adoption Cycle (Moore, 1991)

Moore (1991) introduced the concept of the 'chasm' between the early adopters' and the early majority. Most new products/technologies fail to reach the mainstream market/early majority users. This happens because the early majority is not necessarily influenced by the early adopters opinions and actions. It is only when a critical mass of initiating opinion leaders is built-up, the right marketing and communication focus is evolved, and the right serendipity conditions develop, that the products start moving to the early majority.

Moore further pointed out that the marketing strategy for early adopters would be focused. However, in the early majority markets, the mainstream buyers start endorsing the product, the market expands rapidly. Moore called this the 'tornado' phase of the market and postulated that when a product will 'enter the tornado', the marketer' focus shifts to rapidly executing the market through a robust supply-chain and gaining share before the competition inevitably sets in (Moore, 1991).

Bryan Bollinger and Kenneth Gillingham (2012) studied the diffusion of SPV in California and found that each additional installation increased the probability of adoption by 0.78 per cent in the owner-occupied homes in a zip code. Social interactions, peer effects, neighbour-to-neighbour communications are all key enablers of diffusion of new concepts in a community. This also explains the geographic clustering patterns that characterised the SPV installations in California.

Wustenhagen and Burer (2007) substantiates that social acceptance should be factored into policymaking as it is critical for achieving the goal of renewable energy development. Residents' social acceptance of renewable energy technologies is critical not only to the renewable energy project itself but also to the success of the sustainable development of that region (Rio, 2008).

Guagnano et al. (1986) examined the differences between solar adopters and the public in their perceptions of solar technologies. Using posthoc analysis and discriminant analysis they assessed the differences between adopters, non-adopters, and procrastinators.[1] Their study of 706 residents in California found that typical adopters believed that greater economic, convenience, status, and environmental advantages accrued with solar ownership. The typical adopter was younger than non-adopters and had higher education and income versus non-adopters.

Porter (2011) profiled 133 actual solar users in Arizona. Statistically significant results indicate that the Renewable Energy adopters had smaller households, were older with higher education and greater income levels than the non-adopters. Vasseur and Kemp (2015) surveyed 817 Dutch households and segmented four groups. These were voluntary adopters, involuntary adopters (bought a house with solar panels), procrastinators, and non-adopters. Attitudes were more significant than the demographics in their study.

While there is clear evidence on the role of social networks (early adopters and opinion leaders, mainstream buyers, and laggards) from prior research in the renewables sector, there is a mixed input on trialability. A study of the diffusion of renewable energy consumption in Hungary observed that the prior trial had a positive impact and the users appreciated the financial

[1] Post-hoc and discriminant tests are empirical, inferential tests for a scientific analysis of field data. Post-hoc tests compare different group means and test if they are statistically significant. Groups can be defined based on income, age, or any other demographic variable. Discriminant analysis is another statistical test used when the dependent variable is categorical and independent variables are interval based.

advantage of the ecologically sustainable energy source (Gerdesics, Nagy, Pavluska, Szucs, & Törocsik, 2013). This study was able to identify distinct profiles matching innovators, early adopters, mainstream buyers, and laggards.

Urpelainen and Yoon (2017) investigated the role of product demonstrations in creating the market for solar technology in rural India. They established that the demonstrations did not increase sales but they improved awareness. The availability of credit was the key enabler. In the communities (villages) where credit was facilitated, sales were significantly better.

Dr. Emmanuel Ndzibah (2010) observed the diffusion of solar technologies in Ghana and his study indicates that for users in developing countries affordability, finance, and accessibility were more important than 'greenness' of solar energy.

These studies investigate the diffusion of renewable energy technologies and suggest that there were latent triggers beyond the price-value beliefs. The interplay between the social influence, self-efficacy beliefs (capacity to fund), demographics, awareness, and other factors are reviewed further in the context of the consumer behaviour models.

Consumer Behaviour Models in Literature

Consumer behaviour traditionally leverages a black box model of external stimuli, internal stimuli/consumer characteristics, the decision process, and buyer response (Table 3). Environmental factors apart, the consumer psyche are a key element of the overall buying behaviour and in the diffusion of technologies.

Table 3: Generic Model of Consumer behaviour

Environmental Factors		*Buyer's Black Box*		*Buyer's Response*
Marketing Stimuli	*Environmental Stimuli*	*Buyer Characteristics*	*Decision Process*	
Product Price Place Promotion	Social (including cultural and demographics) Technological Economic Political Natural	Attitudes Motivation Perceptions Personality Lifestyle Knowledge	Problem recognition Information search Alternative evaluation Purchase decision Post-purchase behaviour	Product choice Brand choice Dealer choice Purchase timing Purchase amount

Source: Howard, 1977.

If one could identify variables that may impact the adoption of new technology in a target market and if we could predict adoption with reasonable certainty, one could dramatically reduce the product/technology adoption by decisive interventions. Researchers have used several product/concept/technology adoption models for the buyer's black box including the Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1980), Theory of Planned Behaviour (TPB) (Ajzen, 1991), Technology Acceptance Model (TAM) (Davis, 1989), and Unified Theory of Acceptance and Use of Technology 2 (Venkatesh et al., 2012).

Theory of Reasoned Action

According to the Theory of Reasoned Action (TRA), a specific behaviour or at least the intention to a speci fic behaviour can be predicted if the actor's attitude and subjective norm are known (Fishbein & Ajzen, 1980).

> Attitude (a person's positive or negative feelings toward a specific issue) is defined by two variables: beliefs, regarding a specific behavior and the personal outcome evaluation of these beliefs. Subjective norm (a person's perceived social pressure to think or behave in a certain way) is also defined by two variables: normative beliefs, which are a person's perceptions of what significant others think, believe or do, and the motivation to comply with these points of reference. (Petty, 1981)

Together, the attitudes and subjective norms determine the behavioural intention and the behavioural intention leads to the actual behaviour.

The Theory of Reasoned Action postulates that the intent to perform behaviour precedes the actual performance of the behaviour.

Coleman et al. (2011) have used TRA to explain the adult and student intentions to go green. Again, the findings corroborate that green intent translates into green behaviours. Learning from the study was that making the green products more easily available and the process of buying environmentally friendly products less demanding would improve the younger consumer engagement in pro-environmental behaviour.

However, their respondent sample of 202 adults and 302 business students reduces the results to an academic exercise and underscores the need for a rigourous selection of the target respondents to achieve meaningful results.

Mourad and Eldin (2012) observed a strong correlation between green awareness, green trust, and green brand preference in Egypt. Using TRA, Hae-Kyong et al. (2000) empirically verified the relationship between three variables—concern for the environment, knowledge about renewable

energy, and beliefs about salient consequences of use of renewable energy—with the consumer's willingness-to-pay for renewable energy. Their findings suggest that consumer beliefs about renewable energy may be driven more by perceptions than by pure cognitive processes. Thus, persuasive campaigns that focus on building consumer knowledge will improve the consumer adoption of renewables (especially, those information campaigns that cultivate stronger beliefs about positive consequences of the use of renewable energy).

Theory of Planned Behaviour

Theory of Planned Behaviour (TPB) gives a predictive persuasive model linking beliefs and behaviours building on the TRA by factoring in the impact of perceived limitations on behaviour (Ajzen, 1991) (Figure 2).

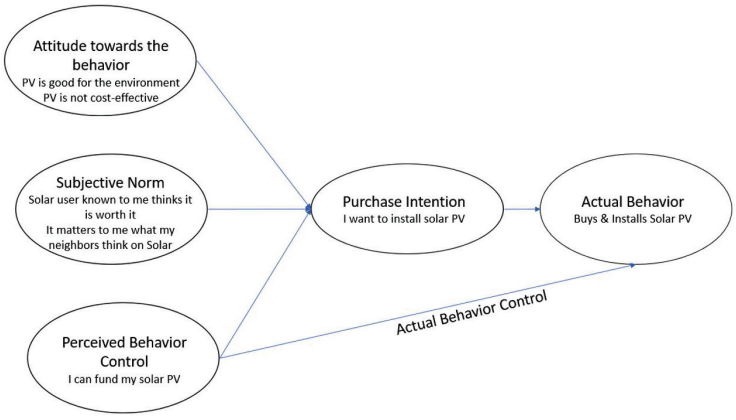

Fig. 2: Theory of Planned Behaviour (Ajzen, 1991), adapted with Photovoltaic (PV) specific examples for illustrative purposes.

Human behaviour is guided by three kinds of consideration. These are as follows:

1. **Behavioural beliefs or attitudes** are defined as the degree of favourableness (or un-favourableness) of a person's evaluation of behaviour.
2. **Normative beliefs or subjective norm** is the individual's perception regarding approval and disapproval of his behaviour by significant others. The direct influencers may be family, friends, colleagues, or immediate proximity neighbours. For example, an individual can demonstrate a controlled, business-like behaviour in a formal office environment. The same individual can have a loud, expressive behaviour as he joins a crowd cheering a home team in a cricket match. In both these conditions, he is getting normative support—from the social influence of his colleagues in the first case and the crowd, in the second case.

3. **Control beliefs or perceived behavioural control** is defined as an individual's perception of ease or difficulty in performing the behaviour of interest, linked to resources, opportunities, and self-confidence.

As a rule, the more favourable the attitude toward behaviour and subjective norm and lesser the perceived behavioural control, the stronger is the person's intention to perform the behaviour in question. To the extent that it is an accurate reflection of actual behavioural control, perceived behavioural control can, together with intention, be used to predict behaviour.

In its simplest form, the TPB can be expressed as the following mathematical function:

$$BI = (W_1)\, AB\, [(b) + (e)] + (W_2)\, SN\, [(n) + (m)] + (W_3)\, PBC\, [(c) + (p)]$$

Where, *BI* : Behavioural intention
AB : Attitude toward behaviour
(*b*) : The strength of each belief
(*e*) : The evaluation of the outcome or attribute
SN : Subjective norms
(*n*) : The strength of each normative belief
(*m*) : The motivation to comply with the referent
PBC : Perceived Behavioural Control
(*c*) : The strength of each control belief
(*p*) : The perceived power of the control factor
W' : Empirically derived weight/coefficient

In environment psychology, TPB has been used to explain why despite sustainable beliefs individuals can have unsustainable actions.[2]

Michelsen and Madlener (2011) have looked at TPB to propose an integrated framework for a homeowner's decision in favour of a renewable Residential Heating System (RHS) with specific reference to the German market. They have used Principal Component Analysis to show that 25

[2] A sustainable belief can be that waste recycling is a good thing and it is a good first step to separate dry, wet, and recyclable waste in the home or workplace in separate bins. The subjective norm can be to support this which means that the collective effort can be meaningful (if the group does not support it, then the effort of one person to separate his waste in separate bins gets nullified). Even if the subjective norm is favouring the attitude, lack of infrastructure, i.e. availability of separate bins or the municipality waste collector accepting and processing separate waste bins can be a limiting factor. TPB's applicability in environmental psychology has been explored by several authors for different beliefs from energy saving to waste recycling (Greaves, Zibarras, & Stride, 2013).

items capturing different adoption motivations can be grouped around six dimensions. These are as follows:

1. Cost aspects;
2. General attitude towards the RHS;
3. Government grant;
4. Reactions to external threats (i.e. environmental or energy supply security considerations);
5. Comfort considerations; and
6. Influence of peers.

Moreover, cluster analysis with the identified motivational factors as segmentation variables revealed three adopter types. These are:

1. The convenience-oriented;
2. The consequences-aware; and
3. The multilaterally-motivated RHS adopter.

The last category of adopters was motivated by a mix of factors ranging from costs to policy to peer influence.

Yuan et al. (2011) have studied the social acceptance of solar energy technologies in China from the domestic user perspective in Shandong province. Their work had shown a high level of social acceptance of solar water heater (but not for SPV), and income, age, and education of residents play a role in the awareness and adoption of renewable technologies.

Liu et al. (2013) investigated renewable energy (electricity) deployment in rural households in Shandong province. Using the analytical framework of TPB, it was found that the 84 per cent of household's choice would be influenced by their neighbour's energy choice and behaviour pattern–clearly establishing an opportunity to diffuse the technology in rural China leveraging a cluster effect. A causal relationship was established between environmental beliefs, social influence, and willingness-to-pay more for renewable electricity (dependent variable). They found that 'positive intention increases with household income, individual knowledge level, and belief about costs of renewable energy use but decreases with individual age'. Enhancing awareness, knowledge, and understanding about renewable energy (for instance, the cost-benefit analysis) would win public acceptance of renewable energy deployment.

Feng et al. (2010) assessed household electricity savings and consumer behaviour in the Liaoning province of China. Li et al. (2013) have applied the TPB model to suggest interventions to introduce solar houses to Chinese farmers and stimulate market activities.

Korcaj et al. (2015) investigated Photovoltaic (PV) adoption in the German context and found that purchase intentions were a function of home owners expected economic returns and behaviour of peers. A sample of 200 homeowners who did not own a PV system participated in an online-survey which explored motives of homeowners relating to PV system purchase intent. They found that:

> …the subjective norm (i.e. peer behavior and expectations) and the attitude towards PV were strong predictors of purchase intention. Attitude towards PV systems was mainly based on aspirations of social status, self-sufficiency, and financial benefits, while efforts, costs, and risks associated with PV systems had a negative impact on attitude.

It was observed that energy storage systems were required to ensure self-sufficiency and functionality beyond sunlight hours. Furthermore, certification of PV systems and their quality/efficiency was required to reduce perceived quality risk by homeowners.

The impact of societal acceptance of SPV is brought out in relief in 'sustainable consumption' by Timothy Riordan that brings out the use of role models to address the attitudes like 'I will if you will' or 'I don't want to sacrifice…when the bloke next door isn't' (O'Riordan, 2006).

The Theory of Planned Behaviour's limitations is that it is primarily linked to TRA and impulse, emotive or habituated behaviour is not modelled in it. Typically, TPB models in renewables have delivered model fits of ~40-50 per cent in Environmental Psychology.

Unified Theory of Acceptance and Use of Technology

The Unified Theory of Acceptance and Use of Technology (UTAUT) is a technology acceptance model formulated by Venkatesh and Susan Brown (2001) in 'User Acceptance of Information Technology: Toward a Unified View'. The Theory holds that there are four key constructs. These are as follows:

1. Performance expectancy;
2. Effort expectancy;
3. Social influence; and
4. Facilitating conditions.

The first three are direct determinants of usage intention and behaviour, and the fourth is a direct determinant of user behaviour. UTAUT theory was developed through a review and consolidation of the constructs of models from earlier research and in longitudinal field studies of employee technology

acceptance (of an IT system) and showed a significant improvement in model fit (Venkatesh & Brown, 2001).

In solar renewable sector, UTAUT was used to study the adoption of Solar Water Heater Systems (SWHS) in Libya (Saleh, Haris, & Ahmad, 2014). The UTAUT model takes intention to use SWHS as the dependent variable determined by four factors which are as follows (Figure 3):

1. **Performance expectancy:** Measures the perceptions of the homeowners that the SWHS would lower the electricity bills and meet their heating needs.
2. **Effort expectancy:** Measures how much individuals feel comfortable in using the system and ease to adopt.
3. **Social influence:** Measures influence of other opinions about the acceptance and usage of SWHS
4. **Attitude towards usage:** Degrees to which households overall react to the use of an SWHS system.

These factors are tempered by awareness/knowledge and environmental concerns.

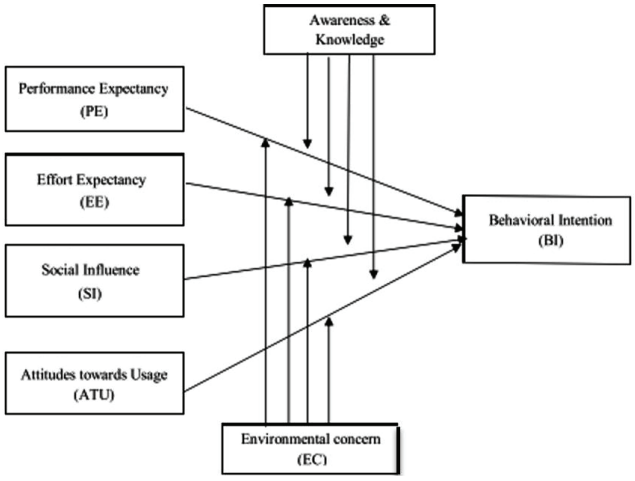

Fig. 3: Towards a UTAUT Based Model for Adoption of SWHS in Libya (Saleh et al., 2014)

The subsequent extension of the UTAUT was proposed by (Venkatesh et al., 2012 March)to include three additional constructs, viz., hedonic motivation, price value, and habit. Individual differences in age, gender, and experience were hypothesized to moderate these constructs. Compared to UTAUT, the extensions proposed in UTAUT2 produced a substantial improvement in the variance explained in behavioural intention (56 per cent to 74 per cent) and technology use (40 per cent to 52 per cent).

Key refinement in UTAUT2 is to evolve the model to consumer use context by adding constructs of hedonic motivation (enjoyment, etc., compliments the previous construct of utility, in consumer use context); price value (compliments previous measures of time, effort because consumers are individually impacted by or are involved in price-cost decisions) and habit (compliments previous intentionality as overall mechanism and driver of behaviour). Habit or past behaviour was also posited by Sommer (2011) as a construct to evolve the TPB. In the case of solar renewables, habits would be prior to green habits (recycling, conserving, and sustainable behaviour). As shown in Figure 4 the facilitating conditions are moderated by age, gender, and experience.

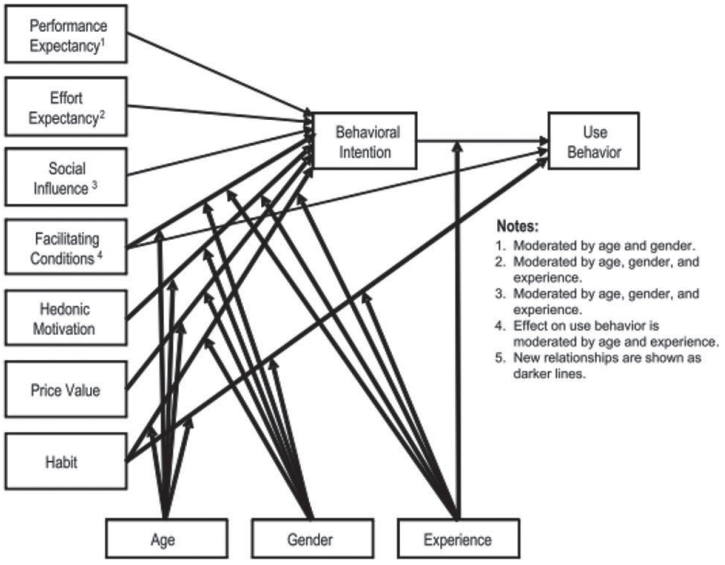

Fig. 4: UTAUT2 Research Model with Additional Contextual Variables of Hedonic Motivation, Price Value, as well as a Habit and Moderating Variables of Age, Gender, and Experience

Essentially, the models attempt to treat the dependent variables related to the buyer's purchase intent as a function of contextual constructs and develop a predictable understanding of the same for impactful marketing and policy decisions. A brief data-analysis of the studies using UTAUT2 models is shared in Table 4.

Key highlights are as follows:

1. An improved fit, with R2 having a high number indicating goodness of model fit. As one adds more variables to a model, R2 could improve. However, R2 assumes that all independent variables explain the variation of the dependent variable. Adjusted R2 addresses it by taking

only that variation in an account which is by significant variables. It is also a preferred GFI (Goodness-of-Fit Index) in multi-variate linear regression. However, (Reference Point 2 below) UTAUT2 independent variables are found to be empirically significant and hence, adjusted R2 also improves showing goodness-of-fit.

2. Table 4 shows the significance of most of the constructs of the UTAUT2 model with some exceptions and modifications as applicable.
3. The use of the UTAUT2 model in case of several products/technologies/ innovations ranging from 'smartphones for m-learning, mobile education, Air BnB room bookings, mobile internet consumers, news personalisation, to social media use in university students (Harsono, 2014).

Clearly, from a practical stand-point, the enriched UTAUT2 model can potentially deliver a better fit and help organisations in the renewables industry design better policies and practices to market technologies to consumers at various stages of the use curve.

Table 4: Data-Analysis of UTAUT2 Studies

#	Author	Sample	Topic/ Technology	Path Coefficients for Constructs							R^2
				PE	EE	SI	FC	HM	PR	HA	
1	Mazharuddin Syed Ahmed (2016)	299	Smartphones for m-learning	0.329***	0.468***	0.145***	0.151***	0.160***	–0.053		86%
2	Ochslein et al. (2014)	266	News personalization		0.352***	0.63*	0.091**	0.53**	0.37**	0.446***	74%
3	Yu (2012)	441	Mobile smartphone education	0.263***	0.027	0.664***	0.560**	0.146**	–0.279***		60%
4	Venkatesh et al. (2012)	1512	Mobile internet consumers	0.21***	0.16**	0.14*	0.16**	0.23***	0.14*	0.32***	74%
5	Harsono et al. (2014)	419	Social media (university students)	–0.291*	0.475*	0.251*	0.015*	–0.063*	0.027**	0.156*	87%

Note: *p < 0.05; **p < 0.01; ***p < 0.001 level

Other Studies on Renewables and the Indian Context

Several researchers have used agent-based models to validate the effect of network agents (social influence) in solar adoption in different geographic contexts in Austin, Texas, Botswana.

Jager (2006) investigated the diffusion of PV systems from the behavioural perspective in the Netherlands. His work addressed 297 actual SPV installed home owners and empirically gathered the motives of the buyers after an SPV promotion campaign in the Netherlands. Financial awareness and general problem awareness are found to be critical motives.

A strong positive correlation is established with social networks and state-led information meetings, technical support meetings which specifically addressed issues relating to technical and bureaucratic barriers.

Hondo and Baba (2010) studied the changes in the environmental behaviour of homeowners with PV systems in Iida City, Japan. The results show that homeowners, where the family members are highly aware of their PV systems, tend to increase the environmental behaviour after installing the PV system. It was also found that an increase in communication about environmental behaviour in a family tends to go together with an increase in environmental behaviour. The findings suggest that the installation of residential PV systems affect people's concern and norms related to energy and the environment and, consequently, influences people's behaviour. Also, the degree of communication in the neighbourhood raises awareness of the PV system.

In the Korean context, Kim, et al. (2014) explored the factors that had a significant impact on the intentions of the public to use solar. The researchers applied a structural equation to the integrated research model using three positive factors comprising system quality, perceived benefits, and trust, which significantly contributed to determining the public's attitude toward solar energy technologies. While empirically sound, this work evolved more as an adaption of the generic consumer behaviour model with select items and it just empirically shows that the intention to use the technologies had a causal relation with two positive variables (public attitude and satisfaction) and one negative variable (perceived cost).

Paul and Uhomoibhi (2012) studied solar power generation and sustainable development in emerging economies and highlighted the issue of lack of qualified solar technicians in un-established PV markets.

Jeneille Hsu's (2018) study of residential solar installations in California demonstrates that cities with large population size, municipal utilities, and high proportions of pro-environment, educated constituents are more likely to adopt solar.

Jayaweera, et al. (2018) have studied residential SPV diffusion in Sri Lanka. Their results show that highly educated middle-aged persons, retirees in Colombo district are more likely to adopt PV. Early adopters reside in larger houses of average or above-average housing quality.

More recently, Parkins, et al. (2018) validated that the purchase intent of the Canadian solar buyer is influenced by visual exposure to solar technology, public engagement, and perceived knowledge (beliefs and habits).

Moderating variables have received varying inputs from different respondents/research samples. Age, income, education levels, and

participation in other environmental schemes have been some of the moderating variables that have evolved in this scan. Briguglio and Formosa (2017) clearly show that just because a user has green behaviour (participates in other environmental schemes like recycling) there is no statistical relationship to the user's off-take of an SPV.

Steel et al. (2015) investigated the impact of environmental beliefs and other factors on the public attitudes for renewable energy technologies (including wind, solar, biotech, geothermal). This study was in the context of Oregon and Washington states of USA. They observed that the demographic variables of age and education had a significant impact on support for such policies, specifically, 'younger respondents and more highly educated respondents were significantly more likely than older respondents and less educated respondents to either support or strongly support government policies' to promote renewables. However, while this study validates the relationship between environmental values and demographics with the attitudes towards renewable policies, there is no linkage of the attitude to government policies with the purchase intent of the individual buyers.

Also, it is observed that several studies have established the solar renewable adopter profile as younger, higher educated with higher income. There are also contrarian views that profile the SPV adopter as older, higher educated with higher income (Porter, 2011). And there are also views that demographics have a lesser role to play versus attitudes (Vasseur and Kemp, 2015). There is a need to test the role of demographics in specific contexts.

Some studies have established that the social acceptance of green products by consumers is improved with the introduction of fiscal incentives and promotion (Coad and Woersdorfer, 2009). Chowdhury and Sumita (2012) examined the German and Japanese high PV penetration and concluded that market-based incentives can induce a voluntary response from consumers that can be as effective as regulatory requirements.

In this context, government policies have successfully stimulated demand by government subsidies and improving the perception of the overall return of investment in SWHS in New Zealand (Lloyd and Roulleau, 2008; Gillingham, 2009).

Janet L. Sawin (2001) examined the role of government policy in advancing the development and diffusion of renewable energy technologies and researched policy effectiveness. Her longitudinal study collated data from 1970 to 2000 and did a comparative analysis of the data, research and development programmes, legislation, regulations, and its causal relation with wind energy diffusion in target states. Germany, Denmark, California, and rest-of-USA were studied because each followed a very different path

and adopted wind energy at a different pace. According to conventional economic logic, renewable energy will achieve greater market penetration once it is cost-competitive with conventional generation. However, Sawin concluded, that 'government policy is the most significant causal variable in determining the development and diffusion of wind energy technology'.

> The policy is more important for bringing wind energy to maturity than a nation's wind resource potential, wealth, relative differences in electricity prices, or existing infrastructure. Further, the policy is essential for enabling technology to succeed in the marketplace once it is cost-competitive. (Sawin, 2001)

Sommerfeld, et al. (2017) studied 22 users who acquired SPV under different feed-in-tariff policy settings. The responses of participants indicate different motivations and energy use behaviour based on policy settings in which SPV was acquired.

Nishimura (2012) explored the catalytic impact of Ontario's Green Energy Act (GEA) which was the first comprehensive feed-in-tariff policy post-European tour of a key legislator. His paper 'Grassroots Action for Renewable Energy: How Did Ontario Succeed in the Implementation of a Feed-in-tariff System?' resonates with the Indian experience with the feed-in-tariffs that drove the initiating phases of India's National Solar Mission (Aggarwal, 2013).

The works of these researchers show that policy can affect renewable technology's perceived or real, costs. It can reduce or eliminate barriers to performance expectancy through standards and reshaping of acceptable product offers. It can also improve financial self-efficacy by the provision of affordable capital. A policy can directly mandate the use of solar (like all new homes on plots > 500 square yards must mandatorily install SPV in India). However, a policy can have an indirect impact on purchase intent for RT SPV on the consumer psyche and attitude. For example, price-value beliefs can be influenced via government subsidies, performance beliefs via the creation of standards and installation norms, and effort expectancy by creating certified and appropriately skilled installer base, easing of bye-laws for installations, etc.

Kapoor (2017) has studied the barriers and challenges for the promotion of SPV (utility-scale) in India in the context of Gujarat and Rajasthan. This research extracted nine factors from 279 responses to a 34-item survey. The extracted factors were financial barriers, policy and political barriers, institutional barriers, land acquisition challenges, land information challenges, administrative challenges, regulatory barriers, market and

technology barriers, and the development cost. Institutional barriers could rise with limitations to direct sale of solar power to large institutional end-customers as that would threaten the power distribution companies' revenues. Political barriers would prevent the inter-state sale of renewable electricity. Infrastructural limitation like available of local substations and lines for power feed-in to the grid would increase development costs.

For factor analysis, a thumb rule used in practice is that the size of the sample should be ten times the number of formative indicators used in the final scale (Hair Jr et al., 2016). Therefore, 279 responses on a 34-item survey are normally less than the academically acceptable sample size (of 340) for factor analysis. However, Kapoor's work still gives a reasonable insight into the institutional utility-scale SPV challenges but cannot be directly extrapolated to the domestic RT SPV segment.

Aggarwal et al. (2019) have empirically identified the factors driving the purchase intent of the Indian domestic solar buyer using the UTAUT2 model with an excellent model fit ($r^2 = 0.79$). They were also able to isolate differences between the innovator, adopter, procrastinator, laggard categories basis these latent constructs. Interestingly, their study conducted in Delhi and Bangalore cities sampled 405 respondents and empirically tested the relationship of the purchase intent with moderating variables (age, gender, education, and income) or with mediating variables (awareness) or with context variables (city and prior ownership). They did not find a statistical relationship between these variables and purchase intent of the RT SPV buyer. However, this study limited itself to a PCA/regression analysis. A model fit must be balanced by a check of holistic, empirical robustness of the model. This is normally done through a Confirmatory Factor Analysis/ Structural Equation Modelling (CFA/SEM) where the overall model is tested on different fitness indices and both convergent and discriminant validity is evaluated. Convergent Validity ensures that the items in the scale are measuring the construct they were supposed to measure. Discriminant Validity ensures that the items do not unintentionally measure something else, i.e. they do not load heavily on another construct. While Aggarwal et al. (2019) have given an initiating study on the use of UTAUT2 model in this context, there is scope for extending the empirical analysis with CFA/ SEM.

Key Observations and Discussion

A literature scan has identified several factors from prior studies that can be used to investigate a more comprehensive and better fit behaviour model for renewable (Table 5).

Table 5

Factors Identified from Literature Scan	*Other Variables*
Social Beliefs	*Moderating Variables*
Environmental Beliefs	Demographics: Age, Gender,
Green Habits	Income, Education
Effort Expectancy (Lack of trained engineers)	
Performance Expectancy (Need for energy	*Mediating Variables*
storage, standards)	Awareness, Ownership
Price Value/ROI Beliefs	
Hedonic Motivation	*Context Variables*
Self-Efficacy Beliefs	City
Government Policy	

Following points are observed:

- There is considerable variation observed on the role of demographics in its impact on the customer purchase intent. Some researchers have observed that age, gender, income, and education vary across the adopter-procrastinator-non-adopter profiles while others have not found any statistically significant impact of these variables.
- This study observes that while there is work done in several geographic contexts, it cannot be extrapolated across the globe as there could be cultural, political, and social differences in the contexts. Accordingly, work done in a rural context cannot be applied to a city context (Urpelainen and Yoon, 2017). Home owner responses in mature markets like USA and Germany cannot be extrapolated to India.
- Observations of the role of awareness, trialability, demonstrations, and prior ownerships will likewise have to revisit in the specific context being studied.
- It also appears from prior research that there are several factors beyond the conventional price-value beliefs and green propositions that could influence the willingness-to-pay for an RT SPV. These will need to be tested in the Indian context to determine the precise significance of these factors and their relative weights in the purchase intent model. Earlier research used some of the earlier identified factors in building their models of homeowner behaviour for solar renewables. These approaches leveraged some elements of the generic consumer behaviour model.
- Over a period, structured models of consumer behaviour have evolved as a stronger academic foundation for evaluating the behaviour intention of the respondents. TPB has been a functional model that has been used by several researchers in different contexts. It brings out the

role of social influence (normative behaviour) along with attitudes and perceived controls on the behaviour. This study observes that the use of TPB develops initiating models of consumer behaviour but does not do a comprehensive exploration of potential factors.

- Technology adoption models particularly, the UTAUT models offer improved fit and are a relatively recent evolution in consumer behaviour studies. Aggarwal et al., 2019 use of UTAUT2 model for studying that the factors of the purchase intent of a residential SPV buyer can be extrapolated and studied in different geographic contexts, longitudinal studies to understand a rapidly evolving SPV market (Figure 5).

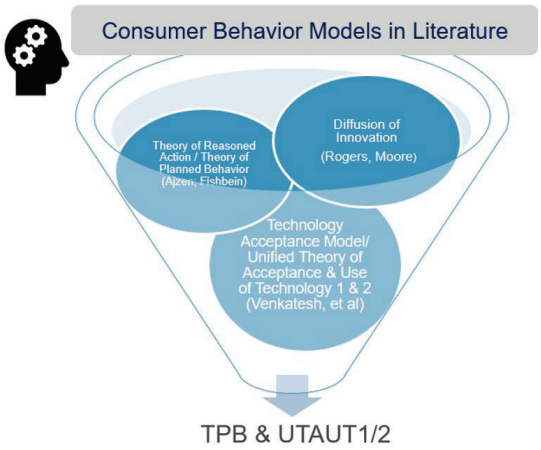

Fig. 5: TPB and UTAUT Extracted as Potent Behaviour Models for Studying Solar Rooftop

Gaps identified in the SPV consumer behaviour research include the following:

1. **Model structure and model fit:** There is ample scope to enhance the earlier research by expanding the dependent variables and exploring improved fits with more current consumer behaviour models. Improved fit can also empirically identify key triggers of the purchase intent of RT SPV in a domestic buyer.

   The identified list of independent variables will need to be tested in a specific context to create a reliable and valid scale.

   Model robustness must be empirically validated. Assumptions of normality and linearity are common in most models. The use of CFA/ SEM enables a more holistic empirical testing of the model on several fitness indices as well as checking the convergent and discriminant validity. While SEM has become a standard tool for analyzing complex inter-relationships between observed and latent variables in various fields

of scientific inquiry, it appears that its adoption in SPV diffusion studies has been slow. Its use is recommended to improve the mathematical rigour in this field.

2. **Inadequate sample/target audience selection:** Several studies have diluted the rigour in the selection of the target audience while sampling. Some have based their observations on a sampling of business students while others have compromised the sample size diluting the empirical validity of the results.
3. **Geographic context applicability/study of city context in India:** Testing in specific city contexts can identify contextual differences between cities that have seen higher solar penetration versus emerging solar cities.
4. **Holistic testing of impact of moderating and mediating variables:** Understanding the actual role of demographics variables, mediating variables can help define the customer profile with a high intent-to-pay for solar and help focused marketing efforts.
5. **Holistic testing of adopter-procrastinator-laggard profile differences:** By creating a psyche profile and understanding the triggers of purchase intent for solar appropriate marketing programmes can be developed that do not rely on 'educated guesses'.

A limitation of this study is that social acceptance and consumer behaviour is a moving target in time and context. Therefore, future investigations need to test the factors of purchase intention in the specific Indian contexts and build a longitudinal database to map the evolution of consumer behaviour for RT SPV over time.

A rich collection of the energy policy literature has explored the behavioural aspects of the energy and solar usage. Most of these studies have reviewed the behavioural patterns and social acceptance in the United States, Europe, China, and other developed countries. Surprisingly, the Indian context has been neglected. The reviewed literature suggests that the use of UTAUT2 for studying the solar rooftop purchase intent of the homeowners delivers improved model fit (Saleh et al., 2014; Aggarwal et al., 2019).

Current research supports the use of UTAUT2 for the continuation of current research with consistent and strengthened methodologies. Well-designed empirical studies, covering holistic testing of all socio-demographic variables, appropriately selected target respondent sampling frames, mathematical rigour of statistical analysis (using tests like CFA/SEM), will help validate improved fit and robust models specific to the geographical/time context being tested in this domain. This will justify its

use and give a strong foundation for better market and policy practices that enable improved consumer acceptance of SPV technologies.

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Solar Energy: A Study of Efficiency in G20 Nations

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Abstract

Renewable Energy is extensively being used around the globe in the power generation sector. With the energy crisis and increased environmental concerns, many countries are moving towards renewable energy sources such as solar. Solar power has experienced rapid development in the past decade across the globe with installed capacity moving from 15 gigawatts (GW) in 2008 to 227 GW in 2016. About 80 per cent of this capacity is present in the G20 nations as of 2016. India is also emerging in the renewable energy scene with high investments in solar energy. There seems to be a great degree of imbalance between the installed capacity and the generated capacity, which causes a lack of efficiency. This study is undertaken to analyze the efficiency of solar energy production in the G20 nations and understand where India ranks, using the Data Envelopment Analysis (DEA) model. It is a non-parametric test, which gives a relative efficiency score for decision-making units. This score helps in determining the efficient and inefficient countries' units. The analysis has been undertaken using secondary data with Installed Capacity and sunshine hours being inputs and electricity generated and reduced emissions being the outputs. The study was conducted for the year 2016. Two models were undertaken as part of the study with different input-output combinations. The DEA model arrives at the efficiency score by comparing the optimal inputs and outputs considered, vis-a-vis, the efficient input-output requirement. The analysis was done using DEAP 2.1 software. The efficiency indicator in the DEA model is a score that is equal to 1. A score of less than 1 is termed as inefficient. The score of 1 indicates efficiency as it shows that there has been optimal usage of the inputs to generate the optimal output. The results showed that 11 countries were efficient, most of them backed by innovative technology and respective country-level initiatives.

Keywords: *Data Envelopment Analysis (DEA), Energy efficiency, Installed and generated capacity, Constant returns to scale, Variable returns to scale.*

Introduction

Energy is key in infrastructure for the growth and well-being of any nation. The power sector in the G20 nations, over the years, has been expanded substantially consisting of both conventional and non-conventional sources of power. With the ever-increasing demand in the power sector, it has become crucial for countries like India and China to expand its generating capacity. The major proportion of power generation in these countries from conventional sources, such as thermal, accounts for around 68 per cent of the total power generated in March 2017. This is leading to concerns in terms

of the environment, as many G20 countries are at alarming levels of carbon emissions. This has led the countries to think over their sources of energy and many countries are slowly making a shift to renewable energy. The G20 countries account for 80 per cent of the capacity of renewable energy in the world (International Renewable Energy Agency [IRENA], 2015). This capacity used efficiently can significantly help in power generation in these countries, which would help reduce environmental concerns.

The G20 countries, in wake of temperature rise, have had many discussions previously. In 2015, the ministers of energy of the nations came together for the adoption of G20 Toolkit, which helps the countries to take up voluntarily deployment of renewable energy partnering with the IRENA. This is one of the first collective initiatives taken in the area of energy by the G20 nations. IRENA will be assisting the nations in chalking out a road map for the way forward in the renewable energy sector. It would also be analyzing the policy framework of the nations and how nations could further progress in renewables and achieve efficiency.

Indian Scenario

With rapid economic growth, the demand in the energy sector of India is on a continuous rise. In India, the primary dependency of energy generations lies upon coal. According to International Energy Agency, India is the second in the world rankings for coal production. With the kind of manufacturing policies such as 'Make in India' coming in for the development of India, the energy needs are on a rise. There is a huge requirement for the investment (the US $2.8 trillion) in the Energy sector in India, of which major chunks of investments need to be directed towards the improvement of energy efficiency (International Energy Agency, 2015).

India ranks third in terms of carbon emissions across the globe. With the major dependency on coal for power generation and using technologies which are not very efficient has garnered India with this ranking. India's carbon emissions account to 791-gram carbon dioxide/Kwh which is higher than the average world emissions of 522-gram carbon/Kwh (International Energy Agency, 2015). This has led the country to rethink its energy policies and make a heavier shift to renewable energy. This form of energy is something that is harnessed from resources that are available abundantly. The installed capacity for renewable (wind, solar, and bioenergy) in our country has increased over the past few years and is expected to tremendously rise till 2040. The decreasing costs of technology are attracting investments but there is still a requirement for subsidies. According to the International

Energy Agency report, the levelised cost of electricity will be equivalent to the costs of wind and solar power by 2040.

According to the National Institute of Solar Energy, 'the solar energy potential estimate in India is 750 GW given that 3 percent of land of every state can be fully utilized.' With the potential in the energy along with the pressure of climate change issues, in 2015 at the Climate Change Conference in Paris, India announced the Solar India Dream. The project target for 2022 is to achieve 100 GW of installed solar capacity. This project was launched as Jawaharlal Nehru National Solar Mission in 2010 but has increased the goal of installed capacity. Solar Energy has ever since been substantially adopted across many states in India including Maharashtra, Rajasthan, Andhra Pradesh, and Madhya Pradesh. Gujarat is one of the leading examples of solar energy. With efficient policies, the state has been able to attain 1 GW installed solar capacity (International Energy Agency, 2015).

Solar energy has three sub-divisions. Solar photovoltaic (PV), solar thermal, and rooftop solar. The focus of this study would be on solar PV and thermal. The solar PV is a machine that can convert sunlight to electricity. PV is the most widely used around the world in the case of renewable energy. Concentrated solar power (CSP), on the other hand, generates power like any conventional energy source. It first generates heat which ultimately gets converted to power. The energy is generated using fluids which help it to convert into steam and finally, power is generated. These can be used along with natural gas as well. When costs are compared, CSP has lower capital costs as compared to PV (Dale, 2013).

It is very important that there is efficiency in the projects undertaken across these countries to ensure good production. Many countries are facing a major problem in many power plants, as there is a lack of efficiency. Many projects with huge investments are being shut in the power sector as they come across constant losses due to a lack of efficiency. It is very important to improve energy efficiency. If installing is the first step, it is also equivalently important to check the efficiency in the installed capacity. Measuring this efficiency is very important to see that goals are being reached. The most popular form of efficiency analysis in the area of energy is DEA. This has been used in the efficiency analysis of many sectors around the globe.

Data Envelopment Analysis helps in providing an efficiency score in a comparative study of decision-making units. It is a non-parametric form of analysis used to generate relative efficiency scores (Cooper et al., 2007). The study has been undertaken for the G20 nations for 2016, with two differentiated models with different input-output combinations using both

CCR (Charnes, Cooper and Rhodes) and BCC (Banker, Charnes and Cooper) approach of DEA. Lack of data availability for certain variables, which led to the non-inclusion of those variables, was a limitation for the study.

Statement of Problem

There have been multiple studies undertaken pertaining to efficiency of energy, but there is very limited literature pertaining to the efficiency of renewable energy. The literature available on renewable energy is mostly based on the efficiency of wind energy. Solar energy efficiency is an area where there is a dearth in literature. When it comes to the efficiency of renewable energy there is a lack of literature based on all the G20 nations. Many of the efficiency studies have been based in Europe. The study aims to fill this gap by undertaking an efficiency analysis of solar energy in the G20 countries supported by secondary data.

Statement of Purpose

One of the major problems across the globe is that the power sector units are facing constant high losses leading to shut down of the units which were established with high investments. This happens due to a lack of efficiency. With the National Solar Mission at hand, India is moving at a fast pace in installing new capacity. Many countries are following a mission-based path for renewables. Though the missions only focus on the installed capacity, it is very important to check that, these units are running efficiently. If efficiency is not taken seriously then most of the units may face the problem, like that of conventional power generating units. Energy efficiency studies have been previously undertaken but very few for renewable energy particularly for solar energy. The purpose of this research is to study the efficiency of solar energy in G20 nations. This study is very crucial as it will give an understanding of where the countries stand in terms of solar energy. This study can also act as reference, if inefficiencies exist, further study of causes can be made which can be used to correct the inefficiencies.

Research Questions

- Are the G20 countries efficient in solar energy production?
- Where India is ranked amongst G20 countries in terms of solar energy efficiency?

Significance of Study

The study being undertaken will help in understanding the efficiency in solar energy production in G20 countries. These countries are equipped

with high capacity in terms of renewable energy, but for the countries to succeed in renewable energy efficiency analysis is very important. Literature in renewable energy is very limited. Most of the available data is specific to wind energy efficiency. The aim of the research is to undertake an efficiency analysis of solar energy in G20 nations to bridge the gap in the literature.

Review of the Literature

The concept of energy efficiency gained importance when world-over, energy crisis cropped in along with the rising concerns of negative impact on the environment. Energy efficiency is defined by the European Union (EU) as 'the ratio of the output of performance, service, goods or energy, to the input of energy.' (European Union, 2015) There have been many studies based on the concept of energy efficiency with outputs varying from Gross Domestic Product (GDP) to Green House Gas (GHG) emissions. According to the International Energy Agency (2015), 'energy efficiency is the sustainable energy system for the future.' In simple terms energy efficiency means to be able to supply a given amount of output with lesser use of input.

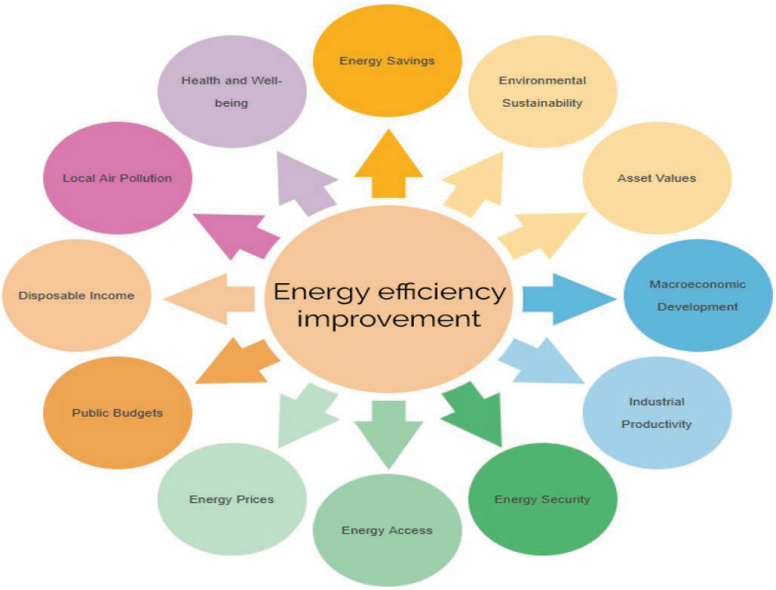

Fig. 1: The Scope of Energy Efficiency
Source: IEA.

Many international organizations including International Energy Agency, International Renewable Energy Agency, etc., have been helping various countries in undertaking energy efficiency studies. Measuring

efficiency can be a tricky concept. Multiple studies so far have used DEA for measuring energy efficiency across countries (Mardani et al., 2018).

Data Envelopment Analysis is a popular non-parametric approach for efficiency evaluation.[1] It has been widely used in many efficiency studies for schools, the hospitality industry, banking, and healthcare. It has also been used for cross-country evaluations (Ceylan and Gunay, 2010). When initially DEA was launched in 1978, it was a model of constant returns to scale. This Model was reworked and extended which made use of variable returns to scale (Ray, 2012).

According to Andersen and Petersen (1993), the DEA is the first step in determining the relative efficiency score but it does not cater to the ranking of the decision-making units. This makes it difficult to compare results with parametric tests which assumes a normal distribution of data and requires a production function to measure efficiency such as Stochastic Frontier used to measure efficiency. The analysis has scores attached to it. A score less than one is said to be inefficient. This means that the same amount of output can be produced with a better combination of inputs.

The study conducted by Makridou et al. (2014) undertakes energy efficiency analysis for the EU countries. As part of the study, DEA and multiple criteria decision aiding are undertaken. The idea was to check the efficiency ranking differences in both types of analysis. For DEA, four different models were undertaken—each having a set of inputs and outputs including GHG, GDP, labour force, energy consumption, etc. The data taken was for 10 years. The results showed that the models with a higher number of inputs and outputs showed higher efficiency estimates in DEA. The results also showed that the countries which are more service-oriented had a better efficiency ranking as compared to the countries which were industrial based. This result is coordinated with the idea that countries with greater dependency on industries are prone to greater energy usage as opposed to those of service-oriented countries and hence, efficiency would have been lesser in the industrial-based countries (Makridou et al., 2014).

A similar study was undertaken in turkey by Ceylan and Gunay (2010), with considering the data for all the EU countries. The idea was to understand Turkey's standing in energy efficiency over the years amongst the EU nations. The study included data from 1997 to 2005. The study was undertaken with the help of DEA. There were two models considered one with only positive output (GDP) and the other with both positive and

[1] As DEA does not provide an equational relationship between the inputs and outputs, i.e. there is no specified function for the inputs and outputs. It is classified as a non-parametric model.

negative (GHG emissions) outputs. The results showed that Turkey has been one of the most energy-efficient countries over the years. This result was mainly because the country is not highly industrialised. When the country was compared with average efficiencies of other EU nations, it still ranked higher than the averages. In the next model when negative output was incorporated, Turkey still ranked amongst top efficiency rankings but comparatively lower estimates than the previous model. This was also the case when negative output was given higher weight. This implies that the country is efficient in productivity but in terms of environmental efficiency, it ranks lower. The same was the case for many other countries.

A study conducted on the efficiency of renewable energy in the EU showed similar results as in the case of Ceylan and Gunay (2010), where two different models with a different number of inputs were taken. Although the average efficiency across both the models was close, the model with a higher number of inputs showed eleven countries to be unit efficient, but the model with a lesser number of inputs showed only four countries to be unit efficient (Aldea et al., 2012).

A case study has been conducted in the United States (US), to compare the efficiencies of various renewable energy sources, including solar (PV and thermal), geothermal, wind (onshore and offshore), and hydro and biomass. Three inputs including levelised cost, land, and water were taken along with four outputs including capacity generated, plant size, employment, and GHG emissions. Using the DEA, it was established that solar and hydro were inefficient whereas the other sources were efficient. The reason behind this was that for solar there were high levelised cost and huge land requirements which caused inefficiency and pertaining to hydro the large land area requirements was claimed the reason behind inefficiency. This study used the benchmark approach, virtual efficiency, and cross efficiency. Amongst all the approaches geothermal ranks the highest (Saalam, 2017).

According to Tugcu and Dogan (2015), G20 nations make the highest proportion of world electricity consumption. A study pertaining to the electricity efficiency of G20 nations was undertaken. This study was performed with the help of DEA along with super efficiency. The efficiency scores of the former and later were considered for the period 1990-2011. It was observed that China has been consistently efficient in electricity production along with Brazil. India, on the other hand, was observed to be inefficient with scores being very low in 2011. Since India, China and Brazil constitute majorly in the production and consumption of electricity. It is important to keep them in view when international policies pertaining to energy are designed.

Table 1: DEA Application in Various Sectors

Author	*Year*	*Country*	*Sector*	*Inputs*	*Outputs*
Lin, Lee, and Chiu, 2009	2006	Taiwan	Banking	• Staff employed (number) • Expense of interest • Deposit operating amount	• Earnings • Loan operating amount • Revenue from operations • Revenue from interest
Manasakis, Apostolakis and Datseris, 2013	2008	Greece	Hospitality	• Beds • Employees • Operational cost	• Total revenues • Overnights
Benneyan, Ceyhan, and Sunnetci, 2007	2007	Multiple countries	Healthcare	• Hospital beds • Health expenditure (per capita) • Trained medical people Immunisation rate • Median age	• Healthy life expectancy at birth • Adult mortality rate • Infant mortality rate • TB prevalence
Tyagi, Yadav, and Singh, n.d.		India	Schools	• Teaching resources, physical resources, and ancillary facilities • teachers' qualities • parent's education • parents' occupation	Average marks in EVS, Mathematics, and Language
Ahmadi and Ahmadi, 2014	2005-07	Iran	Manufac-turing	• Number of employees • Capital formation • Raw materials employed by manufacturing industries • Fuel employed by manufacturing industries	Value-added of manufacturing industries

Source: Tugcu and Dogan (2015).

A study was conducted in China by Liu, et al. (2014) to measure the efficiency of wind energy from 2008 to 2012. This study was undertaken with the help of DEA. The input variables chosen are total installed capacity and capital investment. The output variable taken is electricity production. The model was checked for both comprehensive and technical efficiency. The results showed that in this period, the efficiency score was 1 only in 2012. In all the other years, the wind power industry was inefficient. This result was obtained due to inefficiencies in capital investments such as the loss of equipment in transportation. As the capital investment was efficient it resulted in the efficiency of wind power generation.

Unique efficiency analysis of PV was conducted in China. The study compromised 118 PV plants in various regions of China. This efficiency study pertained to environment efficiency from 2012 to 2016. This study was undertaken using DEA, with input variables being annual sunshine duration, insolation, and covered area. The output considered included installed capacity, annual electricity generation, carbon dioxide emissions, and coal savings. It was seen that 94 per cent of the PV plants were environmentally inefficient. The cause behind this was undermined. The study also included efficiency computation based on the regions (economic zones). This showed that efficiency was least in the region which is highly industrialised as in those areas carbon dioxide emissions are higher (You et al., 2018).

Another study conducted in China on the efficiency of PV, showed a significant positive relationship between the renewable energy policies undertaken by the country and improvement in the efficiency score of the country, i.e. as the government initiatives came into place this helped improve the efficiency of solar energy (Liu, et al., 2017). The study takes the data from 2005 to 2015 which is divided into phases. The DEA method has been used to compute efficiency. The inputs include new installed capacity, power investment, operating costs, covering area, energy replacement rate, and output in the on-grid electricity (generated electricity). There has been a rise in efficiency but the year 2011 showed the highest efficiency as the action plan of that year had implemented many policies in the support and enhancement of renewable energy.

Method of Procedure

Sample

This study aims to understand the technical efficiency of solar power including PV and CSP across the G20 nations for 2016. According to the

IRENA (2015), the G20 nations comprised around four-fifth of the world's renewable energy generation capacity. The majority of nations have heavily invested in solar energy. With this kind of potential, it is essential to check whether these nations can efficiently undertake solar energy production. The G20 nations had a Ministers Energy Meeting in 2015 in collaboration with IRENA, where there was an agreement to chalk out road maps for member nations in terms of renewable energy.

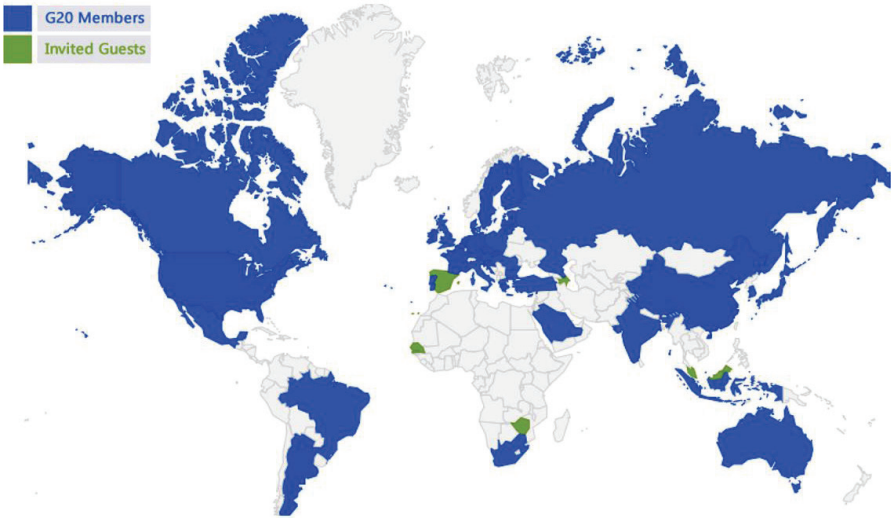

Fig. 2: Map Representing G20 Nations
Source: G20.org

The G20 consists of nineteen individual nations and the EU. Germany, Italy, France, and the United Kingdom are individual nations of G20 as well as the part of the EU. To avoid repetition in the variable data of these countries, in this study the four above-mentioned countries are excluded while taking the figures of the EU. Two inputs and two outputs are considered for the study of efficiency.

Data

Input Variables

- **Installed Capacity:** This is the total electricity that could be generated or produced under ideal conditions by the PV/CSP. It is generally measured in GW. This is being considered in place of capital (including the cost of material used and labour cost) due to data constraints. A few studies on the technical efficiency of electricity have used installed capacity in place of capital (Lam and Shiu, 2001).

- **Sunshine Hours:** This is the total average sunshine hours considered for the G20 nations. For solar energy, the core input is the sunshine as this is the only way of harnessing solar energy. It is measured as the yearly sunshine of the nation during the day, between the rise and the sunset. The data used for the study is the average sunshine data from 1961 to 1990, for all the nations which are the latest available data. The obtained result has been used as the annual sunshine.

Output Variables

- **Electricity Generated:** This indicates the total generated electricity over a span of time (one year in this study). This is measured in Gigawatt-hour (GWh). This is the main performance indicator for solar energy.
- **Reduced Carbon Dioxide Emissions:** The biggest incentive for any nation to move to renewable sources of electricity production is the possibility of a reduction in carbon dioxide emissions, which leads to improved quality of the environment. The greater the reduction in emission, the better is the performance of the nation. The reduced emissions due to shifting to solar energy are measured in million tons.

Table 2: Source of Data

Inputs	*Data Source*
Installed Capacity (GW)	The International Renewable Energy Agency, World Energy Council
Sunshine Hours	UN Data
Outputs	
Electricity Generated (GWh)	The International Renewable Energy Agency, International Energy Agency
Reduced Carbon Emissions (million tons)	The International Renewable Energy Agency

Table 3: Data

Country/area	*Installed Capacity (GW)*	*Average Annual Sunshine*	*Electricity Generated (GWh)*	*Reduced Emissions (million tons)*
South Africa	2.17	2,842.26	3,341	3.20
China	77.57	2,310.67	67,874	64.00
India	9.65	2,617.35	9,790	8.97
Indonesia	0.05	2,975.00	73	0.06
Japan	42.00	1,831.85	50,952	35.02
Korea Republic	4.50	2,164.00	5,123	4.06

Country/area	*Installed Capacity (GW)*	*Average Annual Sunshine*	*Electricity Generated (GWh)*	*Reduced Emissions (million tons)*
Russian Federal	0.08	1,924.50	79	0.04
Turkey	0.83	2,026.00	1,046	0.65
France	7.32	2,176.00	8,160	6.04
Germany	40.72	1,598.00	38,098	32.46
Italy	19.29	2,091.00	22,117	13.41
UK	11.90	1,348.00	10,421	7.62
European Union	103.51	2,039.00	1,11,329	20.26
Saudi Arabia	0.07	3,236.50	129	0.08
Canada	2.66	2,028.00	3,031	2.09
Mexico	0.39	2,534.00	252	0.14
USA	34.86	2,931.69	50,334	37.39
Australia	4.72	2,825.93	6,209	5.11
Argentina	0.01	1,997.88	15	0.01
Brazil	0.08	2,270.00	139	0.08

Source: All the sources mentioned in Table 2.

Table 4: Abbreviations for Reference

BCC	Banker, Cooper, and Charnes
CCR	Charnes, Cooper, and Rhodes model
CRS	Constant returns to scale
DMU	Decision-making Units (countries in this study)
DRS	Decreasing Returns to scale
IRS	Increasing Returns to scale
VRS	Variable Returns to scale

Data Envelopment Analysis is a non-parametric form of analysis. In DEA, multiple inputs and outputs can be considered simultaneously. The analysis is very flexible in the sense that, with the given output one can test inputs to minimise the level of inputs. Similarly, it can be made only oriented to output, with a given level of inputs, outputs can be maximised. This model has been extensively used by many companies for efficiency analysis. The model in 1978 was introduced by Charnes, Cooper, and Rhodes and it was developed further by Banker, Cooper, and Charnes in 1984. The initial model holds constant returns to scale, whereas the extended model considers variable returns to scale.

Data Envelopment Analysis has two types of models—input-oriented and output-oriented. The input-oriented model focuses on minimising the inputs by maintaining outputs at the original level. The output-oriented model aims to maximise outputs by keeping the inputs at the original value. The idea is to increase the outputs. Either way, efficiency scores can be obtained (Zhu, 2011).

One major advantage associated with DEA is multiple inputs and outputs can be considered at the same time having different units of measurement. The analysis gives efficiency scores to the participating decision-making units. The model has been extensively used by many decision-making units in studies related to efficiency. These include schools, colleges, banks, manufacturing, and many more. Many energy-related studies have previously used DEA. According to Tugcu and Dogan (2015), there is no specified model used for efficiency analysis, but DEA has been widely used in energy efficiency analysis. With having an idea of previous studies done in the area, DEA will be adapted to measure energy efficiency.

The model of DEA assumes that a score of 1 of a decision-making unit is considered to be efficient and scores less than 1 imply the units to be inefficient. In this Model, let's take for N number of decision-making units, we have p inputs and m outputs, the CCR model equation is given next.

$$\max E = \frac{\sum_{K=1}^{m} V_k y_k}{\sum_{i=1}^{p} u_i x_i}$$

$$\text{S.T} \quad \frac{\sum_{K=1}^{m} V_k y_{kj}}{\sum_{i=1}^{p} u_i x_{ij}} \leq 1; j = 1, 2, 3, \ldots, n$$

$$v_k u_i \geq 0, \quad k = 1, 2, 3, \ldots, m \quad i = 1, 2, 3, \ldots, p$$

Linear programming conversion by setting denominator equals to 1.

$$\text{Max E} = \sum_{K=1}^{m} V_k y_k$$

$$\text{S.t} \sum_{K=1}^{m} V_k y_{kj} - \sum_{i}^{p} u_i x_{ij} \leq 0 \quad j = 1, 2, 3 \ldots, n$$

$$\sum_{i}^{p} u_i x_{ij} = 1$$

$$v_k, u_i > 0 \quad k = 1, 2, 3, \ldots, m \quad i = 1, 2, 3, \ldots, p$$

The biggest dilemma in DEA is whether to go for the earlier-mentioned CCR model, which assumes constant returns to scale, i.e. with an increase in input, there is a proportional increase in output or go for the BBC model, which takes variable returns to scale. This implies with an increase in inputs the output changes greater than or less than the inputs. There are a couple of rules of thumb that could be followed to choose amongst both. Generally, it is said the larger the variation amongst the outputs or inputs and sometimes both, the better it is to go for variable returns to scale (VRS).

This statement is very vague to be followed. The more reliable rule is to run the Model with both constant returns to scale (CRS) and VRS and check for the differences. If efficiency scores of the majority of units are different, then VRS is preferred (Coelli, et al., 2005). The major difference between CRS and VRS is that the former attains technical efficiency whereas the latter attains pure technical efficiency keeping the optimal scale of operation aside.[2] Technical efficiency counts on the operational size which is not the case with pure technical efficiency (Avkiran, 2001). In CRS, firms can be compared to firms that are very different in size, whereas in VRS it's generally a similar size comparison due to additional assumption of convexity. This is also the difference between technical and pure technical efficiency.

Table 5: Descriptive Statistics

Variables	*Electricity Generated (GWh)*	*Reduced CO_2 Emissions (MT)*	*Installed Capacity (MW)*	*Average Annual Sunshine Hours*
Maximum	1,11,329	64	103.51	3,237
Minimum	14.5	0.007491	0.01	1,348
Mean	19,425.56	12.03525355	18.119	2,288.49
Standard Deviation	29,807.78644	17.32067401	28.57	492.1249541

Source: Author.

From the statistics in Table 5, it can be observed that there is a large margin between the maximum and the minimum values of the considered inputs and outputs. This measure is not reliable to determine CRS or VRS, but it's hinting VRS. To check this, first, the CCR model is undertaken and followed by BCC. This showed that the majority of the DMU's have differences in efficiency amongst both models, hence the BCC model with VRS is used.

Models

The analysis has been undertaken with the help of two models formulated. The first model has installed capacity, average sunshine hours as the inputs along with generated capacity as the output. The second model has an extension to the first, where the reduced carbon emissions are the added output to check the efficiency of solar energy and the environmental efficiency of solar energy, respectively.

[2] Pure Technical Efficiency refers to the measure of efficiency considering the scale of operations into consideration. In case of technical efficiency, the scale of operations is taken into consideration, and sometimes the larger scale of operations is mistaken by the model to be more efficient than the smaller scale.

Table 6: Model Description

Model 1	*Model 2*
INPUTS: Installed Capacity (GW) Average Annual Sunshine Hours	INPUTS: Installed Capacity (GW) Average Annual Sunshine Hours
OUTPUTS: Generated Capacity (GWh)	OUTPUTS: Generated Capacity (GWh) Reduced Carbon Emissions

Source: Author.

The analysis has been undertaken using the DEAP software 2.1 version. Software helps in the efficiency measure and is widely used due to the availability of several methodologies.

Presentation of Findings

Results and Findings

Table 7: Model 1 Results

Country	*CRS Technical Efficiency*	*VRS Technical Efficiency*	*Scale Efficiency*	
South Africa	1.000	1.000	1.000	-
China	0.772	0.790	0.997	IRS
India	0.696	0.770	0.904	IRS
Indonesia	0.792	0.826	0.960	IRS
Japan	1.000	1.000	1.000	-
Korea Rep	0.772	0.899	0.858	IRS
Russian Fed	0.579	1.000	0.579	IRS
Turkey	0.814	0.956	0.852	IRS
France	0.763	0.892	0.855	IRS
Germany	0.788	0.962	0.819	IRS
Italy	0.793	0.927	0.856	IRS
UK	0.606	1.000	0.606	IRS
European Union	1.000	1.000	1.000	-
Saudi Arabia	1.000	1.000	1.000	-
Canada	0.761	0.946	0.805	IRS
Mexico	0.410	0.755	0.542	IRS
USA	1.000	1.000	1.000	-
Australia	0.886	0.895	0.991	IRS
Argentina	0.814	1.000	0.814	IRS
Brazil	1.000	1.000	1.000	-

Source: Author.

An efficiency score of 1 indicates that the DMU is efficient. It can be seen that there are different scores in the CCR and BCC models. It can be observed from Table 7 that there are six countries (highlighted) that are efficient both in terms of CCR and BCC model. There are three countries including the Russian Federation, the United Kingdom, and Argentina, which are efficient only under BCC and not CCR. As discussed previously, the VRS helps in comparing similar size units as opposed to CRS. In total, there are nine countries efficient in terms of VRS.

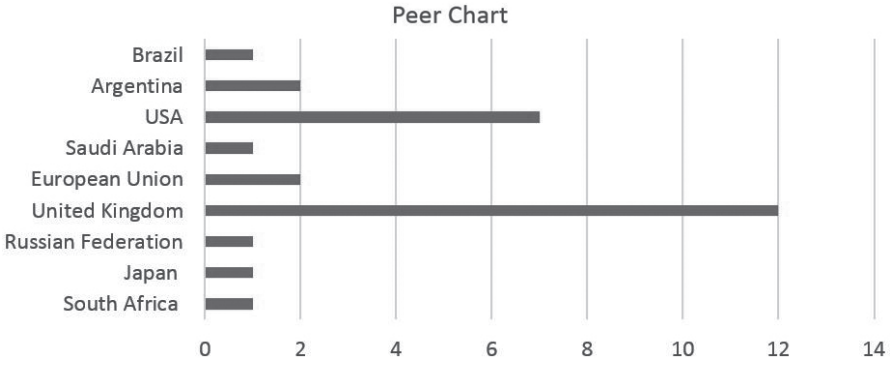

Fig. 3: Peer Chart for Model 1
Source: Created by the author.

Figure 3 shows how many times each of these countries have been chosen as a peer for other countries. This implies these countries have been assigned to other countries to consider their outputs and inputs to achieve efficiency in the suggested countries. This is one of the results of DEA obtained through DEAP.

It can be seen that the United Kingdom has been recommended a maximum number of times followed by the US. Though the United Kingdom has been recommended the greatest number of times, it was not CRS efficient. This shows that though the country was efficient in solar energy, due to its size, it was not CRS efficient.

As mentioned earlier, a score of 1 is considered to be efficient and anything positive less than that is inefficient. The CRS model shows that seven DMU's (countries in this case) are efficient, whereas the VRS model shows that eleven countries are efficient of the twenty. The eleven countries are Brazil, South Africa, China, the US, Saudi Arabia, Argentina, Germany, the UK, the EU, Japan, and Russian Federation. It can be identified from the data set that the size of installed capacity in Russia is small as compared to the other nations. This is also the case with Brazil and Saudi Arabia, the other input (sunshine hours) is large which led to the above results. If

efficient in the CRS model, then they tend to be efficient in the VRS model as well, again the operational size is the reason. In CRS, it could be possible that there are units that are efficient but due to lack of similar size units, they cannot be compared and hence they become inefficient.

The other countries, that remained inefficient in VRS, have improved their position as compared to CRS. Coming to increasing returns to scale and decreasing returns to scale, when the increase in the proportion of outputs is greater than that of increase in the proportion of inputs it is the former and when it's less it's the latter. None of the countries have decreasing returns to scale which is a positive sign. India can be seen as inefficient in solar energy production. With the National Solar Mission, the hope is that there is an expansion of solar energy and improvement in efficiency.

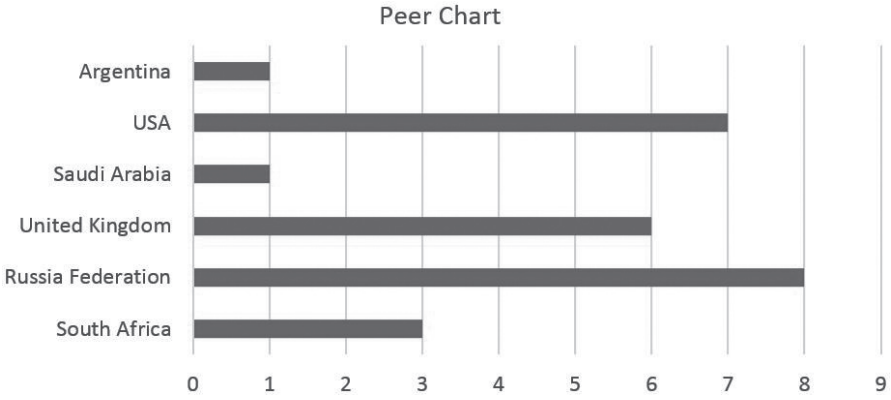

Fig. 4: Peer Chart for Model 2
Source: Created by the author.

Figure 4 in Model 2, recommends the Russian Federation the greatest number of times to other countries to reach or improve their efficiency. This is by the US and then the United Kingdom. The results for both the models also have slack given, which depicts the discrepancies in the inputs and outputs. The slack arises when there is a difference between the considered inputs and outputs, vis-á-vis, the actual level of inputs and output that are required. Targets are also obtained through the results, which show what the ideal inputs and outputs target should be to achieve efficiency. The data for the two-mentioned results has been attached in the appendices for reference.

Comparing both the models, the major difference that stands out is that in terms of both CRS and VRS efficiency, in the first model six countries including South Africa, Japan, the EU, Saudi Arabia, the US, and Brazil were efficient, whereas in the second model along with these countries China was also efficient. The latter model also talks about efficiency in consideration

of the environment. Coming to the VRS efficient, apart from the seven countries mentioned earlier, four countries were efficient as compared to only three in Model 1. These include Argentina, the Russian Federation, the United Kingdom, and Germany. In the former model, Germany was close to efficient but not efficient. It can be observed from the used data set that Germany was amongst the top five in reduced carbon emissions, which was an output included in the later model. This output helped Germany to move from inefficient to efficient score.

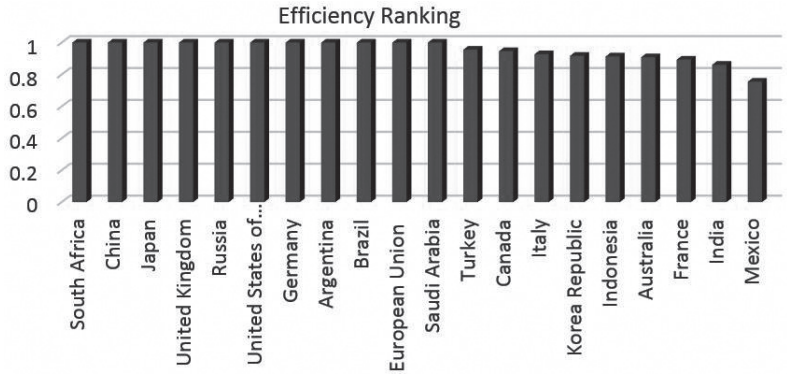

Fig. 5: Rankings
Source: Created by the author.

Coming to where India stands in the efficiency ranking, in both the models, it is inefficient. In the first model, it had a score of 0.770 or 77 per cent efficiency, whereas in the second extended model it has an improve score of 0.861 or 86 per cent efficiency roughly. It also shows increasing returns to scale. India had an improved performance in terms of the environment, i.e. the reduction in carbon emissions. According to the report of the Vasudha Foundation, 2017 there has been a close to four-fold increase in installed capacity of solar since 2014 (where the installed capacity was 2.65 GW). This has helped the country reduce its emissions. In the second model, the reduced emission came into the picture and hence, the country had an improved score. With the increase in the installed capacity (input), there is also an increase in reduced carbon emissions (output), which explains the increasing returns to scale.

Amongst the efficient nations, China stands out, as 2016 was the year in which China became the leading solar energy producer of the world. Its production of solar power almost became twice of what it was. With the country accounting for one-third of world carbon dioxide emissions, it started depending heavily on renewable and mainly solar, which led to this result of world solar power leader. China has been working on the

2020 target of 105 GW solar installation of PV. This has led to the usage of sophisticated technology and hence, greater efficiency and reduction in carbon emissions. China's target of 105 GW solar installation was met in 2017, 3 years before the actual target year of 2020.

It is essential to understand what kind of initiatives the countries are taking up to enhance their share in solar power and its efficiency. Germany and the United Kingdom have very minimal sunshine hours as compared to other countries. Despite this drawback, both have managed to be part of the solar power efficiently. The reason behind this is Germany has been having great research and innovation in solar technology ever since the adoption of the Renewable Energy Act in 2000. South Africa had a major initiative that there would be around 2300 GWh consumption of solar power by 2013. This target of the government played a major role in the development of solar energy in the country which led to a substantial reduction in carbon emissions (World Energy Council, n.d.).

Brazil, Russian Federation, Argentina, and Saudi Arabia are a smaller player in the solar power scene as compared to others in the G20 nations. This has nothing to do with their performance in solar energy. All four countries have achieved efficiency even in terms of the environment. Brazil in the past has faced severe opposition in solar power from big monopolies of conventional energy sources but has managed to pave its way in solar with coming together of ABSOLAR (The Brazilian Association for Solar Photovoltaic) in 2013. Saudi Arabia, with its ambitious target of generating 10 per cent of overall power from solar in the country by 2023 has had a great deal of investments in solar energy and with its efficiency, it's likely to meet its targets.

According to a Bloomberg report,2016 the coldest country is venturing into solar. Hevel, a Russia-based company, has been able to use a particular solar module that is deemed to be the most efficient technology in the world. Panasonic of Japan and the US Sun Power are the only other two counterparts for this Hevel solar technology. This has put Russia in an active space for solar energy expansion in the country. In the PV space, Japan is a world leader in the production of modules. Its mission of increased tapping of renewable energy and establishing the largest floating solar power plant puts Japan in the forefront of things. This has led to increased deployment of solar units in the country with the most efficient technology.

The European Union agenda of low carbon economy has boosted the usage of renewables, especially solar. This has led to increased generation capacity across the EU nations. The US has been one of the most active members of the G20 and the world in making a shift to renewables. Its

greater emphasis on solar due to viability has put the US in the forefront from the very beginning. With great innovation in solar technology, it has been able to achieve efficiency. According to the Office of Energy Efficiency and Renewable Energy deployment of solar power is on a constant rise in the nation due to a multitude of benefits including job creation and reduced carbon emissions.

India is in the process of completion of the National Solar Mission. With heavy installation to meet at the end of the mission, one thing that has hindered India's efficiency in solar is the quality of the plants which can be indicated using plant load factor. Investment Information and Credit Rating Agency (ICRA) in one of its reports pertaining to solar energy in India has stated that across the sample, it undertook amongst the solar plants, more than half of the sample was at a 21 per cent of Plant Load Factor. Around 20 per cent had a plant load factor of above 23 per cent. The plant load factor is an indicator of actual output, vis-a-vis, the total output capacity. The Capital Utilization Factor, which measures the ratio of output to the actual output that could have been produced is of an average of 14. 89 per cent (Ministry of New and Renewable Energy). The earlier-mentioned figures are a testament to the poor performance of the plants. According to IRENA, India is in the world's top five investors for solar energy and related technology, but with the increase in investments and many players entering the market, the quality is of concern which could be a plausible reason behind inefficiency. PI Berlin an research institute in association with the Ministry of New and Renewable Energy took a study of few solar plants in India to analyze the technology and in its report stated that in the sample they reviewed the technology was not up to mark and they do not hold many certification requirements which the government needs to introduce. There are also problems in the wiring and handling of equipment which causes further losses. With Make in India Campaign, India which initially imported the technology majorly from China has started manufacturing solar technology in India with outdated equipment.

Conclusion

This study aims to check the efficiency of G20 in the solar power sector using DEA. The study initially takes a model with two inputs and output including installed capacity and average sunshine hours for the former and electricity generated as the latter. This model is extended to include reduced carbon emissions as an output apart from the earlier mentioned. The extended model helps in understanding the efficiency in an environmental perspective. Both CRS and VRS models of DEA are used. VRS model shows

that nine countries are working at an efficient level of production in solar power in the first model. In the second model, after taking the environmental output eleven countries can be seen functioning at an efficient level. India is not efficient in either model but has a better efficiency score in the second model. It could be correlated that all those countries that were efficient had taken initiatives at the country level which resulted in their efficiency.

Future Recommendations

The study was pertaining to efficiency of solar energy in G20 nations. The study was secondary in nature which led to limited availability of data pertaining to certain variables. The study can be extended to other nations around the world by adding on variables (depending on the availability of data) along with extending the number of years of the study. Further extensions to the study could also be in the individual level solar efficiency such as rooftop solar as its gaining importance in the current world scenario. With increasing sources and harnessing of various forms of renewable energy, this form of study in the future could be applied to the other sources of renewable energy. The results obtained in this study could be further analyzed by other studies to understand the causes of inefficiencies.

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APPENDICES

Table A1: Summary: Model 1

Summary of Output Slacks		Summary of Input Slacks		
Firm Output: 1		*Firm Input:*		
			1	*2*
1	0.000	1	0.000	0.000
2	0.000	2	0.000	0.000
3	0.000	3	0.000	0.000
4	0.000	4	0.000	0.000
5	0.000	5	0.000	0.000
6	0.000	6	0.000	0.000
7	0.000	7	0.000	0.000
8	0.000	8	0.000	0.000
9	0.000	9	0.000	0.000
10	0.000	10	2.152	0.000
11	0.000	11	0.000	0.000
12	0.000	12	0.000	0.000
13	0.000	13	0.000	0.000
14	0.000	14	0.000	0.000
15	0.000	15	0.000	0.000
16	14.751	16	0.000	0.000
17	0.000	17	0.000	0.000
18	0.000	18	0.000	0.000
19	0.000	19	0.000	0.000
20	0.000	20	0.000	0.000

Table A2: Target Summary: Model 1

	Summary of Output Targets	Summary of Input Targets		
Firm Output: 1		*Firm Input:*		
			1	*2*
1	3,341.000	1	2.170	2,842.260
2	67,874.000	2	61.307	1,826.220

3	9,790.000	3	7.426	2,014.061
4	73.000	4	0.041	2,456.332
5	50,952.000	5	42.000	1,831.850
6	5,123.000	6	4.046	1,945.702
7	79.000	7	0.080	1,924.500
8	1,046.000	8	0.793	1,936.469
9	8,160.000	9	6.533	1,941.909
10	38,098.000	10	37.027	1,537.527
11	22,117.000	11	17.879	1,938.034
12	10,421.000	12	11.900	1,348.000
13	1,11,329.000	13	103.510	2,039.000
14	129.000	14	0.070	3,236.500
15	3,031.000	15	2.515	1,917.710
16	266.751	16	0.295	1,914.034
17	50,334.000	17	34.860	2,931.690
18	6,209.000	18	4.224	2,528.717
19	15.000	19	0.010	1,997.880
20	139.000	20	0.080	2,270.000

Table A3: Summary: Model 2

Summary of Output Slacks			Summary of Input Slacks		
Firm Output:			*Firm Input:*		
	1	*2*		*1*	*2*
1	0.000	0.000	1	0.000	0.000
2	0.000	0.000	2	0.000	0.000
3	2,200.428	0.000	3	0.000	0.000
4	0.000	0.000	4	0.000	531.020
5	0.000	0.000	5	0.000	0.000
6	374.019	0.000	6	0.000	0.000
7	0.000	0.000	7	0.000	0.000
8	0.000	0.108	8	0.000	0.000
9	18.241	0.000	9	0.000	0.000
10	0.000	0.000	10	0.000	0.000
11	0.000	2.951	11	0.000	0.000
12	0.000	0.000	12	0.000	0.000
13	0.000	0.000	13	0.000	0.000
14	0.000	0.000	14	0.000	0.000
15	0.000	0.135	15	0.000	0.000
16	14.751	0.038	16	0.000	0.000

17	0.000	0.000	17	0.000	0.000
18	92.340	0.000	18	0.000	0.000
19	0.000	0.000	19	0.000	0.000
20	0.000	0.000	20	0.000	0.000

Table A4: Target Summary: Model 2

Summary of Output Targets			Summary of Input Targets		
Firm Output:			*Firm Input:*		
	1	*2*		*1*	*2*
1	3,341.000	3.200	1	2.170	2,842.260
2	67,874.000	64.000	2	77.570	2,310.670
3	11,990.428	8.970	3	8.306	2,252.804
4	73.000	0.060	4	0.046	2,185.680
5	50,952.000	35.020	5	42.000	1,831.850
6	5,497.019	4.060	6	4.125	1,983.498
7	79.000	0.040	7	0.080	1,924.500
8	1,046.000	0.758	8	0.793	1,936.469
9	8,178.241	6.040	9	6.538	1,943.498
10	38,098.000	32.460	10	40.720	1,598.000
11	22,117.000	16.361	11	17.879	1,938.034
12	10,421.000	7.620	12	11.900	1,348.000
13	1,11,329.000	20.260	13	103.510	2,039.000
14	129.000	0.080	14	0.070	3,236.500
15	3,031.000	2.225	15	2.515	1,917.710
16	266.751	0.178	16	0.295	1,914.034
17	50,334.000	37.390	17	34.860	2,931.690
18	6,301.340	5.110	18	4.285	2,565.395
19	15.000	0.010	19	0.010	1,997.880
20	139.000	0.080	20	0.080	2,270.000

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Financial Challenges and Solutions in Indian Renewable Energy Projects

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Abstract

India is emerging as the growing economy in the world which is witnessed in the past with development in Infrastructure, manufacturing activities, ease of doing business and improved policy framework. According to the International Monetary Fund's (IMF), World Economic Outlook, Indian economy will grow by 5.8 per cent in FY 20 and expected to grow by 6.5 per cent in FY 21. However, the growth is expected to gain momentum with revival in urban and rural demand. Poised to achieve growth, the country's major demand lies in the energy sector due to increasing urbanisation, digitisation, and mobilisation. In 2015-2016, India's per capita energy consumption stood at 1075 kWh (NITI Aayog, 2017) which is much below the world average of 3127 kWh per capital (IEA Statistics, OECD/IEA, 2014). This justifies the reason for more than 300 million Indians not having access to electricity. Demand for energy is expected to rise in the future as increased industrialisation, urbanisation, and government programmes such as Make in India, Rural Electrification, Housing For All, and major infrastructural developments, are all foreseen to put a reckless demand on energy consumption. In addition to this, there is tremendous pressure on the Indian government to increase the share of non-fossil fuel in energy generation. This is because India has ratified the Paris Agreement for reducing Greenhouse Gas (GHG) emissions to the range of 33 per cent to 35 per cent. This would increase the use of a clean source of renewable energy in cumulative power generation to 40 per cent by 2030 (Climate Action Tracker, India, (n.d)). Thus, to keep the emission under the permitted level and providing a contribution to reducing emission, India is continuously focusing on the energy sector. India has set its renewable energy target to 175 GW by 2022 (Solar-100GW, Wind-60 GW, Hydro-5GW, and Bioenergy-10GW) (NITI Ayog, 2015). According to Nishtha and Sarita (2018), the renewable energy target has been revised by the government setting the new target to 227.62 GW by 2022 (Solar-113.49 GW, Wind-66.65GW, Floating Solar and Offshore Wind-31 GW, Small Hydro-5.98 GW, BioMass-10.5GW). However, unlike the ambitious targets set by the government, 2019 has seen a slowdown for renewable capacity addition and a lower number of developers winning auctions because of low energy tariffs in competitive bidding.

This leaves project developers with the only option of squeezing profit margins and due to decreased margin, investors, lenders, and banks put questions on the long-term viability of such projects. In addition, renewable energy projects in India have a high cost of debt as compared to similar projects in Europe and the US, which poses a major obstacle in initial phase of project implementation. The cancellation of such project auctions due to the unavailability of competitive bidders with the lowest tariff put pressure on developers. Further, changing import policies put projects on hold and slows down capacity addition. Although the government has ambition to go beyond 175 GW of target and reach 227 GW by 2022, ecosystems of renewable energy in India have several constraints in achieving this

target. These constraints are particularly due to several issues in the financing of long-term projects, which stands as a major area of concern. Therefore, this paper aims to analyze financial challenges and risks associated with renewable energy projects in India and the solutions for dealing with them. Subsequently, as it is considered imperative to analyze how investments can be increased in such a challenging environment.

This paper will further analyze the challenging environment of new investments in the renewable energy sector. In addition, the paper discusses the various ways to increase investment in achieving the ambitious target of 175 GW.

Keywords: *Renewable energy, Financial challenges, Risk in renewable energy, Capital cost, Financing mechanism.*

Introduction

The Indian government is focusing on energy conservation and the sustainability of Indian Industries. The government has also taken many steps to reduce the intensity of Greenhouse gas emission (GHG) and stabilised structured monitoring system for tracking the progress of sustainability. An initiative towards achieving this target, India has already signed the Intended Nationally Determined Contribution (INDC) Paris Agreement which includes the following (Climate Action Tracker, India, (n.d)):

- To reduce the emissions intensity of the gross domestic product (GDP) by 33 per cent to 35 per cent by 2030 below 2005 levels;
- To increase the share of non-fossil-based energy resources to 40 per cent of installed electric power capacity by 2030, with help of the transfer of technology and low-cost international finance including from Green Climate Fund (GCF);
- To create an additional (cumulative) carbon sink of 2.5–3 GtCO2e through additional forest and tree cover by 2030.

As shown in Table 1, the total installed electricity capacity in India is 367.28 GW as on 30 December 2019 and the share of renewable energy is 84.4 GW (Ministry of Power, 2019). It is represented in Figure 1 that 62.62 per cent of the energy is dependent on fossil fuel, 12.40 per cent on hydro, 1.88 per cent on nuclear, and 23.1 per cent on renewable energy. It is evident that India depends on fossil fuel to meet its energy demand; however, the country lack sufficient reserve to meet demands. India imports increased to 72 per cent from the fiscal years 2004-05 and currently imports 80 per cent of its oil which is expected to increase four to five times by 2030. Coal import is expected to get doubled from 16 per cent to the estimated 30 per cent by 2030. To comply with the Paris Agreement and contributing

to a reduction in GHG, the government is increasing its share of renewable energy in total energy generation.

Table 1: Installed Capacity as on 30 December 2019

Fuel	*Installed Capacity (MW)*
Total Thermal	230,701
Coal	198,495
Lignite	6,760
Gas	24,937
Diesel	510
Hydro (Renewable)	45,399
Nuclear	6,780
Renewables (RES)* (MNRE)	84,400
Total	367,281

Note: * Installed capacity in respect of RES (MNRE) as on 30 November 2019.
Source: Government of India Ministry of Power, *Power Sector at a Glance ALL INDIA* (2019).

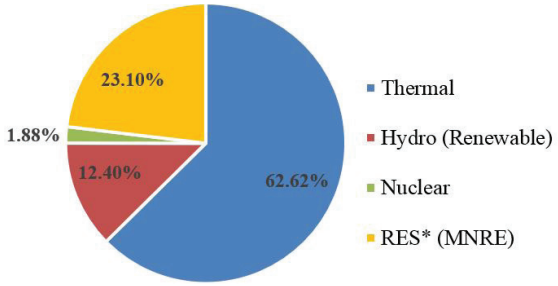

Fig. 1: Sources of Energy
Source: Ministry of Power, power sector at a glance ALL INDIA as on 30 December 2019.

India's Slowdown in Renewable Energy Capacity Addition

The Indian government has shown ambition to reach from 175 GW to 227 GW by 2022 as represented in Table 2, but it seems difficult to achieve

Table 2: Revised Renewal Energy Target

Timeline	*Wind*	*Solar*	*Small Hydro*	*BioMass*	*Floating Solar and Offshore Wind*
Commissioned/Pipeline	46.65	49.49	4.98	9.50	0.00
FY 2019	10.00	34.00	0.50	0.50	16.00
FY 2020	10.00	30.00	0.50	0.50	15.00
Total by 2022	66.65	113.49	5.98	10.50	31.00

Source: Nishtha and Saluja (2018).

the target in the current scenario (Nishtha and Sarita, 2018). To reach the ambitious target of 227 GW by 2022, it is required to achieve the early target capacity addition but the government is witnessing slowdowns in various sectors as discussed later.

Wind Capacity Addition Slowdown

As on FY 2020 (Till Jan 2020), India has installed cumulative wind capacity of 37.61 GW and required to add 22.39 GW of capacity to reach the target of 60 GW of cumulative wind power by 2022 as represented in Figure 2 (MNRE 2020, and *Livemint, 2018*).

India has revised the target based on optimistic scenario to reach 66.65 GW by FY 22 but if continues slowdown in capacity addition is observed then it would be difficult to even achieve earlier officially notified target of 60 GW by FY 22. As illustrated in Figure 3, in last three-years FY 18 to

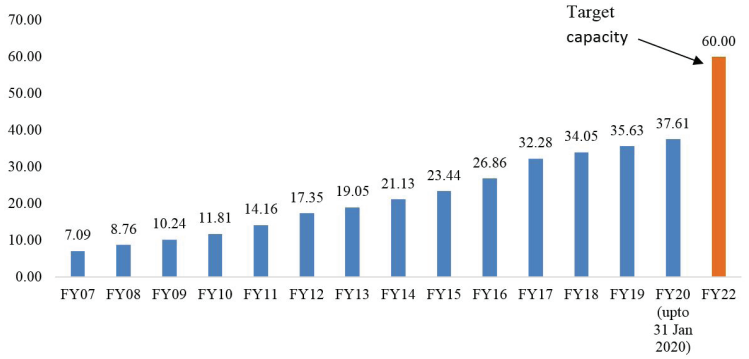

Fig. 2: Wind Cumulative Installed Capacity (GW) as on Jan 31, 2019
Source: Ministry of New and Renewable Energy (MNRE), 2015-2020 and Livemint, 2018.

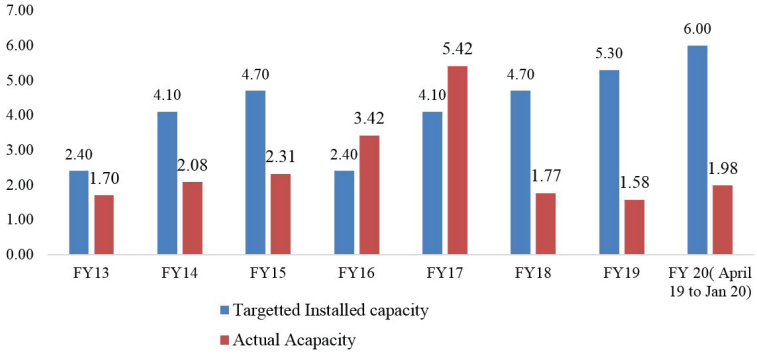

Fig. 3: Wind Energy Target vs Actual Capacity Addition (GW)
Source: Ministry of New and Renewable Energy, 2015-2020 and Tanya Thomas, Livemint, 2018.

FY 2020 (Till Jan 2020) capacity addition deficit is observed as installed capacity is behind the targeted capacity.

If by the end of fiscal year FY 20, India reaches the cumulative capacity of 38 GW, then in next two-years (FY 21 and FY 22), it would be required to add 22 GW, which means 2.75 GW of addition per quarter (from FY21 to FY 22) to reach 60 GW by FY 22.

In best possible scenario with support of the government policy, financing mechanism, equity inflow and keeping the pace of adding 2.75 GW of per quarter, India would be able to achieve 60 GW of target.

Solar Capacity Addition Slowdown

In FY 2020 (Till Jan 2020), India's cumulative solar installed capacity reached 34.04 GW and required to add 65.96 GW by FY 22 as represented in Figure 4 (MNRE 2020,Thomas, 2018). The Indian Government

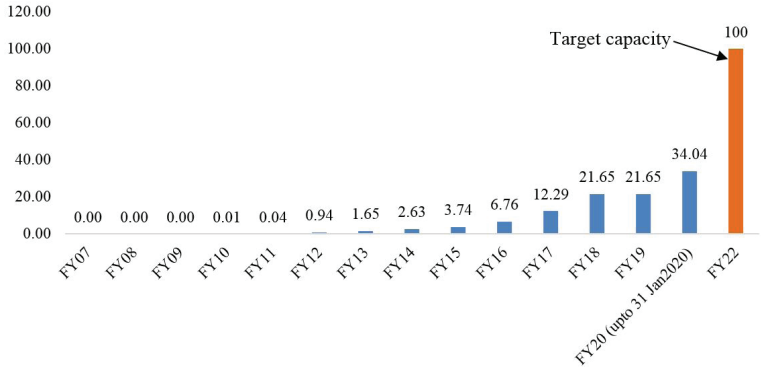

Fig. 4: Solar Energy: Cumulative Installed Capacity (GW) as on Jan 31, 2019
Source: Ministry of New and Renewable Energy (MNRE), 2015-2019 and Livemint, 2018.

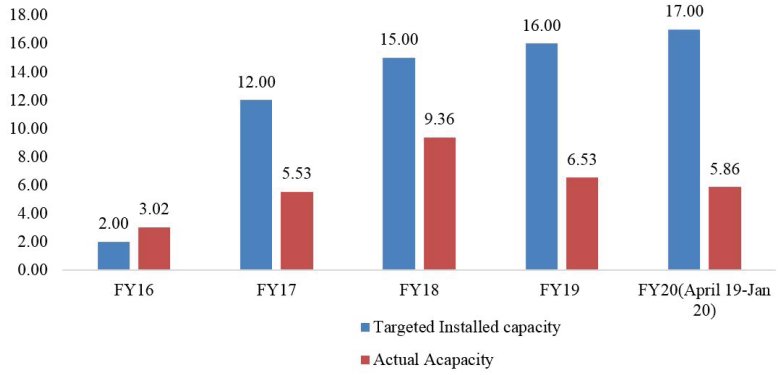

Fig. 5: Solar Energy: Target Vs Actual Capacity Addition (GW)
Source: Ministry of New and Renewable Energy, 2015 and Livemint, 2018.

is optimistic for going beyond officially notified target of 100 GW and announced that Solar capacity will reach to 113.49 GW. By observation of last five years capacity addition trends it seems India many not achieve even 100 GW of target by FY 22. From FY17 to FY19, actual capacity installed is less compared to targeted capacity and in FY 20 also, deficit is predicted because India has installed 5.86 GW in April 2019 to Jan 2020 against target of 17 GW for FY 20 fiscal year as shown in Figure 5 (Ministry of New and Renewable Energy, n.d). If India adds 0.96 GW of capacity in remaining two months (Feb 2020 and March 2020) of FY 20 then addition of 65 GW will be required to achieve target of 100 GW by FY 22. It will be required to add approximately 8.13 GW of capacity per quarter in eight coming quarter (from FY 2021-22) which may not be possible in current scenario.

Financial Challenges and Risk Associated with the Indian Renewable Energy Sector

One of the key challenges in the renewable energy sector is securing finances for the development of projects and in particular renewable energy projects which are capital intensive and hence securing finance become utmost important for the execution of the project (Nishtha and Sarita, 2018). Various financial challenges in the execution of such projects are highlighted in Figure 6.

Fig. 6: Key Challenges in Renewable Energy Financing
Source: Created by the author.

Domestic Currency Depreciation (Fluctuation in Values of Dollar vs Rupee)

Depreciation in domestic currency, i.e. rupee, directly impact renewable energy cost as initial technology-related capital cost payments in renewable energy projects are made mostly in dollars. Any fall in rupee against foreign currency, make the capital cost high for developers and decrease investor's margin. Investor margin decreases as there is no option for increasing renewable energy tariff beyond certain level because of competitive reverse auctioning and developers are left with the option of squeezing return on

investment. The Indian rupee has reached a record low level of Rs 72 vs dollar and fallen 13 per cent against the dollar in 2018 as represented in Figure 7 (FE Online, 2018). Reuter poll of 40 foreign exchange analysts opined that the value of rupee will continue to hover around 70 in the coming years. Depreciation in rupee directly impacts tariff according to the analysis of India rating, 'A Re 1 increase in Rupee-Dollar exchange rate leads to a 2 paisa per unit increase in tariff.' (*Financial Express* report, September 2018). For instance, in the solar energy case, if the rupee depreciates during bidding time then the developer's project duration gets extended by a few months to finalise payment term of the solar module. Currency risk is most prevalent in renewable energy projects especially in the solar energy sector, where most of the payments are made in foreign currency

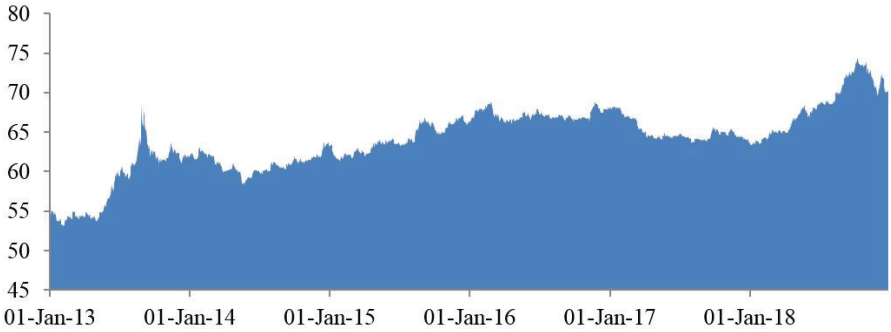

Fig. 7: Rupee vs Dollar from January 2013 to January 2018
Source: Investing.com, USD/INR – US Dollar Indian Rupee (1 January 2013 to 1 January 2018).

Uncertain Policy on Import Duty

The Indian government has an ambitious target of renewable energy along with Make in India move in renewable energy technology. There are very few solar panel manufacturers in India and their domestic consumption is low because Indian solar developers import more than 80 per cent of its solar panels from China and other countries. In July 2018, the government imposed 25 per cent safeguard duty on the import of solar panels from China, Malaysia, and other developed countries for a period of 2 years (Chatterjee, 2018). The duty is proposed to be 20 per cent in January 2020 and 15 per cent in subsequent months (Financial Express report, December 2018). The Ministry of Commerce and Industry has withdrawn the safeguards duty on solar cell and solar module in August 2018, by the order of the court to put a stay on the import duty on solar modules and cell. Table 3 represents import of solar modules in 2017-18, which reached to the US $

Table 3: Import of Solar Module (in US $ Million) from 2012-13 to 2018-19 (April to September)

Country	*2012-13*	*2013-14*	*2014-15*	*2015-16*	*2016-17*	*2017-18*	*2018-19 (April to September)*
China PR	389.43	596.73	603.34	1960.26	2,817.34	3,418.96	839.80
Malaysia	69.98	21.05	83.25	189.27	210.35	179.55	12.37
Taiwan	60.40	34.97	36.12	44.74	58.86	122.44	59.22
Other	307.26	58.37	98.24	150.28	109.95	116.61	126.91
Total Module	827.07	711.12	820.95	2,344.55	3,196.50	3,837.56	1,038.30
India Total Import	4,90,736.65	4,50,199.79	4,48,033.41	3,81,007.76	3,84,357.03	4,65,580.99	2,59,579.40

Source: Ministry of Commerce and Industry; Department of Commerce (n.d.).

Table 4: Import of Solar Module From 2012-13 to 2018-19 (April to September)

Country	*2012-13*	*2013-14*	*2014-15*	*2015-16*	*2016-17*	*2017-18*	*2018-19 (April to September)*
China PR	47.09%	83.91%	73.49%	83.61%	88.14%	89.09%	80.88%
Malaysia	8.46%	2.96%	10.14%	8.07%	6.58%	4.68%	1.19%
Taiwan	7.30%	4.92%	4.40%	1.91%	1.84%	3.19%	5.70%
Other	37.15%	8.21%	11.97%	6.41%	3.44%	3.04%	12.22%

Source: Ministry of Commerce and Industry; Department of Commerce (n.d.).

3,837.56 million from the US $ 711.12 million, in FY 2012-13. China is the biggest exporter of solar modules to India followed by Malaysia, Taiwan, and others. India imports more than 80 per cent of the solar module which is a major cost component in solar energy project deployment and solar energy tariff is affected by an increase in safeguard duty on import of solar modules (Table 4). The project implementation period is adversely affected by an increase in import duty leading to increased capital cost and energy tariff.

Distribution Companies Financial Health and Approach Towards Renewable Energy

Renewable energy projects suffer due to DISCOMs' approach towards timely payment settlements as state-owned DISCOMs suffer from loss, high debt, and lower credit ratings that affect renewable energy projects directly. According to the report of performance to state utility for 2013-14 to 2015-16, for 45 state-owned DISCOMs, 20 DISCOMs have payable days of 2-3 months and 8 DISCOMs have payable days of more than 4 months, and only 12 DISCOMs have payable days of 1-2 months (Figure 8). According to the Ministry of Power Report (July 2018), any delay in payments lead to higher tariffs, as the project needs sufficient margin for delayed payment by DISCOMs. The robust timely payment mechanism

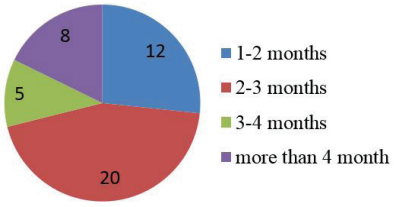

Fig. 8: Payable Days of DISCOMs
Source: The Ministry of Power Report (2018), *State Distribution Utilities Sixth Annual Integrated Rating.*

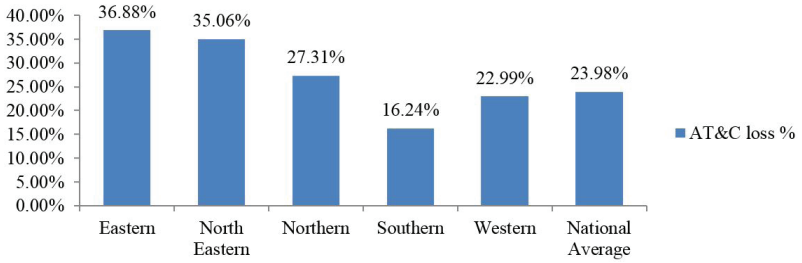

Fig. 9: Aggregate Transmission and Commercial Losses by DISCOMs
Source: The Ministry of Power Report (2018), *State Distribution Utilities Sixth Annual Integrated Rating.*

is required for the developers to increase profit margin, which has shrunk nowadays. Aggregate technical and commercial (AT&C) losses are also one of the reasons for lower operational inefficiency of DISCOMs. Average AT&C losses of all states are around 27 per cent in the FY 2015-16. As illustrated in Figure 9, Eastern and northern states have high AT&C losses, which are above 27 per cent (Ministry of Power Report, Uday States, n.d). To improve the financial health of DISCOMs, the government has started Ujwal DISCOM Assurance Yojana (UDAY) scheme for a reduction in AT&C losses.

As shown in Figure 10, aggregate book losses of utilities increased in the FY 2015-16 to Rs 89,603 crore, compared to 66,022 crore in the FY 2014-15. Loss on subsidy received basis increased to 34.49 per cent in the FY 2015-16 (The Ministry of Power Report, July 2018). Loss on an accrual basis as a percentage of revenue stands at 21 in the FY 2015-16 (Figure 10). The government has launched the UDAY scheme for the revival of the financial health of DISCOMs so that they can provide electricity at an affordable rate. This Scheme is optional for states, under it, the state can take 75 per cent of their respective DISCOMs debt by issuing the sovereign bond and the remaining 25 per cent of debt will be issued by DISCOM in the form of bond. As of now, 32 states/union territories are covered in this Scheme but state utilities still have infrastructure-related issues to overcome losses (Ministry of Power, Government of India, Uday States, n.d).

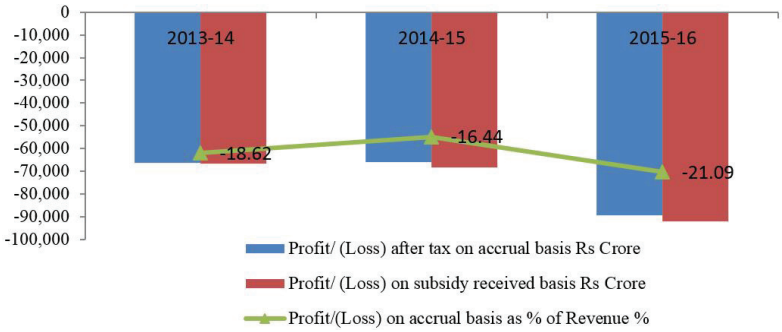

Fig. 10: Losses Incurred by DISCOMs (Rs Cr)
Source: Ministry of Power, State Distribution Utilities Sixth Annual Integrated Rang, July 2018.

Delay in Signing, Renegotiations, and Cancellation of Purchase Power Agreement

Delay in signing, renegotiation and the cancellation of the Purchase Power Agreement (PPA) affect renewable energy developers severally and decrease the interest of investors in such projects. In the past, cases of renegotiation

and cancellation of renewable projects were observed in states like Andhra Pradesh, Uttar Pradesh (UP), and Karnataka. In 2017, UP New and Renewable Energy Development Agency approached developers to reduce the tariff of 215 MW projects, which was negotiated 2 years back. The Company claimed that the state electricity regulator did not approve the procurement of power per unit Rs 7.02 to 8.60, though at the time of the bidding benchmark tariff agreement was 9.33 Rs/unit (Mukul, 2017).

Similar cases of renegotiation occurred in Andhra Pradesh where distribution companies wanted to bring down tariffs of earlier closed PPA which was signed at Rs 4.76 and 4.78 Rs/unit after lower tariff emerged out of Solar Energy Corporation of India (SECI) bid for 1,000 MW. Though the risk is most prevalent in older projects compared to new projects, it could deter the confidence of international and domestic investors.

High Cost of Financing

Most of the renewable energy projects are financed by commercial banks and Non-banking Financial Companies (NBFC). Table 5 represents active banks and NBFCs in the renewable sector. The Indian Renewable Energy Development Agency (IREDA) Limited and Power Finance Companies (PFC) are major government-backed NBFCs. India's total debt investment in 2016-17 is mainly by commercial banks. In 2016-17, the one-year marginal cost of fund-based lending rate (MCLR) in India varied from 8.15 per cent to 9.5 per cent and interest rate on renewable energy is considered 300 basis points above the MCLR. Therefore, the interest rate on the term loan is in the range of 11.15 per cent to 12.5 per cent compared to NBFCs, which provide loans between interest ranges of 9.5 per cent and 11.5 per cent (World Institute of Sustainable Energy, 2017).

Table 5: Existing Financial Institutions in Renewable Energy

Government-backed NBFC	*Private NBFCs*	*Public Sector Bank*	*Private Sector Bank*
IREDA	L&T Infrastructure	State Bank of India	ICICI Bank
Power Finance Corporation	Tata Capital	Canara Bank	Axis Bank
Power Trading Corporation	–	Central Bank of India	HDFC Bank
Rural Electrification Corporation	–	Punjab National Bank	Standard Chartered Bank
India Infrastructure Finance Co. Ltd	–	Andhra Bank	Yes Bank

Source: World Institute of Sustainable Energy, 2017.

The high cost of debt increases the overall cost of renewable energy projects as well as a tariff. According to the comparative study represented in Figure 11 of the Indian solar PV and onshore wind with the US shows that Indian renewable energy cost is 22 per cent to 28 per cent higher due to high financing cost (Shrimali, 2018). Debt cost is the main part of high financing cost, which contributes to 24 per cent to 32 per cent in financing cost.

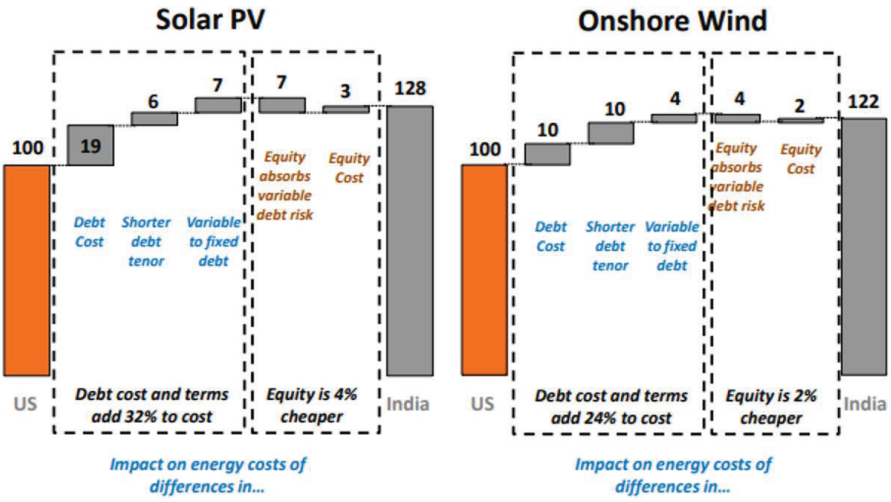

Fig. 11: Comparison of US and Indian Financing Costs for Renewable
Source: Gireesh Shrimali, Climate Policy Initiative, 2018.

Low Availability of Debt

Figure 12 represents three key reasons of projects for not getting financial support (debt financing) from Banks. Investment in renewable energy projects required long-term financing for the development of renewable energy projects. This tenure is approximately 10 years but banks provide short tenure debts due to which payment terms mismatch the cash flow. To fulfill the payment obligation developers were left with the option of re-financing the debt, which increases the capital cost. Banks account the renewable energy projects under the power sector umbrella and previous experience of extending the credits to many thermal power projects has cautioned the banks to finance such sectors. Banks have limited their exposure to the power sector and it is observed in the past that new developers face difficulty in securing finance from banks without any previous long-term relationship with banks. Large developers, who already have a previous association with bank secures finances easily compared to new developers. Technology in the renewable sector in India is in the nascent state but boomed in the

past few years and banks are still not familiar with government policies, support mechanisms by the government to the renewable energy sector. Unavailability of partial or full guarantee to the bank is also one of the barriers in financing renewable energy projects. Off-grid power projects face additional difficulty in securing finances as these projects are small and hence, could not satisfy minimum size financing under corporate financing criteria of banks.

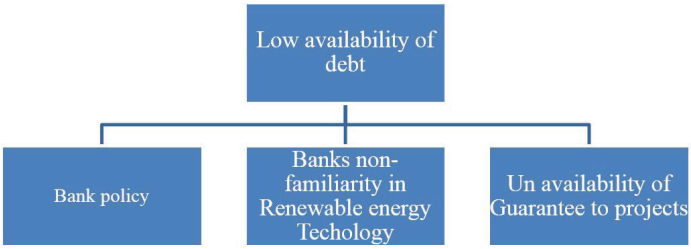

Fig. 12: Causes of Low Availability of Debt
Source: Created by the author.

Lack of Equity Financing

In the previous few years, it has been observed that source of equity financing in India is majorly Private Equity and Venture Capital. It is estimated that in the FY 2016-17, total debt financing in India was Rs 7,11,533 million and equity financing was Rs 3,04,943 million which represents 70 per cent debt and 30 per cent equity (World Institute of Sustainable Energy, Renewable India 2017). Equity finance cost is also high in India because the hurdle rate is between 16 per cent and 20 per cent which is in the range of 10 per cent to 15 per cent for a similar project in the US and Europe (Resurgent India, 2015). Raising debt also depends on how the equity is financed, if companies have difficulty in securing equity part then banks are hesitant in providing debt and also debt costs are high. Although the investors are motivated towards clean energy investments, there is a lack of clarity in available exit options. Generally, equity investors try to exit after a few years and invest in some other lucrative avenues but in renewable projects, they struggle to exit because developers are unable to refinance or secure debt. In Indian renewable energy projects, it is important to keep a balance of equity as well as debt investments for procuring desired investments.

Risk to Investor in Financing Renewable Energy Projects

Despite the government's effort towards the deployment of renewable energy in India, investments in this sector are not increasing at the required level to achieve renewable energy targets by 2022. Investors are reluctant

in investing in the Indian renewable energy sector as renewable energy in India is associated with many risks and investor demands premium to risk. However, due to the government focus on providing the lowest tariff, it becomes difficult to provide high risk-adjusted returns in renewable energy projects. Risks are found in all phases of renewable energy projects such as pre-operational, operational, and completion phases and financial risk as detailed in Figure 13.

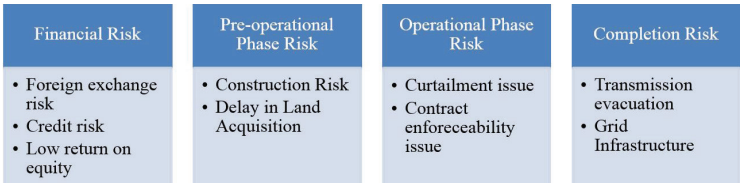

Fig. 13: Types of Risks Involved in the Renewable Energy Sector according to Gireesh Shrimali (2017)

Solution to Financial Challenges in Renewable Energy

For the completion of the target of increasing renewable energy capacity to 40 per cent of the total installed power capacity, a huge amount of investment is required. It was earlier estimated that India would require at least US $125 billion of funds to reach the target of 175 GW in 2022 (Varadhan, 2018). But, after a revised target of reaching 227 GW, it is estimated that India needs the US $50 billion more investment in the renewable sector (Nishtha and Sarita, 2018). Securing the finances and providing liquidity are the main challenges for developers in India and these financing challenges further increased when solar tariff decreased to 2.44 per unit. India had a history of opting traditional financing solution as represented in Table 6 for funding the projects, but in the recent scenario, to fund renewable energy projects, an innovative financing mechanism is required. This is to reduce the cost of debt, as the competitive bidding process reduces the project margin and traditional finances are costly.

Table 6: Traditional Existing Financing Instruments

Debt Instrument	*Equity*
Government-backed NBFCs	Private Equity
Private NBFCS	Venture Capital
External Commercial Borrowing	Development of financial institution
EXIM Bank Finance	Pension funds
Refinance	Sovereign funds
Lease financing	

Source: Created by the author.

Innovative financing mechanism is required which focuses on timely financing, cost0effectiveness, and long-term financing. Financing instruments like investment trust, climate bond, credit guarantee, solar investment trust, etc., are cost effective solutions for funding renewable projects. Developed economies have established dedicated banks (Green Bank) for funding projects, which are beneficial for the environment and contribute to mitigating climate change.

Green Financing Mechanism

A considerable amount of investment is needed to decarbonise the power sector and reach below IEA 2°C scenario. Wind and photovoltaic technologies are increasingly competitive and demand for renewable energy is increasing. Recent renewable technologies have made energy cheaper than the energy obtained by conventional methodology, yet investment of the current scenario is not enough to fully utilise the potential of renewable energy. Increasing investment in renewable energy is associated with many barriers depending on the country profile. In 2017, as shown in Figure 14, global new investment in renewable energy was the US $333 billion, out of which US $132.9 billion was from China, the US $56.9 billion from the United states (Bloomberg New Energy Finance, 2017). India's new investment in the renewable sector stood at the US $11 billion which is 3.3 per cent of global investments. The current inflow of investment in the Indian renewable energy sector is not enough to meet the ambitious target of 175 GW. To overcome the financing barriers many countries have adopted the Green financing route to finance its renewable energy projects. Climate Bond/Green Bond is one of the popular instruments which is

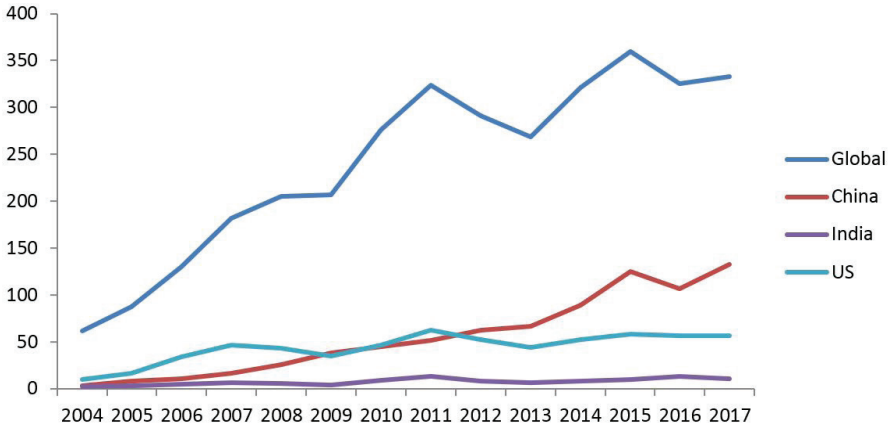

Fig. 14: New Investment in Renewable Energy (US $, Billion)
Source: Bloomberg New Energy Finance (2017).

most soughed by project developers nowadays. Commercial banks are inadequate in providing low-interest rate finances and the required amount of capital for the deployment of such projects. Many developed countries have established dedicated financing banks in the energy sector for funding projects, which are beneficial to the environment and have a social impact by reducing carbon footprint and increasing accessibility to green energy.

Green Bond

Climate finance refers to finance for climate change-related activities. Though the coverage is wide, the United Nations Framework Convention on Climate Change (UNFCCC) standing committee on finance has defined it as:

> Finance aims at reducing emissions and enhancing sinks of greenhouse gases and reducing the vulnerability of, and maintaining and increasing the resilience of, human and ecological systems to negative climate change impacts. (UNFCCC, Climate Finance, 2014)

Green Bond is a dedicated financing instrument under the umbrella of climate finance issued by banks, financial institutions, and governments, proceeds of which entirely go in clean energy and environmentally friendly projects. Green Bond is climate centric bond, mitigating environmental risk and is utilised not only to finance renewable energy but also energy efficiency, water, sanitation, waste management projects which directly impact social life and the environment. In 2017, green bonds were issued in the categories of renewable energy, energy efficiency, clean transport, sustainable water management, sustainable waste management, sustainable

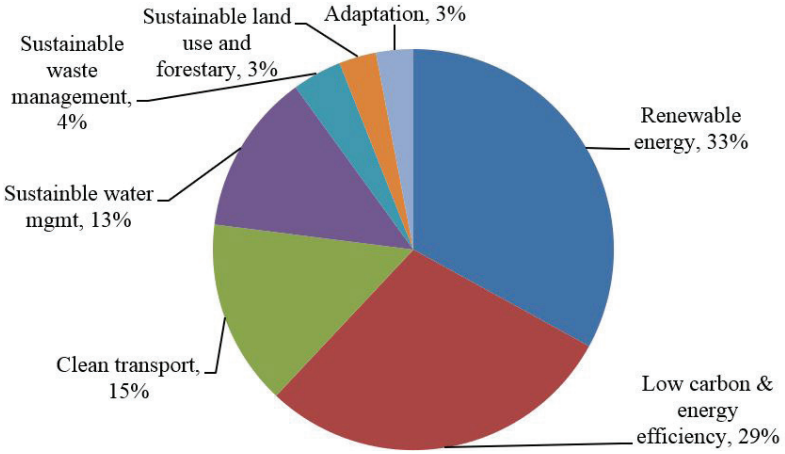

Fig. 15: Percentage Breakup of Climate Bond 2017
Source: Climate Bond Initiative, 2017.

landfill forestry, and adaptation contributing to 33 per cent, 29 per cent, 15 per cent, 13 per cent, 4 per cent, 3 per cent and 3 per cent, respectively in overall Green Bond issued globally (Figure 15; Climate Bond Initiative, 2017). Countries like the USA, China, and France account for 56 per cent of the total 2017 issuance. Fannie Mae, the US agency was on top with the issuance of US $24.3 billion of Green Mortgage-Backed Securities in 2017.

Proceeds to green bonds are mostly in the renewable sector and expected to remain higher compared to other sectors as shown in Figure 16 (Climate Bonds Initiative, 2015 and 2017). However, the percentage contribution of other sectors like, landfill and forestry, waste management, water and sanitation, and energy efficiency is expected to increase further and decreasing the contribution of renewable energy.

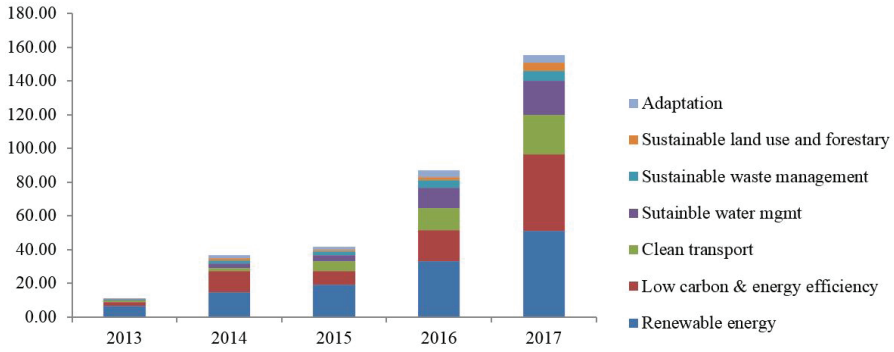

Fig. 16: Contribution (US $ Billions) of different Categories of Climate Bond from 2013 to 2017
Source: Climate Bonds Initiative (2015 and 2017).

Increasing the Issuance of Masala Bond and Bond in Foreign Currency

In 2016-17, seven companies issued green bonds as listed in Table 7 but issuance of Green Bond is still at the nascent phase and it is yet to make space in India and other developing countries. Green Bond is not necessarily to be issued in domestic currency, but it can also be issued in dollars to attract foreign investments. Currency hedging cost is eliminated if bonds are issued in dollars.

To avoid currency risk and hedging costs, a bond issued in domestic currency can be raised overseas. Such bonds are called Masala Bond (not necessarily in the category of Green Bond). Masala bonds are rupee-denominated Bond issued on a foreign platform. Masala name was given by the International Finance Corporation (IFC) to popularise the Indian culture and cuisine on a foreign platform. Issuers of these bonds hedge themselves against currency risk fluctuation and transfer the risk to investors.

The National Thermal Power Corporation (NTPC) issued green masala bonds of Rs 20,000 million in August 2016 on the London Stock Exchange and Singapore Stock Exchange (NTPC Press Release, 2016).

Table 5: Green Bond Issued in India 2017

Issuer	*Amount (US$ Million)*	*Amount (Rs Million)*
Axis Bank	500	33,650
ReNew Power	75	5,000
NTPC	299	20,000
Greenko	500	33,465
Yes Bank	49	3,300
ReNew Power	475	31,872
IREDA	106	7,000
	2004	134287

Source: Climate Bond Initiative, 2017.

Green Bank

Green banks are a financial institution that leverages public and private finance for clean energy projects. Green banks are well-versed with technology, which is beneficial to the environment and reduces investment risk and increases access to finances at a lower cost. Key objectives of establishment of Green Bank is represents in Figure 17 and benefits are shown in Table 8. Worldwide, there are several green banks, which are serving the needs of financing green projects, for example, New York City Energy Efficiency Corporation and Connecticut Green Bank.

Table 8: Benefits of Green Bank

Addresses Knowledge Gaps	• Green bank spread awareness through data associated with similar projects in the past • They can substantiate return profile and viability of the project, which reduces the perceived risk of investors
Generating and Aggregating Demand for Financing	• Financing many small and decentralised project individually involve higher administrative and transaction cost • In such cases, green banks assume borrower risk and based on past experiences of small portfolio guide investors
Addressing Specific Financing Needs	• Green Bank reduces sector-specific gaps example, financing rooftop solar by commercial Banks which are associated with higher interest rate and Green Bank can provide finances at a lower interest rate

Mobilising private capital to meet demand	• Green Banks mitigate the risk of investing in new technologies
Using Public Funds Efficiently	• Green Banks effectively uses public finances in diversified projects to minimize transaction cost and cost of capital

Source: Created by the author

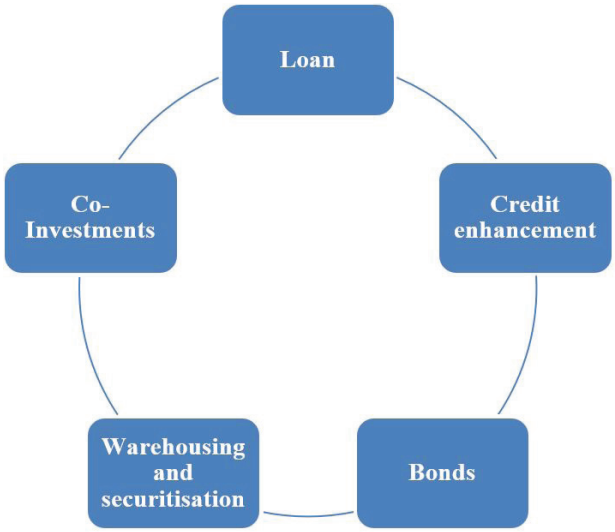

Fig. 17: Key Objectives of Green Bank
Source: New York City Energy Efficiency Corporation (NYCEEC), (n.d)

The New York City Energy Efficiency Corporation (NYCEEC) is a non-profit organisation established in 2010 to help New York City to meet its climate change role and impacting social development. NYCEEC offers loans to building owners and project developers for promoting green projects. Its impact on society is proved by the fact that it has financed the US $142 million for clean energy projects, done 203 building up-gradation, has eliminated 7,69,000 MT of carbon dioxide ($CO_{2)}$ and established 4,984 affordable housing units (NYCEE, n.d).

Connecticut Green Bank

Connecticut Green Bank was the first bank established in the US in July 2011. Bank generated the US $6 private investments for every US $1 of its investment. The Green Bank accelerated the growth of clean energy to nearly 300 MW and a further 4.6 million tons of CO_2 is avoided. Since the inception, Green Bank has mobilised the US $1.3 billion of investment into states out of which 219 million is through Green Bank and 1.1 billion through private investments (Connecticut Green Bank, n.d).

Partial Credit Guarantee Facility

Partial credit facility provides a guarantee of payment in case of lender's default on payment. Under this Scheme, project developers borrow money from financial institution and guarantee the provider, provides payment guarantee for part or full payment in case of default by lender, by charging a fee for its guarantee. Partial credit guarantees increase credit rating of projects and reduce the risk of investments. These are used to encourage lending in projects and the deployment of clean energy projects. These guarantees are provided by the government, government bodies, development banks, and government-backed financial institutions. In India, partial credit guarantee facility is not yet popular. India Infrastructure Finance Company Limited (IIFCL) has a facility for providing partial credit guarantee to enhance credit rating of bonds issued by infrastructure companies. IIFCL takes the credit enhancement of 20 per cent to 50 per cent of the total project cost or total bond issued for a particular project. In September 2015, the first bond issued of Rs 451 crore with enhanced credit rating by IIFCL under partial credit guarantee scheme (IIFCL., n.d).

Infrastructure Investment Trust

An infrastructure investment trust is a route to the de-leverage company's balance sheet and fund projects. Portfolios under this Trust are publicly traded and an investor owns a part of it. The Trust consists of largely completed assets and releases equity to finance infrastructure projects. The infrastructure investment trust route was utilised by Sterlite Power Grid Ventures (SPGVL) to launch IndiGrid to raise Rs 2,500 crore (Prasad, 2016). Crisil rated AAA to IndiGrid fund as it proposed a stable revenue-generating vehicle.

In mid 2019, an infrastructure investment trust started gaining momentum. According to *The Economics Times* news, TATA power is exploring the infrastructure investment trust route to raise equity for financing its 3GW renewable energy portfolio so that it can de-leverage from the balance sheet.

TATA Power is looking to raise Rs 6,000-7,000 crore (the US $750 million-1 billion) of equity from InvIT (Arijit, 2019). The Company will join L&T, Sterlite, Reliance Industries, and Piramal Enterprises for raising equity to finance its operational infrastructure asset.

Canada Pension Plan Investment Board (CPPIB) and Piramal Enterprise are also in the planning phase to set up InvIT to raise the US $600 million to buy operational assets where CPPIB will have a 60 per cent stake and Primal Enterprise will have 15 per cent stake (Indulal, 2019). At the initial

stage, InvIT fund size will be approximately US $600 million where CPPIB and Piramal Enterprise allocation will be US $360 and US $90 million, respectively. (Indulal, 2019)

Solar Investment Trust

Solar Investment Trust is an instrument developed at India Innovative Lab for Green Finance which is a public-private initiative to accelerate innovative investment vehicles in India for green growth. A solar investment trust (SEIT) is a dividend-yielding instrument focused on rooftop solar projects. It targets private finances, high net-worth individual, small and medium-sized enterprises (SME) and corporate for raising fund to mobilise it to commercial rooftop solar developers at the lower capital cost compared to conventional financing route. Cleanmax solar would act as sponsor of the instrument and it is under the planning phase. It addresses the barriers as listed in Figure 18.

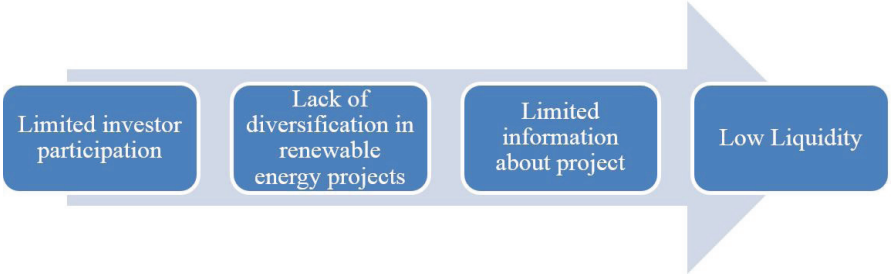

Fig. 18: Barriers Addressed by Solar Investment Trust (SEIT)
Source: Indian Innovation lab for green finance, solar investment trusts, (2017)

Conclusion

The renewable energy sector is an opportunity to meet the energy demand-supply gap, contributing to sustainable development goals (SDG), environmental and climate objectives. Although, the government is focused on reducing carbon footprint in the energy sector through policies, regulations, and providing support to renewable energy project developers, still, securing finances at the early stage of the project is challenging. The solar tariff has reached to record low of Rs 2.44 per unit in 3GW auction of Interstate Transmission System (ISTS) connected solar photovoltaic (PV), which was conducted by Solar Energy Corporation of India, where a solar company ACME emerged as the lowest bidder. Wind energy has also reached to the lowest tariff of Rs 2.43 per unit in 500 MW auction of Gujarat Urja Vikas Nigam Ltd (GUVNL) and the lowest tariff was quoted by Spring Energy Private Limited and KP energy (PTI, 2017; Nishtha and

Sarita, 2018). The dropping tariff in the renewable sector has given fierce competition to developers and tremendous pressure to decrease project cost. A developing country like India whose renewable energy growth is dependent on the import of renewable energy's technology is associated with technology risk which increases the project cost. Though technology cost is coming down, projects which are financed with previous technology face disadvantage of low efficiency and high generation cost. In an interview Nikhil Dhingra, CEO, Acme Solar Holdings says – 'Indian manufacturer holds a very small portion of manufacturing value chain like polysilicon, wafer and cell. There are incremental changes in technology at frequent intervals, which require capital and the know-how to absorb, backward integration and scale help in managing these factors' (Seetharaman, 2018). India's solar and wind energy is dependent on import and developers face several risk premium associated with the project.

Developers are decreasing margins to win the projects in the auction but securing finances and timely execution of the project is of utmost importance. Due to decreased project margins, investors find Indian renewable projects unattractive, which is one of the reasons that renewable energy projects are not gaining impetus as expected and required to meet sustainable goals. Therefore, it is important to earn a return on investments made and the capital cost should be decreased by reducing overhead and financing cost, to keep the flow of investment in renewable sectors. This paper discussed how new financing mechanism can improve the project margin and decrease the cost of investment. Although the government has provided support through policy implementation and dedicated institutions like IREDA, SECI but India still needs dedicated Green Banks and investment trusts to support renewable energy projects. Trust and Green Banks are required to fill gaps in information flow, increasing participation of high net worth individuals, small and medium industries, and individuals. Investment trusts and green banks in developed countries have shown a positive impact of its establishment on society and contributed to the economic growth and green climate objectives. Such institutional support and innovative financing mechanism can accelerate the scaling of renewable energy in India to achieve the target of 175GW by 2022.

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Sustainable Consumption

Understanding the Intention to Adopt Commercial Car-sharing Service: Technology Acceptance Model Approach

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Abstract

Growth in sharing economy has paved the way for access-based service and it has complemented the traditional transport services. Smartphone enable the commuters in utilizing the empty car seats by booking the rides through sharing platforms. However, there are limited studies available to understand the acceptance factors for commercial car-sharing (CC) service to predict the intention to adopt it by commuters soon. Hence, this study develops a conceptual framework consisting of concern for the environment apart from the perceived ease of use (PEOU) and usefulness, as suggested by the Technology Acceptance Model (TAM). Data was collected from 291 commuters of northern India for the current study. Using structural equation modeling, the present study concluded that concern for the environment and perceived usefulness (PU) are the prime factors influencing attitude, which further influence commuters' intention to adopt CC. Further, it was suggested that PEOU has a weak positive relationship with the attitude towards intention to adopt the CC service. The study has helped in deciphering the relative strength of determinants of attitude to adopt CC system with respect to the intention to adopt it. The study also presented important implications for marketers as well as for the civic authorities.

Keywords: *Commercial car-sharing service, TAM, Attitude, Intention to adopt, SEM.*

Introduction

Excessive air pollution is creating a health hazard for all in most big cities in India. There are 30 Indian cities among the list of 100 most polluted global cities (WHO, 2016). The untamed motorization is responsible for the emission of toxic fumes within our breathing zone. According to Transport Research Wing, the Ministry of Surface Transport (2018), the vehicle population has reached 230 million in 2016 compared to 55 million vehicles on road in 2001. Further, data reveals that approximately three-fourths of the total vehicle population is of two-wheelers while approximately 15 per cent of the vehicles are four-wheelers whereas buses contributed only 1 per cent in vehicle population. After examining the data further, it has been found that the number of two-wheelers and four-wheelers have grown by 3.40 per cent and 0.8 per cent from 2001 to 2015, respectively. The number of buses decreased by 0.2 per cent. These figures suggest that commuters are

more inclined towards private vehicles like two-wheelers and four-wheelers. Therefore, to overcome the road congestion and air pollution, there is an urgent need to take deliberate steps to reduce the number of vehicles on the roads.

Commercial car-sharing using mobile applications is emerging as a sustainable option in reducing the number of vehicles on road. The increasing use of CC can transform the overall transportation system in India. These applications allow users to book a ride through a smartphone without using any browser (Tak and Panwar, 2017). Today, various m-taxi service providers like Uber, Ola, Meru, etc., are providing CC services in India. In addition to this, there are several other applications such as Bla-Bla, sRide, Poolcircle, MeBuddie, etc., that are providing car-sharing services. These applications are freely available on the app-stores and can be downloaded easily by anyone using a smartphone.

The adoption of CC service is still at the nascent stage among Indian commuters when compared to its peers like China. India's user preference for CC service is expected to be just 2.9 per cent by 2023 while China is expected to have 27.3 per cent users by 2023 (Statista, 2018). According to a recent study, inspite of the increasing number of CC services, 43 per cent of the respondents still prefer their vehicles for commuting (Majumdar, 2018). However, the Indian government is also implementing strategic policies towards the smart-mobility system to address three major issues related to traffic—accident, congestion, and pollution.

Against this backdrop, it is essential to conduct a study on the antecedents of intention to adopt CC applications by commuters. Therefore, the aim of the present study is to predict the intention to adopt CC applications by identifying the factors responsible for it. The result of the study will be useful for the government and service providers in taking corrective actions to enhance adoption and actual usage of the same.

Research Model and Hypotheses Development

The present chapter is based on the Theoretical Acceptance Model (TAM) originally suggested by Davis (1989), which is the most widely tested model of technology acceptance across various domains. TAM got its roots from the Theory of Reasoned Action (TRA) developed by Ajzen and Fishbein (1980). Originally, developed to test the adoption of word processor technology among IBM employees, TAM explains the causal relationship between PU and PEOU, attitude, intention to acceptance, and adoption and usage of technology. In the last 30 years, it has become the most prevailing and robust model for predicting the users' acceptance of technology (Yousafzai

et al., 2007). Since, shared mobility is hailed as a sustainable alternative of commuting and numerous studies have established environmental concerns (EC) as an important factor for sustainable consumption (Punyatoya, 2014; Kumar, 2013), therefore, we have extended TAM model by adding EC as the third antecedent. The proposed research model employed in this study hypothesizes three factors, namely, PEOU, PU, and concern for the environment affect attitude towards intention to adopt CC service using applications by commuters which further influence intention to adopt the same (Figure 1).

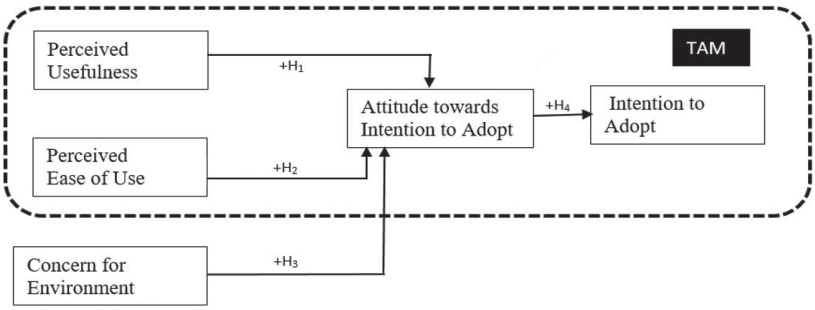

Fig. 1

Perceived Usefulness

Perceived usefulness is defined as the degree to which an individual believes in how much he can be benefited by using applications for booking shared rides for reaching his destination (Liu, 2019). CC is predominantly useful in the regions which are not suitable for pedestrian and without transit facility (Zhou and Kockelman, 2011). Additionally, it has been found that CC service reduces reliance on public transports (Shaheen et al., 2010). Gargiulo et al. (2015), compared CC service with booking a flight where traveller selects the date, time, pick-up point, destination, car type and other details, and then choose the one which best fits his/her needs, among all the options available. CC service is also regarded as economical wherein commuters replacing the single occupied vehicles with the lower-cost shared car options (Hamari et al., 2016). Thus, the proposed hypothesis is as follows:

H_1: PU is positively related with the attitude towards the intention to adopt CC services using applications.

Perceived Ease of Use

Perceived ease of use is another important construct of the TAM framework and it is conceptualized as the degree to which an individual thinks that

how much it is easy to use a system (Davis, 1989). Numerous studies have used PEOU as a significant determinant in adopting any new behaviour (Marakarkandy et al., 2017; Kim J., 2016; Rauniar et al., 2014). Commuters are more likely to adopt CC using applications if they perceive it is effortless, easily available, relaxing, and safe (Chen, 2016; Passafaro, et al., 2014; Verhagen et al., 2012). Hence, the present study states that:

H_2: PEOU is positively related to attitude towards intention to adopt CC service using applications.

Concern for Environment

A large body of empirical evidence supports the environmental benefits associated with car-sharing (Shaheen et al., 2006). People were generally conscious about the impact of the cars on the environment and believed that in the years to come it would cause traffic, air pollution, and climate change (Lane and Potter, 2007; Department for Environment, 2002). The literature shows that CC service has numerous positive environmental effects such as reduction in carbon dioxide emission, noise pollution, vehicle kilometre travelled, and the number of vehicles in a country (Haefeli et al., 2006; Rodier and Shaheen, 2003; Firnkorn and Muller, 2011; Shaheen et al., 2006, Martin et al., 2010). Studies established that respondents characterised environmental benefits as altruistic motives and important for improving life's quality (Schaefers, 2013; Shaheen, 1999; Burkhardt and Millard-Ball, 1986). Also, it has been found that environmentally conscious people are willing to spend more for their commuting needs (Costain et al., 2012). Ciari et al. (2009) found that commuters using CC applications reported an increased level of environmental awareness. Further, the next hypothesis is:

H_3: Concern for the environment is positively related with attitude towards an intention to adopt CC services using applications.

Attitude and Intention to Adopt

Attitude is defined as an individual's overall evaluation of adopting behaviour (Davis, 1989). Ajzen (1991) further extended the model and suggested that attitude impacts users' behavioural intention. Many studies established a link between attitude towards intention to adopt and intention to adopt (Bailey et al., 2017; Moon and Kim, 2001). It is believed that a positive attitude towards technology will positively influence the intention to adopt it. Hence, we propose that:

H_4: Attitude towards intention to adopt is positively related to the intention to adoption of CC services using applications.

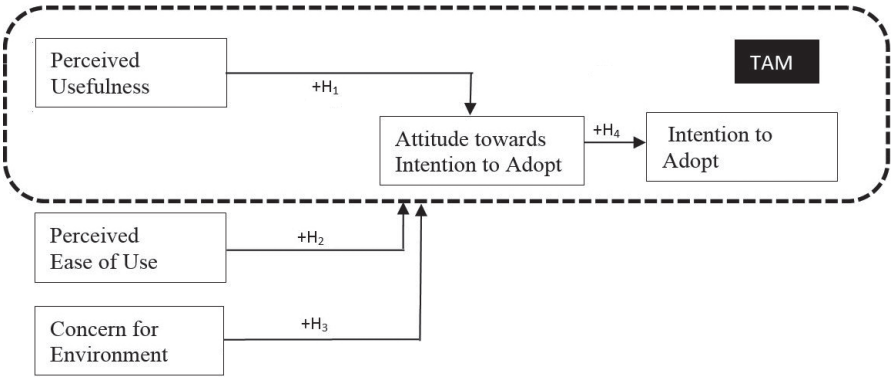

Fig. 2: Hypothesized Research Model for the Study
Source: Created by the author

Research Methodology

This study has used a quantitative methodology for validating proposed extended TAM. Structured questionnaire is used for data collection. Data analysis is done using SPSS and AMOS.

Questionnaire Development

The survey was conducted using a structured questionnaire comprising two segments. Segment one was directed to collect demographic data of the respondents, namely age, gender, educational qualification, etc.

Based on an exhaustive review of the literature, the second segment of the questionnaire was developed. In all, five constructs were included in the conceptual research model, namely, PU, PEOU, concern for the environment, attitude towards intention to adopt, and intention to adopt CC service using applications. Three items used to measure PU based on the work of Gargiulo et al. (2015). PEOU was measured with the help of three items taken from Passafaro et al. (2014) and Verhagen et al. (2012). The three statements for concern for the environment were adapted from Haefeli et al. (2006) and Firnkorn and Muller (2011). The attitude towards intention to adoption was measured using three statements adapted from Davis (1989). Finally, to measure the intention to adopt CC service for reaching the workplace, all three items were tailored from Davis (1989). All these statements were measured on a five-point Likert scale anchored where '1' stands for 'strongly disagree' and to '5' stands for 'strongly agree'.

Inputs were taken from the experts working in the field of sustainable transportation to obtain the face validity of the questionnaire and accordingly suggested changes were incorporated. The survey was conducted after pre-

testing the questionnaire by using a pilot survey with potential respondents who were using CC service through applications. The suggestions given by the respondents were incorporated after a lengthy discussion with them regarding the format and wording of the items in the scale.

Data Collection

The data collection was done in the Delhi-NCR region to study the intention of the commuters towards CC services. The target population of the study was either adopted or at least have an intention to adopt CC service in the near future. Since there is no list available of the commuters using this particular type of mobility option for travelling, respondents were selected using a convenience sampling method. Both online and offline method of survey administration was chosen to fill the questionnaire. A total of 291 responses was utilised for the data analysis.

Table 1 depicts the demographic characteristics of the sample. The majority of the respondents (83.3 per cent) are the users of CC service. The male users are 63.6 per cent and 65.2 per cent are younger than 30 years. 65.2 per cent are the car owners who either using CC through applications or have the intention to adopt it near future for commuting.

Table 1: Sample Profile

Demographics	*Frequency*	*Percentage*
Use of CC		
User	253	87.0
Non-user	38	13.0
Total	291	100
Age		
Below 30	9,231.6	
30-40	13,546.4	
Above 40	6,422.0	
Total	2,91,100	
Gender		
Male	18,663.9	
Female	10,536.1	
Total	2,91,100	
Income per annum (in Rs.)		
≥ 10,00,000	176	60.5
10,00,000–20,00,000	96	33.0
≤ 20,00,000	196.5	
Total	291	100

Demographics	*Frequency*	*Percentage*
Since when use of CC Service		
< 1 Year	79	27.14
1-3 Years	147	50.51
>3 Years	27	9.24
Never	38	13.11
Total	291	100
Frequency of using CC Service		
More than 5 Days a week	18	6.19
3-5 Days a week	76	26.02
1-2 Days a week	34	11.68
Once a While	128	43.88
Never	35	12.23
Total	291	100

Source: Created by the author.

Data Analysis and Results

Based on respondents' view, all the constructs were measured. Reliability and validity of the questionnaire were confirmed using Amos 21 before concluding relationships among the constructs. Table 2 reports the CR and average variance extracted (AVE) values of each construct demonstrating the reliability and convergent validity.

Table 2: Validity and Reliability Measures

Construct and Item	*Std. Loading*[a]	*Alpha Val.*	*CR Ave*
PU	0.724	0.765	0.633
I find CC service helpful in increasing mobility	0.704		
I find CC service economical	0.869		
I find CC service useful	0.662		
PEOU	0.835	0.842	0.576
I find CC service easy to use	0.804		
I find CC service convenient	0.756		
I feel relaxed while using CC service	0.758		
Concern for Environment	0.823	0.825	0.643
I think CC service is a sustainable mode of transport	0.695		
I think CC service is environmentally friendly	0.757		

Construct and Item	*Std. Loading*[a]	*Alpha Val.*	*CR Ave*
I think that CC is helpful inefficiently using fuel consumption	0.824		
Attitude towards Intention to Adopt	0.896	0.902	0.764
I find CC service using the application as a wise option	0.805		
I think CC service using the application is a right approach	0.950		
I think using CC is a good habit	0.844		
Intention to Adopt	0.830	0.848	0.784
In the future, I would like to use CC service	0.848		
I will recommend others to use CC service	0.835		
Everything else being same, I would prefer CC over other modes transportation	0.765		

Note: [a] All factors loadings are significant at $p < 0.001$
Source: Authors' Work.

All the items load on their respective dimensions significantly, ranging from 0.576 to 0.784. Also, all the AVE values obtained are above 0.50, indicating convergent validity among each latent construct (Hair et al., 2006). Internal consistency has been measured through the composite reliability and Chronbach's alpha values which are above 0.70 for each construct (Hair et al., 2006). Table 3 exhibits the correlation matrix showing maximum shared variances (MSV), average squared variances (ASV), and AVE. The MSV and ASV values are less than the value of AVE indicating the discriminant validity among the constructs (Hair et al., 2006).

Table 3: Correlation Matrix, MSV Values, ASV Values

Constructs	*MSV*	*ASV*	*ATT*	*Env.*	*PEOU*	*PU*	*IU*
ATT	0.566	0.192	0.874				
Env.	0.300	0.134	0.512	0.801			
PEOU	0.484	0.093	0.076	0.064	0.756		
PU	0.484	0.122	0.023	0.123	0.696	0.759	
IU	0.566	0.203	0.752	0.469	0.135	0.148	0.885

Note: ATT: Attitude towards intention to adopt, Env.: Concern for environment, PEOU: Perceived ease of use, PU: Perceived usefulness, IU: Intention to adopt
Source: Created by the author

The measurement model fit shows a reasonable fit to the data (Hair et al., 2015), with $\chi^2 = 272.110$ with 109 degrees of freedom (d.f.), χ^2/d.f. = 2.496, goodness-of-fit index (GFI) = 0.905, Tucker-Lewis index (TLI) = 0.901, comparative fit index (CFI) = 0.906, and root-mean-square error of approximation (RMSEA) = 0.058 (Table 4).

Table 4: Measurement Model Estimates

Model	χ^2	*d.f.*	χ^2/*d.f.*	*GFI*	*TLI*	*CFI*	*REMSEA*
	272.110	109	2.496	0.905	0.901	0.906	0.058

Source: Created by the author.

Table 5 shows the results of the structural model fit indices. Comparison of tables 4 and 5 shows that after path analysis there is an improvement in the values of indicators. All the indicators have shown improvement in the values after path analysis indicating a good model fit. For the structural model, the value of chi-square, i.e. (χ^2 = 14.268 with 4 degrees of freedom) and CMIN is (χ^2/d.f.) = 3.667. Other reported indicators such as GFI, TLI, CFI, and REMSEA have also shown improvement over the measurement model (Table 5).

Table 5: Structural Model Estimates

Model	χ^2	*d.f.*	χ^2/*d.f.*	*GFI*	*TLI*	*CFI*	*REMSEA*
	14.268	4	3.667	0.921	0.915	0.928	0.033

Source: Created by the author.

Figure 2 represents the research model with beta values. The path estimates are shown in Table 6 and the values suggest that all the factors identified in the present study such as PU, PEOU, concern for environment influence the attitude towards intention to adopt CC service. Path estimates also suggest that attitude towards intention to adopt is a significant predictor of intention to adopt CC service with R^2 = 78. Further, among all the factors, PEOU is the most important factor with (β = .58, $p < 0.001$), followed by concern for environment with (β = .42, $p < 0.001$) in predicting attitude towards intention to adopt, while PEOU shows significant positive but weak relationship (β = 0.18, $p < 0.01$) with attitude towards intention to adopt. Together, all the factors, i.e. PU, PEOU, and concern for environment predicted 59 per cent of the variance of attitude towards intention to adopt. All the hypotheses framed for the study have been accepted (Table 6).

Table 6: Path Estimates

Hypothesis	*Estimates*	*Results*
H_1. Perceived Usefulness > Attitude towards Intention	1.210**	Accepted
H_2. Perceived ease of use > Attitude towards Intention	0.867*	Accepted
H_3. Concern for Environment > Attitude towards Intention	0.551**	Accepted
H_4. Attitude towards Intention > Intention to adopt	0.813**	Accepted

Note: * Significant at the 0.01 level; ** Significant at the 0.001 level
Source: Created by the author.

Discussion and Conclusion

The extended version of the TAM model has been applied to understand the factors influencing the intention to adopt CC service using applications among the commuters. The results of the study show good empirical support for the hypothesized model (Figure 3). The findings suggest that PU (β = 0.58) is a significant antecedent of attitude towards the intention to adopt CC service. Commuters find CC service as an opportunity to enjoy the benefits of a private vehicle without bearing any cost related to maintenance of a private vehicle. Furthermore, when a commuter uses a taxi on a sharing basis s/he finds it economical while having point-to-point connectivity. For using public transport commuters have to arrive at a specific time and place. Moreover, locally, public transport is not available for 24 hours. Therefore, commuters feel that because of CC using applications, they have more mobility options without any location and schedule barriers. The results of the present study also corroborate with previous researches conducted in the domain of mobility sharing (Yu et al., 2018; Chen and Lu, 2015).

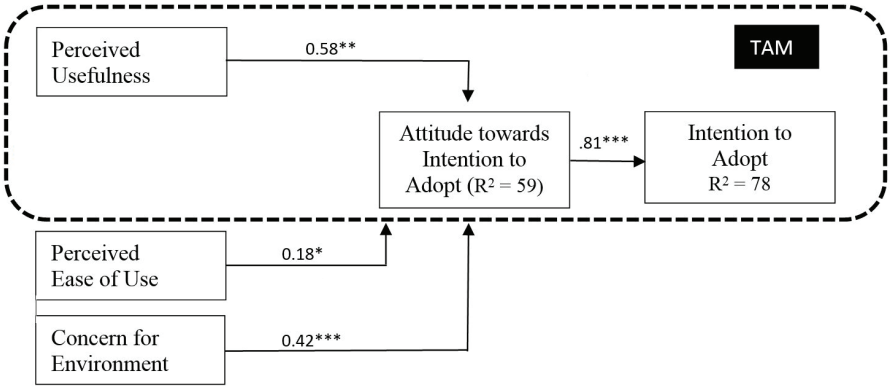

Fig. 3: Research Model with Path Estimates
Source: Created by the author.

Furthermore, one interesting finding of the study is that PEOU exerted significant but weak relationship with attitude towards the intention to adopt CC service. In the literature, the findings on PEOU are mixed. The direct effect of PEOU on attitude towards intention to adopt has been found in the selected studies, but a few studies posited that in voluntary settings (Yu et al., 2018; Jin et al., 2012; Chen and Chen, 2011; Eriksson et al., 2005; Pikkarainen et al., 2004). PEOU might not be important in determining the level of use of a system except in the initial decision-making process. Also, one-third of the studies reviewed in a meta-analysis found to have an insignificant relationship with the attitude towards intention

to adopt(Yousafzai et al., 2007). In the present study, more than half of the respondents are in the habit of using CC service for 3 years and these findings can be justified (Table 1).

In addition to the antecedents from the original TAM, the model developed in this study includes concern for the environment. There is hardly any study that has theorised and empirically tested concern for the environment towards intention to adopt CC service. Results show that concern for the environment has a significant impact on attitude towards intention to adopt CC service. According to the present study, commuters are concerned about the environment and they consider CC service using the application as a sustainable solution for mobility. Similarly, Agatz et al. (2012) found that rising fuel prices, vehicle emissions, and air pollution give rise to the different problems at both global (climate change and global warming) and local levels (hazardous health effects). Martin and Shaheen (2011) also found that CC service in North America has provided a mobility alternative to urban households with fewer emissions reductions.

In sum, no research work till now has been found to assess the intention to adopt CC service using the application by the Indian commuters for travelling. Thus, the determinants of attitude towards intention to adopt the CC service will help in anticipating new advances in this domain. The present study reveals that PU, PEOU, and concern for the environment are crucial factors in predicting the attitude towards intention to adopt the CC service using the application, which further leads to intention to adopt it.

Implications

Commercial car-sharing service is a subset of online to offline service which needs appropriate evaluation in terms of design, development, and marketing. As a relatively novel source of workplace mobility, CC service is not yet well explored by many. Therefore, the present study provides us the opportunity to study this emerging sector and contributing to the literature by adding a new antecedent to map the intention to adopt it. The findings of the study will also help the CC service provider in particular and rental car industry as a whole in designing future strategies to promote their services. They can also use social media platforms in instilling confidence regarding CC service using applications among masses. Moreover, it will also help in the growth of the economy as shared mobility is emerging as a new service and provide employment opportunities to the people. It will also provide inputs to the government for framing transport policies for urban areas to adopt sustainable mobility options by recognising and applauding the

people opting for a sustainable mode of transportation. The findings of the study indicate that CC service enriches mobility options, especially it provides point-to-point mobility. In sum, the present study depicts that commuters have a positive intention to adopt CC service. This scenario will be a win-win situation for all the stakeholders such as customers, companies, government, and society as a whole.

Limitations of the Study and Future Directions

The present study has some limitations also which need to be acknowledged. First, the study is limited in terms of generalisation as the data was collected through a non-random sampling technique from Delhi-NCR only. Second, several moderator factors like age, gender, and ownership of a vehicle can be used to assess the intention to adopt CC service across various groups. Since the study is related to the behavioural aspect of consumers, a longitudinal study could provide more insights. Thus, further studies may be conducted in the other megacities of the country and also take into consideration the privacy/security-related factors as an antecedent of attitude towards the intention to adopt CC service.

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Consumption and Disposal of Saris by Housemaids: An Exploratory Study

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Abstract

The undying love of buying saris can be seen in the magnitude of this classic garment in a woman's wardrobe. This is irrespective of whether they are wearing it or not. This study aims to explore the psychology of keeping or disposing of saris and the possible ways of doing so by housemaids. The primary objective of doing the survey is to find out the kind of saris discarded which are sold in the second-hand cloth market to reuse and upcycle. A survey was conducted through a questionnaire, which was distributed to 100 housemaids in the age group of 25-80 years, working in the South Delhi District of Delhi using a convenience sampling technique. The results showed that their love for sari is still growing although the frequency of wearing is decreasing. It was observed that maids are very important stakeholders for the supply of saris in the second-hand cloth market. The discarded saris are mostly polyester, which was authenticated by visits to the second-hand cloth market in Raghubir Nagar. Polyester saris are preferred by maids because they are affordable and light in weight. They mostly get their saris as gifts or donations. The number of saris they own is much less but the frequency of wearing is high as they do not store their old saris instead, they give these to the bartanwalis of Wagdi community of Gujarat in exchange of new utensils. Then, these ladies of Wagdi community sell those saris to second-hand cloth traders which are further sold in the second-hand cloth market of Raghubir Nagar for Rs 50 to Rs 100 each.

Keywords: *Sari, Housemaids, Second-hand clothes markets, Polyester saris.*

Introduction

Indian women feel a sense of pride in wearing saris. It makes her feel feminine. It is a product of traditional lineage which every Indian woman loves to wear. This classic dress is continuing its legacy through its association with traditional heritage even in today's everyday changing fashion (Ranavaade and Karolia, 2017).

Although India is producing an innumerable variety of traditional and contemporary saris and each type of sari is unique, there is no source of information regarding a number of saris manufactured.

Amongst all the categories of women-wear, saris comprise 37 per cent of the total women wear market (Gugnani and Brahma, n.d.) (Figure 1).

There is a lack of literature on the disposal pattern of the sari. Most of the available data is related to western garments. Mostly, saris are occasion-

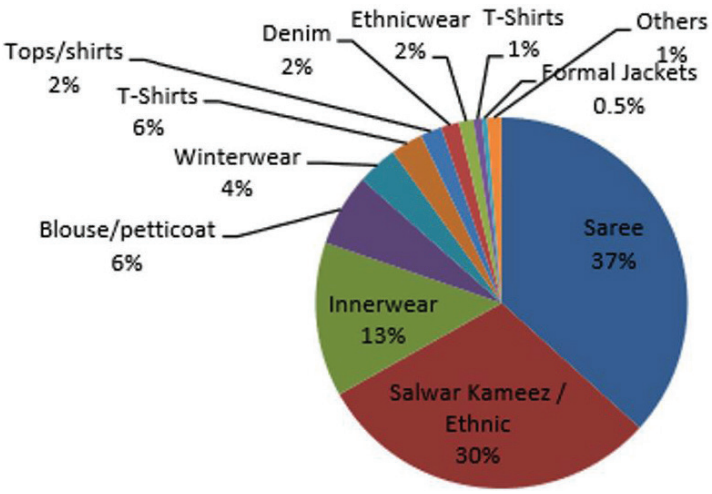

Fig. 1: Share of Individual Categories within Womenswear (2014)
Source: Gugnani and Brahma, n.d.

specific, such as saris for daily wear, saris for different festivals, etc. Women have an emotional connection with their saris because of which they do not want to discard them. Despite their low wearability, they are stored in the wardrobe for many years (Norris, 2010). However, this fact cannot be generalised as it depends on the socio-economic status of the owner of the sari. It has been observed, that the expensive saris are carefully cherished whereas cheaper saris are used and discarded.

Traditionally, the household work has been a responsibility of the women of the house but, in contemporary times, as most of the women are employed, they are dependent on the domestic worker or the housemaids for such work (Harju, 2016). This number is increasing at a rapid rate. According to the Census in 2001, there were 16.2 lakh workers in India as compared to 7,90,000 in 1991 (Lahiri, 2017). According to the Delhi Labour Organisation, there are 5 crore domestic workers in India, which are mostly women.

The Draft National Policy on Domestic Workers formulated by the Ministry of Labour and Employment under the Government of India defines a 'domestic worker' as: A person who is employed for remuneration whether in cash or kind, in any household through any agency or directly, either on a temporary or permanent, part-time or full-time basis to do the household work, but does not include any member of the family of an employer. (www.wiego.org)

They could be skilled or unskilled, part-time or full-time workers. It has been observed that on an average, housemaids who are residing in the

employer's house 24 × 7, do not wear saris regularly whereas, housemaids who come daily from their houses, wear saris on a regular basis.

Shakya and Swami (2016) defined 'waste' as 'the end of apparel lifecycle that causes costly environmental impacts and depletes valuable resources and energy-intensive processing and production processes of apparel manufacturing.'

The Indian Textile and Apparel Industry is expected to reach US$ 223 billion by 2021. The National Household Survey 2008 released by Textile Committee, the Ministry of Textiles stated that on average an Indian purchase 22.41-metre textiles in a year (Shakya and Swami, 2016). Because of this huge demand, every year almost 1-million ton of textile waste is generated, most of which come from the household sources (Saravanan, 2011). This waste is collected by the ladies of Wagdi community and sorted for different end uses. In developed countries, because of strict ecological standards, the sorting criteria have been standardised. Products that are at the apex of best-sellers are termed as diamonds such as branded clothes or clothes that are new in condition (Hawley, 2006).

The product lifecycle often includes the production, consumption, and disposal stage in which the product is discarded and sent to the landfill, which pollutes the environment. This process is known as an open-loop system. The World Economic Forum defines a 'closed-loop system' as 'an industrial system that is restorative and regenerative by intention or design' (Hunt, 2018). Sometimes the reasons of discarding a particular garment is that they are not in vogue, the consumer is wearing it for a long time and do not want to wear it again or they do not fit the first consumer (Claudio, 2007); however, the functional life of the product is still intact and it can be used by some other person. Instead of sending the product to the landfill, these garments are sold to the poor and needy people at affordable rates in the second-hand clothes market. *Bartanwalis* who are from Wagdi community of Gujarat exchange the old garments with new utensils and sell them in various second-hand cloth markets such as Raghubir Nagar and Azad market (Jain and Gupta, 2016). When another person buys the product and starts using it, this whole process can be described as a closed-loop system.

Objectives

1. To analyze the consumption and disposal pattern of saris amongst housemaids.
2. To study the second-hand cloth market in Delhi.

Methodology

The first objective of the study is to analyze the consumption and disposal pattern of saris of housemaids. A survey was conducted on 100 housemaids regarding their consumption and disposal pattern of saris. Housemaids were divided into four age groups, viz., 25-40 years, 40-50 years, 50-60 years, and 60-80 years to study the pattern among different age groups.

South Delhi District of Delhi has been selected for conducting this study. Since Delhi is the capital city of India, a large number of people from across the country come here in search of better opportunities, therefore, this city has a much-diversified population. Therefore, the results would provide a better picture when conducted in a city like Delhi.

A convenience sampling technique has been used for data collection. There were 100 samples selected with due consent and convenience. Convenience sampling technique has been used by many researchers such as Bianchi and Birtwistle who have conducted similar kinds of studies on consumption and disposal of clothing in different countries in 2010 and 2012.

The questionnaire included questions regarding the consumption and disposal of saris. Questions were about how many saris they own; the frequency of buying, wearing, and disposing of the saris; saris they received as gifts; kind of saris they own, etc. The method of frequency distribution was used to analyze these questions. Chi-square test was used for a question to check the following hypothesis about their practice of exchanging saris with utensils.

H1 There is a significant difference between the rate of exchanging saris with utensils from *bartanwalis* among different age groups.

For the second objective, Raghubir Nagar, the biggest second-hand cloth market in Delhi, is managed by the Delhi Urban Shelter Improvement Board of the Delhi government was studied using primary and secondary data (Singh, 2016). Visits have been made to this market and secondary sources were collected through newspaper articles and research papers.

Results

For Objective 1, a survey has been conducted on 100 housemaids through a questionnaire. The results of the questions using frequency distribution are as follows (Table 1 and Figure 2).

20 women in the age group of 25-40 years like to wear saris. 23 women in the age group of 40-50 years like to wear saris. In the age group of 50-60 years, 22 ladies like to wear saris. In the age group of 60-80 years, 23 ladies

Table 1: Do You like Wearing Saris?

Age Group	*Yes*	*No*
25-40 years	20	5
40-50 years	23	2
50-60 years	22	3
60-80 years	23	2

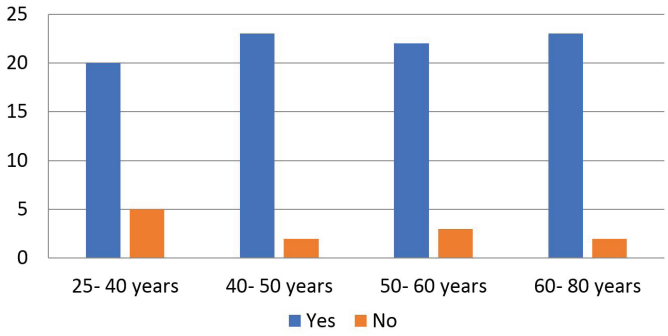

Fig. 2: Do You like Wearing Saris?

like to wear saris. Irrespective of whether they frequently wear the saris or not, the maximum number of women in all age groups likes to wear saris. With this, we infer that age is not a determinant for a woman's love for saris (Table 2 and Figure 3).

Table 2: How Many Saris do You Own?

Age Group	*Less than 10*	*10-30*	*30-50*	*50-100*	*More than 100*
25-40 years	22	3	0	0	0
40-50 years	20	5	0	0	0
50-60 years	20	4	1	0	0
60-80 years	22	2	1	0	0

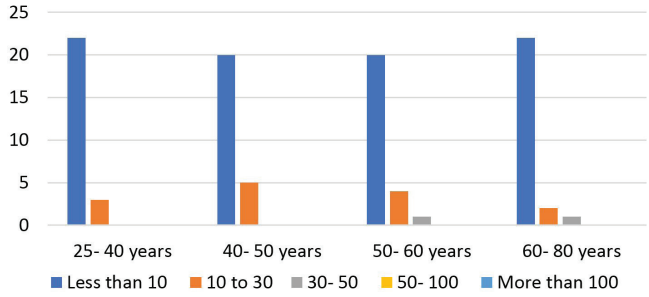

Fig. 3: How Many Saris do You Own?

The majority of women own less than 10 saris. Some ladies own more than 30 saris but such ladies are less in number. Most of the housemaids

own less than 10 sarees as they buy sarees as cheap as Rs 150 to Rs 200 and sometimes they get their sarees as donations from their employer. These saris are inferior in quality, therefore, maids wear them for some time and then discard them subsequently (Table 3 and Figure 4).

Table 3: How Often do You Wear a Sari?

Age Group	*Only on Special Occasions*	*Once in a Week*	*Once in 2 Weeks*	*Once in a Month*	*Everyday*
25-40 years	2	1	1	1	20
40-50 years	1	1	1	1	21
50-60 years	1	1	1	1	21

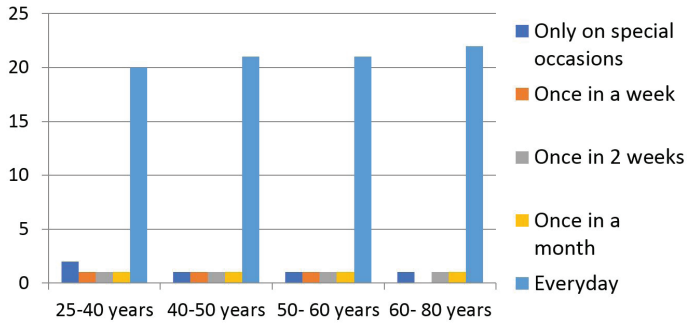

Fig. 4: How Often do You Wear a Sari?

As evident from Table 3 and Figure 4, women across all the age groups wear saris every day. It is felt that, since most of the maids come from Jharkhand and Bihar region, their staple garment is sari (http://www.wiego.org/informal_economy_law/domestic-workers-india); therefore, they feel more comfortable in a sari as compared to any other garment. Another reason for wearing a sari on a daily basis could be the societal norms and their attachment to the garment.

Table 4: Of Your Total Sari Collection, How Many Saris You Received as Donations?

Age Group	*50%*	*30%*	*20%*	*10%*
25-40 years	11	6	4	4
40-50 years	10	7	3	5
50-60 years	12	5	4	4
60-80 years	10	7	5	3

Across all age groups, housemaids receive 50 per cent of their saris as donations from their employers. The reason could be that middle-class and upper-class ladies give their old clothes to their maids as donations (Table 4 and Figure 5).

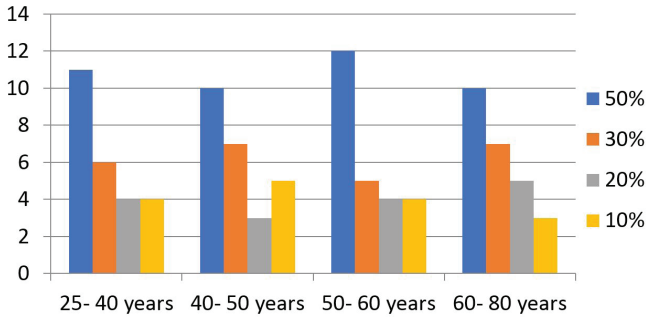

Fig. 5: Of Your Total Sari Collection, How Many Saris You Received as Donations?

18 ladies in the age group of 25-40 years gave their old saris to *bartanwalis*. 24 ladies in the age group of 40-50 years gave their saris to *bartanwalis*. 24 ladies in the age group of 50-60 years gave their saris to *bartanwalis*. 15 ladies in the age group of 60-80 years gave their old saris to *bartanwalis*. It has been observed that the upper- and middle-class people tend to donate whereas housemaids want something back from every cloth they discard (Table 5 and Figure 6).

Table 5: Do You Exchange Your Saris for Utensils or Other Items?

Age Group	*Yes*	*No*
25-40 years	18	7
40-50 years	24	1
50-60 years	24	1
60-80 years	15	10

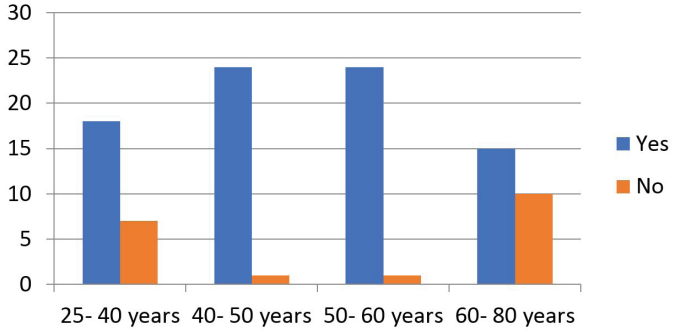

Fig. 6: Do You Exchange Your Saris for Utensils or Other Items?

Results of Chi-Square Test

H1: There is a significant difference between the rate of exchanging saris with utensils from *bartanwalis* among different age groups.

Table 6: Number of Ladies Who Exchanged Saris with Utensils

Age Groups	*25-40 Years*	*40-50 Years*	*50-60 Years*	*60-80 Years*
Housemaids	18	24	24	15

Df = (4 – 1) = 3
Level of significance = 0.05
Chi square test = (18 – 18)2 + (24 – 18)2 + (24 – 18)2
+ (15 – 18)2/18 = 6
Table value = 7.815
Calculated value = 6

There is a significant difference between the rate of exchanging saris with utensils from *bartanwalis* among different age groups.

The groups that are involved in exchanging saris for utensils are between the age group of 40-50 years and 50-60 years. The process of dealing with the women of Wagdi community is time-consuming and requires patience (Jain and Gupta, 2016). The younger and the older groups' handover their saris to the other two groups because the younger group is not interested in bargaining with the *bartanwalis* and the latter group is too old to get herself involved in this process.

Conclusions

1. House maids' frequency of buying is low but the frequency of disposing saris is high. They received most of the saris as gifts or donations.
2. They buy zero to two saris in a year and most of them receive 50 per cent of their total collection of saris as gifts.
3. Most of them are wearing three to four saris in a repeated manner till they are worn out. Subsequently, they give them to *bartanwalis*.
4. They wear their polyester saris on an average of thirty to forty times with repetitive washing.
5. Most of the saris given by them to *bartanwalis* are polyester saris which are less expensive.
6. They also have saris that are worn out.
7. The age group of 25-40 years and 60-80 years are less involved in buying and disposing of saris.
8. They also have a feeling that some of their saris are lying in their wardrobe but the percentage is less.
9. They do not store their old saris instead they give their old saris to the *bartanwalis* in exchange for new utensils. But they also have saris which they do not want to discard or distort like their wedding saris because they are emotionally attached to them.

10. The number of saris they own are much less but the frequency of wearing is higher.
11. They are not very interested in upcycling and pass them to the *bartanwalis* to get some value.
12. The older group has stopped working because of their age. They have been wearing saris all their life so they like to wear the sari now and feel more comfortable in it. They choose other garments when their medical condition is not allowing them to wear saris.
13. On the other hand, ladies in the age group of 25-40 years have more options like salwar suits, pyjamas, etc., so they can shuffle their clothes with other options.

For Objective 2, the second-hand market of Raghubir Nagar was visited three times. It is one of the biggest markets in Delhi for second-hand clothes which comprises about 50 per cent of the total selling items. The market opens at 5 AM and remains active till 10 AM. Approximately 500-600 vendors are present in any point of time to do business. Since the market opens early in the morning and there are no proper light arrangements, so they use a torch. The vendors have to get the ticket of Rs 10 to enter the market premises every day. The place is not very hygienic as litter can be seen all around. The vendors also sell the clothes in bulk. They make bundles beforehand to sell them in bulk. Mostly, people from low-income group buy clothes from this market. Vendors and consumers both have torches with them to check the products because the market begins early in the morning and there is no arrangement of proper lighting. A good amount of crowd can be seen in the market even at 6 AM and doing buying activities. The *bartanwalis* segregate the diamonds, i.e. good polyester saris and sells them in the market. The saris are mostly in wearable condition but they need washing before using them. These are sold at very low prices, for example, a polyester sari can be bought in Rs 50 after some bargaining. Stacks of polyester saris can be seen there. Printed polyester saris, embroidered saris, and saris with sequin work are sold in Rs 50-100. Cotton and silk saris are there in a very limited number which are sold in about Rs 500-1,000. One of the vendors told that the clothes are sold at the low prices so that people with low income can also afford good clothes. These kinds of markets are part of the closed-loop system of saris.

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Corporate Governance and Green Finance

Failure of Corporate Governance or Business Ethics: The Case of ICICI Bank

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Abstract

Most of the corporate governance fiascos can be often attributed to a failure to properly identify and manage conflicts of interest. This issue has once again come to the forefront in the wake of loans (Rs 3,250 crore) granted to Videocon by the ICICI Bank in 2012, wherein it is alleged that the then Chief Executive Officer (CEO) and Managing Director (MD) of ICICI Bank, Chanda Kochhar had a conflict of interest, as her husband Deepak Kochhar had business dealings with Videocon Chairman, Venugopal Dhoot. 86 per cent of this loan (Rs 2,810 crore) provided to Videocon is unpaid and was declared a Non-performing Asset (NPA) in 2017. Throughout this controversy, ICICI Bank had reposed its faith in its MD and denied any conflict of interest. However, Chanda Kochhar resigned in October. In this backdrop, the case study discusses what a conflict of interest is and what the duties of directors towards the company are if their personal interest conflicts with the interests of the company. It raises a few important questions relating to governance practices and business ethics at ICICI Bank, which remain unanswered.

Keywords: *Corporate governance, Business ethics, Directors, Conflict of interest.*

Introduction

Abiding of corporate governance in its true spirit is essential to its effective implementation. The companies by and large conform to the regulatory requirements but despite that, there are aberrations that are bound to occur. Though the importance of corporate governance has been acknowledged in India over the past decade, yet there have been random cases of violation of good governance principles.

An effective system of corporate governance for any company must be established upon the three pillars of transparency, accountability, and integrity. The faith of investors and the public, in corporate organisations has been, time and again, shaken by the wrongdoings, impaired judgements and business mishaps such as frauds. If observed closely, all of these problems can be often attributed to a failure to properly identify and manage conflicts of interest.

Such management actions or events which diminish the faith and trust of investors and other stakeholders can have a devastating effect on the company, capital markets, and even the country. This was evident in the case

of Satyam fraud wherein the BSE Sensex lost 7.3 per cent and the Indian government took over its management. Similarly, Infosys lost Rs 30,000 crore in market value in intra-day trade after the resignation of the previous CEO of the company following accusations of its failing governance.

This issue has once again come to the forefront in the wake of loans (Rs 3,250 crore) granted to Videocon by the ICICI Bank in 2012, wherein it is alleged that the CEO and MD of ICICI Bank, Chanda Kochhar had a conflict of interest, as her husband Deepak Kochhar has business dealings with Videocon Chairman Venugopal Dhoot. Out of 100 per cent, 86 per cent of this loan (Rs 2,810 crore) provided to Videocon is unpaid and was declared a Non-performing Asset (NPA) in 2017.

ICICI Loan to Videocon

Videocon received a loan of Rs 3,250 crore from ICICI Bank in 2012. This amount was part of a loan of Rs 40,000 crore which Videocon received from a consortium of twenty banks led by the State Bank of India (SBI). The then CEO Chanda Kochhar was a member of the credit committee of ICICI Bank that sanctioned this loan of Rs 3,250 crore to the Videocon Group in 2012. A major part, i.e. 86 per cent of this loan (Rs 2,810 crore) provided to Videocon is unpaid and was declared an NPA in 2017.

The issue of a conflict of interest in loans approved by Chanda Kochhar-led ICICI Bank to the Videocon Group was first raised in 2016 when a whistleblower raised similar concerns. There were issues of conflict of interest as there have been multiple business dealings between Videocon Group and NuPower Renewables Pvt Ltd., a company founded and headed by Chanda Kochhar's husband Deepak Kochhar during 2008 to 2013. NuPower is a wind energy firm and is one of the Independent Power Producers (IPPs). It has almost 700 MW of renewable energy assets operating and in process located across the Indian states of Tamil Nadu, Karnataka, Rajasthan, Maharashtra, Andhra Pradesh, and Madhya Pradesh. The Company sells power to various state grids through 13- to 20-year power purchase agreements and also sells directly to corporate customers on long-term power-purchase agreements.

The transactions between Videocon Group and NuPower Renewables Ltd. are summarised hereafter in Figure 1.

Corporate governance experts have criticised the loan sanctioned by ICICI Bank to Videocon, in the light of the odd arrangement between firms promoted by Videocon's CMD Venugopal Dhoot and Deepak Kochhar. The nature of transactions between them is not clear and raises

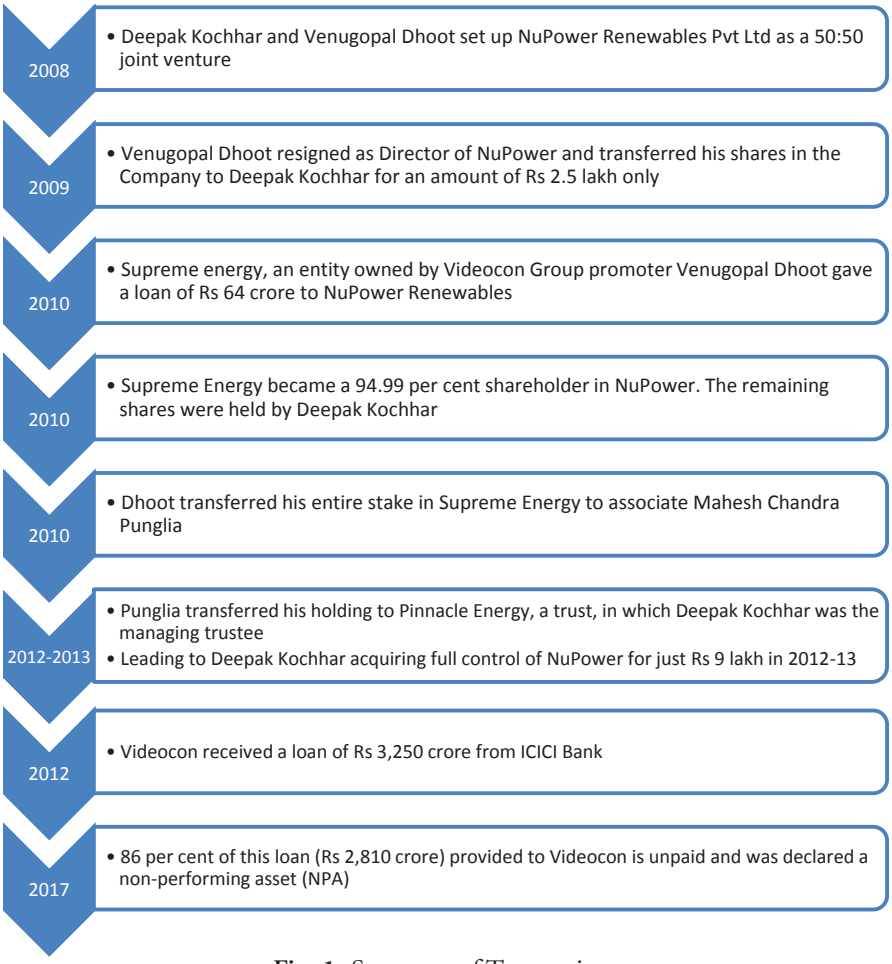

Fig. 1: Sequence of Transactions
Source: Compiled by the author

several questions that remain unanswered. An explanation is still needed for the following issues:

1. What was the reason for the exit of Venugopal Dhoot from the Company he co-founded with Deepak Kochhar?
2. What were terms of the loan of Rs 64 crore given by Supreme Energy Pvt Ltd owned by Venugopal Dhoot to NuPower?
3. What was the reason for the transfer of 94.99 per cent shareholding from Deepak Kochhar to Supreme Energy Pvt Ltd (owned by Venugopal Dhoot) in 2010?
4. Why did Venugopal Dhoot transfer his shareholding to associate Mahesh Chandra Punglia in November 2010, who then over a period of 3 years transferred the shareholding back to Deepak Kochhar?

5. How was the valuation of the final stake transfer of NuPower for Rs 9 lakh arrived at?

Conflict of Interest in Case of Another Family Member

There are also allegations of conflict of interest in the case of Rajiv Kochhar, who is Chanda Kochhar's brother-in-law (brother of Deepak Kochhar). Rajiv Kochhar, through his company Avista Advisory, advised borrowers of ICICI Bank on their foreign loans, helping them restructure foreign currency-denominated debt deals worth over US$ 1.7 billion over 6 years. These borrower companies include Videocon, Jai Prakash Associates, Jai Prakash Power, GTL Infrastructure, and Suzlon.

The Bank's Stance

The Board of the Bank, however, reposed its faith in Chanda Kochhar as the MD and CEO of the Bank. The public statement made by the Bank after these allegations stated that the Board does not see it as a conflict of interest in any manner since Videocon Group is not an investor in NuPower Renewables. Chanda Kochhar was a part of the credit committee which sanctioned this loan facility to the Videocon Group but there was no need to recuse herself from this Committee. Bank also said that all disclosures necessary according to regulations were made and credit approval systems of the Bank are robust enough to stave-off conflicts of interest.

Regarding the issue concerning Rajiv Kochhar, the Bank has said that the 'brother of a husband' or 'brother-in-law' is not covered within the definition of a 'relative under the Companies Act, 1956 or 2013 or the rules thereunder. Hence, there was no requirement of any disclosure of such a relationship by any official of the Bank.

Questions remain about the conduct of the ICICI Bank board as well. How did the Board come to the conclusion that there was no conflict of interest? Over what period of time did the Board deliberate this and did it examine relevant documents from credit committee meetings? Further, there is also an important question that was an internal investigation conducted? If yes, this investigation was not disclosed to the exchanges. Moreover, would it not be best practice for the Board to seek an external investigation report?

Corporate Governance Issues

The banking system in any country runs on people's trust and confidence. But the boards of the Indian banks have not paid adequate attention to the complaints

of the whistleblowers. In many cases of lapses, it has been noticed that banks have failed in terms of regulatory oversight and prompt corrective measures. In these cases of crisis, it can also be observed that the board of directors fails to perform their primary function of supervision and monitoring and also corporate governance principles of fairness, transparency, integrity, and accountability are overlooked in such cases.

The series of transactions discussed in the case of ICICI Bank also gives rise to some serious issues relating to the corporate governance practices followed at the Bank. It also raises some doubts relating to the role of the independent directors. In India, not much discussion takes place about the performance or contribution of the independent directors in influencing bank or company outcomes and strategies. Moreover, the true level of independence of the independent directors is also doubtful in the case of many boards. The case of ICICI Bank raises governance issues relating to conflict of interest, related party transactions, disinterested quorum, and the role of independent directors. Hereafter these corporate governance issues have been discussed in detail.

Conflict of Interest: Were there any conflicts of interest and were the potential conflicts disclosed to the ICICI Bank's Board?

Conflict of interest is one of the agency problems which arise because of separation of ownership from management and control. It arises in a situation where an agent, i.e. a director of a company does not act in the best interests of a principal, i.e. a shareholder. Corporate Governance actually concerns these agency problems and the way in which shareholders and other stakeholders can effectively exercise influence and exert control over the actions of company managers. In this environment, the board of directors has to play a significant role in mitigating the potential conflicts of interest.

Various studies in the area of corporate governance make a discussion on agency problems mainly concerning the potential conflicts of interests between principals and agents. Jensen and Meckling (1976) applied Agency Theory to modern companies and formulated an idea that dates back to Adam Smith (1776). They say that when ownership and control of companies are separated, there is potential for conflicts of interest between owners and controllers.

A conflict of interest occurs when an individual fails to exercise independent judgement or perform his role in an objective manner, due to his involvement in another role. If he works for his personal interest overlooking his official interest, conflict is bound to occur. It is not always

necessary that he has exploited his position to obtain an actual monetary or non-monetary benefit. There are two types of conflicts. These are:

- **Personal Benefit Conflict:** This type of conflict occurs when a person applies the knowledge or information obtained from their official role to gain a personal benefit. This benefit may be a financial or measurable benefit enjoyed directly or through a related person, a close relative or an associate company.
- **Conflicts of Loyalty:** This type of conflict takes place when a person's official duty towards a company is in conflict with his duty to another person or entity. In this case, he has to commit his loyalty to any one of them, which prevents him from acting in an independent or objective manner in the best interest of the company.

A person, who holds a fiduciary role has the foremost duty to avoid any conflicts of interest and take decisions with undivided loyalty towards their organisation. The fiduciary role means a position of trust and confidence. The directors of a company are placed in a fiduciary role in their relationship with the company and shareholders whom they represent in all business dealings and decisions. Thus, they are required to make decisions in the best interest of the company rather than their personal interest. In the case of ICICI Bank, the issue of conflict of interest may have been overlooked.

Related Party Transactions: Were the transactions between Chanda Kochhar's husband and the Videocon Group identified or disclosed as related party transactions?

The Companies Act 1956 did not define 'related party transactions'. However, it dealt with restrictions imposed on various transactions with parties like directors or their relatives, firms in which such directors or relatives are partners, other partners of such firms. The Companies Act 2013 defines the whole concept of related party transactions under Section 188, which combines the provisions of sections 314 and 297 of the Companies Act 1956. Section 188 lays down the following provisions:

- **Disclosure by Interested Directors:** Every director of a company must disclose the nature of his interest whether direct or indirect involvement in the contract or arrangement entered into or about to be entered in to by the company, at the meeting of the board in which such contract or arrangement is put for discussion.
- **Board Disclosures:** The report of the board of directors shall disclose every related party transaction or a contract or an arrangement along with the justification for entering into such a contract or arrangement.

Disinterested Quorum: Chanda Kochhar was a member of the credit committee which approved the loan to the Videocon Group. Was the legal requirement of disinterested quorum satisfied in the case?

Section 174 of the Companies Act 2013 discusses the 'interested directors' or disinterested quorum. An 'interested director' means a director within the meaning of Section 184(2) of the Companies Act 2013. It means a director who has a direct or indirect concern in a contract or arrangement between the company and any other company or firm related to the director. Under the Act, the requirement of a disinterested quorum has to be satisfied with conducting a valid board meeting. This is also essential for ensuring good corporate governance by a company, and the directors are expected to disclose any interest that they have in any matter to be discussed by the board.

ICICI Bank had a credit committee whose function was to approve loans and review key borrower accounts. Chanda Kochhar was a member of this Committee which sanctioned the loan to Videocon. Thus, it raises the pertinent question that whether the legal requirement of disinterested quorum satisfied in this case and whether Kochhar disclosed her interest in the transaction to the Committee.

Role of Directors (specifically the independent directors): Were the issues discussed above raised by the independent directors on the Board of ICICI Bank?

The 'Report on Company Law' given by Expert Committee on Company Law under the Chairmanship of Dr JJ Irani (2005) had also laid down that directors have the duty not to place themselves in a position where their fiduciary duties towards the company may conflict with their personal interests. If such conflicts arise, directors would have a duty to give preference to the protection of the interest of the company. It has also been laid by various researchers that the board members should not be seen merely as 'agents' of the shareholders but as the trustees of stakeholders (Aoki, 1984; Blair and Stout, 1999).

It has been established by various judicial precedents that the directors have fiduciary duties to act in a prudent and reasonable manner in the best interests of the companies where they hold positions of directorships. The directors hold the positions of trustees as well as agents of their companies, hence they have fiduciary duties. The Companies Act 2013 laid down the duties of directors clearly under its Section 166, for the first time.

According to Section 166 of the Companies Act 2013, duties of directors of a company are as follows:

1. To act in accordance with the Articles of Association of the company.
2. To act in good faith in order to promote the objects of the company for the benefit of its members as a whole and in the best interest of the company and its stakeholders like the employees, shareholders, community, and the environment.
3. To exercise his duties with reasonable care, skill, and due diligence and to exercise independent judgement.
4. To avoid conflicts of interest.
5. To not try to achieve any undue gain or advantage either for himself or for his relatives, partners or his associates. If a director is found guilty of such making any such undue gain, he shall be liable to pay an amount equal to that gain to the company.

According to Section 149(6) of the Companies Act 2013, every listed public company shall have at least one-third of the total number of directors as independent directors. The objective of mandating the appointment of independent directors was to ensure that the affairs of the company are conducted properly and that Satyam like scams do not reoccur. The new law also wanted to encourage independent directors to act as whistleblowers and actively flag off any wrongdoing by the company management.

According to Agency Theory and various corporate governance reforms that have made in recent years, the higher the percentage of independent directors, the more effective the board would be in reducing agency costs (Fama, 1980). Two main attributes enable outside directors to act effectively as monitors and reduce agency costs—first, their independence and second, their desire to protect their reputation capital (Cadbury, 1992). It is expected that independent directors would be more effective in monitoring and controlling opportunistic behaviours of the management and thereby reduce potential agency conflicts (Means, 2017; Williamson, 1990Jensen and Meckling, 1976; Hermalin and Weisbach, 1998). It has also been advised that the presence of independent directors on the boards would ensure that managers are not the sole evaluators of their own performance (Baysinger and Hoskisson, 1990). Independent directors also enhance the power of the board and its committees in terms of reducing potential agency conflicts and expropriations by the management.

The Board of ICICI Bank comprised six independent directors including the Chairman of Life Insurance Corporation (LIC), one government nominee, and five executive directors. The duty of the board of any company is to look into the interest of the company and not the CEO personally. While the executive directors can be influenced by the CEO, the role of independent directors can be put under the scanner. In this

particular case, the Board may have lacked the supervisory oversight which is expected of the independent directors. The independent directors play an important role in ensuring due diligence in implementing core policies and good corporate governance practices. But the accountability of directors, in this case, can be questioned. The Board acted hastily while giving a clean chit to the CEO in March 2018, while the independent directors should have examined the issues without any affiliation before arriving at any conclusion.

Issues Relating to Business Ethics

Another important concern raised by this case is the matter of business ethics. The boards of the companies are entrusted with the duty to ensure that the management shall observe the ground rules of ethics, transparency, and disclosure. There is always a tussle between ethical practice and a deviant practice or malpractice which is not specifically prohibited by the regulatory authority. Thus, the board has to ensure that the rules and regulations laid down by the regulatory bodies like Securities and Exchange Board of India (SEBI) are adhered to by the company in true spirit. The boards shall constantly try to uphold the public trust that they enjoy by the virtue of the positions that they hold in the companies (Ghosh, 2000). The board shall act as the custodian of the code of corporate ethics and ensure that good corporate governance practices should be inbuilt in the management of the company. The ethics research in corporate governance is mainly concerned with executive values and motivation because the executives (as fiduciaries) have moral duties to the shareholders (Easterbrook and Fischel, 1996; Williams and Ryan, 2007). These duties can be upheld by the executives who adhere to personal ethics and respect all the stakeholders (Cosans, 2009).

The case in the discussion has raised some very compelling questions on the corporate ethics of ICICI Bank. Though transactions between ICICI Bank, Videocon, and NuPower were not covered within the legal definition of 'related party transactions' according to the provisions of the Companies Act 2013 but it was the ethical duty of the MD of ICICI Bank to make full disclosures to the Board in this regard. This omission to disclose may amount to a breach of trust and ethics is closely related to trust. The ethical questions which emerge out of this case are—that why did not Chanda Kochhar disclose to the Board that her husband had business interests with Venugopal Dhoot and recuse herself from the credit committee when the matter of Videocon was being discussed. Another question is that was the ICICI Board aware of the business dealings of Rajiv Kochhar (brother-

in-law), and if it was, why was the matter ignored? Was there no trouble anticipated in the future by the Board of ICICI Bank.

Conclusion

While the companies present technicalities to prove that they are compliant and are on the right path, the issue of corporate ethics demands a much broader and more transparent approach. The principle of transparency demands that all facts available should be disclosed and corporate governance should be placed before everything else.

This case has once again exposed the fact that though Indian companies have emphasized upon revisiting and revising their board-level policies and procedures by implementing the revised Clause 49 of the listing agreement, for the majority of the companies it has been a 'box-ticking' approach. Specifically, the focus of most companies has been on ensuring legal compliance, for example, changing the composition of their boards to ensure an appropriate mix of executive, non-executive and independent directors. But beyond this, not much has been done substantively in the true spirit. Corporate governance is still viewed as a compliance-driven exercise by a majority of the listed companies in India. They channel their efforts at implementing the bare minimum requirements, which would avert any legal troubles. But the true value of governance is much more than ensuring compliance with regulations. In fact, the actual essence of the revised Clause 49 lies in the requirement for a company to review and manage all the risks facing it. This is because the spirit of corporate governance is about putting in place safeguards around any contingency that could have a serious negative impact on a company and its stakeholders.

Good corporate governance can be attained when the independent directors are able to minimise the problem of asymmetric information within the board. The board must emphasize upon the executive management that clean corporate governance practices and processes do not solely mean compliance with various laws, and other critical aspects of due diligence must not be averted. Regulatory authorities like the Reserve Bank of India (RBI) and SEBI should make an effort to put in place the regulations required for establishing the accountability of the independent directors.

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Exploring Green Investment on the Dynamics of Behavioural Finance and Stock Performance

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Abstract

The changing domain of business is warranting new ways of looking into the business needs in the future. Taking a cue from the need to deliver something different, the advent of 'Green Products' and the concept of 'Green' are being incorporated in all the dimensions of business. Be it marketing, finance, human resource (HR), operations, you name one, Green is there. The question which pops up naturally is: whether incorporating Green makes any business sense? Or It's just another way of market positioning? And more importantly what does this Green mean? Let's explore. Green in its very humble appeal is symbolic of products and services that are environment-friendly or causes minimum ecological and environmental damage. What about Green Finance? Then logically it should be financing activities that promoted this ecological and environmental growth. But, the question is: How? Well, it simply implies that fund needs to be collected from people who care about Green and to be deployed to the companies who care about Green. Is it so simple? Going Green needs a long-term commitment on the part of the top management, requires a thorough set of practices that incorporate sustainability within its framework, and of course, a huge amount of outlay is required. To channel funds for Green Commitment, returns and risk are the two important issues that need to be taken care of. Most of the investors care about risk and return and the market believes that Green Commitment is more of a social and ethical initiative and does not make much financial sense (some may differ) (Fontaine, 2013). At this juncture, what is needed is to delve into the nuances of behavioural aspects of financing activities of individuals to understand their Investment Personalities in Socially Responsible Investment (IPSRI). The demographic factors, psychic factors, and financial factors will act as Independent Variable (IV) to understand its impact on IPSRI which will act as Dependent Variable (DV) through the Multinomial Logistic Regression Model. For the study, IPSRI will be divided into four categories based on the proportion of their investment in Socially Responsible Investment (SRI) and Non-SRI Investment. This will be the first objective of the study. The second objective will aim to understand whether investing in SRI is worth. An investigative analysis of the performance of SRI and non-SRI stocks through different risk-adjusted measures along with evaluation based on net selectivity criteria will highlight the performance dynamics of the stocks. The present intervention will help us identify two important dimensions; first, understanding the IPSRI and the influencing factors and second, whether it makes sense to go for SRI in comparison to non-SRI in purely performance parameters.

Keywords: *Investment personalities, SRI, Green Investment, Behavioural finance, Sustainable investment.*

Introduction

Externalities generated by commercial endorsements have an impact on social organisations which can be positive or negative. The accounts of this limited resource, which lacked more natural resources, have given the impression of teachers, as well as policymakers, keeping in mind the situation and ending debate and starting a political initiative.

Sustainability as an idea is based on the understanding that the present generation will take care of the future because resources will end with time. Business processes and related mobility utilise incomparable concepts that keep in mind the sustainability and protect the resources for future generations. Stability, growth, and business mobility became more attractive while talking about developing countries and emerging markets.

The growth of development in the developing market represents an interesting conflict in relation to the sustainability of business development. Compared to developed markets, international organisations are looking to reverse the growth of developing markets to meet the proposed environmental requirements to address sustainability issues. Companies follow environmental goals, whose purpose is to reduce the environmental impact of their activities. Infosys, Tata Group, and Wipro have included sustainability in their business model. Small groups such as Kirloskar have defined strategic priorities for the development of energy-efficient and durable products (Wyeth, 2013). It is important to realise that sustainability operates at three levels of stability and its meaning is still difficult to achieve. Corporate stability is even more difficult to achieve at the operational level; however, without compromising future growth, companies try to increase their ability to meet their current needs. Quinn and Dalton (2009), while highlighting their integration into social, economic and environmental aspects and organisational life, highlight the integration of dimensions.

The economic aspect of sustainability reveals concerns about the profitability of the company to maximise monetary gains and increases the competitive market environment. Market dynamics requires a wide range of practices to reduce cost structure and focus on increased profitability. To grow and survive in the growing market environment, companies stick to their profitability on value addition and analysis and focus on the expansion of the company.

We started this discussion on this matter that companies want to develop the belief that people believe in their future investment value. To maximise profits with the highest standards of value, value proposition norms of stakeholders of specific companies inspire the plans and maintain the balance of these proposals.

Why should companies think about sustainability? This proposition reveals that companies primarily try to increase their earning by investing in the mind of the investor. The obvious answer is still very difficult to achieve, without worrying about the environment in which the company operates. Investors and stakeholders encourage policies that increase the outcome or benefits as a result of their company's development and search results. However, in recent years, the need for environmental protection and the pursuit of increasing a company's operating profitability have made the concept of sustainability more complex.

The government's guidance programmes and many initiatives of international policies make sustainability more meaningful. It is necessary to understand that the powers of society should be completed in the long run. Entrepreneurial mobility and its activities in society should complement each other so that sustainability is involved in the company's operation. Interested observers have to understand this point and encourage companies to start long-term goals to take care of assets, environment, and positive outflow, which affect the development and stability of the company. We can find increasing evidence of literature, where people who are interested in improvements in products and services, usually use Green Technology and promise to build a better future.

In this study, an attempt was made to analyze Green Stock (SRI) in response to financial performance. This study has been built on the basis of understanding that if the financial performance of the SRI stock can be analyzed and compared with the non-SRI stock, then we can understand how and why people are interested in certain stocks.

Investment Personality and Investment Decisions

There are distinct perceptual errors that creep in and exhibit a correlation with investment personalities. The factors affecting investment personalities were studied by Sadi et al. (2011) and were identified to be mostly perceptual errors. Investors consider all kinds of side effects during investing and the investment personality was affected by this type of consideration. The particular was conducted based on the data of Tehran stock market, the five parameters charter (extroversion, agreeableness, conscientiousness, neuroticism, and openness) and the investors' perception errors (over confidence bias, availability, hindsight, escalation of commitment, randomness) were considered for the study. Grinblatt and Keloharju (2000) in their study segmented the investor into distinct behavioural groups based on their biases. The objectives were to segment the investor into distinct behavioural groups based on their biases, to understand the investment

preferences and profile of the identified segments, and to understand the implications for financial service providers. The efficient transmission of information on the rational use of the savings for investment is highlighted by Islamoglu et al. (2015). It was identified in the study that the probability of profit and loss in the investment process makes decision-making difficult for individuals. Makori and Jagongo (2013) in their study analyzed the investment decision based on different factors. The main objective is to determine the factors effecting the behaviour of the individual investor. Big five personality traits were used to understand the personality psychology and Positive and Negative Affect Scales (PANAS) was used to collect data on emotion by Wang (2005). It helped the researcher in knowing the relation between the positive emotion and the rising price in the financial market and also the negative emotion and the falling price of in the financial market. The impact of emotional intelligence and the processing of emotional information on portfolio performance were studied by Clark and Soutar (2004). It was found that emotional intelligence acts as a guiding force of investment behaviour and creates positive personal results. The repeated asset allocation in a portfolio by investors was studied by Scott and Lane (2000).

The study aimed at understanding the effect of goal setting and affect framed feedback on repeated asset allocation investment decisions. The investment behaviour based on the insights of experts and policymakers were studied by Parker (2014). The main objective was to investigate the relationship between personality traits, risk-taking attitude, and investment decisions among potential private investors in Kazakhstan. Investor's feelings have a significant impact on the equity pricing (Nelson, 2014). Baker and Ricciardi (2015) in their study discussed the insight about key factors influencing the behaviour of retail investors with respect to demographics in relation to their investment and their decision-making processes. Kudryavtsev et al. (2013) in their study stated how feelings influence individuals' decision-making process. The objective of this study was to examine the potential functional and dysfunctional roles of feelings in decision-making. Rzeszutek et al (2015) in his paper discussed the German investors of a publicly-traded company that put into perspective the aforementioned detrimental choice-effect, the impact of reputation on individual investor behavior, and reveals a diversity of loyalty effects of corporate reputation. Loewenstein (1999) in a study overviewed the new emotion-related developments in decision research. The objectives were to identify the errors that every individual make when they judge the circumstances of some future happenings and to simplify heuristics that

individuals use to cope up with the complex decision-making process. McConnell et al (2014) in their study highlighted how these biases affect the investment advisors. The main aim is to examine the effects of three behavioural biases on investment advisors. Investment advisors are those people who help their clients in decision-making issues such as investing, insurance, borrowing, taxation, and retirement planning. Zhang et al. (2016) in his study discussed the theoretical issues of defining and modelling sentiment in an intuitive and parsimonious way. The objective of the paper was to define and model investor's sentiment in a way that is accurately similar to the actual investor behaviour.

Objectives of the Present Study

The present intervention will help us identify two important dimensions; first, whether it really makes sense to go for SRI in comparison to non-SRI in purely performance parameters and second, understanding the IPSRI and the influencing factors. The objectives of the study are as follows:

- To understand the performance dynamics of SRI and non-SRI stocks based on risk-adjusted measures.
- To employ net selectivity return as an evaluation criterion between general stocks portfolio and socially responsible stock portfolio.
- To study the IPSRI and the influencing factors.

Methodology

The study uses two distinct sets of methodology for the study. The first part of the work looks into the performance of SRI stocks. The second part of the work looks into the behaviourial dynamics of the IPSRI. The methodologies for both parts are discussed separately.

To analyze the performance analysis of the SRI and non-SRI stocks the methodological dimension considers the methodology demonstrated by Hume and Larkin (2008) and made internationally acceptable by Hamilton et al. (1993) and Statman (2005).

Research Design

The empirical study is based on the secondary data from the Bombay Stock Exchange (BSE) and the National Stock Exchange (NSE). The closing price of indices S&P BSE GREENEX and S&P BSE 100 ESG are used as proxies for socially responsible stocks, S&P BSE SENSEX and NIFTY 50 are used as proxies of socially non-responsible stocks, and NIFTY 500 is used as a proxy for the market portfolio. The entire socially responsible stocks in BSE

are considered for the study. The data considered for the study is from April 2010 to March 2018.

Analysis Tools

- **Return:** The monthly returns the indices are calculated using the following formula:

  $$\text{Return} = \frac{\textit{Current day closing price} - \textit{Previous day closing price}}{\textit{Previous day closing price}} \quad ...(1)$$

  The average monthly return of the indices is calculated for the given period.
- **Risk:** The formula for risk is given by

  $$\text{S.D.} = \sqrt{\frac{(R_i - \bar{R})^2}{n-1}} \quad ...(2)$$

  Where R_i = Monthly return of the i^{th} stock over a period of time

  $\overline{R}$ = Average return of the i^{th} stock

  The variance is given by the formula

  $$\text{Variance} = \frac{(X_i - \bar{X})^2}{n-1} \quad ...(3)$$
- **Covariance:** The formula for covariance is

  $$\text{Covariance } (i, m) = \frac{\sum(R_i - \bar{R}_i)(R_m - \bar{R}_m)}{n-1} \quad ...(4)$$

  Where R_m = Monthly return of the market
- **Beta:** The beta, β is calculated using the formula

  $$\text{Beta} = \frac{\textit{Covariance } (i,m)}{\sigma m^2} \quad ...(5)$$

Risk-Adjusted Measures

- **Sharpe ratio:** Sharpe ratio is calculated as:

  $$\text{Sharpe ratio} = \frac{AR_p - R_f}{\sigma p} \quad ...(6)$$

  Where, AR_p = Average return of the portfolio

  The R_f = Risk-free rate of return

  σ_p = Standard deviation of portfolio return
- **Treynor ratio:** Treynor ratio is given by:

  $$\text{Treynor ratio} = \frac{AR_p - R_f}{\beta p} \quad ...(7)$$

  Where, AR_p = Average return on the portfolio

  R_f = Risk-free rate of return

  β_p = Portfolio beta
- **Jensen Measure:** The difference between the actual returns received and the expected level of risk in a portfolio is measured by this tool.

- **Information ratio:**

$$\text{Information Ratio} = \frac{E[R_p - R_b]}{\sigma} = \frac{\alpha_p}{\sigma_{ep}} \quad \ldots(8)$$

Where, α_p = Jensen's measure or abnormal return of the portfolio
σ_{ep} = unsystematic risk of the portfolio

Fama Decomposition Measure

To capture systematic risk, unsystematic risk, and net selectivity, this particular measure proposes to decompose the excess returns generated from the portfolios and decompose them into several separate components of systematic risk, unsystematic risk, and net selectivity to evaluate the portfolio performance.

Research Type

For the second part, descriptive research is conducted. Data is collected with the help of a questionnaire designed for the study among different people in Guwahati, Tezpur, and Silchar. The population consists of individuals who have knowledge about the stock market and invest in the stock market. All the participants were employees, businessmen or students.

Sampling Procedure

The purposive sampling procedure is used in this study.

Sample Size

The sample size for the research is 200.

Variables

The dependent and independent variables of the study have been discussed in the below paragraph.

Dependent Variable

Investment personality based on sustainable investment is categorised into four categories: AIPSI, MIPSI, BIPSI, and CIPSI according to the percentage

Table 1: Percentage of the Total Investment in SRI and Non-SRI Stocks in Different Sustainable Investment Categories

Category	*SRI (% of Total Investment)*	*Non-SRI (% of Total Investment)*
AIPSI IPSI (AIPSI)	90	10
MIPSI IPSI (MIPSI)	70	30
BIPSI IPSI (BIPSI)	50	50
CIPSI IPSI (CIPSI)	10	90

Source: Created by the author.

of the total investment in SRI and non-SRI Stocks. The classification of the dependent variable is presented in Table 1.

Independent Variables

The independent variables selected for the study includes the following:

1. Demographic Factors (age, marital status, occupation, monthly income);
2. Psychic Factors (rational decision, bias, highest gain, fear of loss, betting, the joy of profit);
3. Financial Factors (safety, past performance, time of trading, frequency, satisfaction level on dividend, capital gain, quick gain, safety, liquidity, tax benefit, diversification, and hedge).

Statistical Design

Multi-nominal Logistic Regression Analysis is used for the second part of the analysis. It is the regression analysis to conduct when the dependent variable depends on more than two independent variables.

Results and Discussions

The result of the study has discussed below:

Performance of SRI

Using the various risk-adjusted measures like Treynor ratio, Sharpe ratio, Information ratio, and Jensen measure, the study attempted to analyze the results of the portfolio. To fulfill the second objective of the study Fama Decomposition measure was used. The four selected stocks, namely, GREENEX and ESG as SRI portfolio; whereas, NIFTY 50 and SENSEX as general stock company indices were considered for analysis and their Average monthly returns were considered (Table 2).

Table 2: Monthly Return, Risk, and Risk-adjusted Measures of Various Portfolios

Portfolio	*GREENEX*	*ESG*	*SENSEX*	*NIFTY*
Return (%)	1.77	1.04	0.745	0.2467
Risk (%)	5.69	5.62	4.257	3.513
B	0.319	0.907	0.6955	0.90257
Unsystematic Risk	4.767	4.703	3.5623	2.60938
Sharpe Ratio	0.199	0.06730	0.02208	0.02464
Treynor Ratio	0.01236	0.00413	0.001350	0.00092
Jensen's Measure	0.00935	0.001934	–0.000523	–0.00102
Information Ratio	0.1963	0.041109	–0.014664	–0.0394

Source: Created by the author.

The results exhibited a high-risk profile of the portfolio as is evident from the higher values of Sharpe ratio, Treynor ratio, Jensen measure values, and Information ratio. The portfolios were found to be less diversified. GREENEX with an average monthly return of around 1.78 per cent performed better compared to ESG (1.03 per cent monthly return). The value of high beta indicated higher sensitivity of the SRI stocks ESG and GREENEX to market volatilities and fluctuations.

Table 3: Fama Decomposition Results of the Various Portfolios

Portfolio	*GREENEX*	*ESG*	*SENSEX*	*NIFTY*
Return for bearing market risk	0.001908	0.00192	0.00147	0.00183
Return for bearing unsystematic risk	0.001187	0.00121	0.000903	0.0000524
Net selectivity	0.008179	0.000726	–0.000143	–0.00109

Source: Created by the author.

Based on the net selectivity bias as measured by the Fama decomposition measure, the SRI stocks were found to outperform the market and the general stocks (Table 3). The net selectivity numbers of SRI stocks were found to be positive whereas for the general stock indices they were negative. As far as the returns are concerned, SRI stocks exhibited around 0.001187 per cent return per month in comparison to 0.0000524 per cent return per month by NIFTY 50. The SRI stocks were able to generate higher returns due to more exposure towards unsystematic risk (macro-economic factors) in comparison to other general portfolios.

Table 4: Effect of Demography Factors on Investment Personality based on Sustainable Investment (IPSI)

Model Fitting Information				
Model	*Model Fitting Criteria*	*Likelihood Ratio Tests*		
		Chi-Square	*df*	*Sig.*
Intercept Only	120.71			
Final	61.104	59.605	42	0.038

Source: Created by the author.

In Table 4, the p-value is below 0.05. It shows that the IPSI is highly influenced by demographic factors.

Table 5: Investment Personality based on Sustainable Investment (IPSI)

Investment Personality based on Sustainable Investment (IPSI)		*Sig.*	*Odds*
AIPSI	Intercept	0.997	
	[Gender = Female]	0.994	0
	[Gender = Male]	0.998	0
	[GENDER=MALE]	.	.
	[AGE = 30-40 years]	0.993	0
	[AGE = 40-50 years]	0.993	0
	[AGE = Above 50 years]	0.993	0
	[AGE = BELOW 30 years]	.	.
	[MARTIALSTATUS = MARRIED]	1	2.10
	[MARTIALSTATUS = UNMARRIED]	.	.
	[OCCUPATION = GOVT EMPLOYEE]	0.999	91.797 (very high)
	[OCCUPATION = PRIVATE EMPLOYEE]	0.999	117.16 (very high)
	[OCCUPATION = RETIRED]	.	0
	[OCCUPATION = SELF-EMPLOYEE]	0.997	0
	[OCCUPATION = STUDENT]	.	.
	[MONTHLYINCOME = Rs. 20000-30000]	0.996	0
	[MONTHLYINCOME =Rs. 30000-40000]	0.997	0
	[MONTHLYINCOME = Rs. 40000-50000]	1	0.15
	[MONTHLYINCOME = ABOVE Rs.50000]	1	0.545
	[MONTHLYINCOME = BELOW Rs.20000]	.	.
	[MONTHLYINCOME = NO INCOME]	.	.
BIPSI	Intercept	0.819	
	[GENDER=FEMALE]	0.477	3.425 (very high)
	[GENDER=Male]	0.996	0
	[GENDER=MALE]	.	.
	[AGE=30-40 years]	0.979	0
	[AGE=40-50 years]	0.978	0
	[AGE=ABOVE 50 years]	0.996	0
	[AGE=BELOW 30 years]	.	.

BIPSI	[MARTIALSTATUS=MARRIED]	0.981	0
	[MARTIALSTATUS=UNMARRIED]	.	.
	[OCCUPATION=GOVT EMPLOYEE]	0.993	0
	[OCCUPATION=PRIVATE EMPLOYEE]	0.993	0
	[OCCUPATION=RETIRED]	0.997	0
	[OCCUPATION=SELF-EMPLOYEE]	0.998	0.001
	[OCCUPATION=STUDENT]	.	.
	[MONTHLYINCOME = Rs. 20000-30000]	0.995	0
	[MONTHLYINCOME = Rs. 30000-40000]	1	0.36
	[MONTHLYINCOME = Rs. 40000-50000]	0.996	0
	[MONTHLYINCOME = ABOVE Rs. 50000]	0.996	0
	[MONTHLYINCOME = BELOW Rs. 20000]	.	.
	[MONTHLYINCOME = NO INCOME]	.	.
MIPSI	Intercept	0.822	
	[GENDER=FEMALE]	0.183	3.253 (very high)
	[GENDER=Male]	0.997	0
	[GENDER=MALE]	.	.
	[AGE=30-40 years]	0.703	0.713
	[AGE=40-50 years]	0.61	0.502
	[AGE=ABOVE 50 years]	0.996	0
	[AGE=BELOW 30 years]	.	.
	[MARTIALSTATUS=MARRIED]	0.545	1.669
	[MARTIALSTATUS=UNMARRIED]	.	.
	[OCCUPATION=GOVT EMPLOYEE]	0.993	0
	[OCCUPATION=PRIVATE EMPLOYEE]	0.993	0
	[OCCUPATION=RETIRED]	0.998	0
	[OCCUPATION=SELF-EMPLOYEE]	0.99	0
	[OCCUPATION=STUDENT]	.	.
	[MONTHLYINCOME=20-30]	0.993	0
	[MONTHLYINCOME=30-40]	0.993	0
	[MONTHLYINCOME=40-50]	0.993	0
	[MONTHLYINCOME=ABOVE 50]	0.993	0
	[MONTHLYINCOME=BELOW 20]	.	.
	[MONTHLYINCOME=NO INCOME]	.	.

Source: Created by the author.

The Reference is CIPSI.

1. There is 110 per cent chance to shift from CIPSI to AIPSI if there is a change in marital status (From Unmarried to Married)
2. There are 85 per cent chances to shift from AIPSI to CIPSI if there is a change in monthly income from No Income to Income under 40-50.
3. There are 64 per cent chances to shift from BIPSI to CIPSI if there is a chance to shift from No Income to Income between 30- and 40.
4. There are 50 per cent chances to shift from MIPSI to CIPSI if there is a chance to shift from age younger than 30 years to age between 40 and 50 years.

Table 6: Effect of Psychic Factors on Investment Personality based on Sustainable Investment (IPSI)

Model Fitting Information				
Model	*Model Fitting Criteria*	*Likelihood Ratio Tests*		
		Chi-Square	*df*	*Sig.*
Intercept Only	135.588			
Final	62.804	72.784	42	0.002

Source: Created by the author.

In Table 6, the p value is less than 0.05. Thus, it indicates that there is a much high effect of psychic factors on investment personality (Table 7).

Table 7: Investment Personality based on Sustainable Investment (IPSI)

Investment Personality based on Sustainable Investment (IPSI)		*Sig.*	*Odds*
AIPSI	Intercept	0.995	
	[RATIONALDECISION=NO]	0.993	0
	[RATIONAL DECISION=YES]	.	.
	[BIAS = NO]	0.988	0
	[BIAS = YES]	.	.
	[HIGHEAST GAIN=AGREE]	0.997	0
	[HIGHEAST GAIN=DISAGREE]	0.998	0
	[HIGHEAST GAIN=NEUTRAL]	0.996	0
	[HIGHEAST GAIN=STRONGLY AGREE]	.	.
	[FEAR OF LOSS = AGREE]	0.992	0
	[FEAR OF LOSS = DISAGREE]	0.996	0
	[FEAR OF LOSS = NEUTRAL]	0.991	0
	[FEAR OF LOSS = STRONGLY AGREE]	.	.
	[BETTING=AGREE]	0.987	0
	[BETTING=DISAGREE]	0.992	0
	[BETTING=NEUTRAL]	0.987	0

AIPSI	[BETTING=STRONGLY AGREE]	.	.
	[JOY OF PROFIT=AGREE]	0.194	12.721 (very high)
	[JOY OF PROFIT=DISAGREE]	.	0
	[JOY OF PROFIT=NEUTRAL]	1	2.349
	[JOY OF PROFIT=STRONGLY AGREE]	.	.
BIPSI	Intercept	0.992	
	[RATIONAL DECISION=NO]	0.984	0
	[RATIONAL DECISION=YES]	.	.
	[BIAS =NO]	0.871	0.762
	[BIAS =YES]	.	.
	[HIGHEAST GAIN =AGREE]	0.987	0
	[HIGHEAST GAIN=DISAGREE]	1	0.837
	[HIGHEAST GAIN=NEUTRAL]	0.987	0
	[HIGHEAST GAIN=STRONGLY AGREE]	.	.
	[FEAR OF LOSS=AGREE]	0.995	0
	[FEAR OF LOSS=DISAGREE]	1	0
	[FEAR OF LOSS=NEUTRAL]	0.995	0
	[FEAR OF LOSS=STRONGLY AGREE]	.	.
	[BETTING=AGREE]	0.997	0
	[BETTING=DISAGREE]	0.995	0
	[BETTING=NEUTRAL]	0.998	0
	[BETTING=STRONGLY AGREE]	.	.
	[JOY OF PROFIT=AGREE]	0.502	2.449
	[JOY OF PROFIT=DISAGREE]	.	0
	[JOY OF PROFIT=NEUTRAL]	0.986	0
	[JOY OF PROFIT=STRONGLY AGREE]	.	.
CIPSI	Intercept	0.648	
	[RATIONAL DECISION=NO]	0.09	7.996 (very high)
	[RATIONAL DECISION=YES]	.	.
	[BIAS=NO]	0.698	1.596
	[BIAS=YES]	.	.
	[HIGHEAST GAIN=AGREE]	0.176	0.071
	[HIGHEAST GAIN=DISAGREE]	0.362	5.972 (very high)
	[HIGHEAST GAIN=NEUTRAL]	0.398	0.278
	[HIGHEAST GAIN=STRONGLY AGREE]	.	.
	[FEAR OF LOSS=AGREE]	0.992	0
	[FEAR OF LOSS=DISAGREE]	0.992	0
	[FEAR OF LOSS=NEUTRAL]	0.992	0
	[FEAR OF LOSS=STRONGLY AGREE]	.	.

CIPSI	[BETTING=AGREE]	0.992	0
	[BETTING=DISAGREE]	0.99	0
	[BETTING=NEUTRAL]	0.992	0
	[BETTING=STRONGLY AGREE]	.	.
	[JOY OF PROFIT=AGREE]	0.256	3.743 (very high)
	[JOY OF PROFIT=DISAGREE]	0.999	0
	[JOY OF PROFIT=NEUTRAL]	0.072	0.079
	[JOY OF PROFIT=STRONGLY AGREE]	.	.

Source: Created by the author.

The Reference is MIPSI.

1. There is a 130 per cent chance to shift from MIPSI to AIPSI if there is a chance to shift from Strongly Agree to Neutral to the statement 'Joy of profit always urge to make more investment.'
2. There is a 140 per cent chance to shift from MIPSI to BIPSI if there is a chance to shift from Agree to Strongly Agree to the statement 'Joy of profit always urge to make more investment.'
3. There is a 23 per cent chance to shift from BIPSI to MIPSI if there is a chance to shift from Yes to No for the question 'Are you always bias in your investment decision?'
4. There is a 16 per cent chance to shift from BIPSI to MIPSI if there is a chance to shift from Strongly Agree to Disagree to the statement 'Biasness always lead to highest gain.'
5. There is a 72 per cent chance to shift from CIPSI to MIPSI if there is a chance to shift from Strongly Agree to Neutral for the statement 'Biasness always lead to highest gain.'

Table 8: Effect of Financial Factors on Investment Personality based on Sustainable Investment (IPSI)

Model Fitting Information				
Model	*Model Fitting Criteria*	*Likelihood Ratio Tests*		
	–2 Log Likelihood	*Chi-Square*	*df*	*Sig.*
Intercept Only	152.33			
Final	5.87E+04	.	##	.

Source: Created by the author.

In Table 8, the significance is less than 0.05. Thus, the effect of financial factors is highly significant in investment personality.

Table 9: Investment Personality based on Sustainable Investment (IPSI)

Investment Personality based on Sustainable Investment (IPSI)		Sig.	Odds
AIPSI	Intercept	0.973	
	[Ability to cope with uncertainty = Type A]	0.917	0.339
	[Ability to cope with uncertainty = Type B]	.	.
	[SAFETY=NO]	0.788	0.47
	[SAFETY=YES]	.	.
	[PAST PERFORMANCE=NO]	0.516	3.991 (very high)
	[PAST PERFORMANCE=YES]	.	.
	[TIME=1-2 YR]	0.971	0
	[TIME=10 YRS]	0.974	0
	[TIME=6 MON-1 YR]	0.969	0
	[TIME=LESS THAN 6 MON]	0.968	0
	[TIME=MORE THAN 12 YRS]	.	.
	[FREQUENCY=DAILY]	0.793	0.012
	[FREQUENCY=MONTHLY]	0.944	0.645
	[FREQUENCY=WEEKLY]	0.992	0.94
	[FREQUENCY=YEARLY]	.	.
	[DIVIDEND = HIGHLY SATISFIED]	0.98	0.882
	[DIVIDEND=NEUTRAL]	0.849	3.482 (very high)
	[DIVIDEND=SATISFIED]	.	.
	[CAPITALGAIN=DISAGREE]	0.832	0
	[CAPITAL GAIN=HIGHLY SATISFIED]	0.699	0.095
	[CAPITAL GAIN=NEUTRAL]	0.851	0.443
	[CAPITAL GAIN=SATISFIED]	.	.
	[QUICK GAIN=D]	0.886	0.099
	[QUICK GAIN=DISAGREE]	0.99	0.668
	[QUICK GAIN=HIGHLY SATISFIED]	0.613	6.099 (very high)
	[QUICK GAIN=NEUTRAL]	0.912	0.561
	[QUICK GAIN=SATISFIED]	.	.
	[SAFETY_A=DISAGREE]	0.698	0.044
	[SAFETY_A=HIGHLY SATISFIED]	0.965	1.133
	[SAFETY_A=NEUTRAL]	0.847	0.588
	[SAFETY_A=SATISFIED]	.	.
	[LIQUIDITY=DISAGREE]	0.893	860.178 (very high)
	[LIQUIDITY=HIGHLY SATISFIED]	0.851	0.344
	[LIQUIDITY=NEUTRAL]	0.28	0.017
	[LIQUIDITY=SATISFIED]	.	.

AIPSI	[TAX BENEFIT=DISAGREE]	0.86	0
	[TAX BENEFIT=HIGHLY DISAGREE]	0.815	0
	[TAX BENEFIT=Highly satisfied]	0.835	0.07
	[TAX BENEFIT=HIGHLY SATISFIED]	0.789	63.371 (very high)
	[TAX BENEFIT=NEUTRAL]	0.692	0.302
	[TAX BENEFIT=SATISFIED]	.	.
	[DIVERSIFICATION=DISAGREE]	0	0
	[DIVERSIFICATION=HIGHLY DISAGREE]	0	0
	[DIVERSIFICATION=HIGHLY SATISFIED]	0.721	0.001
	[DIVERSIFICATION=NEUTRAL]	0.343	70.815(very high)
	[DIVERSIFICATION=SATISFIED]	.	.
	[HEDGE=DISAGREE]	0	.c
	[HEDGE=HIGHLY DISAGREE]	.	.c
	[HEDGE=HIGHLY SATISFIED]	0.824	23.724(very high)
	[HEDGE=NEUTRAL]	0.925	1.364
	[HEDGE=SATISFIED]	.	.
BIPSI	Intercept	0.997	
	[Ability to cope with uncertainty=Type A]	0.6	0.014
	[Ability to cope with uncertainty=Type B]	.	.
	[SAFETY=NO]	0.899	1.372
	[SAFETY=YES]	.	.
	[PAST PERFORMANCE=NO]	0.195	9.780(very high)
	[PAST PERFORMANCE=YES]	.	.
	[TIME=1-2 YR]	0.997	933.282(very high)
	[TIME=10 YRS]	0.999	0.16
	[TIME=6 MON-1 YR]	0.998	166.898(very high)
	[TIME=LESS THAN 6 MON]	0.998	63.826(very high)
	[TIME=MORE THAN 12 YRS]	.	.
	[FREQUENCY=DAILY]	0.861	4.017(very high)
	[FREQUENCY=MONTHLY]	0.864	0.444
	[FREQUENCY=WEEKLY]	0.524	0.038
	[FREQUENCY=YEARLY]	.	.
	[DIVIDEND=HIGHLY SATISFIED]	0.623	0.151
	[DIVIDEND=NEUTRAL]	0.744	0.219
	[DIVIDEND=SATISFIED]	.	.

BIPSI	[CAPITAL GAIN=DISAGREE]	0.885	0.004
	[CAPITAL GAIN=HIGHLY SATISFIED]	0.981	1.106
	[CAPITAL GAIN=NEUTRAL]	0.834	2.403
	[CAPITAL GAIN=SATISFIED]	.	.
	[QUICK GAIN=D]	0.6	579.642(very high)
	[QUICK GAIN=DISAGREE]	0.862	85.888(very high)
	[QUICK GAIN=HIGHLY SATISFIED]	0.537	4.089(very high)
	[QUICK GAIN=NEUTRAL]	0.443	14.119(very high)
	[QUICK GAIN=SATISFIED]	.	.
	[SAFET Y_A=DISAGREE]	0.981	0.91
	[SAFETY_A=HIGHLY SATISFIED]	0.583	4.130(very high)
	[SAFETY_A=NEUTRAL]	0.591	0.232
	[SAFETY_A=SATISFIED]	.	.
	[LIQUIDITY=DISAGREE]	0.727	0
	[LIQUIDITY=HIGHLY SATISFIED]	0.648	0.18
	[LIQUIDITY=NEUTRAL]	0.413	0.123
	[LIQUIDITY=SATISFIED]	.	.
	[TAX BENEFIT=DISAGREE]	0.933	0.04
	[TAX BENEFIT=HIGHLY DISAGREE]	0.936	0.042
	[TAX BENEFIT=Highly satisfied]	0.833	7.973(very high)
	[TAX BENEFIT=HIGHLY SATISFIED]	0.857	0.208
	[TAX BENEFIT=NEUTRAL]	0.793	1.836
	[TAX BENEFIT=SATISFIED]	.	.
	[DIVERSIFICATION=DISAGREE]	0.02	0
	[DIVERSIFICATION=HIGHLY DISAGREE]	0.857	0
	[DIVERSIFICATION=HIGHLY SATISFIED]	0.714	85.898(very high)
	[DIVERSIFICATION=NEUTRAL]	0.409	0.041
	[DIVERSIFICATION=SATISFIED]	.	.
	[HEDGE=DISAGREE]	0.943	0.067
	[HEDGE=HIGHLY DISAGREE]	.	0.006
	[HEDGE=HIGHLY SATISFIED]	0.397	0.001
	[HEDGE=NEUTRAL]	0.744	2.864
	[HEDGE=SATISFIED]	.	.

CIPSI	Intercept	0.999	
	[Ability to cope with uncertainty=Type A]	0.8	0.211
	[Ability to cope with uncertainty=Type B]	.	.
	[SAFETY=NO]	0.89	1.226
	[SAFETY=YES]	.	.
	[PAST PERFORMANCE=NO]	0.66	1.987
	[PAST PERFORMANCE=YES]	.	.
	[TIME=1-2 YR]	0.998	0.045
	[TIME=10 YRS]	0.999	0.066
	[TIME=6 MON-1 YR]	0.998	0.05
	[TIME=LESS THAN 6 MON]	0.999	0.302
	[TIME=MORE THAN 12 YRS]	.	.
	[FREQUENCY=DAILY]	0.531	0.009
	[FREQUENCY=MONTHLY]	0.943	0.639
	[FREQUENCY=WEEKLY]	0.748	0.121
	[FREQUENCY=YEARLY]	.	.
	[DIVIDEND=HIGHLY SATISFIED]	0.615	4.150(very high)
	[DIVIDEND=NEUTRAL]	0.141	0.005
	[DIVIDEND=SATISFIED]	.	.
	[CAPITAL GAIN=DISAGREE]	0.938	3.606(very high)
	[CAPITAL GAIN=HIGHLY SATISFIED]	0.533	0.118
	[CAPITAL GAIN=NEUTRAL]	0.874	1.377
	[CAPITAL GAIN=SATISFIED]	.	.
	[QUICK GAIN=D]	0.765	0.111
	[QUICK GAIN=DISAGREE]	0.504	0
	[QUICK GAIN=HIGHLY SATISFIED]	0.673	0.493
	[QUICK GAIN=NEUTRAL]	0.25	34.671(very high)
	[QUICK GAIN=SATISFIED]	.	.
	[SAFETY_A=DISAGREE]	0.973	1.188
	[SAFETY_A=HIGHLY SATISFIED]	0.463	6.090(very high)
	[SAFETY_A=NEUTRAL]	0.192	13.943(very high)
	[SAFETY_A=SATISFIED]	.	.
	[LIQUIDITY=DISAGREE]	0.924	0.161
	[LIQUIDITY=HIGHLY SATISFIED]	0.558	0.215
	[LIQUIDITY=NEUTRAL]	0.423	0.349
	[LIQUIDITY=SATISFIED]	.	.
	[TAX BENEFIT=DISAGREE]	0.862	18.376(very high)
	[TAX BENEFIT=HIGHLY DISAGREE]	0.741	479.733(very high)

CIPSI	[TAX BENEFIT=Highly satisfied]	0.857	3.754(very high)
	[TAX BENEFIT=HIGHLY SATISFIED]	0.472	19.639(very high)
	[TAX BENEFIT=NEUTRAL]	0.349	0.235
	[TAX BENEFIT=SATISFIED]	.	.
	[DIVERSIFICATION=DISAGREE]	0.785	6.316(very high)
	[DIVERSIFICATION=HIGHLY DISAGREE]	0.752	0.003
	[DIVERSIFICATION=HIGHLY SATISFIED]	0.801	0.118
	[DIVERSIFICATION=NEUTRAL]	0.51	0.114
	[DIVERSIFICATION=SATISFIED]	.	.
	[HEDGE=DISAGREE]	0.773	0.006
	[HEDGE=HIGHLY DISAGREE]	.	0.094
	[HEDGE=HIGHLY SATISFIED]	0.495	68.689(very high)
	[HEDGE=NEUTRAL]	0.567	3.759(very high)
	[HEDGE=SATISFIED]	.	.

Source: Created by the author

The reference is MIPSI.

1. There is a 140 per cent chance to shift from MIPSI to BIPSI if there is a chance to shift from Satisfied to Highly Satisfied regarding satisfaction level in capital gain.
2. There is an 80 per cent chance to shift from BIPSI to MIPSI if there is a chance to shift from Satisfied to Highly Satisfied regarding the satisfaction level in a tax benefit.
3. There is a 53 per cent chance to shift from AIPSI to MIPSI if there is a chance to shift from Yes to No regarding the satisfaction level in safety.
4. There is a 36 per cent chance to shift from AIPSI to MIPSI if there is a chance to shift from Yearly to Monthly regarding the frequency of trading.
5. There is 12 per cent chance to shift from AIPSI to MIPSI if there is a chance to shift from Satisfied to Highly Satisfied regarding the satisfaction level in the dividend.
6. There is 56 per cent chance to shift from AIPSI to MIPSI if there is a chance to shift from Satisfied to Neutral.
7. There is 140 per cent chance to shift from MIPSI to BIPSI if there is a chance to shift from Satisfied to Neutral regarding satisfaction level in capital gain.
8. There is 79 per cent chance to shift from CIPSI to MIPSI if there is a chance to shift from Satisfied to Highly Satisfied regarding the satisfaction level in liquidity.

Table 10: Representation of the Final Calculation of the Factors Affecting the Four Variables

Factors	*Variables*		*Explanatory Factors*	*Sig*	*Odds*
Demographic	Investment personality	CIPSI to AIPSI	Marital Status (Married)	1	2.10
		AIPSI to CIPSI	Monthly income (Rs. 40000-50000)	1	0.15
		BIPSI to CIPSI	Monthly income (Rs. 30000-40000)	1	0.36
		MIPSI to CIPSI	Age (40-50 years)	0.61	0.502
Psychic	Investment personality	MIPSI to AIPSI	Joy of profit (agree)	1	2.349
		BIPSI to MIPSI	Bias (No)	0.871	0.762
			Highest gain (disagree)	1	0.837
			Joy of profit (Agree)	0.502	2.449
		CIPSI to MIPSI	Highest gain	0.398	0.278
Financial	Investment personality	AIPSI to MIPSI	Safety (No)	0.788	.42
			Frequency (Monthly)	0.944	0.645
			Dividend (highly satisfied)	0.98	0.882
			Capital gain (neutral)	0.815	0.443
		BIPSI to MIPSI	Tax benefit (highly satisfied)	0.857	0.208
		MIPSI to BIPSI	Hedge (neutral)	0.744	2.804
			Capital gain (neutral)	0.834	2.403
		CIPSI to MIPSI	Liquidity (highly satisfied)	0.558	0.215

Source: Created by the author.

Conclusion

The selection and timing ability of the manager are fundamental in providing superior portfolio performance. In the light of portfolio performance and diversification perspective, it is imperative to include different kinds of stocks in the portfolio. The inclusion of SRI and non-SRI in the portfolio provides enough diversification. The performance of

the portfolio is also affected by the performance of individual stocks. The SRI stocks were found to highly performance-oriented in comparison to the non-SRI stocks. Volatile macro-economic variables were found to be less influential in affecting the SRI stocks. The SRI stocks were also found to be more diversifiable. Diversification of the SRI equity portfolio can increase the return on security mentioned in this specific study. It can be concluded that SRI shares in India can remain stable in the coming years; investors will be more interested in depositing their money in SRI shares, which will increase the chance of creating winning positions. To invest in sustainable investment, it can be concluded that investment personalities play a significant role in deciding the amount of investment made in the SRI stocks. The performance ability of SRI stocks was found to be superior in comparison to the non-SRI stocks. Investors do not invest in SRI stocks due to the difference in the type of the investment personalities. If the influencing factors of the investment personalities are calibrated properly, then the shift in investment personality can be managed effectively to create a win-win situation for both return and sustainability.

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Sustainable Food and Agriculture

Food Processing in India: A New Horizon in Agribusiness Entrepreneurship

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Abstract

India is the second largest producer of fruit and vegetable in the world and 30 per cent of India's fruits and vegetables is lost due to the poor post-harvest management practices. India has low levels of processing and value addition as compared to other nations of the world. There is a need of encouraging the food processing as agribusiness ventures in the country to improve the processing and value addition of fruits and vegetables to eventually boost up the rural and urban economy of the country. The United States (US) is processing 90 per cent fruits and vegetables, followed by Malaysia 83 per cent, South Africa 80 per cent, the Philippines 78, Brazil 70 per cent, and India only 2-3 per cent. The Government of India emphasized on export and setting up of venture in food processing sector by initiating many schemes like agro processing cluster development, setting up of Mega food park, cold storage and cold chain infrastructure development. Lack of infrastructure, backward and forward linkage, and sanitary and phytosanitary measures are the major issues which is slowing down the growth and development of the food processing sector in India. Food processing is a growing industry in India and it has huge opportunities for entrepreneurship in agribusiness. This paper is an attempt to identify the agribusiness opportunities and prospects of the food processing sector in India. The objectives of the paper is to analyze the present status of food processing in India, prospect of food processing as agribusiness opportunities in India, and also to know the various challenges for entrepreneurship in food processing in India. The study is based on the secondary data which was collected from journals, books, magazines, and web resources of the Ministry of Food Processing, the Ministry of Agriculture and Cooperation, etc. Value addition in India is merely 2 per cent which is very low and export of processed food from India shows contraction or negative and imported items shows increased growth. The government emphasized entrepreneurship and export of processed food through various schemes are the finding of the study.

Keywords: *Food processing, Agribusiness, Entrepreneurship, Opportunities.*

Introduction

The food processing sector undertakes significant importance in the national economy due to the potential to create huge employment opportunities. The food processing industry is one of the largest industries in the country mainly on the account of its strong agricultural base. Food processing industry is large in size and fifth in ranking in industries and having a share of 9 per cent in manufacturing and 11 per cent in agriculture

(ASSOCHAM, 2015). The food processing industry depends on the supply of raw material on agriculture and India is leading in agricultural production like milk, pulses, bananas, mango, guava and the second largest producer of fruits and vegetables in the world after China. Therefore, India has immense potential for food processing side. Our processing and value addition level is very low compared to other countries (Radhakrishanan and Sriraman, 2014). Various value addition techniques enhance their shelf life and it helps to surplus for export of processed product (Sanal and Kumar, 2017). In India, surplus of agriculture produce and lack of nutritive food or shortage of quality nutritive food is the major concern for increasing population of the country. There are 30 per cent of fruits and vegetables that gets destroyed due to poor post-harvest handling. The study conducted by MOFPI in 2010 has projected harvest and post-harvest losses of major agricultural produces at the national level up to Rs. 44,143 crore per annum (MOFPI, Government of India, 2014-15). There is scope of agribusiness in the country in processed, semi-processed, and fresh agri produce sectors like cold storage development, transportation, processing of papaya, sapota, banana, guava, aonla, pomegranate, mango, and carambola (also known as star fruit), storing, etc. Food processing level in each food category is very low in India as compared to other developed nation. India accounts for just around 1 - 2 per cent of the global processed food trade (Anonymous, 2012).

The objectives of the paper is to analyze the present status of food processing in India, prospect of food processing as agribusiness opportunities in India, and to know the various challenges for entrepreneurship in food processing in India. The structure of paper consists of Introduction, Methodology, Result and Discussion, and Conclusion.

Objectives of Study

The following are objectives of this research:

1. To analyze the present status of food processing in India;
2. To assess the prospects of entrepreneurship in food processing as agribusiness opportunities in India; and
3. To assess the challenges for entrepreneurship in food processing and value addition of fruits and vegetables in India.

Review of Literature

Food processing industry is sighted growing and viable due to increased domestic consumption and emergent capabilities to meet the standards and

demand for traded commodities and processed goods around the world (Brason et al., 2018). India is undoubtedly the largest milk producing country in the world. India has highest population of cows and buffaloes. Since the Indian independence, dairy industry is showing steady and vigorous growth rate of 3 per cent. Sector has expansion in supply chain and milk processing facilities. Dairy farming by developing own cattle farm can do forward integration in the milk processing. It also helps in reducing bargaining power of the consumers (Jadawala and Patel, 2017). A significant share of the industry is concentrated in rural and semi-urban areas, which developed strong backward and forward linkages. It has also created strong positive effects of interlinked sectors and boosted the growth of the local economy of the nation. Mega Food Park Scheme is based on Cluster approach which anticipates advanced agricultural and horticultural-processing zone containing state-of-the art processing facilities with the support of infrastructure and well-established supply chain, where farmers, processors, and retailers can ensure the maximisation of value addition, minimising wastages or post-harvest losses, and helps in increasing farmers' income and creating employment opportunities particular in rural area. (Anonymous, 2017). Food processing sector has the potential to be a major driver in the growth of India as well as entrepreneurship in coming years. Without growing number of entrepreneurs and entrepreneurship, an economy is definite to become slow in growth. Entrepreneurship plays a very vital role in the growth of rural areas as well as an economy of the entire country (Negi, 2013). The growth potential of India's food industry sector is relatively substantial in terms of its value added. India is the world's third largest food producer with the potential of becoming the number one during the next couple of years. Adding value to the farm products and other material constituents is the mode in which the food processing industries contribute to state and national economy (Behera, 2009). Food processing sector and the exciting possibilities of beneficial change brought by transformative technologies, have opened many opportunities to entrepreneurs and accelerated the process of wealth creation (Desai, 2003).

Methodology

The study is based on secondary data. The relevant data is collected from various sources such as the Ministry of Commerce and Industry, the Ministry of Agriculture, the Department of Agriculture, the Government of India, and also books, magazine, journals, articles, research papers, annual reports on food processing, websites, etc. The secondary data were collected, analyzed, and presented with the help of graph, charts, tables,

etc. The quantitative methods were used and secondary data was analyzed using SPSS software. To fulfill constructed objectives of the present study the secondary data has been gathered.

Result and Discussion

In the total worlds export of processed products, the US share 10.3 per cent which is the highest share among all nations, followed by the Netherlands 5.7 per cent and Germany 5.5 per cent. India share only 2.2 per cent in the total world's export of processed product. The share of different countries in the total world exports of processed products for 2015-16 is presented in Table 1.

Table 1: Share of Different Countries in Total Worlds Exports of Processed Product (2015-16)

S. No.	*Country*	*Share in Value in World's Export (%)*
1.	USA	10.3
2.	The Netherlands	5.7
3.	Germany	5.5
4.	China	5.1
5.	Brazil	5.1
6.	France	4.7
7.	Spain	3.6
8.	Canada	3.4
9.	Italy	3.1
10.	Belgium	3.0
11.	Argentina	2.7
12.	Indonesia	2.3
13.	Thailand	2.2
14.	India	2.2
15.	Mexico	2.1

Source: Research Bureau, Chamber of Commerce and Industry, compiled from Trade Map.

India is the second largest producer of fruits and vegetables in the world. India also exports fresh fruits and vegetables to other nations. However, India's fruits and vegetables processing level is very low. In India, 30 per cent of fruits and vegetables are damaged due to improper post-harvest management of the crops.

Table 2 depicts the USA processed 60 per cent fruits and vegetables which is the highest among all nations, followed by Malaysia (processed 83 per cent of fruits and vegetables). India processed only 2 per cent which is

Table 2: Fruit and Vegetables Processing at Global Level (2015-16)

S. No.	*Country*	*Processing (%)*
1.	USA	90
2.	Malaysia	83
3.	South Africa	80
4.	The Philippines	78
5.	Brazil	70
6.	Thailand	40
7.	China	40
8.	India	2-3

Source: Available at https://www.scribd.com/doc/35958478/Current-Status-of-Food-Processing-Industry, accessed on 8-09-2018.

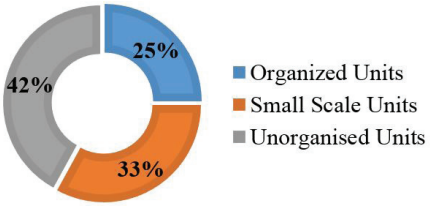

Fig. 1: Structure of Indian Processed Food Industry
Source: Annual Report 2014-15, Ministry of Food Processing Industries.

very low at the global level. The Food Processing Industry in the country is fragmented and largely constituted by unorganised sector.

Figure 1 depicts the structure of the Indian Processed Food Industry. The Food Processing Industry in India is mainly in an unorganised form which contributes 42 per cent to the total Food Processing Industry. Besides this, 33 per cent small-scale units and 25 per cent are organised in the Food Processing Industry in the country.

Export Zones in India

For the purpose of developing and collecting raw materials for processing and value addition to basic agriculture products, better price for agriculture produce, improvement in product quality, and promoting trade-related research, the Government of India formed agri-export zones in the country for a particular product on the basis of their production and availability (Table 3).

Indian economy is the fastest growing economy in the world and the fourth largest economy in the term of purchasing power parity, 1.32 billion consumers with increasing demand for branded food. India has a competitive advantage in terms of agricultural production (Table 4).

Table 3: Crop-wise Agri Export Zones in Different States of India

State	Agriculture Produce
West Bengal	Pineapple, Lychee, Potatoes, Mango, Vegetables, Darjeeling Tea
Karnataka	Gherkins, Rose, Onion, Flowers, Vanilla
Uttarakhand	Lychees, Flowers, Basmati Rice, Medicinal and Aromatic Plants
Punjab and Gujarat	Vegetables (Cabbage Broccoli, Okra, Peas, Carrot, Baby Corn, Green Chilies, Green Beans, Tomato), Basmati Rice, value added Onion
Uttar Pradesh	Potatoes, Mangoes, Vegetables, Basmati Rice
Maharashtra	Grape and Grapevine, Kesar, Mango, Flowers, Onion, Pomegranate, Banana, Oranges
Andhra Pradesh and Kerala	Mango Pulp and Fresh Vegetables, Gherkins, Chilly, Horticulture Produce
Jammu and Kashmir	Apples, Walnut
Tripura and Assam	Pineapple, Fresh Ginger
Madhya Pradesh and Rajasthan	Potatoes, Onion, Garlic, Seed Spices, Sharbati Wheat, Lentil, Grams, Coriander, Cumin

Source: Available at http://www.apeda.gov.in/apedawebsite/trade_promotion/Agri_Export_Zone.htm, accessed on 08-12-2018.

Table 4: India's Competitive Advantage in Food Processing

Particular	*Production (Million Tons) FY 2015-16*	*Global Rank*	*Global Share (%)*
Milk	141.1	1st	17
Pulses	17.2	1st	21
Buffalo Meat	1.4	1st	42.8
Bananas	28.1	1st	27.8
Mango and Guava	22.7	1st	39
Tea	1.1	2nd	28
Rice	105.4	2nd	22
Sugarcane	359.4	2nd	21
Wheat	89.4	2nd	15

Source: World Bank FAOSTAT, Tea Board, APEDA, ICAR, the Ministry of Agriculture, available at www.ibef.org

Current Food Processing Level of India (2015-16)

Current overall food processing level in India is at a very nascent stage; however, it is 35 per cent in milk which is highest in the country followed by meat processing (21 per cent), marine products (8 per cent), poultry (6

per cent) and fruits and vegetables processing (2 per cent) which is very low. There is scope for increasing this processing level in the country**.** Value addition in food processing in India is merely 20 per cent compared to other countries. It is over a 23 per cent in China, 45 per cent in the Philippines, and 188 per cent in the UK (Saraswati, 2014) (Figure 2).

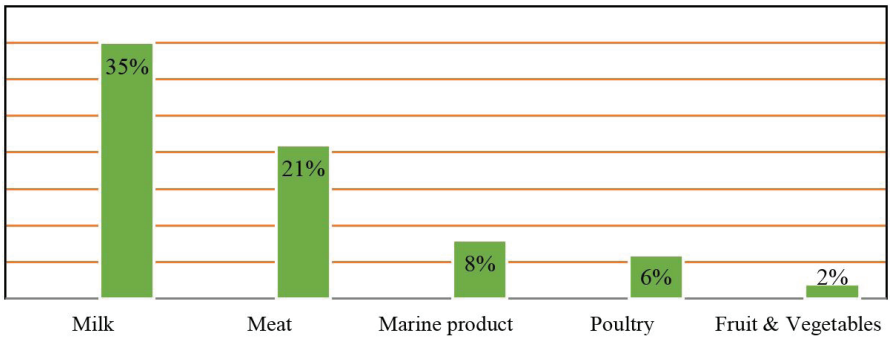

Fig. 2: Current Food Processing Level of India in Different Segments
Source: National Magazine on Food Processing & Trade February 2016, p. 24.

Food processing is a big industry in India and it has different segments in which agribusiness of processed products and food processing can be start and India has a competitive advantage in raw material production for the processing and export of the particular processed product (Table 5).

Table 5: Segments of Food Processing Industry

Sector	*Component*	*Growth, Production, and Opportunities*
Food Processing	Fruits and Vegetables	Second largest producer of fruit and vegetable 25% of sector growth by 2025
	Milk	Largest producer of milk in the world (146.3 MT)
	Meat and Poultry	Largest producer of buffalo meat (1.4 MT 2015)
	Marine products	Fish production 13.0 MT (2015-16)
	Grain processing	Total foodgrain production is more than 270 MT
	Consumer foods	Fastest growing sector (packaged food, aerated soft drink, alcoholic beverage)

Source: Available at http://www.grantthornton.in/globalassets/firms/india/pdfs/food_processing_sector.pdf, accessed on 12-11-2017.

India export many processed food items to the different countries and import many processed items from the other nations. The increasing the export level minimise processed food items which India imported from other nation can lead the Indian food processing industry in the right direction. India' food processing industry is mainly export oriented. Its geographical situation gives it a unique advantage of connectivity to the Asian and Middle East nations (Table 6).

Table 6: Trends of Exported Processed Product of India

Particular	*R Square*	*Sig.*
Linear	0.264	0.297
Quadratic	0.992	0.001

Source: Ministry of Food Industry, available at www.ibef.org/industry/indian-food-industry.aspx, accessed 19-11-2017, data analyzed by SPSS software, CAGR 0.098

Table 6 depicts that there is 0.098 per cent compound annual growth in the export of processed products in India. The value of R is 0.264 in the linear equation and 0.001 in quadratic equation, which is significant. The trend in export of processed products is showing upward growth, however, some extends it showing decline trends. India export processed food to the different countries and earn foreign exchange which boost the country rural and urban economy (Husain, 2017). Major countries where India's processed products are exported are presented in Figure 3.

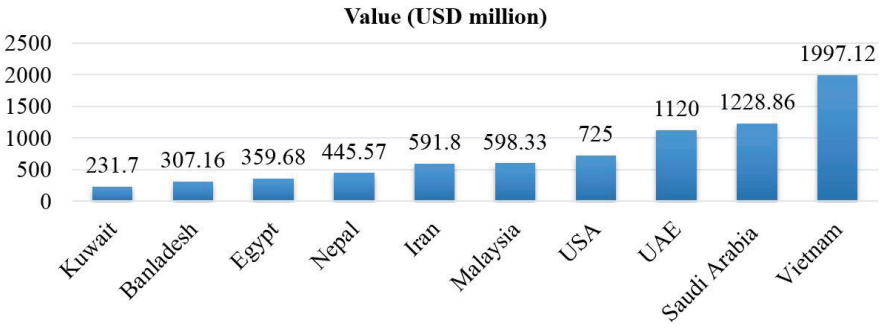

Fig. 3: India's Major Destinations of Processed Food and Agricultural Related Product Exports in FY16 (US$ million)

Source: Ministry of Food Processing Industries, APEDA, Ministry of Commerce and Industry.

Figure 3 depicts India's major destination of processed food and agricultural related products export to different countries in US dollars—Kuwait 231.7 million, Bangladesh 307.16 million, Egypt 359.68 million, Nepal 445.57 million, Iran 591.8 million, Malaysia 598.33 million, USA 725 million, UAE 1,120 million, Saudi Arabia 1,228.86, and Vietnam 1,997.12.

Government Initiatives for Food Processing Sector

There are many opportunities for entrepreneurship in food processing (Negi, 2013). The government emphasized on export of processed food and promoted many schemes for the growth of the food processing sectors like Pradhan Mantri Kisan SampadaYojana which includes making agro

processing cluster, setting up of Mega foodparks, cold chain infrastructure development, food safety and quality assurance, and skill development (MoFPI and DIPP, 2015-16).

Constraints in Food Processing

Major constraints or problems for the progress of the Indian food processing industry include lack of adequate infrastructure, particularly rural road connectivity, inadequacy of information and marketing linkages, lack of electricity supply, and the absence of cold chain systems (Singh et al., 2012). The Sanitary and Phytosanitary measures (SPSs) imposed by various nations restricted the potential of Indian food processing. Raw material, food quality safety, and health-related issues are the key barriers in the developed country (FICCI, 2010). The product contamination during storage, processing, and packaging also restricted the export of the processed products.

Conclusion

India's competitive advantage in agricultural production creates tremendous scope for food processing and value addition. There is only the need for better infrastructure development and quality assurance of the processed product, which will create millions of employment in the country and boost the nation economy. The policy and schemes of the government also helps in the growth of the food processing sector. Rising disposable income, growing young population, changing lifestyle, and food habits is the strong growth drivers of the food processing sector. Untapped market with strong growth potential has opportunities in the food processing sector.

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Impact of Green Revolution on Price Sensitivity of Agriculture in India

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Abstract

A major technology revolution is expected to impart a market orientation to the sector in which it takes place. This study examines if such an orientation resulted in Indian agriculture after the Green Revolution (GR). It adopts a Nerlovian framework to estimate the responsiveness of the non-foodgrain sector in post-GR agriculture to changes in the real relative prices faced by it for a period of 33 years (1976-77 to 2009-10). The study finds no conclusive evidence suggesting improved price elasticity. To contrast, the price-responsiveness of those regions where GR is seen to be relatively more successful, a panel regression with random effects specification is run separately on four states, namely, Punjab, Haryana, Kerala, and Tamil Nadu. But even here, no clear evidence of significant response of agricultural supply to market signals is found. The study's findings suggest that several non-price factors may be acting as constraints to farmers' ability to respond to market signals. The findings also raise some important questions about the effect of an important non-price factor, viz., fertiliser consumption, which increased exponentially after the GR. Better insights can be obtained only by conducting a more in-depth analysis of the dynamics of agricultural supply. As the performance of commercial agriculture in the years after the GR shows no direct evidence of increased market orientation, the study's findings raise concerns over the reliance on price-based policy measures to deal with India's agricultural crisis.

Keywords: *Terms of trade, Agricultural production, Technology adoption, Market orientation, Green revolution.*

Introduction

Conventionally, agriculture is referred to as the 'traditional' sector. As an economy develops, modern 'capitalist' methods of production emerge. It is expected that the organisation of production in agriculture too will orient itself towards commercialisation. The Lewis (1954) and Fei-Ranis (1961) models attempt to theorize this 'commercialization of agriculture' resulting from sustained interaction with the 'modern' sector. This study is an attempt to examine if there are any indications of the emergence of such market-orientation in Indian agriculture after the seed-water-fertiliser technology revolutions (commonly known as the Green Revolution [GR]) that the sector has witnessed. If not, then the government's reliance on the price-based policy response to the issues faced by the sector becomes questionable.

Broadly, the factors exerting influence on agricultural supply can be classified into the price and non-price factors. The profitability of an enterprise depends, to a large extent, on its ability to optimise production and supply concerning price-signals received from well-functioning markets. However, vast information gaps exist in agricultural markets of developing countries, which are reflected in disproportionately large differences between farm harvest prices and retail prices, as well as in relatively low supply response of farmers to market signals (Misra, 1998; ASCI Consultancy, 2000; Deb, 2005; Olayiwola, 2013). Furthermore, several works have established that non-price factors play a very significant role in affecting the supply elasticity of agriculture in India. These include Parikh (1967), Madhavan (1972), Thamarajakshi (1977), Palanivel (1995), Deb (2005) among others. Non-price factors include agro-climatic variables (soil quality, rainfall, etc.), the extent of technology adoption, factors contributing to the human capital formation (education, agricultural research, and extension), etc. The present paper makes technology adoption a reference point to check whether it has enabled cultivators to respond better to prices.

Out of the total population engaged in agriculture, over 45 per cent are cultivators (Census of India, 2011). Their returns are directly determined by the volume of their marketed surplus, the prices they receive for their produce, as well as the price of inputs or cost of production. If farmers act as rational economic agents, they should make supply decisions to optimise the profit function. If evidence of such behaviour is found then we can infer that Indian agriculture is undergoing a transition from being a largely traditional subsistence activity to a modern market-oriented enterprise. One way of analysing this is by way of examining how responsive Indian agriculture has been to changes in the relative prices faced by it. More importantly, this responsiveness to price should have, at the least, improved in those regions of the country where modern farming practices have taken ground, i.e. the states where the GR was successful.

Review of Literature

In India, the examination of responsiveness of agricultural supply received attention after independence. A widely prevalent notion is that the price responsiveness of farmers in poor countries is either very low, zero or even negative. When the new government of independent India initiated various price and non-price support measures to agriculture, works were conducted to assess the effectiveness and efficacy of such measures.

Studies find that the pre-independence period sees a significant influence of price on agricultural supply (Raj Krishna, 1963; Narain, 1960; Herdt,

1970). However, the debate on supply responsiveness in independent India remains inconclusive. The year 1980-81 is usually taken as the beginning of a new phase as after this the economy grew faster, and numerous policies affecting the agricultural sector took effect. Studies report price responsiveness to increase post this period (Misra and Hazell, 1996; Morris, 1997; Alagh, 2004). However, they do not suggest a strong price-market orientation of the agricultural economy as a whole. In particular, among different crops, food crops show relatively lower price elasticity compared to cash crops (Narain, 1960; Alagh, 2004; Mythili, 2006). Another important observation relates to the influence of non-price factors on supply response, which studies find to either dominate over price factors in farmers' decision problem or to be as important as price factors (Thamarajakshi, 1977; Krishna, 1982; Palanivel, 1995; Desai and Namboodiri, 1997; Gulati, 1998; Parikh, 1967; Madavan, 1972; Deb, 2002). It can be seen that the relevance of non-price factors have not decreased over the years.

On methodological issues, studies increasingly point towards the importance of appropriately identifying variables that are assessed for estimating supply response (Deb, 2002; Alagh, 2004). Conceptual differences in identifying correct price and non-price variables as well as in the formulation of the empirical model lead to wide differences in the findings and conclusions of studies. Most works on supply response are undertaken in the Nerlovian model framework or some modified version of the same. However, there are important methodological concerns with the model. Hence, in recent years, researchers lay focus on devising alternative models to overcome such limitations. Deb (2005) and Tripathi (2008) adopt the cointegration analysis and Error Correction Model (ECM) to overcome some such problems.

Research Gaps

Deb (2002) provides a comprehensive analysis of the literature on this subject. After covering more recent works to add to this extensive analysis we get an indication of some important research gaps. Although the supply response of individual crops is well-documented, studies related to aggregate output remains to be a less researched area. Again, works in the post-reform era are too few. While several studies examine the influence of non-price factors like irrigation, seed ration, fertiliser, landholding size, etc., there exists no comprehensive study that looks into the interaction between modern technology adoption and transition towards market-orientation of agriculture. From the perspective of policymaking, filling these research gaps

become crucial in the current phase of the crisis with which the agrarian sector is struggling.

Objectives of the Study

In light of the earlier discussion, this study attempts to analyse whether India's agricultural supply has become responsive to price signals with the large-scale adoption of modern technology after the GR. The specific objectives of the study are as follows:

- To estimate price-responsiveness of the non-foodgrain sector of Indian agriculture for the period 1976-77 to 2009-10.
- To estimate and contrast price-responsiveness of some major commercial crops in Indian states where GR has been relatively successful, for the period 1994-95 to 2009-10.

Conceptual Framework

Past studies repeatedly highlight the significance of dealing with conceptual issues in supply response studies (Deb, 2002; Alagh, 2004). The validity of results is contingent on the suitability of variables and empirical models employed. Supply response models attempt to model agricultural output as a function of price. Agricultural output is expected to be a function of the relative or real output price, which is the ratio of output price over input price. This price is often referred to as the Terms of Trade (TOT) between agriculture and industry, which is the index of prices received by the farmers and the prices paid by the farmers. It captures changes in producer prices, intermediate input costs, real exchange rates, and world market prices. The other factors affecting supply, termed as the exogenous shifters, include weather and technology parameters. These are represented by annual rainfall and the extent of irrigation and fertiliser use. Their choice is constrained by the availability of data.

The present study is conducted in the framework of partial adjustment and expectations formation, i.e. the Nerlovian Model. Producers' price expectations play a key role in supply response analysis. There are three alternative agricultural producer price expectations hypotheses, viz., naive expectation, adaptive expectation, and rational expectation. Naive expectation means the expected price is the actual price in the previous period. Adaptive expectation means that people form their expectations about what will happen in the future based on what has happened in the past. While in the case of rational expectation, future events are forecasted by taking all available information into account. Rational expectation

behaviour in agricultural decision-making is not relevant in the case of a developing country like India, where levels of literacy among farmers are low and dissemination of market information is poor (Tripathi, 2008). However, it can be assumed that farmers do learn from their past mistakes. Therefore, the problem at hand can be suitably analysed using adaptive expectations.

Methods and Procedures

The study is analytical in nature and uses appropriate econometric procedures to meet its stated objectives. This section explains the data, its sources and the methodological framework within which the study is conducted.

Data

The study uses credible secondary data sources to meet its objectives. Data on terms of trade, area, production and yield of crops as well as gross irrigated area are obtained from *Agricultural Statistics at a Glance* and other publications of the Directorate of Economics and Statistics (DES), Department of Agriculture and Cooperation, Government of India as well as the *Handbook of Statistics on the India Economy* published by the Reserve Bank of India. Due to the unavailability of TOT data prior to 1981-82 from DES, the paper uses the Thamarajakshi (1990) series subjected to necessary adjustment for base year conformity (Appendix 1). Data on fertiliser consumption, production, and rainfall are obtained from the Fertilizer Association of India (15215 and 16851).

Model Specification

The study is carried out in the Nerlovian Adaptive expectation framework. According to Nerlove (1958), planned output (Q^*) at any time (t) can be expressed as a function of expected price (P^*) and exogenous shifters (Z) like technology change, weather condition, etc.

$$Q_t^* = a + bP_t^* + cZ_t^* \qquad ...(1)$$

The Model assumes that technological and institutional constraints operating in agriculture do not permit immediate full adjustment in output in response to price expectations. The 1 year lagged relative price (TOT_n) is assumed to represent the farmers' expected price. As the presence of adjustment lags of variable factors is likely to cause the actual output to differ from the desired ones, the actual output is assumed to be only a fraction of the desired output (Q_t^*):

$$Q_t - Q_{t-1} = \delta(Q_t^* - Q_{t-1}) \qquad ...(2)$$

where, Q_t is actual output in period t, Q_{t-1} is actual output in period $t-1$, and δ is the adjustment coefficient (δ lies between 0 and 1).

Now to obtain expected price at a given time, we assume farmers to maintain in their memory the magnitude of any mistake made in the previous period and learn by adjusting the difference between the actual and expected price in $t-1$ by a fraction λ. Thus, the expected price is given by:

$$P^*_t = P^*_{t-1} + \lambda(P_{t-1} - P^*_{t-1}) \text{ or } P^*_t = \lambda P_{t-1} + (1-\lambda)P^*t\text{–}1 \quad ...(3)$$

Plugging the values of Q^*_t and P^*_t into Equation (1)

$$Q_t = A_0 + A_1 P_{t-1} + A_2 Q_t - 1 + A_3 Z_t \quad \ldots(4)$$

Here, A_0 is $a\delta\lambda$, A_1 is $b\delta\lambda$, A_2 is $(1-\delta) + (1-\lambda)$, and A_3 is $c\delta$.

The short-run price elasticity is given by A_1, while the long-run price elasticity is given by $A_1 / 1 - A_2$.

Now, to capture the exogenous factors (Z), the study incorporates indices of rainfall, irrigation and fertiliser consumption. Thus, the equation to estimate supply response is of the form of Equation (5).

$$Q_t = A_0 + A_1 P_{t-1} + A_2 Q_{t-1} + A_3 AAR_t + A_4 IRR_t + A_5 FERT_t + \mu \quad ...(5)$$

where: Q_t and Q_{t-1} – Index of planned agricultural supply at time t and $t-1$ respectively (Base: triennium ending 1993-94); P_{t-1} – Real output price at time $t-1$ represented by index TOT for agriculture versus non-agricultural sector. (Base: triennium ending 1990-91 = 100); AAR_t – A rainfall dummy variable (represents a shortfall of annual average rainfall by more than 10 per cent from long-term normal rainfall in period t); IRR_t – Index of Irrigation (which is the ratio share of total irrigated land in the gross cropped area in period t to the same for triennium ending 1993-94); $FERT_t$ – Index of fertilizer consumption (ratio of fertilizer consumed per hectare of gross cropped area in period t to the same in triennium ending 1993-94); μ – Error term.

However, there may be endogeneity due to the influence of unobserved variables assimilated in the error term. Another source of endogeneity arises from the possibility that fertiliser consumption may be correlated with past year's output. To overcome later, the annual production of fertilisers (*FERT_P*) is used as an instrument for annual fertiliser consumption. It has an average level of correlation with fertiliser consumption and low correlation with the other regressors. The details of correlations between all regressors are provided in Appendix 2. The Model is estimated using a Generalised Method of Moments (GMM) as specified by Equation 6.

$$Q_t = A_0 + A_1 P_{t-1} + A_2 Q_{t-1} + A_3 AAR_t + A_4 IRR_t + A_5 FERT_t + \mu$$
$$FERT_t = B_0 + B_1 FERT\_P_t + \upsilon \quad \ldots(6)$$

The debate over which variable represents 'planned output' accurately is still unresolved. Hence, the present paper estimates the equation using alternative specifications of area, yield, and production for 'planned output'.

Area of Study

The area of study is India. First, the study examines the presence (or absence) of price responsiveness in the case of major commercial crops for Indian agriculture as a whole. Next, it moves forward to examine the same only for specific states where GR has been acknowledged as being successful.[1] The study identifies four states to carry out this analysis, viz., Punjab, Haryana in the north, and Kerala and Tamil Nadu in the south.

Time Period of Study

The study focuses on the period after GR. It takes the mid-1970s as the beginning of the reference period since it marks the beginning of technology adoption by farmers. Due to data availability considerations, the study can only include observations till 2009-10.

Results and Discussion

The paper discusses its findings in two sub-sections: the first present results from supply response estimation for India's non-foodgrain sector at the aggregate level, and the next present results for the select states in the GR belt.

Supply Response of India's Non-foodgrain Sector to Relative Price Movements

To represent the non-foodgrain sector, the paper uses a basket of major commercial crops comprising oilseeds,[2] sugarcane, tea, coffee, cotton (lint), tobacco, raw jute, and mesta. Different publications of the Directorate of Economics and Statistics, the Ministry of Agriculture, and the Reserve Bank of India identify these selected crops as major commercial crops in India. They are aggregated by taking unweighted averages to obtain measures of the variables representing the supply of the non-foodgrain sector.

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[1] The phrase 'Success of Green R evolution' is used here in a narrow sense and relates to the marked increase in crop yields in these states, with most farmers adopting HYV seeds.

[2] Oilseeds data comprises total for nine oilseeds out of eleven in all.

To examine the plausibility of results from a fitted econometric model with respect to economic concept and rationality, we make a prior expectation of signs of the estimated coefficients and their sizes. The coefficient of Variable P is expected to have a positive sign to have evidence of price responsiveness. The technology shifters, irrigation coverage (IRR) and fertilizer consumption (FERT) are also expected to have positive coefficients since they positively impact supply. The rainfall dummy is expected to have a negative coefficient (since it takes the value of 1 to signify rainfall deficit). However, in case the coefficient of rainfall is not significant, it will imply that agriculture has not overcome its excessive dependence on rainfall and is not able to cope with shortfall through irrigation.

In total, the paper uses three alternative specifications of the dependent variable (agricultural supply) to estimate Equation (6). These are respectively total production, the area planted, and yield (Tables 1, 2, and 3). We

Table 1: Results of Regression 1

Model 1: Generalised Method of Moments (GMM), using observations 1978-2009

Dependent variable: d_Production; Instrumented: d_FERT, Instrument: d_FERT_P)

	Coefficient	*Robust Std. Error*	*Z*	*p-value*
const	–2.57	5.48	–0.47	0.64
d_P	–0.10	0.41	–0.25	0.81
$d\_PROD_{(t-1)}$	–0.35	0.27	–1.27	0.20
AAR	–4.46	2.73	–1.63	0.10
d_IRR	0.16	0.68	0.24	0.81
d_FERT	1.13	0.80	1.41	0.16

Wald chi^2 = 22.41(p-value): 0.0004; GMM C statistic $chi^2(1)$ = 2.93 (p = 0.056); Durbin-Watson: 1.86

Table 2: Results of Regression 2

Model 2: GMM, using observations 1978-2009 Dependent variable: d_AREA[3]

	Coefficient	*Robust Std. Error*	*Z*	*p-value*
const	0.66	0.83	0.79	0.43
$d\_P_{(t-1)}$	–0.07	0.29	–0.26	0.80
$d\_AREA_{(t-1)}$	–0.07	0.18	–0.37	0.71
d_IRR	–0.16	0.31	–0.52	0.60
d_FERT	0.15	0.24	0.62	0.54

Wald chi^2 = 45.3 (p-value): 0.000; GMM C statistic $chi^2(1)$ = 0.276 (p = 0.60); Durbin-Watson: 1.67

[3] Here, ARR is excluded although rainfall affects output and yield; it is unlikely to affect acreage planted.

Table 3: Results of Regression 3

Model 3: GMM, using observations 1978-2009 Dependent variable: d_YIELD

	Coefficient	*Robust Std. Error*	*Z*	*p-value*
const	–3.31	5.67	–0.58	0.56
$d\_P_{(t-1)}$	–0.38	0.42	–0.91	0.36
$d\_YIELD_{(t-1)}$	0.00	0.35	–0.01	0.99
AAR	–0.71	3.68	–0.19	0.85
d_IRR	–0.01	0.56	–0.02	0.98
d_FERT	0.84	0.73	1.15	0.25

Wald chi2 = 10.40 (p-value): 0.06; GMM C statistic chi2(1) = 2.96 (p = 0.08); Durbin-Watson: 2.1

observe an issue of non-stationarity with all the variables except *ARR*. The variables P_{t-1}, IRR_t, $FERT_t$, and $FERT\_P_t$ become stationary on taking the first difference. For Q_t, the lagged value for time $t-1$ appears significant after taking the first difference. But Q_{t-1} already enters the equation by design. Time series plots and correlogram for the variables are provided in Appendix 2.

The first two models are highly significant as a whole with p-value being less than 0.001, while Model 3 is significant at the 10 per cent level. The GMM C statistic is not significant in any of the three models, which means that we cannot reject the null hypothesis that all variables are exogenous. This justifies our model specification. However, in all of the models, the price variable is not significant at 10 per cent level. This indicates that at the aggregate level, the non-foodgrain sector (represented by a basket of major commercial crops) does not show significant responsiveness to relative real price movements.

Supply Response of Major Commercial Crops in Select Green-revolution Belt States

To assess price responsiveness in the identified region, the paper uses data from the four selected states from 1994-95 to 2009-10. The dependent variable is an index of the total production of major commercial crops, viz., nine oilseeds, cotton (lint), sugarcane, raw jute, and mesta (Base: triennium ending 1995-96). However, due to lack of data availability for state-specific TOT, the model uses the all India TOT figures to represent real relative prices. Now, according to Gauss–Markov theorem, OLS will be the best linear unbiased estimator (BLUE) if the error terms are independently and identically distributed (IID). This is often unlikely in the context of panel data. Hence, a Fixed Effects Model (FEM) or a Random Effects Model (REM) may be more adequate alternatives to OLS.

To test if a FEM is more suitable to the dataset at hand, the joint significance of differing group means is calculated using the software package Grelt. Four group means are subtracted from the data.

Residual variance: 20193.9/(64 – 6) = 348.17

Joint significance of differing group means:

F (3, 58) = 4.92925

p-value : 0.00406356

The low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favour of the fixed effects alternative.

However, FEM is unable to estimate the effect of time-invariant regressors, which the REM estimator can carry out more efficiently. To check if a REM specification is consistent, we conduct the Hausman test.

Hausman Test Statistic

$$H = 5.35807$$

$$\text{p-value} = \text{prob (chi-square (2)} > 5.35807) = 0.0686294$$

The p-value is greater than 0.5, pointing in favour of the null hypothesis that the REM is consistent in this case. Thus, we adopt a REM specification using stacked time-series data. Table 4 presents the results.

Table 4: Results of Panel REM

Model 4: Random-effects (GLS), using observations 1994-2009: n = 64
Included Four Cross-sectional Units
Time-series length = 16
Dependent variable: PRODt

	Coefficient	*Std. Error*	*z*	*p-value*
Const	56.1453	131.67	0.4264	0.6698
$PROD_{(t-1)}$	0.472789	0.0839518	5.6317	< 0.0001***
$P_{(t-1)}$	0.0589623	1.28669	0.0458	0.9634

Mean dependent var	114.8796	S.D. dependent var	28.46680
Sum squared resid	26074.68	S.E. of regression	20.50755
Log-likelihood	–283.1269	Akaike criterion	572.2537
Schwarz criterion	578.7304	Hannan-Quinn	574.8052

The results show that here too the price variable is not statistically significant in determining production levels. This leads us to infer that even in the select states where GR has been markedly successful, there is no clear evidence of market orientation through improved price responsiveness of supply. However, a stronger conclusion can only be drawn if we regress agricultural supply against state-specific TOT data as well as incorporate some of the exogenous shifters.

Conclusion

This study aims to evaluate whether the large-scale adoption of modern agricultural practices brought about by the GR could impart some market-orientation to India's supply of agricultural output. Accordingly, it assesses the responsiveness of the aggregate supply of some major commercial crops to changes in real-relative prices faced by agriculture for a period of 33 years from 1976-77 to 2009-10. The study does not find any statistically significant impact of relative price movements on agricultural supply. The same observation is made even for a set of four states where GR has been markedly successful. Thus, the study does not find any conclusive evidence suggesting improved price elasticity of agricultural supply resulting from the technology revolution in India's agriculture. This adds to the ambiguity in the literature on this subject for the post-reform period. As the academic interests in examining supply response and price sensitivity dwindled in recent years, there are very few studies taken up for a comparable period. Mythili (2006) does not find the price responsiveness to have improved in the post-reform period. Alagh (2004) too only finds a weak acreage response of the market-determined sector to TOT in the period after the 1980s. Thus, the findings of this paper along with those of previous works, raise concerns over the government's reliance on price-based policy measures to deal with India's agricultural crisis.

The results of the study also provide some additional indications. It does not find the incorporated non-price factors (including increased fertiliser consumption) to be significant in augmenting supply. One reason may be that the relationship between the non-price factors and supply is no longer linear. This opens up two lines for further research. The first is to examine the possible existence of a non-linear relationship between fertiliser consumption and yield, which Equation (6) does not capture. The second relates to assessing the composition of increased fertiliser consumption in light of widespread deviations from the ideal N:P:K[4] ratio. Research in these two lines may provide some important explanations for the finding of the study. Furthermore, other non-price factors like credit availability, road connectivity to market and other infrastructure, public investment, total factor productivity, extension services, etc., may be key variables that constrain or facilitate farmers' ability to respond to changes in relative prices. Thus, effective policy formulation necessitates studies that

[4] The N:P:K ratio refers to the ratio between nitrogen, phosphorous, and potash-based fertilisers as a used unit of cropped land. Too much deviation from the ideal ratio (4:2:1) may harm soil productivity, and hence output.

investigate the impact of such non-price factors on improving agriculture's market response.

To conclude, although the study does not find any indication of improved price responsiveness of agricultural supply resulting from the GR, its findings are subject to certain limitations. One important issue is to look into structural breaks in the period considered, the presence of which can alter the results of the analysis. The state-level analysis can be made more representative by calculating ToT for each state as the ratio of implicit price deflator of agriculture to that of non-agriculture.[5] Thus, the study opens up several lines for further research and raises some important questions which, when answered, can lead to a better understanding of the dynamics of agricultural supply.

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[5] Deb (2002) shows through rigorous statistical investigation that in spite of the methodological differences, these alternate series reflect similar attributes as the conventionally used TOT series over comparable periods.

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APPENDICES

Appendix 1: TOT: The Thamarajakshi Series and The DES Series

Year	*Thamarajakshi Series*		*DES figures*
	Original	*Adjusted*[*]	
1970-71	109.90	108.43	NA
1971-72	104.00	102.61	NA
1972-73	106.80	105.37	NA
1973-74	115.70	114.16	NA
1974-75	112.40	110.90	NA
1975-76	101.50	100.15	NA
1976-77	99.90	98.57	NA
1977-78	104.50	103.11	NA
1978-79	100.00	98.67	NA
1979-80	95.90	94.62	NA
1980-81	89.70	88.50	NA
1981-82	89.90	88.70	88.70
1982-83	91.70	90.48	91.40
1983-84	97.00	95.71	91.60
1984-85	97.00	95.71	93.90
1985-86	91.60	90.38	93.60
1986-87	91.10	89.88	95.70
1987-88	98.50	97.19	97.40

[*] Adjustment Factor = 0.987; Base 1981-82 = 100

Source: Thamarajakshi (1990); Directorate of Economics and Statistics (DES), Ministry of Agriculture

Appendix 2: Correlations Between Regressors

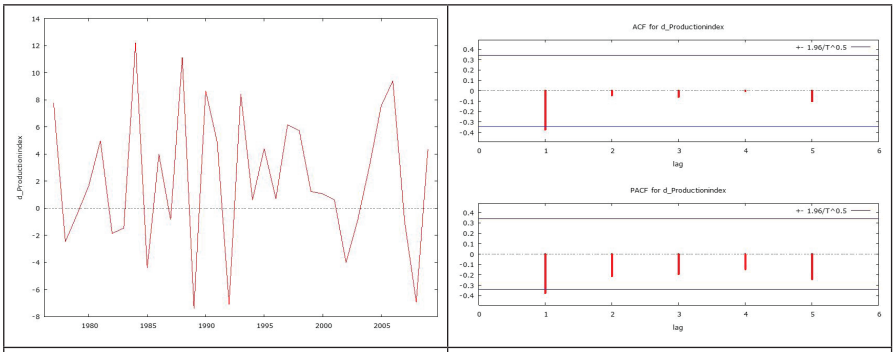
Correlations among Regressors								
	d_area	*d_prod*	*d_yield*	*d_tot*	*d_irr*	*dumm_arr*	*d_f_con*	*d_f_prod*
d_area	1.00							
d_prod	0.32	1.00						
d_yield	–0.46	0.68	1.00					
d_tot	0.14	0.33	0.21	1.00				
d_irr	0.52	0.18	–0.26	0.09	1.00			
dumm_arr	0.06	–0.29	–0.30	–0.12	0.18	1.00		
d_f_con	0.37	–0.08	–0.36	–0.06	0.09	0.06	1.00	
d_f_prod	0.16	–0.02	–0.14	–0.06	–0.07	0.13	0.41	1.00

Codes	Explanations
d_area	First difference of area planted
d_prod	First difference of output/production
d_yield	First difference of yield
d_tot	First difference of TOT
d_irr	First difference of irrigated area proportion
dumm_arr	dummy for rainfall deficit
d_f_con	First difference of fertiliser consumption
d_f_prod	First difference of fertiliser consumption

Appendix 3: Stationarity Tests

Dependent Variable

Production

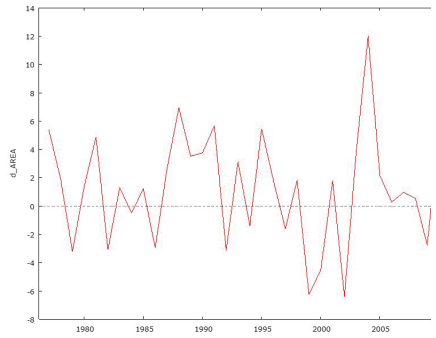


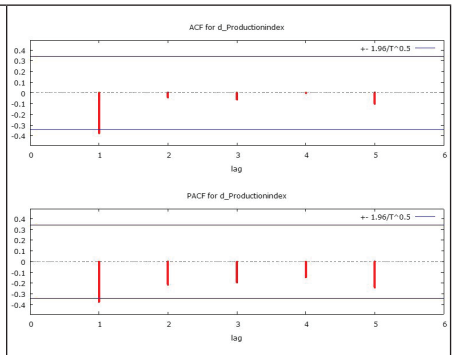
Time-series Plot | Correlogram

LAG	*ACF*	*PACF*	*Q-stat.*	*[p-value]*
1	–0.3740**	–0.3740**	5.0499	[0.025]
2	–0.0423	–0.2118	5.1164	[0.077]
3	–0.0596	–0.1923	5.2530	[0.154]
4	–0.0003	–0.1444	5.2530	[0.262]
5	–0.1002	–0.2399	5.6669	[0.340]

Autocorrelation function for d_Productionindex

Area

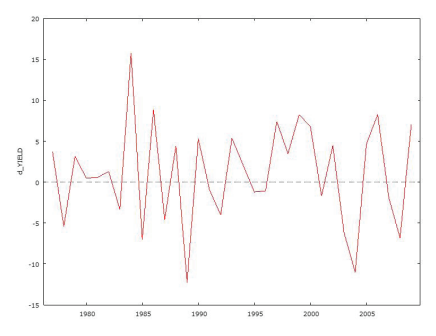


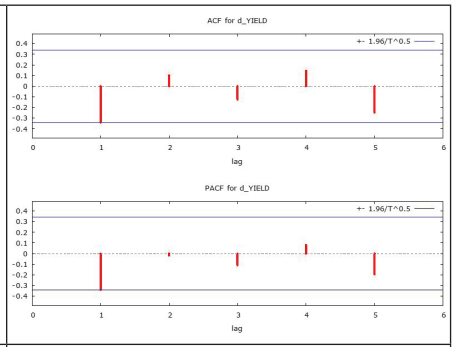


Time-series Plot	Correlogram

LAG	*ACF*	*PACF*	*Q-stat.*	*[p-value]*
1	0.0106	0.0106	0.0042	[0.949]
2	–0.0877	-0.0878	0.2983	[0.861]
3	0.1132	0.1161	0.8046	[0.848]
4	–0.2561	-0.2734	3.4796	[0.481]
5	–0.2594	–0.2421	6.3196	[0.276]
Autocorrelation function for d_Area				

Yield



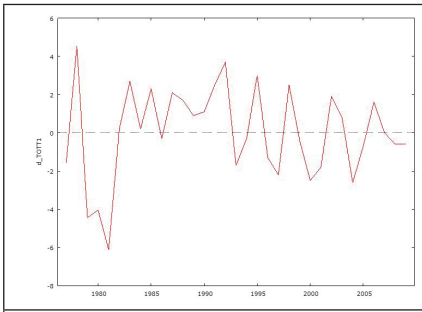


Time-series Plot	Correlogram

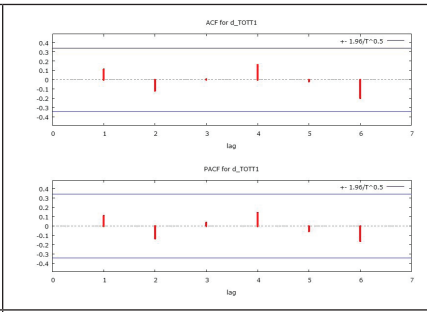
LAG	*ACF*	*PACF*	*Q-stat.*	*[p-value]*
1	–0.3415**	–0.3415**	4.2084	[0.040]
2	0.1012	–0.0174	4.5900	[0.101]
3	–0.1253	–0.1088	5.1942	[0.158]
4	0.1463	0.0814	6.0467	[0.196]
5	–0.2485	–0.1951	8.5936	[0.126]
Autocorrelation function for d_Yield				

Explanatory Variables

Price: TOT



Time-series Plot

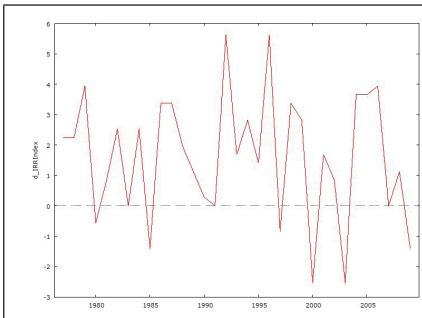


Correlogram

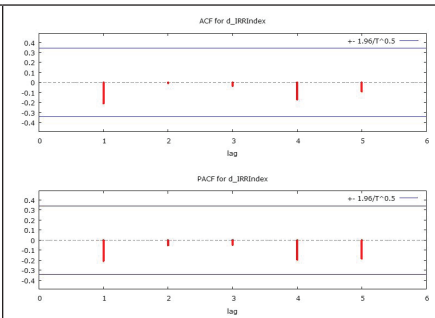
LAG	*ACF*	*PACF*	*Q-stat.*	*[p-value]*
1	0.1108	0.1108	0.4429	[0.506]
2	–0.1186	–0.1325	0.9672	[0.617]
3	0.0045	0.0351	0.9680	[0.809]
4	0.1590	0.1427	1.9751	[0.740]
5	–0.0193	–0.0553	1.9904	[0.850]
6	–0.1966	–0.1603	3.6446	[0.725]

Autocorrelation function for d_TOT1

Irrigation



Time-series Plot

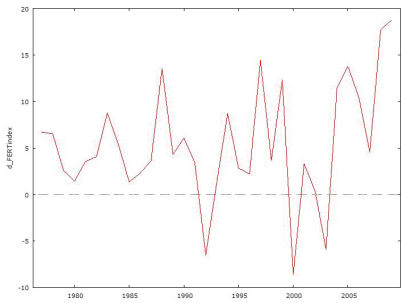


Correlogram

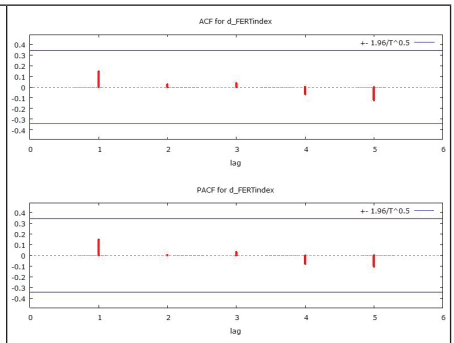
LAG	*ACF*	*PACF*	*Q-stat.*	*[p-value]*
1	–0.2083	–0.2083	1.5663	[0.211]
2	–0.0055	–0.0512	1.5675	[0.457]
3	–0.0328	–0.0468	1.6089	[0.657]
4	–0.1688	–0.1956	2.7438	[0.602]
5	–0.0874	–0.1856	3.0586	[0.691]

Autocorrelation function for d_IRRIndex

Fertiliser Consumption



Time-series Plot



Correlogram

LAG	*ACF*	*PACF*	*Q-stat.*	*[p-value]*
1	0.1452	0.1452	0.1452	[0.383]
2	0.0259	0.0049	0.0049	[0.675]
3	0.0354	0.0316	0.0316	[0.841]
4	–0.0668	–0.0783	–0.0783	[0.908]
5	–0.1216	–0.1045	–0.1045	[0.899]

Autocorrelation function for d_FERTindex

Education and Health for Sustainable Development

Quantifying Perception of Master of Business Administration (Finance) Graduates towards Sustainable Development: An Application of Fuzzy Analytical Hierarchy Process

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Abstract

Accounting plays a very important role in the sustainable development of the organisation. The role of an accountant can be neglected if the business does not want to survive and sustain its operations in the long term. Extant literature supports the fact that the Management Accountant plays an important role in accounting for the sustainable development of the organisation and business dynamics. Legitimacy Theory supports this understanding and can be explored to find the effect and the role that an accountant plays in providing sustainable development to its organisation. The process of sustainable development starts from the understanding of sustainability in its core dimension right from the beginning of the process of education and development. Exposure of would-be Masters of Business Administration (MBA) graduates, who are pursuing a management degree course and are exposed to the nuances of the finance and accounting field will be part of the system of the organisation and their business. Their understanding is of utmost importance in deciding whether they will be involved in the process of providing sustainable understanding to the business or not. Thus, it is imperative to highlight and understand their understanding and the role which the accountants and finance professionals play in providing the sustainable development perspective to the business and organisation.

Sustainability as a concept takes into consideration certain dimensions that are not universally agreed upon; however, consensus prevails in the literature that sustainability must encompass and address the area of Economic, Environmental, Social and Ecological paradigms. Sustainability and its perception thus can be categorised as a dimensional set having certain factors that are weighted to decide the continuum of scale. More succinctly it consists of understanding certain criteria to reach into the ultimate understanding of sustainability based on a hierarchy of criteria. The understanding of each of the criteria is subjective in nature, quantification techniques to objectify the subjectivity understanding helps in better scoring of the perception.

Fuzzy Analytical Hierarchy Process (FAHP) is an application of Fuzzy Logic into the assignment of weights in the criteria involved in the Multi-Criteria Decision Making Model (MCDM). The perception about sustainability in this paper is structured as an MCDM problem and fuzzy logic is applied to quantify the fuzziness in the perception about sustainability. The finance professionals are not directly involved in the accounting procedure of the organisation, but they are no less accountable for their role in the sustainable development process of the business. An understanding of the perception about the sustainability of would-be managers would help the management in understanding their sustainability matrices and the evolving mindset of the managers.

Keywords: *Management accounting, Sustainable development, FAHP, MCDM, Legitimacy theory, Accounting.*

Introduction

Resources are used to get output primarily to satisfy needs emanating from the society at large. Some of the needs are felt needs, whereas others are unfelt needs. Rapid urbanisation, globalisation, commercialisation and consumerism coupled with the marketing phenomena of making goods and services available have put a lot of unnecessarily pressure on the ever depleting natural resources. The depletion of natural resources has caught the attention of academia, policy makers and thinkers around the globe for quite a long time. Ancient literature supports and prescribes means and tools to understand the nature of this depleting natural resources and judicious use of the resources. Sustainability as a concept and philosophy of life is propagated through several techniques from the past and efforts have been initiated to ingrain sustainability thinking into the life of people. Thinkers have propounded this concept when they felt the need to make people aware of the depletion of resources. 'Limits to growth' as a theory and thinking caught the attention of people around the globe with realization that resources needs to be taken care of, if the earth has to see the future. Clarity on the dynamics and the essence of sustainability is quite understood and appreciated. However, the interpretation and operational definition of sustainability are considered to be a very complex and multidimensional issue. It is understood from the literature that sustainability encompasses multidimensional aspects and usually takes care of equity, efficiency and intergenerational equity primarily based on the dimensions of environment, society and economy. It is also understood that sustainability as a concept not only look into the economic, environmental, social and ethical dimension rather it aims to develop an integrated framework on which the concept can act to give strategic inputs to reserve and preserve the depleting resources and ensure its optimum utilisation.

Discussion on sustainable development and its management always takes into consideration certain questions that need to be understood and identified in a way that makes the concept meaningful and operationally applicable in a wide range of situations. It is pertinent to enquire into the question that what is the actual meaning of sustainability and what is the basic content in the concept of sustainability. Scientific literature is abundant with studies which try to analyze sustainability into different qualitative aspects of ecological, social, institutional, economical and political dimension. In several studies it is confirmed that sustainability as a

concept is complex and its evaluation is problematic in nature (Dzemydiene, 2008). The interpretation of sustainability is quite difficult and requires a lot of understanding to clearly define its concept (Ciegis, 2004). There is no supportive literature that justifies that there is a universal approach to sustainable development as it encompasses various scopes depending on the communities and institutions defining sustainability (Heinen, 1994). Based on this line, similar dimension was observed in another study (Radermacher, 1999). Numerous books, literature, articles and research papers have talked and contained the word sustainability but no clear-cut understanding is presented on those findings and the definition is not spelled out as observed by Spedding (1996). The duality in the definition of sustainable development encompasses the complex nature and makes it even more difficult to cover both the aspect of development and sustainability as observed by Ciegis (2004). Managerial, ethical, technical, and philosophical dimension towards sustainable development is observed in economic literature and their implications in the sustainable development are well documented (Munasinghe, 1993; Pearce et al., 1989; Pezzey, 1989; Pezzoli, 1997). The conceptual definition and understanding of sustainable development are quite difficult to observe in the literature and makes it difficult to arrive at any one dimensional concept of sustainable development (Pierantoni, 2004). However, during 1992, the phrase describing sustainable development was constituted by the World Bank which continues to present itself in the academic literature and all the discussions on sustainability (World Development Report, 1992). This definition and the understanding of sustainable development was carried forward in the 1992 Rio de Janeiro Declaration on Environment and Sustainable Development which describes sustainable development as follows:

> The use of natural resources in an rational and replenishing way to provide a long term continuous development to the society to meet the present need of the generation without compromising on the needs of the future generations (Rio Declaration on Environment and Development, 1992).

From the economical point of view sustainable development is emphasized in the study by 1990, Harwood and it is defined as:

> Development of a set of system to efficiently and effectively use the resources providing balance to the environment and provide benefits to the society, people and be friendly with the species (Environmental Challenges in Farm Management).

Some of the authors and thinkers have understood sustainable development as the optimisation of economic and social benefit without compromising on the future benefits which needs to be incorporated in the present system of working and utilisation of resources (Goodland and Ledec, 1987). Growth which is supported by the physical and social environment leading to economic development is also understood as sustainable growth by Pirages (1977). Certain thinkers have also understood sustainable development to be a process of economic development and structural changes helping to broaden human possibilities (Petkeviciute and Svirskaite, 2001). This particular understanding points out to the fact that sustainability is to be understood and applied from a thinking perspective and one should create possibilities and make people assume responsibilities leading to the development of society and create opportunities for future generations. Creating opportunities for future consumption and the use of resources is understood to be one of the fundamental dimensions of sustainability (Weitzman, 1997). Production may be one of the most considered phenomena from the economic point of view but authors have also pointed at productivity as a measurable dimension of sustainable development or rather sustainability of the economy is understood to be the ability of the social system or the economic system to use and maintain its resources to keep on increasing the productivity of its resources for future generations (Conway and Barbier, 1990). A generalised definition of sustainable development was propounded by Pearce (1989) which states that sustainable development should include the creation of a social and economic system that guarantees support. The various dimension of sustainable development is discussed, however, it is understood by International Union for Conservation of Nature (IUCN), United Nations Environment Programme (UNEP) and World Wide Fund for Nature (WWF) (1991) that sustainable development, sustainable consumption and sustainable growth are to be placed and understood as an equivalent concept defining the very basic idea of sustainability which talks about the re-generating capacity of the ecosystem leading to a sustained and continued growth and development.

Catton (1986) describes sustainable development as the generating capacity of the ecosystem without putting a maximum load on the environment leading to sustainable growth and development. Sorlin (1997) understands sustainable development as the ecological balance which is present in the societal and economic system which enhances the carrying capacity of the system and supports the greatest number of population in the coming years. The regenerating capacity of the resources and the inherent

capability to keep on continuously providing means and ways to generate other resources is a part of sustainable development which may enhance sustainability or may put a limit to its growth (Holdgate, 1993). Some thinkers have identified that the cost associated with the development of the society is not to be put into the shoulder of the future generation is the basic dimensions which explains sustainable development (Pearce, 1993). This dimension looks into the ethical aspect of sustainability and tries to capture the responsibility of use of resources by the present generation keeping in mind basic understanding that the past generation have made use of the resources in a sustainable way, hence, it continues to be a legacy for the present generation to present the resources to its future generation in a more beautiful way (Norton, 2007).

Review of Literature

Accounting as a process is supposed to solve the public interest and has been understood both in the public and private as a method of providing sustainability (Gray and Collison, 2002). Literature supports the fact that the role of accounting and the issues involved in sustainability is quite evident from the studies, which highlights that the accountants have a significant role to play in the environmental issues (Gray et al., 1993). The role of an accountant is not only limited in maintaining and recording transaction but they are also a part of the business management whose job is to understand the consequences of the actions on the environmental, economical and social dimension number (Gray et al., 1993). It is also argued that the organisations cannot fully embrace the culture of sustainability unless all the sectors and organisations involved in the business fully understand the issues of sustainability (Gray et al., 1993). However, it is seen in some of the studies that the response of the accounting and finance communities towards sustainability is fairly superficial and lukewarm (Gray et al., 1993). The non market activities associated with the accounting process are often seen to be reflected in the process of accounting which in turn has wide ramifications in the environmental dimensions of the organisation. Only financial indicators may not be sufficient enough to merit the selection of any project, however, the environmental and social aspects also needs to be taken care of. There is an overwhelming need in the literature which supports the claim that, better quality information regarding the sustainable practices is to be understood for providing sustainable development (De Villiers and Van Staden, 2012; Ball, 2005; Bebbington and Gray, 2001; Albelda, 2011; Wilmshurst and Frost, 2001).The dimensions of sustainability based on economic, social and environmental aspect, economic and environmental aspect cannot remain

stable without the social aspect and in turn the environmental and social aspect cannot stand irrespective of the financial aspect, thus, the financial professionals must also understand the need of sustainable development (Wilmshurst and Frost, 2001; Albelda, 2011). The role of Management Accountant in providing this support for sustainable development is not very prominent in the literature. What is pertinent is to understand the perception of the professionals specially related to finance and accounting about their understanding of sustainable development and the role that they are supposed to play in providing sustainability. It is highlighted by Ahrens and Chapman (2007) that within the dynamics of organisational framework it is the role of the Management Accounting Practices to understand how the members prepare and negotiate the strategies and budgets as well as the performance targets. Management The the accountants are also seen to be facilitators in the process of decision making which has an impact on the sustainability paradigm of the organisation Burnett and Hansen (2008), Sartorius et al. (2007). Sustainable development in the present context is seen to be incorporating several means and ways in the organisation to provide sustainable development. A standardized procedure followed by an organisation in the name of the International Organisation for Standardization (ISO) is one of such prevalent practices. The role of the accountant in this sustainability framework may range from involvement in the audit of the environment, internal audit requirements, investment proposal appraisals, and other issues of the organisation keeping in perspective the environmental benefits associated with the projects (Gray et al., 1993). Traditional role of the accountant managers were supposed to be involved in reporting of financial statements, taxation and auditing activities of the organisation (Parker, 2000), however, with the changing scenario of the organisation, the role of the accountant has evolved over a period of time and encompasses understanding the environmental perspective of the projects undertaken by the business. The role of the accountant was directly involved in the process of planning and development of the organisation as understood in the studies (Milne, 1996; Parker, 2000). Management Accountants are also seem to be playing an important role in the decision making process (Byrne and Pierce, 2007). It is also found out that the Management Accountants are playing the bean counter type role and also the role of a business partner Granlund and Lukka (1998); Sharma et al. (2010).

The forward-looking collaborative and strategic role orientation of the Management Accountant is found out in the studies by Granlund and Lukka (1998) and Sharma et al. (2010). The traditional role of the Management

Accountant has evolved over a period of time Albelda (2011). Management Accounting role is that of a facilitator in the decision making process as the relationship between the economic and environmental performance has increased over the period of time and has become even more imperative that organisation is unable to neglect (Burnett and Hansen 2008 ; Myburgh 2001). Another study by Albelda (2011) supports the role played by Management Accountant in facilitating the sustainable development of the organisation. It is found out that the Management Accountant role in sustainable development revolves around two dimensions: one is to identify and define the environmental cost associated explicitly in the costing system and secondly the role of the Management Account is to explain the education criteria to reduce the arbitrariness of environmental cost from that of the override account. However, there is limited participation of the Management Accountant in the sustainable development process and identified by Wilmshurst and Frost (2001). It is due to the limited understanding of the Management Accountant role in the sustainable process of the organisation as identified by Wilmshurst and Frost (2001). They identified that the role of the Management Accountant in the organisation can be perceived in the dimensions of

1. Focus on that compliance requirement and performance requirement within the internal setup of the organisation; and
2. Information related to the economic dimension as understood in the disclosures of external reports.

It is highlighted by CIMA (2011) that it is important for the Management Accountant to understand their role in the sustainable development. CIMA report 'Sustainability and Role of Management Accountant' focuses on this dimension and highlights that within the organisational setup Management Accountant must play an active role in the strategy formulation and decision-making process related to sustainable steps initiated by the organisation .Research highlights the fact that a limited role is given to the Management Accountant and the financial professionals to frame policies and take active interest in the strategic decision making involved in the sustainable development process (Berry et al., 2009). However, it is found out that the practices of accounting are mostly guided by the underlying values of economic activity within the organisation which is quite vivid to involve Management Accountant in the process of sustainable development (Ball, 2005; Adams and Frost, 2008).

Then the need for Management Accountants to engage in sustainable development process emerges from the fact that

1. With the jurisdictional requirement including sustainable development requirements for the organisation to have an the accountant in the team
2. Organisation and leaders have taken up sustainable development to be most important aspect of the organisational setup
3. Social change has influenced the perceptions about sustainability and organisations need to take care of this.

Literature and research considerable supports the fact that Management Accountant has an active role in the practices and policies leading to sustainable development within the organisational setup (Ferreira et al., 2010; Milne, 1996; Berry et al., 2009; Parker, 2000). Thus, the following research questions can be framed based on this understanding:

1. What role does the Management Accountant have to play and the perceptions of them about their role in the sustainable development process? and
2. The process of involvement of the Management Accountant in the sustainable development activities is marred by any perceived barriers by the Management Accountant.

The Rationale of Considering MBA (Finance) Students Considered as Management Accountants

Accountants are also seen to be facilitators in the process of decision-making which has an impact on the sustainability paradigm of the organisation (Burnett and Hansen, 2008; Sartorius et al., 2007). Sustainable development in the present context is seen to be incorporating several means and ways in the organisation so as to provide sustainable development. A standardised procedure followed by organisation in the name of ISO is one of such prevalent practices. The role of an Accountant in this sustainability framework may range from involvement in the audit of the environment, internal audit requirements, investment proposal appraisals, and other issues of the organisation keeping in perspective the environmental benefits associated with the projects (Gray et al., 1993). Traditional role of Accountant Managers were supposed to be involved in reporting of financial statements, taxation activities, and auditing activities of the organisation (Parker, 2000); however, with the changing scenario of the organisation, the role of Accountant has evolved over a period of time and encompasses understanding the environmental perspective of the projects undertaken by the business. The role of Accountant was directly involved in the process of planning and development of the organisation as understood in the studies (Milne, 1996; Parker, 2000). Management Accountants are seen to be playing an important role in the decision-making process (Byrne

and Pierce, 2007). It is also found that the Management Accountant are playing the bean counter type role and also the role of a business partner as understood in the studies of Granlund and Lukka (1998) and Sharma, et al. (2010). There has emerged a need for a collaborative role of finance and Management Accountants. With the changing dynamics of the working environment, there is no distinct difference in the role played by finance professional and Management Accountants. The lack of sample for distinct Management Accountants and due to convenience of sampling MBA (Finance) students were selected as a proxy for Management Accountants. However, it is found that the practices of Accounting are mostly guided by the underlying values of economic activity within the organisation which is quite vivid to involve MBA (Finance) graduates in the process of sustainable development (Ball, 2005; Adams and Frost, 2008).

Legitimacy Theory: A Prologue

Accounting for sustainable development and associative role of Management Accounting and finance professionals in the sustainable development process and communication mechanism of information and manipulation of the perception of plans and action is related to sustainable development based on the premises of legitimacy theory. The theoretical basis of social disclosure and the motivation about the role of Accountant in providing such information is based on the understanding of the legitimacy theory (De Villiers and Lubbe, 2001; Van der Laan, 2009). It is the organisational responsibility to operate within the norms and bounds of the respective societal framework as highlighted in the legitimacy theory (Guthrie and Parker, 1989; Suchman, 1995; Fogarty, 1996; Brown and Deegan, 1998; Wilmshurst and Frost, 2000; Sharma and Davey, 2013). This sense is changing over a period of time and the organisation requires to be responsive enough to overcome changing scenarios (Lindblom, 1994). Legitimacy theory is also defined as:

> the presence of the status score and systems and procedures within the value systems of an entity in tune with the large social system of which the entity is a part and is congruent with the individual entities understanding and the overall societal paradigm (Lindblom, 1994).

Any disruption and disparity threats to the system and makes the individual legitimacy vulnerable (Lindblom, 1994). Organisation operates within the social dimensions and needs to justify its operation to the society which has the resources and if it fails to justify the society, the society may not renew the contract and withdraw support and revoke its contract for

its operations (Brown and Deegan, 1998). This may result in reduction of demand and the business processes may be put into jeopardy due to non-cooperation of the systems and the social structure on which the business is operational and prohibit the operation of the business due to large-scale agitations ultimately leading the government to impose restrictions, taxes, and any other measures to jeopardise the working of the organisation (Brown and Deegan, 1998). Thus, the business must highlight the minimum required information to the society about its operational procedures (Brown and Deegan, 1998). Some of the authors understand legitimacy to be a condition in which the value system of the entity persists within the largest societal value system (Brown and Deegan, 1998). The society always tries to manipulate and balance the cost-benefit analysis with the business entity operational and using the resources of the society and thus always perceives the organisation to behave and act according to the societal norms (Guthrie and Parker, 1989). For organisational survival, legitimacy is seen to be a resource (Meyer and Rowan, 1977; Oliver, 1991). The legitimate organisation as seen by the society is benefited because they can receive economic resources and get political and economic social support needed for their survival (Oliver, 1991; Ogden and Clarke, 2005; De Villiers and Van Staden, 2006). It is also argued that legitimacy is a set of activities that is seen to be appropriate and accepted within the socially constructed system of norms, values, and behaviour dimensions within the definition and dynamics of the society (Suchman, 1995). However, Ogden and Clarke (2005) understand and points legitimacy to be more of a subjective understanding and an assumption and perceived behaviour characteristics of the organisation which is supported or rejected within the societal framework. Working with the organisation within the accepted societal norms and procedures is seen to be fine with the society and the societal norms as highlighted (Meyer and Rowan, 1977; Ogden and Clarke, 2005; Sharma and Lawrence, 2008; 2009; Lawrence et al., 2009). It is highlighted that legitimacy can be achieved provided they are supported by the stakeholders and support organisation who endorse the working of the organisation (Fogarty, 1996).

Objectives of the Study

Following are the objectives of this research:

1. To ascertain the perception of the MBA students about the role they are supposed to play in the organisation about sustainable development practices.

2. To quantify the subjective perception about sustainable development into the objective score.
3. To highlight the perception about the sustainable development drivers and the important factors of accounting as applicable in sustainable development.
4. To ascertain the perceived barriers to sustainable development and the sustainable development practices MBA graduates like to implement.

Research Methodology

The study is highly focused on the role of Management Accountant and their perception of the sustainable development practices proxies by MBA (Finance) graduates. Thus, the need for the study and paucity of time encouraged to go for purposive sampling. Total numbers of 60 students were purposefully selected for the study on which 50 numbers of students reported back with the questionnaire and the response rate was around 83.33 per cent.

Analytical Design

The data was gathered to build a perception about the Management Accountant role in the sustainable development in the Indian context from the MBA students who are pursuing their management course and are expected to be part of the finance domain in any business organisation. The questionnaire survey was directed towards the MBA students focusing on the issues related to sustainable development on which Accounting plays a role and the involvement of the graduates in this area. The questions were adopted from the questionnaire survey as proposed by Dimitrov and Davey (2011) and from the literature available on the Management Accountant involvement in sustainable development (Milne, 1996; Wilmshurst and Frost, 2001; Albelda, 2011). The method of enquiry was based on a survey using questionnaires design for the study. Informal structured interviews with the students were conducted to understand their perception about the process of sustainable development in the organisation setup. A total number of 60 students were selected for the purpose of the study on which 50 numbers of students reported back with the questionnaire and the response rate was around 83.33 per cent. The responses were quantified on a five-point Likert scale with Strongly Agree (5) and Strongly Disagree (1). The subjective perception was then objectified using FAHP for the respondents on an individual basis and a collective basis. The objectified perception was categorised into four categories as shown in Table 1.

Table 1: Objectified Perception

Type of Perception	*Range*
Lower Sustainability Perception	1to2
Balanced Sustainability Perception	2 to 3
Moderate Sustainability Perception	3 to 4
Excellent Sustainability Perception	above 4

The responses were categorised based on the total defuzzified score as mentioned in Table 1.

Results and Discussion

The findings of the survey to ascertain the perception of the MBA students about the role they are supposed to play in the organisation about the sustainable development practices is presented in the following four dimensions:

Main Criteria

- **Dimension One:** Perception for Sustainable Development Drivers (PSDD)
  Description: Management Accountants Perception about the Sustainable Development Drivers
- **Dimension Two:** Accounting Factors towards Sustainable Development (AFSD)
  Description: Important Factors of Accounting as Applicable in Sustainable Development and the Perception of it
- **Dimension Three:** Sustainable Development and Perceived Barriers (SDPB)
  Description: Sustainable Development and the Perceived Barriers to it
- **Dimension Four:** Sustainable Development Practices to Implement (SDPI)
  Description: Sustainable Development Practices MBA Graduates like to Implement

Sub-Criteria

- **Dimension One:** Perception for Sustainable Development Drivers (PSDD)
  1. Regulation
  2. Retention
  3. Sustainability Report
  4. Shareholders Requirement

- **Dimension Two:** Accounting Factors towards Sustainable Development (AFSD)
  1. Overseas Pressure
  2. New Tech Growth
- **Dimension Three:** Sustainable Development and Perceived Barriers (SDPB)
  1. Cost
  2. Institution Support
- **Dimension Four:** Sustainable Development Practices to Implement (SDPI)

  Sustainable Development Practices MBA Graduates like to Implement
  1. Externalities
  2. Global Reporting

Measurement of Overall Perception

The overall perception of the MBA graduates are discussed below:

Table 2: Management Accountants Perception About the Sustainable Development Drivers

Dimensions	*Strongly Disagree*		*Moderately Disagree*		*Neither Agree or Disagree*		*Moderately Agree*		*Strongly Agree*		*Ranking*	*Mean*
	%	*Nos*	*%*	*Nos*	*%*	*Nos*	*%*	*Nos*	*%*	*Nos*		
Regulations and laws	0	0	0	0	42	21	32	16	26	13	2	3.84
Retention of employees	0	0	56	28	44	22	0	0	0	0	8	2.44
Sustainability report production makes a difference in accessing financial capital	0	0	22	11	24	12	30	15	24	12	7	2.56
Shareholders seeking sustainable activity reporting while engaging with the companies	4	2	20	10	18	9	28	14	30	15	4	3.60

Table 2 reflects the perception of the MBA students regarding the sustainable drivers in an organisational setup. The total number of students interviewed for the purpose revealed that on average 'regulations and laws' were found to be the most important driver for sustainable development. This category was ranked the highest with a mean score of 3.84. Among the other factor, the perception of MBA students revealed that 'Shareholders seeking sustainable activity reporting while engaging with the companies' was the second most important factor was ranked the second with a mean score of 3.60. However, the factor 'sustainability report production makes

a difference in accessing' and 'retention of employees' was ranked the third and the fourth with a mean score of 2.56 and 2.44, respectively.

Table 3: Important Factors of Accounting as Applicable in Sustainable Development and the Perception of It

Dimensions	*Strongly Disagree*		*Moderately Disagree*		*Neither Agree or Disagree*		*Moderately Agree*		*Strongly Agree*		*Ranking*	*Mean*
	%	*Nos*	*%*	*Nos*	*%*	*Nos*	*%*	*Nos*	*%*	*Nos*		
Overseas government pressure	22	11	30	15	26	13	16	8	6	3	8	2.54
Growth of newer technology is encouraged due to the adoption of sustainable development practices	16	8	14	7	10	5	26	13	34	17	3	3.48

The MBA students were asked to rank the factors which are accountable for sustainable development within an organisation and identify the most important factor (Table 3). The analysis reveals that 'Growth of newer technology is encouraged due to adoption of sustainable development practices' were identified to be the most important driver for sustainable development in an organisational setup with a mean score of 3.48 and was ranked top amongst the entire factor. 'Overseas government pressure' was ranked the second amongst all the factors which were thought to be providing sustainable development to the organisation. The score of this factor was 2.54.

Table 4: Sustainable Development and the Perceived Barriers to It

Dimensions	*Strongly Disagree*		*Moderately Disagree*		*Neither Agree or Disagree*		*Moderately Agree*		*Strongly Agree*		*Ranking*	*Mean*
	%	*Nos*	*%*	*Nos*	*%*	*Nos*	*%*	*Nos*	*%*	*Nos*		
The cost associated with the sustainable development report is higher than the benefits in curd from the reports	10	5	26	13	2	1	26	13	36	18	4	3.52
The institutional support mechanism is not enough	8	4	22	11	20	10	30	15	20	10	6	3.32

Table 4 reflects the sustainable development and the perceived barriers to sustainable development by MBA students. The result reveals that 'the cost associated with sustainable development report is higher than the

benefits in curd from the reports' is perceived to be the most important barrier in the sustainable development of the organisation. This particular dimension is ranked first amongst all the factors identified as a barrier to sustainable development with a mean score of 3.52. 'Institutional support mechanism is not enough' is perceived to be the second most important factor acting as a barrier in the sustainable development of the organisation. This particular criterion was ranked with a mean score of 3.32.

Table 5: Sustainable Development Practices MBA Graduates like to Implement

Dimensions	*Strongly Disagree*		*Moderately Disagree*		*Neither Agree or Disagree*		*Moderately Agree*		*Strongly Agree*		*Ranking*	*Mean*
	%	*Nos*	*%*	*Nos*	*%*	*Nos*	*%*	*Nos*	*%*	*Nos*		
Global reporting initiative for comparison	44	22	36	18	16	8	2	1	2	1	8	1.82
Consideration of externalities cost in the costing system	28	14	28	14	10	5	20	10	14	7	4	2.64

To understand the sustainable development practices which the MBA students would like to adopt, the analysis reveals that 'Consideration of externalities cost in the costing system' was perceived to be the most difficult and was ranked first by the students with a mean score of 2.64 amongst the entire factor (Table 5). 'Global reporting initiative for comparison' was ranked as the second most important sustainable development practices that the MBA students would like to implement in the organisation to boost sustainable development in the organisation. This factor was ranked second with an average score of 1.82.

Mathematical Formulation Used in the Study

The following mathematical formulation is used in the study:

Fuzzy Sets, Triangular Fuzzy Numbers, and Fuzzy Analytical Hierarchy Process

The elimination of excluded extensions in the manner of making good and bad decisions means that the law has been given credit. However, it has been seen for many years that the exclusion of the middle often leads to false results. An attempt was made to consider the full range of test levels. The ability to add logic to a human decision and accurate information often leads to material problems. In the proposed Fuzzy Theory of Zade, the curiosity of human thought has been kept in mind. The set, which contains the components, which do not scale the membership function in a clear number, is defined as a vague set

scale from zero to continuous degree. To allocate the membership function, the obscure principle considers the human perception and confusion of decision-making. A 'deep' concept, such as the classical set theory, mathematical and programming, can be 'obscure' by generalising the idea of a clear set of an ambiguous set with the Fuzzy range.

The special class of divided numbers is defined, whose membership is defined as three spreading TFN by the real numbers (l, m, and u). A triangular fuzzy number (TFN) has been created in the image below. The numerical number of the triangle is shown in Eq 1 and Figure 1.

$$\mu_A = \begin{cases} \dfrac{x-l}{m-l}, & l \le x \le m \\ \dfrac{u-x}{u-m}, & m \le x \le u \\ 0, & otherwise \end{cases} \quad \ldots(1)$$

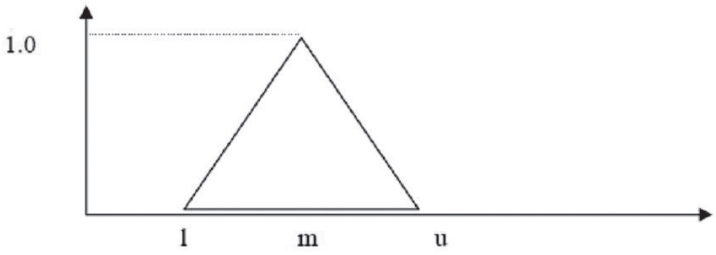

Fig. 1

The operational laws between two triangular fuzzy numbers M1 and M2 are as follows:

$$M_1 + M_2 = (l_1 + l_2, m_1 + m_2, u_1 + u_2) \quad \ldots(2)$$

$$M_1 \times M_2 = (l_1 l_2, m_1 m_2, u_1 u_2) \quad \ldots(3)$$

Analytic Hierarchy Process

The Analytical Hierarchy Process (AHP) was presented by Thomas Saaty as the best choice for classifying decision-making options and for many decision-makers. It takes care of making complex decisions and helps the decision-maker to set priorities and choose the best option. AHP reduces complex decisions in a series of comparisons and summarizes the results that help to consider the subjective and objective aspects of the AHP decision. AHP considers a set of benchmarking criteria and a series of alternative options to make the best decision. For each evaluation criterion, it creates a weight compared to the pair's criteria; the most important is to get the highest score. AHP is determined by comparing both secondary and main

criteria and pairs through the discovery of Eigen vectors. The Eigen vector considers the matrix permeability problem and the score is made to maintain the highest order of the perimeter. High scores, the options will be good to these criteria. Later, to achieve a degree, AHP determines the overall score by combining the weighted weight of the criteria and option. A weighted sum of scores is calculated at last.

Fuzzy Analytic Hierarchy Process

Uncertainty and confusion related to the mapping of perception bring in the limitations of the conventional AHP process leading to look for improvisation in the traditional AHP process. The comparison was done with a comprehensive linguistic scale from 0 to 10. TFNs were used to remove the reciprocals from the pair wise comparison matrix. The TFNs corresponding to various verbal judgements is stated using Table 6 and Figure 2.

Table 6: Fuzzy Linguistic Preference Scale

Verbal Judgement	*Explanation*	*Triangular Fuzzy Number*
Very Low (VL)	A response is worst	(0, 1, 2)
Low (L)	A response is slightly worse	(1, 2, 5, 4)
Medium (M)	A response is so-so.	(3, 5, 7)
High (H)	A response is good.	(6, 7, 5, 9)
Very High (VH)	A response is very good.	(8, 9, 10)

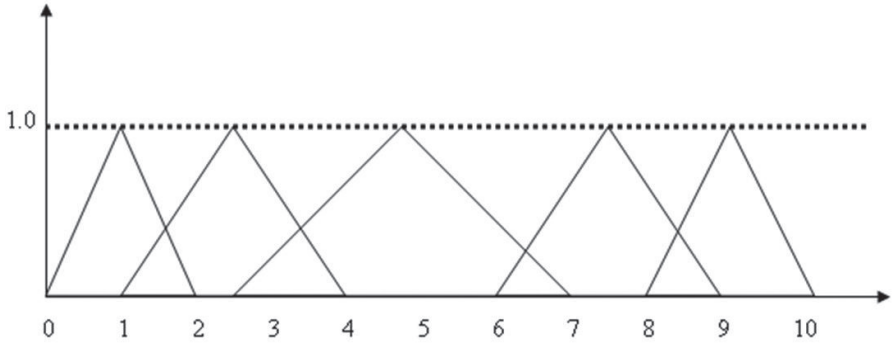

Fig. 2: TFN's for Verbal Judgement

Evaluation of Fuzzy Pair Wise Comparison

Experts explain the answer on the degree of importance compared to the other in the pair-wise comparison. Expert feedback was compiled with the help of questions designed for this purpose. Expert answers were coded to the fuzzy pairs on a scale of 0-10. For positive responses table, value was

considered and for negative responses inverse and reverse order value was considered in tune with the Buckley's method. Buckley's method gives tough assurance and resolves the problem of transitivity compared to matrices. The pessimistic, most likely, and optimistic decision-making environment are represented by minimum value, most plausible value, and maximum value of TFNs.

Here the fuzzy comparison matrix is defined as:

$$\tilde{A} = \begin{pmatrix} 1 & \tilde{a}_{12} & .... & \tilde{a}_{1n} \\ \tilde{a}_{21} & 1 & .... & \tilde{a}_{2n} \\ \tilde{a}_{31} & \tilde{a}_{32} & 1... & \tilde{a}_{3n} \\ .. & .. & \tilde{a}_{nn-1} & 1 \end{pmatrix} \quad ...(4)$$

The minimum value, most plausible value & maximum value of the triangular fuzzy number are described by a_{ij}^{L}, a_{ij}^{M}, a_{ij}^{U} respectively and the relative importance of each criterion in pair wise comparison is stated by $\tilde{a}_{ij} = (a_{ij}^{L}, a_{ij}^{M}, a_{ij}^{U})$.

The fuzzy weights are generated from the comparison matrix. But, in order to simplify the process of calculation the fuzzy pair wise comparison matrix is broken into crisp matrices of A_L, A_M, A_U where these crisp matrices are constructed by taking the minimum values, most plausible values & maximum values from the triangular fuzzy numbers.

Calculation of Element Weight

The Normalization of the Geometric Mean (NGM) method (Buckley et al., 1985) is applied to calculate the weights from the fuzzy pair wise comparison matrices which is given as follows

$$\omega_i = \frac{a_i}{\sum_{i=1}^{n} a_i}, \text{ where } \left(\prod_{j=1}^{n} a_{ij} \right)^{1/n}$$

a_i is the geometric mean of criterion i, a_{ij} is the comparison value of criterion i to criterion j and is the i^{th} criterion's weight, where $\omega_i = 0$ and $\sum_{i=1}^{n} \omega_i = 1$.

In order to make group assessment, the opinion of the evaluator is aggregated into one. The aggregation of the experts' judgments is done using average mean in the following way, where, evaluation given by expert is considered to be $E_i = (a_L^{(i)}, a_M^{(i)}, a_U^{(i)},$

$$\tilde{A} = \left(\frac{1}{n} \sum_{i=1}^{a} a_L^{(i)}, \frac{1}{n} \sum_{i=1}^{a} a_M^{(i)}, \frac{1}{n} \sum_{i=1}^{a} a_U^{(i)}, \right) \quad ...(5)$$

The weight of i^{th} sub criteria under k^{th} main criteria is computed by

$$(w_k \times S_{ki}) \quad ...(6)$$

where w_k is the k^{th} main criteria weight and S_{ki} is the weight of i^{th} sub criteria with respect to k^{th} main criteria. The crisp weight of the sub criteria finally calculated by defuzzifying the product of fuzzy numbers obtained in equation number (7) as

$$s_l = \left(\frac{\left(\frac{1}{n}\sum_{l=1}^{n} a_L^{(l)} + 2\left\{ \frac{1}{n}\sum_{l=1}^{n} a_M^{(l)} \right\} + \frac{1}{n}\sum_{l=1}^{n} a_U^{(l)} \right)}{4} \right) \quad ...(7)$$

The ladder of the problem and defuzzified weight are presented in Table 7.

Table 7: Ladder of Problem and Defuzzified Weights

Main Criteria	*Sub Criteria*	*Weights*	*Would Be Managers (WBM)*
PSDD	Regulation	0.081106	WBM1
	Retention	0.065635	WBM2
	Sustainability Report	0.096005	WBM3
	Shareholders Requirement	0.048422	…
AFSD	Overseas Pressure	0.051456	…
	New Tech Growth	0.026873	…
SDPB	Cost	0.039528	…
	Institution Support	0.059329	WBM48
SDPI	Externalities	0.478878	WBM49
	Global Reporting	0.052769	WBM50

Table 8: Subjective Perception and Objectified Perception

Criteria	*Subjective Perception*	*Objectified Perception*
Regulations and laws	3.84	0.311447108
Retention of employees	2.44	0.160149472
Sustainability report production makes a difference in accessing financial capital	2.56	0.245772338
Shareholders seeking sustainable activity reporting while engaging with the companies	3.6	0.174318889
Overseas government pressure	2.54	0.130698171
Growth of newer technology is encouraged due to the adoption of sustainable development practices	3.48	0.093518412
The cost associated with sustainable development report is higher than the benefits in curd from the reports	3.52	0.139137637

Institutional support mechanism is not enough	3.32	0.196970758
Global reporting initiative for comparison	1.82	0.871557753
Consideration of externalities cost in the costing system	2.64	0.139310093
Total Score		2.46288063

According to Table 8, the summary score of all the respondents when objectified comes to 2.46 signifying the fact that would be managers are not so concerned about sustainability practices on average.

Table 9: Summary of Perception (Individual Perception)

Type of Perception	*Range*	*Numbers*	*Percentage*
Lower Sustainability Perception	1 to 2	6	12.0
Balanced Sustainability Perception	2 to 3	20	40.0
Moderate Sustainability Perception	3 to 4	17	34.0
Excellent Sustainability Perception	above 4	7	14.0

The individual subjective perception and the objectified score are summarized in Table 9. The analysis reveals that on an average around 40 per cent of would be managers (MBA Students) exhibited Balanced Sustainability Perception. Around 34 per cent exhibited Moderate Sustainability Perception. Only 14 per cent of would be managers (MBA Students) showed Excellent Sustainability Perception whereas 12 per cent showed Lower Sustainability Perception. Overall it can be said on an average that would be managers (MBA Students) have balanced to moderate Sustainability Perception, whereas some would be managers (MBA Students) were very high on Sustainability Perception.

Implications and Recommendations

The study revealed that the companies should focus on shareholders seeking sustainable activity reporting while engaging with the companies along with the retention of employees to increase their sustainability score amongst the MBA (Finance) graduates. The organisation should focus on the growth of newer technology due to the adoption of sustainable development practices as it was identified to be the most important driver for sustainable development in an organisational setup. Organisations should take care of the cost associated with the making of sustainable development report as the cost associated with sustainable development report is higher than the benefits incurred from the reports is perceived to be the most important barriers in sustainable development of the organisation. Consideration of externalities cost in the costing system is also an important factor to be

looked into by the organisations aiming for sustainable development. As the analysis reveals that on an average around 40 per cent of would be managers (MBA Students) exhibited Balanced Sustainability Perception, organisations should initiate training programmes to convert the identified managers into ambassadors of sustainability of their respective organisations.

Conclusion

It is argued that legitimacy is a set of action that is seen to be appropriate and accepted within the socially constructed system of norms, values, and behaviour dimensions within the definition and dynamics of the society. However, arguments points out that legitimacy is more of a subjective understanding and an assumption and perceived behaviour characteristics of the organisation which is supported or rejected within the societal framework. Working of the organisation within the accepted societal norms and procedures is seen to be fine with the society and the societal norms. It is understood that legitimacy can be achieved provided they are supported by the stakeholders and support organisation who endorse the working of the organisation. Exposure of would be MBA Graduates to the nuances of finance and accounting field will definitely be part of the system of the organisation and their business. Their understanding is of utmost importance in deciding whether they will be involved in the process of providing sustainable understanding to the business or not. Thus, this study is helpful in highlighting and understanding their role in providing a sustainable development perspective to the business and organisation. Although the finance professionals are not directly involved in the accounting procedure of the organisation, but they are not less accountable for their role in the business sustainable development process.

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Barriers to Institutional Education for Refugees: A Case Study of Rohingya Community in Bangladesh

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Abstract

The massive influx of refugees in recent times is daunting. On one hand, the international communities are struggling to propose a sustainable solution to this havoc; on the other hand, securing the rights of these stateless people are posing significant challenges. Under current circumstances, refugee education, despite being strongly advocated, faces numerous barriers. Defining the corresponding terms, the primary objective of this paper is to identify those existing barriers and investigate the extent of those barriers. In this paper, institutional education is limited within primary education, i.e. from grades 1 to 5. The definition for 'Refugee' is set according to the standard United Nations High Commissioner for Refugees (UNHCR) which states:

A refugee is someone who has been forced to flee his or her country because of persecution, war or violence. A refugee has a well-founded fear of persecution for reasons of race, religion, nationality, political opinion or membership in a particular social group. Most likely, they cannot return home or are afraid to do so. War and ethnic, tribal and religious violence are leading causes of refugees fleeing their countries.

This case study is based on the Rohingya community in Bangladesh. The extensive secondary research methodology is applied to extract the results which circumnavigate the following potential areas—the financial condition of the refugees, language and curriculum barriers, and current refugee education policies. Limitations of the approach are fittingly identified.

Keywords: *Refugees, Rohingya community, Institutional education, Education framework, Sustainable development.*

Introduction

The world in recent days has seen a sharp rise in forced displacement and persecution. With one person being displaced every two seconds, both the severity of the crisis and the sufferings of the refugees are increasing (United

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This is to clarify that this paper titled 'Barriers to Institutional Education for Refugees: A Case Study of Rohingya Community in Bangladesh' is authored by Erina Mahmud and Nalifa Mehelin. The paper is an original piece of work with each of the sources appropriately cited. The paper has not been published/sent for publication/accepted for publication anywhere else.

Nations High Commissioner for Refugees [UNHCR] 2018). According to the 2018 statistics, UNHCR has now about 25.6 million refugees under its radar, half of whom are younger than 18 years. While the numbers cannot reflect the agony and uncertainty refugees go through, it can show the severity of the situation. The ever-increasing number of refugees rightly depicts how insufficient the measures and policies have remained compared to the complexity of this crisis so unprecedented. Research has shown that an average refugee spends about 20 years in exile and to live a dignified and self-sufficient life during this period and beyond, one needs access to education (Devictor, 2016). It applies more to child refugees.

Every child deserves an education. When it comes to refugee children, the case is even stronger. In addition to teaching basic life skills, schools tend to give them a sense of normalcy and hope for the future in the midst of all the chaos. It also serves as an investment towards a better future—whether they are repatriated or integrated into the new society, perhaps education will bring prosperity in their home country and/or sustain development in the new one. The basic step to this is ensuring access to primary education. Although globally 91 per cent of children attend primary school, the number is 61 in the case of refugees; falling even shorter (50 per cent) in low-income countries (UNHCR Education, 2017). In this scenario, the challenges to access primary institutional education need to be examined thoroughly. This paper explores these very challenges and finds results circumnavigating these potential areas—financial condition of the refugees, language and curriculum barriers, and current refugee education policies. It also discusses the limitations of the approach taken towards ensuring primary education.

Objectives

The objective of the paper is to identify the barriers to access primary education for Rohingya refugees. This paper has identified and discussed three such major barriers:

1. How financial conditions of the refugees contribute to low accessibility of primary education.
2. How language differences and curriculum discrepancies prove as additional disadvantages to the refugee children, and
4. Whether the current refugee education policies put in place are adequate to support this disadvantaged community.

Terminology

Rohingya

Having somewhat similar, if not identical, understanding of the term 'Refugee' is crucial for many purposes, especially for its operational aspect. While many organisations are working for refugees, scope and area of their work depending on how they define it. As most of these works involve around aiding the refugees and providing them with the necessities of life, establishing precise criteria of who can identify as refugee becomes very important. However, due to the definition's wide applicability and the power to hold agencies accountable, the term can be susceptible to parochial interests and subjectivity. Additionally, given the highly sensitive nature of the refugee cases, states can have widely differing positions in identifying refugees. In this scenario, having an internationally accepted definition becomes imperative.

Agreeing upon a universal definition of refugee came with numerous questions, doubts, and debates. After going through the turmoil of two world wars, the International Refugee Law (IRL) arose in the twentieth century to develop a mechanism to protect the refugees from persecution. In 1951, states came together and prepared a course of action. As a result, 'The 1951 Refugee Convention' defines a refugee as:

> …someone who is unable or unwilling to return to their country of origin owing to a well-rounded fear of being persecuted for reasons of race, religion, nationality, membership of a particular social group, or political opinion.

Although the 1951 definition was widely welcomed, it had geographical and temporal limitations as it recognised refugees only coming from Europe and before 1951. The 1967 protocol was issued to amend these limitations by enabling a universal coverage. According to the Protocol, a person can be recognised a refugee, if four criteria are fulfilled. These are: (1) There should be a 'well-founded' fear of 'persecution'; (2) The persecution must be based on five reasons (race, religion, nationality, membership of a particular social group, or political opinion); (3) S/he should be outside their country/nationality/habitual residence; and (4) S/he must be unable to return to the country due to the fear of persecution or lack of protection.

Although the Protocol tried to accommodate the limitations and newly emerging scenarios, shortcomings remained. Terms like 'well-founded fear' or 'persecution' contain subjective elements that can be defined in different ways. Despite the mentioned limitations, it is the most widely accepted and used definition by the states and the organisations all over the world. In this

paper, the definition of a refugee is set according to the Refugee Convention 1951 and its 1967 protocol.

By this definition, the Rohingya population from Myanmar is internationally recognised as refugees. Rohingya population meets all the criteria the Refugee Convention seeks for. However, the Bangladesh government is reportedly reluctant and so far has not made a move to grant 'refugee' status to Rohingya people (Zaman, 2017). The wide assumption behind this reluctance has been the responsibility that comes with the refugee status from the internationally binding documents. In this paper, we consider the Rohingya population in Bangladesh as refugees according to the internationally set criteria.

Institutional Education

This paper looks at the Rohingya population's access to primary institutional education. We consider primary institutional education to be ranging from grades 1 to 5 as it is both in Bangladesh and Myanmar. This research explores exclusively the access to primary education as it is the stepping stone of institutional education; without access to which higher education is unreachable. While almost 60 per cent of the Rohingya population in Bangladesh is children, the status of their primary education enrolment can be terrorising (UNHCR, 2018). Securing at least the primary education can reduce the vulnerability this section of the population otherwise faces.

Methodology

Qualitative in nature, this paper adopts an extensive secondary research methodology. A large body of literature has been reviewed to explore the barriers. The main sources of secondary data are electronic media. Data and reports from national and international organisations working on the refugee issue have been consulted. This literature includes newspaper articles, journal entries, fact-finding reports, blog posts, books, statistics on the issue of the refugee crisis by different international and non-governmental organisations like the United Nations, Human Rights Watch, Save the Children, Migration Policy Institute, Translators without Borders, etc. Write-ups from the migration and refugee scholars also have been consulted and contextualised. The gathered data was then analyzed to see the relevance of the case studies.

To do so, the paper has been divided into multiple sections. Defining the terminologies, the paper briefly discusses the Rohingya Refugee Crisis. The first section of 'Data and Analysis' explores the financial condition of the Rohingya refugees that leads to poor access to primary education. The

discrepancies in languages and curriculum between the country of origin and the host country are also discussed in the next section. The last section of the analysis sheds light on the current refugee education policies and how their shortcomings confound the whole scenario. The limitations of this research have also been discussed in the next section.

Rohingya Refugee Crisis

British Broadcasting Corporation (BBC) presents a rapid introduction to the crisis explaining the descent of the Rohingya community. The Rohingya, according to the article, is one of the many ethnic minorities in the country. Rohingya Muslims represent the largest percentage of Muslims in Myanmar, with the majority living in Rakhine state. According to the BBC article:

> But the government of Myanmar, a predominantly Buddhist country, denies the Rohingya citizenship and even excluded them from the 2014 census, refusing to recognize them as a people. It sees them as illegal immigrants from Bangladesh.

The Myanmar military subsequently started its targeted violence upon the Rohingyas in Rakhine state—burning villages, brutally killing people, raping women, illegally confiscating their assets, and many more vehement crimes.

The Rohingya Refugee crisis dates back to the 1970s. Between the timespan of 1978-92, around 2,00,000 Rohingyas have fled to Bangladesh to escape the targeted violence (ACAPS-NPM, 2017). However, the recent influx is one of its kinds. The population factsheet of the UNHCR elaborates on the details of the influx (2018). The total number of refugees as of 31 December 2018 is 9,06,572 with 2,09,078 families. Of the total number, 34,172 which amounts to a meager 4 per cent of the population are registered refugees. The remaining 96 per cent, which amounts to 8,72,400 refugees are unregistered. There are a total of 11 refugee camps housing this massive amount of people. Only two of them are registered camps.

The UNHCR factsheet sheds light on other divisions of the population as well (2018). The population of the Rohingya community is divided as such—55 per cent children, 42 per cent adults, and 3 per cent elderly. Of the 55 per cent of children, there are 9 per cent male and 9 per cent female children in the age group of 0-4 years and 12 per cent male and 11 per cent female children are in the age group of 5-11 years. The percentage of the refugees who originated from Maungdaw is 67, 26 per cent came from Buthidaung, 5 per cent from Rathedaung, and 2 per cent from other

districts of the Rakhine state. The current influx began in late 2016, with 8 per cent of the current population (73,915 people) arriving before October 2016. The period, October 2016-August 2017, witnessed about 94,461 refugees (about 11 per cent) entering the territory of Bangladesh. The major migration happened during the month of August to December of 2017. A total number of 7,21,944 refugees (around 80 per cent) arrived in Bangladesh. After that period, there has been a slow influx which amounted to 16,252 refugees.

'The United Nations described the military offensive in Rakhine, which provoked the exodus, as a 'textbook example of ethnic cleansing' claims the BBC article (2018).

Data and Analysis

After carefully screening the data, the analysis brings out three key points—financial barriers, language and curriculum barriers, and the current policy barriers. These are further delineated in this part.

Financial Barriers

To understand the financial dynamics of the Rohingya community, proper assessment of their financial state of affairs needs to be addressed. A minority in Rakhine state, the Rohingya community is one of the most impoverished communities of Myanmar. A thorough assessment of Rakhine state, therefore, may enable us to understand the context of the situation regarding education.

A UNHCR report states that about 68 per cent of refugees worldwide come from only five countries in the world. These are the Syrian Arab Republic, Afghanistan, South Sudan, Myanmar, and Somalia. Of the five countries, Myanmar is the origin country for 1.2 million refugees (2018). While the estimated national poverty rate in Myanmar is 32 per cent, the poverty rate in Rakhine state alone is 78 per cent (Lambert, 2017) where 36.70 per cent (UNHCR, 2016) of the population are children under 18 years. A 2013 United Nations Development Programme (UNDP) report states that, despite achieving significant improvements in reducing national poverty in recent years, the difference in poverty reduction rates between Rakhine state and the whole country remains widely different (Schmitt-Degenhardt, 2013). The Report further details the state-wise poverty dynamics. Out of 6,588 household samples, the number of households living in chronic poverty is 1,122 and the number of households entering into poverty is 1,306. Moreover, the state accommodates farmers, fishermen, inhabitants of low-lying areas/riverbanks, fish/pond owners, casual

labourers, the impoverished Muslim community, and fire-wood collectors. The data reveal significant evidence of the meagre financial background of the inhabitants of Rakhine state which also houses the Rohingyas.

On the other hand, a United Nations International Children's Emergency Fund (UNICEF) report on Rakhine state reveals the census of primary education in the state. Comparing the national data with the data from Rakhine state, the Report brings out staggering inequality in terms of access to education in the Rohingya community. While the national average of pre-school attendance is 23 per cent, the average in Rakhine state is 5 per cent. The average of Primary School Enrollment and Primary School Completion at the national level is 88 per cent and 54 per cent, respectively whereas for Rakhine state, it is 71 per cent and 32 per cent, respectively. The data is presented in Figure 1 (UNICEF, 2013).

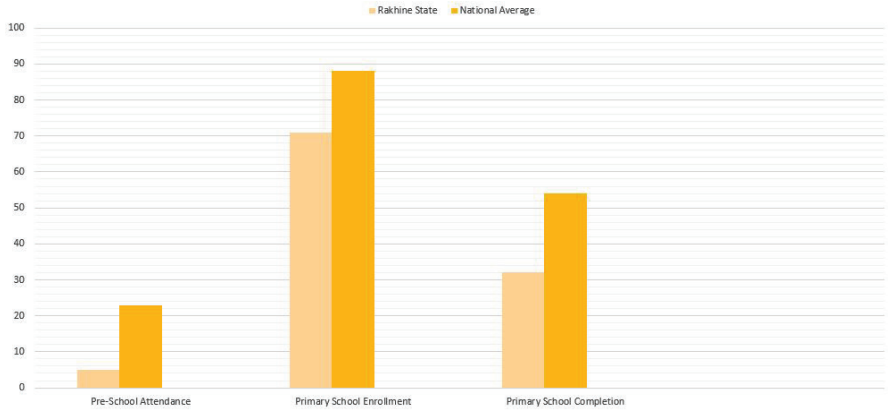

Fig. 1: Primary Education in Rakhine State
Source: UNICEF (2013)

After the Rohingya Refugee Crisis, about a million of refugees came to Bangladesh, a country currently struggling with its 164 million population. The Prime Minister of Bangladesh, Sheikh Hasina, accepted these streams of refugees and accommodated them in Kutupalong Refugee Camp in Cox's Bazar, the southern district of Bangladesh already battling with a population of about 26,55,000 (Population City, 2016). Describing the nature of Kutupalong Refugee Camp, the Editorial Director of the World Food Program USA writes, 'Kutupalong is not only the biggest refugee camp on the planet, with a population of 1 million and counting, it's also the most densely populated. And it took just six months to more than double in size.' (Altman, 2018)

According to the 2011 District Statistics published by Bangladesh Bureau of Statistics, Cox's Bazar is a pre-dominantly agrarian economy

with 44.15 per cent of the 3,35,825 households making their living by farming. Because of being a coastal district, fishing is a popular source of managing livelihood. Other than farming, there are 40,086 number of non-farm activities of which 24,986 establishments are for wholesale and retail trade. Apart from trade, Cox's Bazar is also less advanced in terms of access to education. Figure 2 indicates the number of primary schools enlisted in Ukhia, the host upzilla of the refugees (Bangladesh Bureau of Statistics, 2011).

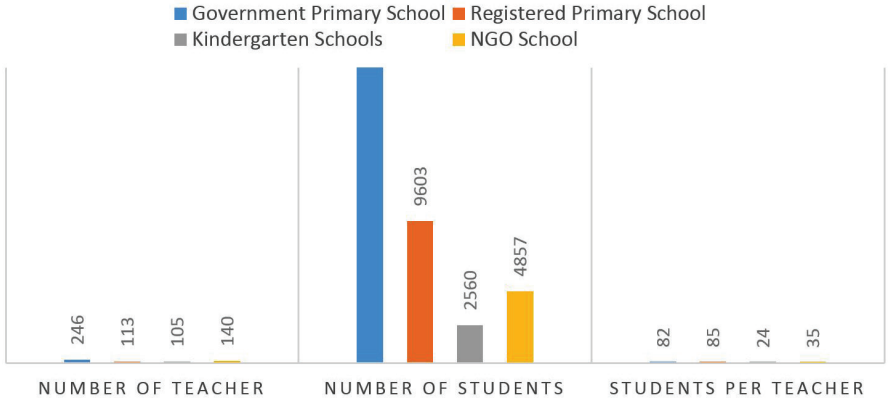

Fig. 2: Ukhia Primary School Statistics

Source: District Statistics 2011, Cox's Bazar, Bangladesh Government

The data represents the poor condition in Ukhia. Under these circumstances, while the host country itself is struggling to ensure basic rights, the learning centres in the camps can seldom provide quality education.

In one of their articles, The Norwegian Refugee Council states:

> Today there are approximately 250 learning centers in the camps, run by UNICEF and Save the Children. The goal is to have 350,000 children attend classes, which means building another 2000 learning centers (Fossvik, 2017).

The Report also admits the dire urgency of providing educational assistance to 4,50,000 children between the ages of 4 and 14. While the data presented here appropriately contextualise the struggle, the question of access to education remains. The data, therefore, unfolds the following consequences:

- It is evident from the data that hailing from Rakhine state, a greater portion of the refugees is not financially endowed. While education rate was already low in their home country, the situation worsened in the host country.

- The report titled *Joint Education Needs Assessment: Rohingya Refugee in Cox's Bazar* highlighted the percentage of children attending the learning centres. It illustrates: 'For primary aged children (aged 6-14), 57% of girls and 60% of boys of having attended learning centers since arriving in Bangladesh. Attendance is weaker at the Early Childhood Care and Development (ECCD) level (aged 3-5) – only 43% of both boys and girls with reported attendance.'

  In addition, the Report claims that prior to displacement, 50 per cent of girls and 58 per cent of boys aged 8 years and above reported graduating from at least Grade 1 in Myanmar's school system and those who had access to education, on average have completed three grades of schooling with 31 per cent of boys and 25 per cent of girls reported having completed Grade 3. Only 57 per cent of children who attended school in Myanmar have attended a learning centre since arriving (Relief Web, 2018).
- The Report further points out the barriers to attending these learning centres. It states, 'Work at home or outside the home was identified as a barrier by 20% of parents of primary-aged children (6-14).' The Norwegian Refugee Council reports similar reasoning claiming, 'Social norms and safety issues affect adolescent girls' access to education and boys are kept out because they need to help their families earn money and get a livelihood.' Therefore, it can be inferred that acquiring financial stability plays a bigger part as a barrier in access to primary education. And to achieve that security, children are opting for work inside or outside the camps rather than attending learning centres.

Language and Curriculum Barrier

When it comes to educating the refugees, language and curriculum barrier remains one of the most persistent challenges. Without hardly any synchronization or a common ground to build policies upon, navigating this barrier and designing inclusive policies is imperative for ensuring the education for refugees. Rather than sticking to the traditional medium of education, special emphasis should be given on content encompassing vocational skills. Therefore, analyzing language and curriculum barrier is pivotal to assess the policy gap.

Language

Language plays a crucial role in availing rights—more so when it comes to education. Assuming refugees to be a homogenous group has made access to education difficult. Refugees come from very many different backgrounds

and are anything but homogeneous. Their skills and preferences of language can very well differ, even when they come from the same country. In a 2018 Report titled *Joint Education Needs Assessment: Rohingya Refugee in Cox's Bazar*, it has been documented that 50 per cent of the refugee population prefers Rohingya to be language of instruction—although it is an oral language without a standardised and internationally recognised written script (Translators Without Borders, 2017)—compared to 15 per cent each preferring Burmese and English (The Education Sector, 2018). However, when it comes to learning a new language Bangla comes second with 62 per cent preference with English (90 per cent) being the first preference of the parents.

In addition to addressing the difference in preferences, the proficiency of language also differs. A significant number of refugees come to their destination country with very limited knowledge of that country's language, formal institutional education or literacy skills in their language but many come with multilingual proficiency. The first scenario is stronger for Rohingya refugees in Bangladesh: in a survey 'Rohingya Zuban' by *Translators Without Borders,* 73 per cent Rohingya respondents identified themselves as illiterate (2018). The 'Rohingya Zuban' report states an even more interesting fact—of the respondents of their survey, only 17 per cent of males and 6 per cent of females could read basic Burmese texts although it is the national language of Myanmar (2018). The differing level of literacy and linguistic skills then makes it more difficult for a government to come up with a uniformed curriculum to give them access to education.

Often there is insecurity regarding teaching the host country's language. The wide assumption is equipped with the host country's language and lower-wage, refugees will take up the jobs previously available to the host population. In addition to that, while refugees welcome the idea of educating their children, the question remains—in case of repatriation, can the children resume their studies given their previous education has been in a different language? With such concerns and, the preferences and proficiency being diverse, language does become a strong barrier to education.

Curriculum

The difference in curriculum and the lack of content also prevent the smooth functioning of the temporary schools situated at the camps. At present, no standardised curriculum is being taught across the learning centres. The formal education system cannot be accessed by the refugee children and the Bangladeshi curriculum cannot be taught in the learning centres (The Education Sector, 2018). Since no formal curricula have been

approved, teachers report that 'the content of teaching is often improvised and unstructured, and that they lack the means to adequately distinguish between children of different ability levels' (2018). In the same Report children have also reported 'feeling under-stimulated in learning facilities, often covering material they have already studied in Myanmar' (2018). Another strategic problem pointed out by the *Joint Education Needs Assessment: Rohingya Refugee in Cox's Bazar* is that there is a lack of resources to align the curricula in learning centres with that of the Myanmar one (2018). There is also a lack of validation or recognition of the learning centres situated at the camps. While students are mostly taught Rohingya, Burmese, Bangla and English, the lessons are basic and go up to only an equivalent level of Grade 2. In this scenario, the schools can only serve to teach a very basic and personalised lesson which are not even recognised by the educational institutions outside.

Even with the provision of a special school for refugee children, the barrier is difficult to win. One Teach for All (TFA) fellow working in Austria shares her experience regarding the language barrier among Syrian refugees (Sadek-Stolz, 2016). With the teaching team prepared to address multiple levels of German in the classroom, some students initially struggled to understand the class lectures which led them to participate only partially. While initially some of the refugee students had a hard time to engage, teaching them the everyday language of the host country (in this case German) helped them to gradually integrate in the classroom and the new environment. This method can be applicable in the Rohingya refugee case as well. In this way, these vulnerable children can learn Bangla which will allow them to communicate and exchange views with others and participate into the classroom. Integration with the Bangla curriculum can also become smoother in the long run.

Current Refugee Education Policies

Article 26(1) of The Universal Declaration of Human Rights proclaims, 'Everyone has the right to education. Education shall be free, at least in the elementary and fundamental stages. Elementary education shall be compulsory (United for Human Rights 2018).' While Article 26(1) announces the 'Right to Education', the International Covenant on Economic, Social and Cultural Rights (ICESCR) describes the scope of this right (United Nations, 1999). Article 13 of the ICESCR highlights the four A's of education. These are availability, accessibility, acceptability, and adaptability. In terms of Primary Education, Article 13(2) describes the four A's as such:

- *Availability:* 'Functioning educational institutions and programs have to be available in sufficient quantity within the jurisdiction of the State party.'
- *Accessibility:* 'Educational institutions and programs have to be accessible to everyone, without discrimination, within the jurisdiction of the State party.' The point further adds, 'Education must be accessible to all, especially the most vulnerable groups, in law and fact, without discrimination on any of the prohibited grounds.'
- *Acceptability:* 'The form and substance of education, including curricula and teaching methods, have to be acceptable (relevant, culturally appropriate, and of good quality) to students and, in appropriate cases, parents.'
- *Adaptability:* 'Education has to be flexible so it can adapt to the needs of changing societies and communities and respond to the needs of students within their diverse social and cultural settings.'

Additionally, The1951 Refugee Convention declares education as one of the rights of refugees. Under the earlier-mentioned context, Rohingya children hold the right to education. However, the proclamation of this Right is subjected to constraints: (1) The legal status of Rohingyas in Bangladesh; (2) Current status of the camps; and (3) The lack of global inclusive education policy.

Rohingyas in Bangladesh

Article 1(A) of The 1951 Refugee Convention terms refugees as 'A person who owing to a well-founded fear of being persecuted for reasons of race, religion, nationality, membership of a particular social group or political opinion is outside the country of his nationality and is unable or, owing to such fear, is unwilling to avail himself of the protection of that country…(UNHCR, 1951)'. According to this definition, the Rohingya Community falls under the definition of refugees. However, the Government of Bangladesh denied them the status of refugees (Wake and Yu, 2018). As they are not recognised as refugees, ensuring their rights do not fall under any obligation for the host country. Moreover, Bangladesh was not one of the signatories of The 1951 Refugee Convention and therefore, is not subjected to its protocol. An article titled 'Rohingyas and Refugee Status in Bangladesh' articulates the ambiguity of the context. Although the government recognised Rohingyas as refugees back in 1991 and provided them due to assistance, it had no documented domestic legal policy framework. Bangladesh only recognises a body of international law that provides the framework for protecting refugees (Phiri, 2008). The Asia Refugee Policy Analysis highlights the current refugee status of Bangladesh. The Report states:

> Despite the prolonged and continued presence of refugees in Bangladesh, there is a reluctance to introduce legislature and institute policies related to the definition, regulation, and protection of refugees and asylum seekers (Venugopal, 2018).

There has been no national-level policy framework specifically targeted towards refugees. In the absence of legal status, the barriers to institutional education remain at the apex. Without documentation, it is difficult to assimilate these children into schools. Keeping all other factors constraint, this alone creates a reluctance to provide a basic entrance to schools and therefore creates the ripple effect of illiteracy.

Current Status

The current status of the refugee camps presents an even grimmer scenario. Considering the criteria mentioned in the ICESCR, the refugee children are not even close to moderate learning centre facilities, let alone basic institutional education. *Dhaka Tribune*, a leading Bangladeshi newspaper, provides the statistics of the availability of learning centres across refugee camps. It states, 'Across all the refugee settlements in Cox's Bazar, there are 5,40,000 children of school age, but only 1,60,552 have spaces in the TLCs [Temporary Learning Centres].' (Opu, 2018) In addition, the Joint Education Needs Assessment identifies the lack of available learning centres as one of the access barriers. 'Learning centres are running at capacity and are unable to enrol more primary aged children. The second condition, accessibility, becomes a key issue regarding maintaining attendance', illustrates the report (Relief Web 2018). BRAC, the largest NGO operating in the camp, states in one of its reports: It is often difficult to ensure regular attendance. The children often have to stay back home in the absence of their mother or collect food from distribution centres, or ongoing vaccination campaigns or surveys by NGOs (Alam, 2018).

Although the learning centres are contributing to guarantee *Acceptability* and *Adaptability*, the main concern lies within *Availability* and *Accessibility*. As long as those are in jeopardy, the barriers to institutional education through learning centres are likely to remain an unsuccessful attempt.

Lack of Inclusive Global Refugee Education Policy Framework

The absence of an inclusive global refugee education policy framework is much needed to pull out the entire lost generation (Ghafar and Masri, 2016). The Rohingya crisis stirred a storm in international medium with an appeal to help and assistance. While the international bodies were responsive to the crisis, regional organisations kept mum over the issue,

with the Association of South-East Asian Nations (ASEAN) adopting no interference policies and SAARC refraining from commenting at all. All these secondary measures do nothing to solve the crisis at hand. The refugee crisis is not a new phenomenon. The international governing bodies should finalise a policy mandate rather than leaving it to individual states. Other than this initiative, too much is at stake and the blame of this has to be borne by the domestic, regional, and international authorities.

Limitations

The lack of primary data is the main limitation of this research. Due to time and budget constraints, data from the schools could not be collected to compare with the literature reviewed. With data from primary sources, researchers could gain insight from the interviews of people working on this issue which has not been possible in such a short time. Additionally, with the number of refugees increasing every day, it is impossible to get the most updated statistics and information. The data generated are vast yet lack of the most updated data has affected this study. Another crucial drawback is the near absence of undocumented refugees from the narrative and the numbers. We assume that the undocumented refugee children have even sterner access to primary institutional education; however, very little data is out there to substantiate this claim. Finally, the nature of every refugee case is unique and assuming homogeneity is only to understand the overlying causes. Practically, there are many more challenges and the extent can very well differ from each other. This study serves to point out only those general barriers.

Conclusion

From the analysis of the data, the paper draws its conclusion and calls upon improvement on the current status quo. We found that a legal education policy framework is pivotal for elevating the barriers accessing primary education. In addition, the bureaucratic complexity and intricate politics should not undermine the need for these vulnerable children. Our analysis also dictates that access to education is likely the only way to break this cycle of structured poverty and free these children. It is time to act upon it universally by creating an inclusive and rigorous policy framework for refugee education.

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Discourse on Ambulatory Healthcare in Uttar Pradesh, India: A Study Based on NSS Data

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Abstract

For India to achieve and sustain a double-digit growth rate there is a need to priotise the health sector. Ambulatory (non-hospitalisation or out-patient care) services are an entry point to healthcare services. Promptly diagnosing and treating medical conditions may prevent unnecessary inpatient admissions, reducing demand on health services and associated healthcare costs. Therefore, the access to non-hospitalised healthcare is crucial and the lack of which can be taken as the 'unmet demand' for healthcare in general. Our study is based on the National Sample Survey 71st Round (2014) unit-level data on Social Consumption: Health and aims to analyze the magnitude and nature of demand for access to ambulatory healthcare in Uttar Pradesh concerning the socio-economic barriers. Uttar Pradesh, an Indian state located in the northern part of India, suffers from disparities in access to healthcare services across the different socio-economic classes. The study points out the two most important barriers to access medical care in Uttar Pradesh. These are income and gender. The intra-household discrimination against women is very strong in the urban sectors. The availability of services and medicines in public institutions can increase the utilisation in the sector and arrest high out-of-pocket (OOP) expenditure in both the sectors.

Keywords: *Non-hospitalisation, Ambulatory care, Out-patient, Utilisation, Inter-sectional analysis, Decomposition analysis, PCA, Uttar Pradesh.*

Introduction

There is a proverb that 'Health is not everything in life, but without health, life is nothing.' However, in the past, many development planning documents had considered health expenditure as consumption good rather than investment in human capital. Today, the role of health in development has been recognised and it has been given priority in almost all recent development agendas. The United Nations Development Programs (UNDP 1990) published its first Human Development Report that bordered the concept of development by including health and education along with income as the measure of the development of a country. Recently, the United Nations has also emphasised on health and well-being for all in its Sustainable Development Goals (SDG 2017). Several studies documented the fact that improvement in health status contributes to gross national

product (World Bank Reports, 1984 and 1993; World Health Organization, 1994; EkWempu et al., 1990). The link between economic development and health is also evident from the literature (Duraisami and Mahal, 2005; Thomas and Frankenberg, 2002). However, barriers to access healthcare facilities are common in most of the developing countries.

Literature on access to healthcare services often talks about the supply and demand-side barriers (Jacob et al., 2012; O'Donnell, 2007; O'Donnell et al., 2007; Ensor and Cooper, 2004; Oliver and Mossialos, 2004). Inadequate infrastructure, inefficient and/or insufficient health personnel, the availability of basic services and medicines, etc., come under supply-side barriers. While, demand side barriers include factors like geographical, cultural, caste, social, educational, gender, and economic constraints (Balarajan et al., 2011; Harris et al., 2011; Baru et al., 2010; O'Donnell, 2007; Ensor and Cooper, 2004). Access to ambulatory (out-patient care or non-hospitalisation care) healthcare is very crucial as it is the entry point to the healthcare system. The successful provision of ambulatory personal health services is most significant contributor to the healthcare system's performance in the most developing countries. Timely access to ambulatory services is important for patient well-being and has the potential to contribute the largest immediate gains in health status in populations, especially for the poor. Prompt diagnosis and treatment of medical conditions may prevent unnecessary in-patient admissions, reduce demand on health services, and associated healthcare costs. However, many developing countries fail to provide basic ambulatory healthcare services to their citizen. Consequently, an 'unmet demand' for ambulatory healthcare services is observed in most of the developing countries in the world (Bose and Dutta, 2014; Berman, 2000). India is also suffering from the same problem.

Almost all the health-related policy documents in India have emphasised on improving access to quality healthcare by the poor and disadvantaged sections of the society (Bhore, et al., 1946; Government of India, 2017). However, evidences show that the access to healthcare, quality of services, inequality, and inequity in-service distribution are still a major concern for the Indian healthcare system (Jayaraman, 2014; National Health Policy 2015 Draft, 2014; Jaiswal and Saba, 2014). Poor public health expenditure, insufficient monitoring on private healthcare providers and its pricing have pushed the Indian health system into such abysmal state (Selvaraj and Karan, 2009) Consequently, around 75 per cent of the total ambulatory care in India is treated in the private sector (Ravi, et al., 2016). Moreover, households are relying more on their income to finance their healthcare expenses. Due to the lack of insurance coverage and other financial support,

it is observed that about 30 per cent of the rural population could not seek any treatment during their illness (Patel et al. 2015).

Despite all such obstacles and bottlenecks, few Indian states (like Kerala, Tamil Nadu) have managed to improve their healthcare system; however, few states (Uttar Pradesh [UP], Madhya Pradesh, Orissa) are suffering from multi-faced problems in healthcare provision and distribution. It is documented that the performance of UP in terms of the Human Development Index (HDI) is very poor (Uttar Pradesh Human Development Report, 2007). It is also revealed from the studies that intra-state disparity is also persistent in the state (Ravi and Kapoor, 2017; Kumar, et al., 2012). Major health indicators in the state like life expectancy at birth, infant mortality rate, etc., are far below the Indian average (Human Development Report, 2016; Uttar Pradesh Human Development Report, 2007). It is also observed that the healthcare system in the rural UP is even worse and the quality of publicly provided healthcare services are very wretched. The unregulated private sector, poor availability, lack of accountability, and awareness among people exacerbates the situation in the state. According to the National Sample Survey (NSS Report, 2016) estimates that around 7-8 per cent of the population is morbid in the state and the majority of them are choosing private facilities for their treatment. The Report also shows that people are paying a considerable amount during their ambulatory care treatment both in the rural and urban sectors of the state (NSS Report, 2016).

In this background, the paper attempts to study the barriers to and determinants of access to ambulatory healthcare in UP. Specifically, the objectives of the study are to examine the access to ambulatory healthcare by various socio-economic groups of UP and to study the socio-economic factors influencing access to healthcare facilities and the choice of providers. The study also aims to analyze the inter-groups and intra-group disparity in access to healthcare facilities in the state. The paper has been divided into four sections. Section I introduces the paper; while data and methodology of the paper have been discussed in Section II; Section III represents the results; and the last section discusses and concludes the paper.

Data and Methodology

Data

The National Sample Survey (NSS) 71 round data on Social Consumption: Health has been used for the study. The 25.0 schedule of the survey has collected information from all the states and union territories (UTs) of India. A stratified multi-stage sampling procedure has been followed to

collect information from 65,932 households with 55 per cent representation from the rural sector. From UP, data were collected from 7,921 households (4,918 households from the rural and 3,003 households from the urban sector). At the individual level, 29,924 persons from rural and 17,159 persons from the urban sector have provided information for the survey. Data were collected on various household characteristics (religion, social groups, types of latrine, drainage, sources of drinking water, monthly consumption expenditure, etc.). Detail information on demographic details of the household members (age, gender, education, marital status, etc.) was also collected in the Survey. Data on details of treatment and related costs were collected from the household members who were hospitalised (1-year reference period) or were suffering from any ailment (reference period of 15 days).

Variable Construction

The National Sample Survey reports monthly consumption expenditure of the households. We have calculated the monthly per capita consumption expenditure (MPCE) from it and classified the households into five equal classes, namely, Poorest (P), Lower middle (LM), Middle (M), Upper middle (UM), and Richest (R). However, to accommodate the difference between the cost of living in the rural and urban areas, MPCE classes were formed separately for each sector. Social groups (SGRP) of the households have been reported under four categories, namely, Scheduled Tribe (ST), Scheduled Castes (SC), other backward castes (OBC), and others. We have clubbed the first three categories under 'backward' class and renamed the rest as 'general' class. At the individual level, we have clubbed the age (AGE) of an individual into five categories, namely, 0-5 years, 6-14 years, 15-34 years, 25-59 years, and 60 and above. The education of an individual is also reported in NSS data. We have grouped the education of the household head (EDU) into four categories, namely, illiterate, up to the primary, up to secondary, and above secondary.

Method

Literature has clearly distinguished the difference between access and utilisation of healthcare services. Penchansky and Thomas (1981) defines the access as the 'degree of fit' between the health system and patients depending on five A's, namely, Acceptability, Affordability, Availability (physical), Accessibility, and Accommodation. Utilisation, on the other hand, could be defined as the 'realised access' (Bose and Dutta 2015). For the present study, we have considered only utilisation of healthcare services

as with the information available from NSS it is difficult to calculate the extent of access.

To calculate the utilisation of healthcare services across various socio-economic groups, exploratory data analysis has been applied. Here, we have estimated the percentage share of a particular socio-economic group in total utilisation of the service (out-patient care). Determinants of utilisation of healthcare facilities and choice of the provider have been estimated using the logistic regression. We have defined the binary dependent variable, namely, 'utilisation of medical advice' (0 as NO and 1 as Yes) to have a limited dependent model. The explanatory variables included in the models are MPCE class the household belongs to represent the economic factor; demographic characteristic is captured by AGE and SEX of the patient; EDU of the household head to represent the awareness of the household, and SGRP to include a social factor of healthcare utilisation.

Hence, the equation for the regression is given as:

$$\pi_i = ln\,(p_i / 1 - p_i) = \alpha_0 + \beta_1 MPCE + \beta_2 AGE + \beta_3 SEX + \beta_4 EDU + \beta_5 SGRP + \varepsilon_i \quad \ldots(1)$$

Where, p_i is the probability of utilising healthcare facility during illness, i.e. $p(\pi_i = 1)$. The marginal effect of the j^{th} explanatory factor on p_i is estimated by

$$\delta p_i / \delta x_{ji} = \hat{\beta}_j\,[p_i\,(1 - p_i)] \quad \ldots(2)$$

The National Sample Survey also reports the choice of provider for the treatment during illness. Another set of logistic regression analysis has been carried out to find out the determinants of the choice of provider. The model of the regression is:

$$\varphi_i = ln\,(p_i / 1 - p_i) = \gamma_0 + \rho_1 MPCE + \rho_2 AGE + \rho_3 SEX + \rho_4 EDU + \rho_5 SGRP + \varepsilon_i \quad \ldots(3)$$

Where, φ_i is the probability of utilising private healthcare facility for treatment, i.e. $p(\varphi_i = 1)$. The marginal effect is also estimated here.

Based on the results obtained from the regressions, inter-sectional and decomposition analysis are also carried out. In the inter-sectional analysis, we have tried to capture the relative effectiveness of EDU in enhancing inter-household (MPCE class wise) access. Total twenty groups were formed with the four EDU classes and five MPCE categories.[1] The Poorest-illiterate (P-illiterate) group has been taken as the reference category to run the logistic

[1] The groups are P: illiterate, P-up to primary, P-up to secondary, P: above secondary, LM: illiterate, LM: up to primary, LM-up to secondary, LM-above secondary, M-illiterate, M-up to primary, M-up to secondary, M-above secondary,

regression. The dependent variable was the utilisation of healthcare facilities (YES = 1 and NO = 0). The decomposition analysis has been implemented to locate the intra-household gender bias in the utilisation of healthcare facilities. We have grouped MPCE class and SEX into ten categories and P-Female has been taken as the reference category to run the regression.[2] The binary dependent variable for the regression was the utilisation of the healthcare facility (YES = 1 and NO = 0).

Results

Four types of exercises have been conducted in the study. These are: (1) data analysis for the pattern of utilisation of healthcare facility; (2) logistic regressions to estimate the effect of socio-economic factors on the utilisation and choice of provider; (3) inter-sectional analysis to capture the relative effectiveness of education in enhancing inter-household utilisation, across different income classes; and (4) decomposition analysis to locate the intra-household gender-bias present within income class.

Utilisation to Healthcare: Descriptive Results

It is revealed in Table 1 that, in UP, the percentage of morbid people in the urban area utilising some out-patient medical advice for their aliment was more than that in a rural area. In the rural sector, around 81 per cent of the morbid people were utilising medical advice whereas, in an urban area, a similar figure is around 88 per cent. The share of public facilities in the utilised health care was 15 per cent and 16 per cent in rural and urban sectors, respectively. The urban people utilise ambulatory services more than their rural counterparts, across all income classes except the poor. Overall, the utilisation of the public facility remains low in both sectors.

It is suggested from Table 1 that awareness in terms of education can be a possible reason for not availing ambulatory care facilities, it would be justified to analyze the pattern of utilisation across education level. It is shown in Table 2. It is observed that education directly affects the percentage of morbid people utilising out-patient medical advice for their aliment, especially in a rural area. Low levels of education are linked to the low level of utilisation of out-patient medical treatment in both the sectors. Higher utilisation is reported by the people belonging to higher education class (above primary and above secondary).

UM-illiterate, UM-up to primary, UM-up to secondary, UM-above secondary, R-illiterate, R-up to primary, R-up to secondary and R-above secondary.

[2] The groups are: P-female, P-male, LM-female, LM-male, M-female, M-male, UM-female, UM-male, R-female, and R-male.

Table 1: Share of Utilisation in Healthcare Facilities Across Income Classes and Regions

MPCE Class	*Rural*		*Urban*	
	All Facilities (% of Morbid)	*Public Facilities (% of All facilities)*	*All Facilities (% of Morbid)*	*Public Facilities (% of All facilities)*
P	77.90	16.50	74.97	16.69
LM	81.38	11.01	91.16	20.97
M	81.79	11.58	91.00	9.60
UM	72.65	16.77	91.64	12.78
R	91.03	17.05	92.69	19.71
Total	80.86	14.58	87.84	16.13

Note: P: Poorest; LM: Lower-middle; M: Middle; UM: Upper-middle; R: Richest
Source: Extracted from NSSO 71 Round Unit level data.

Table 2: Share of Utilisation in Healthcare Facilities Across Education Groups, Age Group, and Regions

All Facilities (% of Morbid)			
Variable	*Groups*	*Rural*	*Urban*
EDU	Illiterate	76.93	86.38
	Up to Primary	79.16	78.9
	Up to secondary	84.28	92.69
	Above Secondary	90.17	89.4
AGE	0-5	81.05	94.42
	6-14	82.54	81.48
	15-34	83.59	82.73
	35-59	80.11	90.49
	60+	77.89	87.44
SG	Backward	81.01	83.92
	General	80.39	93.02
GEN	Male	80.46	86.9
	Female	81.23	88.6
Total		80.86	87.84

Source: Extracted from NSSO 71 Round Unit level data.

The utilisation of ambulatory facilities across age group, social group, and gender are also shown in Table 2. In urban UP, the highest utilisation is observed for the children. In the rural area also, utilisation of care services for children's health is high, though it is much lesser than that in an urban area. In general, a higher percentage of morbid urban individuals, across all age group, is found to utilise the medical facility than their rural counterpart except for those in the age group 6 to 14 years and 15 to 34 years. For

rural UP, the utilisation increases as the individuals grow older, but a reverse trend is found for those who are aged 35 years or above.

Table 2 reveals the region-wise share of utilisation in healthcare facilities across social groups. In the rural sector, backward classes have more utilisation of medical facilities as compared to the general class. The urban scenario is completely the opposite, with only 84 per cent of morbid people belonging to backward classes who utilise out-patient care as compared to 93 per cent of morbid of general class. Surprisingly, females in both sectors are utilising more medical care facilities compared to males.

The untreated ailment may lead to severe health concerns in the longer run. NSSO collects information on the respondents who reported their morbidity but were abstained from seeking any treatment or advice. The possible reasons for such behaviour have already been discussed and go in line with those mentioned in the NSSO Survey. They are manifold: (1) *Ailment not considered serious* is the primary cause of no-treatment in both the sectors. People, especially illiterate and uneducated tend to take their healthcare as a least important thing; (2) *Lack of medical facility* in a rural area and *too expensive nature of facility of satisfactory quality* in urban areas are also responsible for the less utilisation of such services. Lack of public healthcare facilities and privatisation of healthcare are barriers in the utilisation of ambulatory services; (3) *Quality* of public facilities are not satisfactory in rural and urban sectors, even if they are available; (4) *Service availability* in rural and *long waiting time* in the urban region are the barrier to utilisation of public healthcare facilities.

Determinants of Utilisation to Healthcare and Choice Provider

Four types of regression are run here. Two dependent variables have been defined, viz., MED and PVT. MED denotes the utilisation of healthcare facilities during illness. It is a binary variable. PVT represents the utilisation of private healthcare facility for treatment. If the private facility is utilised then 1 is assigned, 0 otherwise. Hence, it is also a binary variable. Two regressions, for rural and urban sectors each, have been conducted for each dependent variable. The relevant logistic regression equations taking MED and PVT separately have been mentioned earlier. The marginal effects are reported in Table 3.

The significant values of long-run chi-square indicate that overall regressions in all the cases are meaningful. The factors affecting the utilisation of the service in rural areas are shown in Regression I. For a rural area, MPCE is not coming out to be an important determinant of the utilisation of the care services except for the richest class. The same is true for the

choice of services. Age, sex, and social group of the individual show the same pattern for the utilisation of the facility, in general. Education comes out to be significant indicating the significance of awareness in enhancing the utilisation.

For an urban area, improvement in economic status plays an important and significant role in raising the utilisation. Age comes to have an inverse relation with the utilisation of medical healthcare facilities. As age grows the utilisation falls. The result is significant for two age groups. Utilisation falls as the person moves from 0-5 years to 6-14 years and then to 15-34 years age group. Sex, education, and social group are not significant in explaining the utilisation in an urban area.

Table 3: Determinants of Utilisation to Non-hospitalised Medical Care and Type of Provider in Uttar Pradesh (Marginal Effects)

Variable	*Categories*	*MED*		*PVT*	
		Regression I	*Regression II*	*Regression III*	*Regression IV*
		Rural	*Urban*	*Rural*	*Urban*
MPCE (P as the reference)	LM	0.02	0.06**	0.04	0.07**
	M	0.04*	0.07**	0.01	0.05
	UM	0.00	0.09***	0.02	0.05
	R	0.07***	0.17***	0.01	0.10***
AGE (0-5) as reference)	6-14	–0.02	–0.06**	–0.06*	–0.06
	15-34	0.03	–0.05**	–0.05**	–0.09***
	35-59	0.01	–0.02	–0.07***	–0.10***
	60 and above	0.00	–0.01	–0.06***	–0.11***
SEX (Female as ref)	Male	0.00	0.01	0.00	0.00
EDU (Illiterate as reference)	Up to Primary	0.02	0.00	0.04*	–0.01
	Up to secondary	0.06***	0.02	0.02	0.03
	Above secondary	0.09***	–0.01	0.03	0.07**
SGRP (Backward as ref)	General	0.00	0.00	–0.02	–0.01
# of observations		2,237	1,562	1,882	1,397
Pseudo R^2		0.021	0.0609	0.0106	0.0289
LR (chi^2)		41.01***	64.13***	17.04***	36.84***

Note: * significant at less than 10% level; ** significant at less than 5% level; *** significant at less than 1% level.
Source: Authors' estimation.

Regressions III and IV report the impact of all explanatory variables considered here on the choice of the nature of services in rural and urban areas, respectively. In rural UP, MPCE does not have any effect on the choice, even for the richer classes. Age has an inverse relation to the probability of choosing private medical services. The sex and social groups are not important in deciding which type of services would be used. Education is coming significant only for the initial stage. In urban UP also, sex and social group are not significant. MPCE is a deciding factor in choosing between public and private services in two stages. The probability of choosing private services increases or that of public services falls as MPCE goes from the poorest to lower middle class and second when it jumps to the richest class. Age is significant at all levels, except for the first one. The chance of using public services increases in the older ages. Private medical care is chosen when the individual attains the highest education level in urban UP.

Inter-sectional Analysis – Monthly per Capita Consumption Expenditure and Education of Household Head

In the last section, we saw that both income and education played an important role in determining the probability of utilisation of medical care. So, in this section, we are trying to study the *relative dominance* of the effect of MPCE over the education of the household head and vice-versa at inter-household level. So, in terms of MPCE, we are dividing the observations into five classes and within each MPCE-class, observations are divided into four classes in terms of EDU. Then the logit regression is re-run by dropping relatively unimportant variables like age, sex, and social group. The odd-ratios from the regression are reported in Table 4. Odd ratios (ORs) measure the probability of having utilisation of medical care compared to non-utilisation and they are defined as $[P_i/(1-P_i)]$ (for i^{th} observation) in the logistic regression.

Results in Table 4 show that education has a positive role in the utilisation of medical care for the middle-income classes of the rural sector, the value of the odds ratio being as high as 5.15 (Q_3 and above secondary) and statistically significant at less than 1 per cent level. Education plays a significant role in enhancing utilisation only for the richest class in the rural sector. In Q_5 in the rural sector, all the values of OR are significant. Richest class of the urban sector is enjoying significantly higher utilisation of medical care when the household head has above the primary level of education, the value of ORs being pretty high in magnitude (8.40, 14.66) and statistically significant at less than 1 per cent level. The upper middle class is also having greater utilisation when the household head has an education above the secondary level.

Table 4: Logistic Odd Ratios with Inter-Sectional Classes (MPCE and EDU) for Utilisation of Non-hospitalised Medical Care

MPCE	Education	Rural	Urban
Poorest (P)	up to primary	1.46	1.14
	up to secondary	1.75*	1.22
	above secondary	1.97	0.75
Lower Middle (LM)	Illiterate	1.59*	1.34
	up to primary	1.62	2.21*
	up to secondary	1.16	2.62**
	above secondary	1.97	1.14
Middle (M)	Illiterate	1.24	1.51
	up to primary	1.42	2.03
	up to secondary	3.26***	2.59**
	above secondary	5.15***	1.57
Upper Middle (UM)	Illiterate	1.35	1.00
	up to primary	0.76	1.02
	up to secondary	2.21***	1.96
	above secondary	1.58	2.16**
Richest (R)	Illiterate	1.62*	1.00
	up to primary	4.32***	1.00
	up to secondary	2.51***	8.40***
	above secondary	5.70***	14.66***

Note: * Significant at less than 10% level; ** Significant at less than a 5% level; *** Significant at less than a 1% level.
Source: Authors' estimation.

Decomposition Analysis: Monthly per Capita Consumption Expenditure and SEX

In our model, sex did not have any significant influence while MPCE has a favourable influence on the utilisation of healthcare. In this section, we are trying to study the influence of gender in determining the utilisation of healthcare. We have formulated ten classes by making two-way classification in terms of SEX and MPCE. The ten categories are: P-female (base category), Q_p-male, LM-female, LM-male, M-female, M-male, UM-female, UM-male, R-female, and R-male. Figure 1 provides the graphical representation of the relevant ORs.

For each sub-class, the corresponding values of OR are much higher for urban areas as compared to rural areas. But urban ORs are mostly insignificant except the first one (Q_1-male or P-Male) while rural ORs are mostly significant to expect for Q_5 (R) MPCE. It is interesting to note that

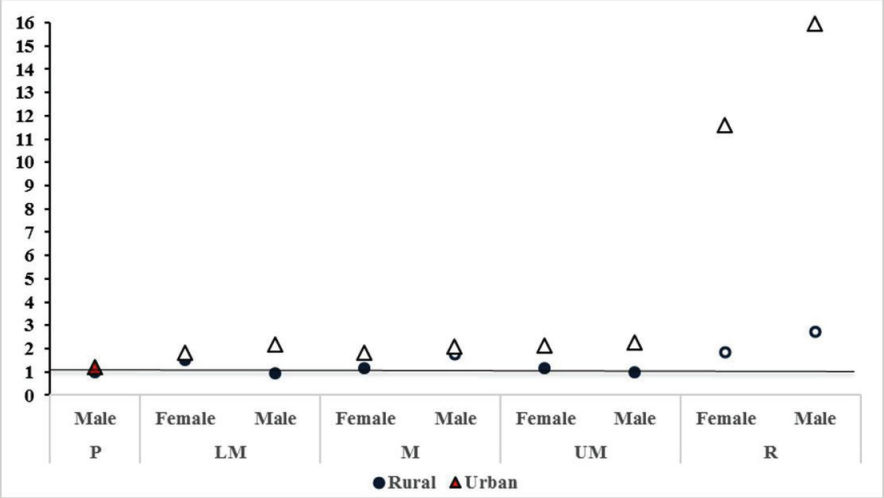

Fig. 1: Differences in Utilisation to Medical Services by MPCE Classes and SEX (Odds Ratio)

Note: Filled figure signifies that the estimate is significant at 5% level.
Source: Authors' estimation from NSS data

compared to Q_1-female (P-female), all classes of both sectors have higher utilisation of non-hospitalised medical care. In the urban areas, male in all income classes has a higher utilisation of medical care as compared to females. While in rural areas, Q_2-female or LM-female and Q_4-female or UM-female have a higher probability of getting medical utilisation than their respective male counterparts. On the other hand, Q_3-male or M-male and Q_5-male or R-male have better utilisation than their female counterparts. This clearly shows that gender bias is present in both the sectors. Also, in urban areas, Q_4-female or UM-female has higher medical utilisation than Q_3-male or M-male but lower than Q_5-male or R-male. In rural area also, Q_5-female has higher utilisation than Q_4-males. The same is true for Q_2-male and Q_3-female. But opposite pattern is observed for Q_3-males and Q_4-females. Across income class, Q_5-female has higher utilisation than Q_4-female who have again higher utilisation than Q_3-female.

Discussion

The direct relation between the income and utilisation is very obvious as better economic condition raises the affordability of medical care, especially when the care is of private nature. Moreover, it may be due to higher awareness of the people in terms of higher education with the higher economic status which makes them feel the need for curative care. In rural part of UP, the utilisation of the public facility is the maximum among

the rich class followed by the upper middle and poor class. The poor may not treat some of their morbidities as serious ones and hence not consider visiting ambulatory services. This happens due to a lack of awareness. This provides a possible explanation for lower utilisation by the poor than the richer class. The same pattern is observed in the urban UP also and the explanation goes in the same line, though the utilisation of the public facilities by the lower middle class is the highest among all in the urban area followed by richer class. Better availability, apart from awareness, maybe a possible explanation. It is clear from the analysis that public facilities are highly underutilised in both sectors. Still, utilisation is better in the urban sector as compared to rural.

The utilisation of facilities is reported to be more by higher education classes. It ensures that education enhances awareness and people realise the need for medical advice. The health of the children generally gets the foremost importance in the household. It is reflected in the highest utilisation by the age group 0-5 years in urban UP. In the rural sector, the utilisation and age follow the same direction up to 35 years, after which an opposite trend is observed. Better awareness of the younger individuals may pull them and their children to the care services if they fall ill. For the urban sector, apart from children utilisation is the highest among 35 years and above age group. Better availability probably plays a significant role here.

The utilisation by females has been more than males in both sectors. The lack of availability of proper medical care facilities in the rural area leads to the longer time involved in the transport and treatment. It implies the loss of income of the workers. Given that, males are involved in work in a higher percentage than females, utilising medical care is not always a feasible option for them. Females, on the other hand, may utilise the care service without losing much, especially those who are engaged in household management and not involved in full-time jobs.

In the regression analysis, Regression I does not reflect MPCE to be an important determinant of the utilisation of healthcare and choice providers. As mentioned before, the lack of availability of the care services may be a major barrier for the utilisation. Economic status does not have much role to play if the service is itself unavailable to the potential users. Only the rich class can afford to travel to the distance where the health services are available and hence Q_5, in reference to Q_1, becomes a significant factor in determining the utilisation. The utilisation increases if the income of the individual is lifted from Q_1 to Q_5. Age, sex, and social group of the individual show the same pattern probably because of the same reason. The only significant factor coming out for rural areas is the education level of the household

head. The rise in the level of educational attainment in the initial stage does not matter much in raising awareness. It becomes important as the person attains education up to secondary and above level. It happens because mere elementary education may not always be enlightening to realise the need for timely medical care. Education after a threshold provided the required knowledge that initiates awareness which, in turn, raises the utilisation. For urban UP (Regression II), MPCE plays a significant role in raising the utilisation. Better economic condition increases the affordability and awareness through better education. They, in turn, enhances the utilisation provided the facility is available nearby. The inverse relation between age and utilisation happens probably due to the better immunity in later ages. As the resistance and immunity in the infant stage (0-5 years age group) is generally low and vulnerability is very high, all types of morbidity require appropriate care. So, utilisation is high at this stage. As a person overcomes this stage, the body recovers certain diseases on its own and hence, care and advice are not always a necessary option. The result is not significant for higher age cohorts as in the old age people become more vulnerable to diseases due to lack of enough resistance.

The impact of MPCE on the choice of the nature of services in rural UP is not significant (Regression III). This happens because rural areas lack adequate availability of medical services, especially that of private nature. The non-existence of no or satisfactory private services makes even the richest class unable to utilise the care and hence, MPCE is coming insignificant for all the expenditure classes. The choice of private services is less probable for older people. Private services are generally expensive. As infants' health is of the top-most concern in any household, private care is available mostly for them. It is because in many instances, the quality of public care is believed to be unsatisfactory in nature. The utilisation of private services goes down as the person grows older with better resistance against diseases. Lack of availability may not be relevant in the matter of kids' health. It, in turn, suggests that public services are a more common option for elder persons. Improvement in the education above a threshold affects the choice. A small upgradation in the education standard makes people choose private services, though the variable is not significant for the higher education level. These explanations remain unaltered for the behaviour of MPCE and AGE observed as determinants of choice of services in urban UP as well (Regression IV).

The inter-sectional analysis shows that education has a significantly high OR for the third and fifth quintiles of MPCE. The utilisation of medical care is significantly high in terms of high OR only for the richest class of the

rural sector. In urban UP, the upper-middle class and the richest class utilise the medical care significantly when the education of the household head is above secondary and primary levels, respectively. It implies that any policy enhancing the level of education of the household head is more effective when the individual has already reached higher income status than a policy that looks at income and education in isolation. Improvement in the economic condition is necessary for better utilisation but it is not sufficient unless the individual or the household head is endowed with education up to the level which creates awareness for utilising the healthcare facility. A policy taking care of both is the primary need of the moment.

Decomposition analysis shows that gender bias in favour of males in the utilisation of care is present in both the sectors. In addition, higher utilisation by females belonging to Q_3 than males belonging to Q_5 in the urban sector indicates a strong presence of income effect. The same can be observed in rural areas as well as Q_3-female and Q_5-female has higher utilisation than Q_2-males and Q_4-males, respectively. Within a group, among the same sex, the utilisation rises along with the income class. Income does have a role to play in increasing the utilisation.

Conclusions

In a nutshell, two factors are mainly explaining the variation in the utilisation of healthcare services. They are monthly per capita expenditure (a proxy for income) and education. Non-availability of the service in satisfactory quality and/or to an adequate extent is a major impediment to the utilisation of such services. This is a problem of serious concern in a rural area where MPCE can raise the utilisation only at the upper-most stratum of the income class. Again, it is not at all significant in the case of utilisation of public services. Improvement in awareness through a better provision of education can be a long-term solution to this problem. The study shows that the educational attainment of the head of the household is a significant factor in raising the utilisation. However, a better economic status is a prerequisite for an increase in the utilisation of ambulatory services both in rural and urban UP. There exists some gender discrimination in utilising the service in some of the income classes. Here also, education can be a solution to the removal of intra-household discrimination against females.

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Economics of Sustainable Development

Predatory Pricing and the Notion of Multi-Market Dominance: A Case of the Indian Telecom Industry

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Abstract

The academic literature recognises the role of predatory pricing as a tool for protecting or enhancing market share which can be used by incumbent firms in an industry. But the Reliance Group of Industries, which was an outsider to the high-end telecommunication segment in India not so long ago, has been able to appropriate significant market share from existing players in the industry by using a mix of bundling and predatory pricing strategies. This Chapter primarily argues that much of the academic surprise associated with the Reliance case can be explained with the 'deep pocket argument', i.e. how a cash-rich firm can diversify into areas outside its current areas of specialisation.

Introduction

The entry of the Reliance Group of Industries into the high-end telecommunications industry in India is a curious case in corporate strategy. The academic literature recognises the role of predatory pricing as a tool for protecting or enhancing market share which can be used by incumbent firms in an industry. But Reliance, which was an outsider to the high-end telecommunication segment not so long ago, has been able to appropriate significant market share from the existing players in the industry by using a mix of bundling and predatory pricing strategies. In this Chapter, we primarily argue that much of the academic surprise associated with the Reliance case can be explained with the 'deep pocket argument'. This Argument explains how a cash-rich firm can diversify into areas outside its current areas of specialisation. A secondary element of Reliance's predatory strategy is the bundled nature of the product being offered to exploit the externalities created in network industries. While these kinds of predatory pricing strategies are good for the consumer and the shareholders of the predator firm, it may not be sustainable for the predatory firm and may be detrimental for the long-term stability of the market.

In the next section, we briefly discuss the Reliance story that motivates this Chapter. In the subsequent sections, we discuss the insights from the literature on diversification, bundling, switching costs, and the deep pocket

argument. Subsequently, we discuss the impact on the welfare of the agents in the market due to predatory pricing. The final section summarizes the essential argument.

The Reliance Story

The Reliance Group of Industries is an Indian conglomerate with ventures in many areas such as exploration and production, textiles, corporate security, telecom, petroleum refining, marketing, petrochemicals, and retail. The conglomerate is among the top performers in each of these sectors and holds a dominant position in several of them.

In September 2016, Reliance launched its first subsidiary in the telecom sector, namely, Jio. Jio is the only voice over LTE (Vo-LTE) provider in India with a subscriber base of 306.7 million at the end of March 2019 (Telecom Regulatory Authority of India (TRAI), 2019). Jio commercially launched its services in September 2016 and could amass a subscriber base of 50 million within the first 83 days, a feat that took other players over a decade to achieve. This business was acquired by Reliance in 2016 for 4,800 crore. With this move and the subsequent launch of Jio, Reliance became the only firm to own a broadband spectrum in 22 zones in India making it the first telecom firm to hold a pan-India unified license. The vast capacity of Jio's network makes it capable of providing high-speed internet connectivity for improving the government-citizen interface in sectors such as education, healthcare, and security (Rishi et al., 2018).

The initial phase of Jio's entry into the telecom sector was marked by the distribution of free services (free voice calling and unlimited 4G free data) in various locations to establish a user base. Another feature that distinguished the brand was the bundling of multiple telecommunications and linked services to meet closely related customer needs through one product at prices significantly lower than the market rate. Jio, thus, became a comprehensive answer to the demand for data, audio calling, messaging, news, and entertainment.

Given the level of Jio's success and some specific characteristics of the telecommunications industry, predatory concerns become an important consideration. The rest of this Chapter will examine components of Jio's strategy underscoring the potential for predation. In particular, we will focus on the issue of predatory pricing.

Business Diversification

The choice of business diversification is a vital element of corporate strategy (Markides and Williamson, 1994). A company can diversify by

either acquiring existing businesses or investing in the development of new businesses or both. Threats to the core business induce some form of diversification to strengthen the revenue mix and find new sources of profits.

A class of studies argues that diversified firms are valued less than their more focused counterparts on average (Lang and Stulz, 1994). Such a 'diversification discount' considers the agency and behavioural problems arising from diversification to argue that the potential costs of diversification outweigh the benefits gained (Berger and Ofek, 1995).

The coinsurance argument has challenged this perspective and emphasized the benefits of diversification indicating a 'diversification premium' (Kuppuswamy and Villalonga, 2015; Hann et al., 2013). This argument suggests that the combination of imperfectly correlated cash flows among different business segments of a firm can reduce bankruptcy risk (costs), increase debt capacity, and allow for higher tax benefits (Lewellen, 1971; Leland, 2007). For example, Hann et al. (2013) show that diversified firms have a lower cost of capital than their stand-alone counterparts. Maksimovic and Phillips (2002) point out how conglomerates (corporation made of several seemingly unrelated businesses) can divert funds from their less productive ventures to more productive ones as an explanation for their increased market power.

The coinsurance argument provides several explanations for a firm's decision to diversify. This study will focus on the resource-based view. Even in early literature, resources have been recognised as a key factor in explaining diversification. For example, several studies view the multi-market operations of diversified firms as a management strategy for resource-dependent relationships (Burt, 1983; Teece, 1982; Lemelin, 1982; Penrose, 1959). Consequently, a systematic relationship can be hypothesised between the resource profile of the firm and the market it chooses to enter. Multiple authors have reasoned that the level of specificity of a resource to the end product determines the degree of relatedness in diversification, i.e. if a firm owns relatively inflexible resources, it is constrained to diversify in a more related manner than if the firm owned relatively fungible resources (for example cash) (Montgomery and Wernerfelt, 1988; Williamson, 1975).

An extension of this resource-based view can also incorporate natural resource constraints. For example, firms in mature industries where the demand growth has plateaued to a certain extent would be better off diversifying into newer markets. Firms/industries with oil or petroleum as (the basis of) their core competence face the reality of an increasingly stricter natural resource constraint. This threat to profitability has the potential

to encourage diversification in, particularly unrelated industries. Several firms in the Kenyan oil industry are now moving into retail of car wash, convenience stores, pharmacies, etc (International Energy Agency, 2018).

We distinguish between two types of diversification strategies: in related diversification, businesses share strategic resources such as technology or distribution channels; in unrelated diversification, the company's businesses do not share any strategic resources or have interrelationships of tactical importance.

Related diversification can help exploit economies of scope in the short run to achieve competitive cost advantages (Lecraw, 1984; Singh and Montgomery, 1987). In the longer run, it can help a firm build long-term competitive advantage by accumulating new strategic assets at a faster and cheaper rate than its competitors (Markides and Williamson, 1994). The rationale for unrelated diversification is not so obvious. One of the reasons for favouring unrelated diversification over related is the presence of excess financial resources (in the form of liquidity) lying with the firm (Chatterjee and Wernerfelt, 1991). The argument is based on the *flexibility* of three kinds of resources a firm possesses: physical assets, intangible assets, and financial resources. While the former two are fairly inflexible and can only be used in related diversification, the latter can be used for any kind of diversification. This is also in line with Jensen's (1986) free cash flow argument. We will revisit the issue of unrelated diversification below in the context of predatory pricing.

Bundling Goods With Network Effects

Bundling is a strategy by which firms sell two or more of their goods together in some fixed proportions. These goods can be substitutes, complements, a combination of both or independent (Chung et al., 2013). Bundling is of two kinds: pure and mixed bundling. In a pure bundle, the two goods are only sold together and not independently. In a mixed bundle, the goods are sold individually and are also available as a package. Importantly, charging a sufficiently high price for individual components effectively translates into selling a pure bundle (Nalebuff, 2003). An example of this is the separate applications under the Windows Office package which, bought separately are a more expensive purchase (Nalebuff, 2003).

Bundling enables firms to extract higher rent from individuals with varying valuations on individual goods as a result of the predictive power of bundling. This helps in setting an optimal price whereby more consumers would find the bundle worth buying than if sold individually. Bakos and Brynjolfsson (2000) define the predictive value of bundling as the

phenomena by which it is easier for a seller to predict how a consumer will value a collection of goods than anyone of those goods individually. For this reason, among others, bundling has been a point of discussion in antitrust policy for decades.

Here, it becomes important to contrast contractual bundles from technological ones. Contractual bundles are easier for the consumer to exit in the sense that the autonomy of consuming one or more of the goods in the bundle still rests with the consumer. For example, if a vacation package includes meals, the consumer may still choose to eat outside (while paying for the meal). In contrast, in a technological bundle, this autonomy of disposal of one of the goods in a bundle can be quite costly or even impractical for the consumer. For example, Microsoft's integration of Windows and Explorer left customers with no option but to use Explorer as their default browser for the fear of incompatibility of other browsers with the Windows operating system (Hazlett, 1999). In this manner, technological integration can help capture significant market share in multiple product markets leading to *multi-market dominance*.

An interesting type of technological bundling is the case with information goods—there are positive network externalities associated with their usage. Telecommunications users gain directly from more widespread adoption and telecommunications networks with more users are also more attractive to non-users contemplating adoption (Klemperer, 2004).

Bakos and Brynjolfsson (2000) showed that a mere addition of any information good to a bundle of goods can help a bundler profitably enter a market and dislodge the incumbent by capturing a majority of the market share. This is illustrated by the case of Jio; its bundling strategy aggregated information goods such as the Jio app with telecom services such as internet and audio calling. This unique bundle of services comprehensively met the telecom needs of consumers and caused major disturbances to the market positions of other oligopoly players.

Switching Costs, Penetration Pricing, and Introductory Offers

Switching costs arise if a buyer incurs transactions, learning or pecuniary costs when changing suppliers (Klemperer, 2004). A classic product exhibiting switching costs is a bank account that has high transaction costs associated with both the opening and the closing. Similarly, users of any particular incompatible technology (such as Windows) can have substantial learning costs if they were to switch to a different operating system like Linux.

Large switching costs lock a buyer with a product in the longer run. Here, long-term commitment to a seller is based on a short-term price contract in the initial period. Large switching costs create ex-post market power for which the firms compete ex-ante (Klemperer, 2004). This encourages fierce ex-ante competition to lock in the initial buyer translating into strategies such as penetration pricing (low prices in the initial stage to attract buyers) and introductory offers (to increase market penetration). For example, Jio's initial offering to Indian consumers provisioned a free SIM card, unlimited high-speed data among other things.

The telecommunication and the information technology (IT) sector are classic examples of industries characterised by high switching costs and network effects. According to Farrell and Klemperer (2007), this is because 'consumer's value forms of compatibility that require otherwise separate purchases to be made from the same firm.' A combination of switching costs and network effects creates a situation of customer *binding* to the initial supplier and in turn, leads to an ex-ante competition amongst firms to capture the customer base. One of the central questions in literature is with regards to the extent to which the ex-ante fierce competition is comparable to the standard period-by-period competition. It is argued that such 'competition for the market' or 'life cycle competition' can be much more intense than usual.

The consensus is that switching costs while encouraging small-scale entry, dissuade sellers from raiding one another's customer base. Thus, any aggressive form of entry is ruled out (Farrell and Klemperer, 2007). Therefore, even though the firms are expected to obtain higher profits, it is likely to be a result of the over-exploitation of existing customers rather than siphoning from a rival's consumer base. It is expected, therefore, that the oligopoly structure which arises as a result of switching costs and network effects is unlikely to be disturbed majorly once the initial market has been captured. A similar result was posited by Williamson (1975) who highlighted the *fundamental transformation* by means of which, the initial winner of a bidding game enjoys an advantageous position over rival suppliers due to control over transaction-specific assets. Thus, in terms of entry into the industry, the incumbent is always at a potential advantage. It is only natural, therefore, to ask questions addressing anti-trust concerns when as aggressive an entry as Jio is observed. Additionally, given the proliferation of penetration strategies used by firms, predatory behaviour becomes even harder to detect.

For example, in the case of Jio, the low price (indicative of low marginal cost in a competitive setting) could be an indicator of predatory behaviour or

simply a lower cost per unit as a result of technology differences. Historically, the telecom sector has been characterised as having high barriers as a result of huge sunk costs, economies of scale, and network externalities (Brock, 1981). In India, while players apart from Jio had to face significant sunk costs, Jio did not face such costs due to its strategic acquisition of an existing player in the market. The absence of these sunk and potential asymmetry in cost structures put Jio at an almost complete competitive advantage.

The previous two sections highlighted characteristics of Jio App's strategy which were complemented by the nature of the telecom sector. In the next two sections, we take a look at the role of the other businesses in Reliance's portfolio in facilitating potentially predatory pricing by Jio.

Predatory Pricing and the Deep Pocket/Long Purse Argument

Predatory pricing refers to the practice of introducing a lower price, higher quality or more innovative product strategically to drive competitors out of the market (Gottesman, 2004). The usual argument that price cutting is a monopolising technique begins by assuming that the predator has a dominant position in the same market where it engages in price-cutting (McGee, 1958). The current study attempts to challenge this traditional notion of dominance with the idea of *multi-market dominance* by means of unrelated diversification and deep pockets.

What determines the success of a predatory price strategy? Predatory pricing involves price cutting in the short run to drive out competitors and hence, enjoy monopoly profits in the longer run. Short-run sacrifice for long-run profit maximisation often seems like a rational decision but the success of this strategy hinges upon the firm being able to do two things. One, it should be able to survive the initial loss-making period to get to a situation where it captures the entire market share. Two, it must be able to recoup its losses in the long run by raising prices.

This is where the deep pocket argument comes in. The idea is based on the premise that predatory pricing or pricing at a level lower than the competitive market price is a risky move for the predator. Acquisition of a larger market share by this move would only be successful if the predator were able to dissuade entry in the long run. Several studies have argued that the phenomenon of predatory pricing is unlikely to be economically rational in most cases (McGee, 1980; Easterbrook, 1981). This is because of the severe short-term losses which the firm would suffer when pricing predatorily. Even if the firm were to successfully drive out the rival, it can only recoup its short-term losses when it increases its prices over the long

run. Therefore, in the absence of significant entry barriers, predatory pricing is not a rational move (Bork, 1978).

There have been many attempts to identify the determinants of a reliable predatory strategy. One of the theories explaining the credibility of rational predatory behaviour is the deep pocket argument. The early mentions of this argument were made by McGee (1958), Telser (1966), and Benoit (1984). The deep-pocket or long purse argument hinges on the premise that the decision to engage in predatory practices is strategically determined by a firm's capital structure. For example, 'low-debt and cash-rich firms can prey upon high-debt and cash-poor rivals' (Rocca, 2011). In this manner, predatory incentives are a decreasing function of the entrant's debt level. Empirical work such as Chevalier (1995) verifies that debt weakens the competitive position of firms. The financial structure of a firm can have a variety of metrics. For e.g., the financial vulnerability of a firm due to informational asymmetries in the market was shown to be a factor in the decision regarding predation by the incumbent (Poitevin, 1989). Another study by Gottesman (2004) postulates the strategic use of convertible debt by an incumbent firm to avoid predation.

A large body of literature strongly assumes that a firm's dominant share in the market (which is naturally held by the incumbent) is their 'war chest', with which they can engage in predatory behaviour and subsequently, a price war if the situation so necessitates (McGee, 1958). Therefore, the incumbent in a particular industry is always at an advantage when compared to the entrant. (Telser, 1966; Benoit, 1984; Fulghieri and Nagarajan, 1996) Thus, generally, the outcome of predation under the long-purse argument favours the incumbent firm and suggests its emergence as the dominant market player. However, this assumption subsumes the explanation of how a seller acquires the monopoly power that he must have before he could practice predatory pricing (McGee, 1958).

To fill this gap, several explanations have been provided to support the idea of a *vulnerable entrant* and a *stabilised incumbent*. A study by Fudenberg and Tirole (1986) argued that the entrant's lack of 'history of cash flow generation' makes it difficult for them to find equity investors. The borrowing compelled by this difficulty leads to a larger borrowing obligation for the entrant as compared to the incumbent. This makes it relatively easier for the incumbent to engage in a price war if necessary. Williamson (1975) echoed this sentiment to posit that the entrant is a higher risk borrower and hence, has a higher interest rate schedule than the incumbent. Therefore, even with the same financial structure, the incumbent would be able to reduce prices more aggressively. Along similar lines, Poitevin (1989) proposed that

the debt taken by an entrant acts as a signal to investors. The incumbent's reputation (if favourable) allows it to have a flexible financial structure while the entrant's lack of reputation forces it to use its financial structure as a signal allowing for predation.

In this manner, a firm's capital structure plays an important role in determining the extent and credibility of their strategies as predator or prey. However, all the explanations for the deep-pocket argument presented so far are limited to the account of how the entrant or the incumbent can use their respective positions *within the given market* to engage in predatory behaviour or fight the same. In the next section, we examine the case of the firm diversifying in different markets/industries.

Unrelated Diversification and Predatory Pricing

Here we discuss how diversification or coinsurance can aid in predatory behaviour by a firm. McGee (1958) argues as follows: Assume that the would-be monopolist (say W) does not have a dominant market share in its current market of interest, say T. But W has an absolute monopoly in some other market 'T' and earns substantial profits there. In market T, there are several competitors that W would like to eliminate. It cuts price below cost and continues to do so till the average variable costs are not covered and not expected to be covered such that the competitors drop out. It is important to note that W does not sell enough in the market to control it. This implies that when W attempts to lower the price below the competitive level, it must be prepared to serve an increasing number of customers. This is because, a price-cutting strategy naturally compels W to lure away customers from its competitors unless they match the price set by W. Otherwise, given successful price-cutting, W would end up selling more and consequently losing more from selling at a lower price. Or, in the case where the upfront value of the competitor's firm is less than the cost of engaging in a predatory war, W would choose to buy out the competitor upfront. Predation would thus be profitable only when it leads to a reduction in purchase prices way below the competitive levels offsetting the huge losses incurred from it. Naturally, such strategies require substantial cash flow to earn monopoly profits which are explained by the deeper pockets possessed by W due to its highly profitable ventures in T'.

This brings us back to the earlier concept of multi-market dominance. Here, the dominant position held by a firm in one market is determining the nature and success of its strategies (and hence, market position) in another market by means of a fungible resource such as cash.

Procyclicality of Lending Behaviour and *Deeper* Pockets

The fundamental principles of rationality and profit maximisation suggest that banks should lend funds to a particular project if and only if the net present value of the project is positive. But, the pro-cyclical[1] nature of non-performing loans (NPLs) in the Indian banking scenario is suggestive of a different story[2] Possible explanations for this phenomenon (relevant to Reliance's case) include banks' over-optimism about borrowers' prospects inducing a reduction in credit standard requirements paving way for borrower default. For example, an increase in the collateral valuation during an upturn can lead to increased lending despite minimal changes in earning capacity. Additionally, the fundamental principal-agent problem implies that bank managers have an incentive to advance loans based on a myopic view of earnings during expansions which can later turn into NPLs. The systematic rewards associated with credit *growth* as opposed to *profitability* exacerbate this problem with herd behaviour kicking in at the aggregate level (Jiménez and Saurina, 2006; Rajan, 1994; Kiyotaki and Moore, 1997).

The gross NPLs of the Indian banking system accounted for 7.5 per cent of the total outstanding loans for the financial year ending March 2016. A major portion of this came from the public sector banks which had a three-fold increment in gross NPLs from 2015 to 2018. (Ministry of Finance, 2019). For the same period, the ratio of NPLs to the total loan disbursement emerged as a significant determinant of the credit growth in both non-food and industrial sectors (RBI, 2019). With 9.3 per cent of bank credit being disbursed into telecom, steadily rising debt-equity ratios for most operators in the industry is worrying. This reliance on leverage allows for even deeper pockets for entrants with long-standing repute (acquired due to successful businesses in multiple markets). Even more importantly, the additional risk undertaken by these players can very possibly be written off in the form of bad loans even while other players in the market continue to struggle for survival.

Welfare Impacts of the Predatory Strategy

For the consumers, in the short run, low prices and attractive bundling to establish consumer base is largely utility enhancing. However, the high switching costs create a binding situation for the consumer where any switch

[1] Pro-cyclicality of NPLs is defined as a positive correlation between the credit growth and the proportion of NPLs in the total credit disbursement.

[2] Indicative of repayment capacity.

to a different company can be quite costly. Hence, any increase in price in the long run is bound to affect the consumer negatively.

For the incumbent, engagement in the predatory price war is a risky move. This is because it is accompanied with asymmetric information. In the cost signalling model of predation, the predator aims to convince the market that it is a low-cost provider. Hence, the predator drastically reduces prices below the short-run profit-maximising level to mislead the prey into believing that the predator has lower costs and exit the market. Such a strategy would only be successful when the prey does not know the cost structure of the predator and they cannot engage in a price war (Bolton et al., 2000).

From the shareholders' perspective, a successfully diversified portfolio is preferred to a non-diversified one due to lower risks. However, the long-term valuation of the predator firm may be affected by uncertain market conditions, particularly if the exposure to the more competitive market is large. Morrison et al (1996) and Busse (2002) discuss such cases in the context of pricing in the aviation industry.

Conclusion

In the preceding discussion, we have highlighted that Reliance's foray into the high-end telecommunications business is one, a case of unrelated diversification and two, is marked by the use of predatory pricing and bundling strategies. While bundling enables a firm to extract higher rent in industries that demonstrate network externalities, slashing prices enables a firm to capture higher market share. The literature on predatory pricing somewhat presumes that the incumbent firm has an advantage in a price-war due to switching costs. The deep-pocket argument, however, explains why a cash-rich firm like Reliance would compete in an unrelated field. Our conjecture, that the capital structure of Reliance, vis-à-vis, that of its competitors allows the competitive buffer necessary for Reliance's predatory behaviour, remains to be verified in the future.

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Happiness: Driven by Economic Factors – A Study of Happiness Index with Some Economic Indicators

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Abstract

The well-being of people has been in coverage of the media in terms of the Happiness Index (HI) for the past few years. Any student of Economicsstarts the journey by understanding the concept of utility which ranks the satisfaction of individuals by consumption of several goods and services. The modern theory of utility is based on ordinal ranking. Later, as one moves on to theories of development economics, one comes across the concepts of Human Development Index (HDI) which emphasises that people and their capabilities should be the criteria for assessing the development of a country along with economic growth. The recent development of the happiness concept encouraged this paper to find the relation, if any, between the indicators of development including the HDI. Elements of doubts creep in if happiness is not related to the development indicators, the urge for economic development would be absent on part of the policymakers in the absence of any push from the people, who might remain happy, even being in impoverishment and well below the development ladder.

Introduction

In recent times, the emphasis is given on the subjective well-being of people of nations. Though the main emphasis of development economics remains around the economic indicators such as the Gross Domestic Product (GDP), concerns circle around concepts of the human development approach. To avoid problems of GDP as a measure of economic well-being, economists started to think about another Index of Economic Performance in which individuals can be categorised by their income groups or asset levels and their individual growth of well-being can be measured before understanding the growth in aggregative well-being (Stanton, 2007). In the process, the HDI emerged to be the best index of social welfare, published every year by the United Nations (UN). The HDI is a summary measure of average achievement in key dimensions of human development—a long

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and healthy life, being knowledgeable, and have a decent standard of living. The HDI is the geometric mean of normalised indices for each of the three dimensions. Besides the economic growth, people and their capabilities should be the main criteria for assessing the development of a country.

Early concepts of happiness come from the philosophies of Buddha and Aristotle. They talked about different viewpoints on happiness. However, it all discussed happiness as a basic aspiration of mankind or an idea used in different ways involving society. The Gandhian philosophy of simple living and high thinking also somehow relates to the concept of happiness, though in a different context under much compromised national and international politics of deprivation. Sen (1985) asked to make a distinction between the happiness of emotion and the cognitive evaluation of the quality of some source of happiness. But it's very important to understand the difference between these two meanings of happiness as it may mislead the measures—a poor man can report a very high level of happiness in a certain time if he mistakenly understands the meaning of the word 'happiness' as an emotion (Hall and Helliwell, 2014). This is an important discussion that needs to be addressed in contemporary research on human well-being.

The United Nations Sustainable Development Solutions Network has come up with the World Happiness Report after adopting the resolution on *Happiness: Towards a Holistic Definition of Developmen*t. The first report was published in April 2012. For this, the UN suggested measuring HI. HI attempts to measure the mental and physical health of a country's citizens, it deals with people's mental satisfaction with their life, environment, their freedom to choose, social justice, etc. This Index is explained by aspects like GDP per capita, social support, healthy life expectancy, freedom to make life choices, as well as generosity and perceptions of corruption. Changes in reported happiness may track social progress which would perhaps reflect little more than transient changes in emotion. Moreover, impoverished people who express happiness in terms of emotion might inadvertently diminish society's will to fight poverty.

Human Development Project (UNDP) of the 1990s has been to define a new way to measure economic well-being based on that new idea. It focuses on three important human capabilities. These are health, education, and a decent standard of living. Health is represented by life expectancy, education by literacy and school enrollment (the literacy and school enrollment indices are combined in weighted average as the education index [EI]), and the standard of living by GDP per capita. The HDI is calculated as the geometric mean of the earlier-mentioned three normalised indices.

Sen *(1999)* puts emphasis on the subjective value of human life. Freedom and well-being depend on social and economic understanding with development, political, and civil rights with the autonomy to participate, modernisation, and technological progress helps to have greater independence. According to Blanchflower and Oswald (2005), when in a country the majority of the population is poor and they cannot even attain the basic needs like food, clothing, and shelter, at that time the main objective should be higher growth rate of an economy and once a moderate rate of growth can be achieved then there is a need for further well-being of the society. According to them, *Food comes first and philosophizing second. As economies get richer, however, they can afford to question the need for further riches*. A greater volume of wealth or income does not seem to buy extra happiness.

Hall and Helliwell (2014) explain Sen's ideas of two different concepts of happiness by using the first two World Happiness Reports that respondents of the surveys are able to understand the difference between happiness as an emotion and happiness as a judgement about the quality of life as a whole. When they were asked different questions, the responses of individuals to these different questions were highly distinct. A very poor person might report himself to be happy emotionally at a specific time, while also reporting a much lower sense of happiness with life as a whole and indeed, as we show later, people living in extreme poverty, whether in terms of income or social support, do report low levels of happiness with life as a whole.

Helliwell, et al. (2015) in the World Happiness Report (2015) explained that HI is reported on the basis of ladder scores. According to the Statistical Appendix of the World Happiness Report 2015, each person of the sample is asked questions on corruption, social support, and freedom to make life choices and generosity and to rank these on a 10-point scale. Moreover, some objective measures like GDP, healthy life expectancy, and measures of inequality with Ginni scores were taken and finally, the happiness scores are derived on a 10-point scale by some complex calculations.

In this chapter, we try to find and analyze those components that we find in literature or our philosophical perspective to be an effective determinant of happiness. The objective of this study is to find the linkage of HI with its possible determinants including HDI among others. Moreover, whether HDI is a credible determinant of HI is questionable as a purely subjective index is being attempted to tie up with objective measures of development when perceptions of this subjectivity have chances of variations from society-to-society. The recent development of happiness concept encouraged this chapter to find the relation, if any, between the indicators of development

including HDI. Elements of doubts creeps in if happiness is not related to the development indicators, the urge for economic development would be absent on part of the policymakers in the absence of any push from the people, who might remain happy, even being well below the development ladder.

Methodology and Data

Happiness Index and HDI are quite similar aspects yet they have a basic difference that HI is an empirical approach based on individual perceptions based on subjective evaluation (on the basis of a questionnaire to rank specific criterion as included in the HI, on a 10 point scale, typically as what the person thinks, which is a subjective perception), whereas the HDI is a conceptual one and with objective criterion. HDI can be calculated by collecting data of GDP, life expectancy, and school enrollment; but HI can't be calculated on the basis of income, life expectancy or education level, rather it can be asked to a person about his perception regarding the ranking of his happiness. On the basis of their answers, HI is formed by taking the average of ranks given by the sample individuals.

From the HI rank of a country, we can understand the position of that country on the basis of the happiness of its population but as we don't know the economic determinants of a person's 'happiness', we can't conclude that the changes reflected in a country's happiness score is the reason of any changes in economic indicators or human development. In this chapter, we are trying to find out the determinants of HI. For arguments we can say, happiness that is the evaluation of one's life as a whole can depend on his income, education, health, the dispersion of mean income of society from his income, etc. So we are interested to check if there is any relationship among a country's HI, GDP, HDI, income inequality, life expectancy, mortality rate (MR), EI, etc.

For understanding their relation we consider the HI as the dependent variable and the remaining mentioned earlier as independent variables ($Y = \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_n x_n$). Then some regressions are done to check the value of β, i.e. if there is any relation between HI and those variables. Here we will particularly focus on the relation of HDI with HI, as HDI includes the most important requirements of a healthy lifestyle as income, education, and health. We checked the correlation between these two ranks of the countries. Next, we checked the relation between the changes in HDI and changes in HI from period t to t+1, i.e. if changes in happiness score are affected by the changes in the human development level of a country or not.

Then we took the deviation of HDI and HI ranks of different countries and divided the countries according to their income groups. We try to understand if there is any concentration of high/low deviation of ranks in any income groups. In this chapter, we concentrate on years 2005-07, 2010-12, 2015, 2016, and 2017 only due to a lack of available data.

2015 World Happiness Report (WHR) contains 158 countries (includes 151 countries that have the happiness scores in the 2012-14 period, plus 7 countries that have the happiness score in 2011 but not in 2012-14). In 2016, WHR includes 157 countries (among which 153 countries was in 2013-15 Report and it included new countries, which were not in 2013-15 but was in 2012) were included. In 2017, 155 countries (1 more country was included, which was there in the 2013 Report but got dropped in 2014-16.

Analysis

First, to find the relationship among the variables, the following correlation tables depicts Gross National Product (GNP), HDI, Purchasing Power Parity (PPP), Life Expectancy Index (LEI), Inequality of Income (II), MR, and EI.

The following correlation tables (1 to 5) are built for each of the years 2005-07, 2010-12, 2015, 2016, and 2017 using the data of Gross Domestic Product (GDP), HDI, PPP, LEI, II, MR, and EI of those respective years. (In the case of 2005-07, income equality data were not found for many countries and excluded from the calculation of correlation table for 2005-07. In the case of 2017, for the same reason MR is excluded).

We find a high correlation between GDP and PPP, LE and HDI Value, EI and HDI value, MR and HDI Value and EI and LE for all years. Since LE and EI are all highly correlated with HDI, we take HDI as a regressor,

Table 1: Correlation Table for GDP, HDI, PPP, LEI, MR, and EI (2005-07)

2005-07	*GDP*	*HDI*	*PPP*	*Life Expectancy Index*	*Mortality*	*Education Index*
GDP	1					
HDI	0.293181	1				
PPP	0.936073	0.222819	1			
Life Expectancy Index	0.268925	0.908857	0.220496	1		
Mortality	–0.23994	–0.7853	–0.21492	–0.93678	1	
Education Index	0.266692	0.953207	0.184737	0.791984	–0.62823	1

Source: Calculated by authors.

Table 2: Correlation Table for GDP, HDI, PPP, II, LEI, MR, and EI (2010-12)

2010-12	*HDI*	*GDP*	*PPP*	*Inequality of Income*	*Life Expectancy*	*Mortality Rate*	*Education Index*
HDI	1						
GDP	0.263909	1					
PPP	0.198219	0.944958	1				
Inequality of income	–0.35804	0.0525	0.063366	1			
Life expectancy	0.917628	0.243584	0.191652	–0.35696	1		
Mortality rate	–0.82413	-0.21842	-0.18763	0.4038	–0.95621	1	
Education Index	0.962659	0.232687	0.157862	–0.37211	0.824589	–0.71089	1

Source: Calculated by authors.

Table 3: Correlation Table for GDP, HDI, PPP, II, LEI, MR, and EI (2015)

2015	*HDI Value*	*GDP*	*PPP*	*Income Inequality*	*Life Expectancy*	*Mortality Rate*	*Education Index*
HDI Value	1						
GDP	0.222771	1					
PPP	0.182301	0.939376	1				
Income Inequality	–0.30722	–0.0039	0.007793724	1			
Life Expectancy	0.918888	0.20395	0.169304399	–0.32496	1		
Mortality Rate	–0.84314	–0.17723	-0.161195348	0.386471	–0.95035	1	
Education Index	0.954302	0.205911	0.155554537	–0.3002	0.83174	–0.74546	1

Source: Calculated by authors.

Table 4: Correlation Table for GDP, HDI, PPP, II, LEI, MR, and EI (2016)

2016	*HDI Value*	*GDP*	*PPP*	*Income Inequality*	*Life Expectancy*	*Mortality Rate*	*Education Index*
HDI Value	1						
GDP	0.220288	1					
PPP	0.176853	0.930327	1				
Income Inequality	–0.21557	0.011937	0.029029901	1			
Life Expectancy	0.913877	0.206437	0.1665419	-0.233102734	1		
Mortality Rate	–0.8538	-0.17934	-0.15980628	0.301104108	–0.95449	1	
Education Index	0.957886	0.202324	0.149306627	–0.225412906	0.832722	–0.74936	1

Source: Calculated by authors.

Table 5: Correlation Table for GDP, HDI, PPP, II, LEI, and EI (2017)

2017	*HDI Value*	*GDP*	*PPP*	*Income Inequality*	*Life Expectancy*	*Education Index*
HDI Value	1					
GDP	0.22065	1				
PPP	0.176704	0.930512	1			
Income Inequality	–0.32796	–0.01207	–0.01599	1		
Life Expectancy	0.930454	0.201458	0.166969	–0.33765	1	
Education Index	0.965505	0.196104	0.140291	–0.3199	0.852682	1

Source: Calculated by authors.

between GDP and PPP they have a high correlation, we keep PPP as a regressor and also keep income inequality as the last regressor.

Next, the calculated regression tables are presented with HI as Y variable (regressand) and HDI, PPP, II as the X variables (regressors). We have taken HI data based on yearly happiness reports in which HI is reported on the basis of ladder scores reported by the world happiness survey of those respective years. We will test at a 95 per cent confidence interval whether there is any relation between HI and these variables. Here we consider the following:

- Null hypothesis Ho: There is no linear relation between HI and HDI/PPP/II, i.e. $\beta_1 = 0/\beta_2 = 0/\beta_2 = 0$.
- Alternative Hypothesis H1: There is a linear relation between HI and HDI/PPP/II, i.e. $\beta_1 \# 0 / \beta_2 \# 0 / \beta 3 \# 0$.

Here $\alpha = 0.05$, i.e. at 5 per cent level of significance, if the p value is smaller or equal to 0.05 then we reject the null hypothesis and accept the alternative hypothesis.

In Table 6, a p value of HI on HDI is < 0.05, implying that there is a linear relation between HDI and HI or $\beta_1 \# 0$; hence, we do not accept the Null hypothesis. But p value of HI on PPP is > 0.05 and we do not reject the Null hypothesis, we conclude that there is no linear relation between HI and PPP, i.e. $\beta_2 = 0$.

In Table 7, a p value of HI on HDI is > 0.05, implies that there is no linear relation between HDI and HI or $\beta_1 = 0$; hence, we do not reject the Null hypothesis. But p value of HI on PPP is > 0.05 and we do not reject the Null hypothesis, we conclude that there is no linear relation between HI and PPP, i.e. $\beta_2 = 0$. Also, p value of II > 0.05 so Null hypothesis accepted; hence, there is no relation between these two variables, $\beta_3 = 0$.

In Table 8, the p value of HDI is < 0.05, implies that there is a linear relation between HDI and HI or $\beta_1 \# 0$; hence, we reject the Null hypothesis.

But p value of PPP is > 0.05 and we do not reject the Null hypothesis, we conclude that there is no linear relation between HI and PPP, i.e. $\beta_2 = 0$. Also, the p value of II > 0.05 so the Null hypothesis is accepted; hence, there is no relation between these two variables, $\beta_3 = 0$.

Table 6: Regression Table for HI on HDI, PPP (2005-07)

Regression Statistics	
Multiple R	0.810754
R Square	0.657322
Adjusted R Square	0.651657
Standard Error	0.672243
Observations	124

ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	2	104.8889	52.44447	116.0504	7.26E-29			
Residual	121	54.68127	0.451911					
Total	123	159.5702						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.65745	0.260088	6.37265	3.51E-09	1.142537	2.172363	1.142537	2.172363
HDI	5.473904	0.37576	14.56757	2.18E-28	4.729989	6.21782	4.729989	6.21782
PPP	3.97E-14	3.61E-14	1.101412	0.272903	-3.2E-14	1.11E-13	-3.2E-14	1.11E-13

Source: Calculated by authors.

Table 7: Regression Table for HI on HDI, PPP, and Income Inequality (2010-12)

Regression Statistics	
Multiple R	0.161082
R Square	0.025948
Adjusted R Square	0.000537
Standard Error	1.100567
Observations	119

ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	3	3.710602	1.236867	1.021152	0.386042			
Residual	115	139.2935	1.211248					
Total	118	143.0041						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	4.39116	0.630391	6.965776	2.17E-10	3.142478	5.639843	3.142478	5.639843
HDI	1.090034	0.704889	1.546391	0.124758	–0.30622	2.486285	–0.30622	2.486285
PPP	1.24E-14	4.48E-14	0.276918	0.78234	–7.6E-14	1.01E-13	–7.6E-14	1.01E-13
Inequality of income	0.010306	0.010377	0.993188	0.322703	–0.01025	0.030861	–0.01025	0.030861

Source: Calculated by authors.

Table 8: Regression Table for HI on HDI, PPP and II (2015)

Regression Statistics	
Multiple R	0.796172
R Square	0.63389
Adjusted R Square	0.625242
Standard Error	0.71114
Observations	131

ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	3	111.2032	37.06772	73.29688	1.41E-27			
Residual	127	64.22648	0.50572					
Total	130	175.4296						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.916504	0.372846	2.45813	0.015314	0.178709	1.654299	0.178709	1.654299
HDI	5.929497	0.420381	14.10505	9.13E-28	5.097638	6.761355	5.097638	6.761355
PPP	5.99E-15	2.53E-14	0.236613	0.813338	-4.4E-14	5.61E-14	–4.4E-14	5.61E-14
Inequality of income	0.009769	0.006227	1.568856	0.11917	–0.00255	0.022091	–0.00255	0.022091

Source: Calculated by authors.

Table 9: Regression Table for HI on HDI, PPP, and II (2016)

Regression Statistics	
Multiple R	0.823851
R Square	0.678731
Adjusted R Square	0.671081
Standard Error	0.667975
Observations	130

ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	3	118.7734	39.59114	88.73143	6.38E-31			
Residual	126	56.22003	0.446191					
Total	129	174.9935						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.835898	0.345369	2.420303	0.016934	0.152423	1.519373	0.152423	1.519373
HDI	6.188552	0.394829	15.67402	2.2E-31	5.407197	6.969906	5.407197	6.969906
PPP	3.67E-15	2.25E-14	0.16333	0.87052	–4.1E-14	4.82E-14	–4.1E-14	4.82E-14
Inequality of income	0.003663	0.005998	0.610717	0.542487	–0.00821	0.015533	–0.00821	0.015533

Source: Calculated by authors.

According to Table 9 (for 2016), a p value of HDI is < 0.05, we reject the Null hypothesis, there is a linear relation between HDI and HI or β_1 #

Table 10: Regression Table for HI on HDI, PPP, and II (2017)

Regression Statistics	
Multiple R	0.83698
R Square	0.700535
Adjusted R Square	0.693517
Standard Error	0.640941
Observations	132

ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	3	123.0073	41.00243	99.80982	2.34E-33			
Residual	128	52.58312	0.410806					
Total	131	175.5904						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.858583	0.343368	2.500478	0.013666	0.179172	1.537995	0.179172	1.537995
HDI	6.117186	0.373098	16.39564	3.03E-33	5.378947	6.855424	5.378947	6.855424
PPP	–5.9E-16	2.02E-14	–0.0292	0.97675	–4E-14	3.93E-14	–4E-14	3.93E-14
Inequality of income	0.005144	0.006232	0.825412	0.410674	–0.00719	0.017474	–0.00719	0.017474

Source: Calculated by authors.

0. But p value of PPP is > 0.05 and we do not reject the Null hypothesis, we conclude that there is no linear relation between HI and PPP, i.e. $\beta_2 = 0$. With a p value of II > 0.05, so Null hypothesis is accepted; hence, there is no relation between these two variables, $\beta_3 = 0$.

According to Table 10, p value of HDI is < 0.05; hence, we reject the Null hypothesis. This implies that there is a linear relation between HDI and HI or $\beta_1 \# 0$. But p value of PPP is > 0.05 and we do not reject the Null hypothesis, we conclude that there is no linear relation between HI and PPP, i.e. $\beta_2 = 0$. Also, p value of II > 0.05 so Null hypothesis is accepted; hence, there is no relation between these two variables, $\beta_3=0$.

Our results with HI score and HDI establishes the fact that HI scores are linearly dependent on the HDI scores except for 2010-12. Apparently, this seems to be good enough result showing the perception of happiness being dependent on the HDI, establishing that the 'subjective' evaluation of 'Happiness' coming from the 'objective' criterion of economic 'well-being'. But at the same time, what is observed is that the perception of well-being is more on the rank (relative position) rather than the score (absolute measure). In literature, we do not find any benchmark score for a satisfactory level of happiness or HDI. Rather we are concerned more with the relative position of the country in the rank list of HI or HDI. This indulges us to introspect more, now through the ranks of these two indices: HI and HDI.

Here we compare the HI and HDI ranks of different countries at different years by calculating the Rank Correlation between these countries. In 2005-07, the rank correlation R = 0.81656; in 2010-12 R = 0.1028201; in 2015 R = 0.413006; in 2016 R = 0.677815; and in 2017, R = 0.777884. For 2 years, R is very low, one year R is moderate and for 2 years, R is high. This clearly shows that for at least our dataset it cannot be unambiguously stated that the rank of HI and that of HDI have any one-to-one correspondence. Now, according to ranks, our study shows a major deviation from the result we have got from the previous analysis, here according to the ranks. The range of rank between HI and HDI varies between 1 and 113. This large variation in ranks between the two variables encourages us to check the deviation of ranks income group-wise for the countries. The reason behind taking countries according to income groups comes from the perception of happiness which might differ according to income levels. Hence, we have taken the deviation of HDI and HI scores of different countries and divided the countries into four income groups (according to the World Bank classification—high-income group, the upper-middle income group, the lower-middle income group, and the lower-income group). Then to

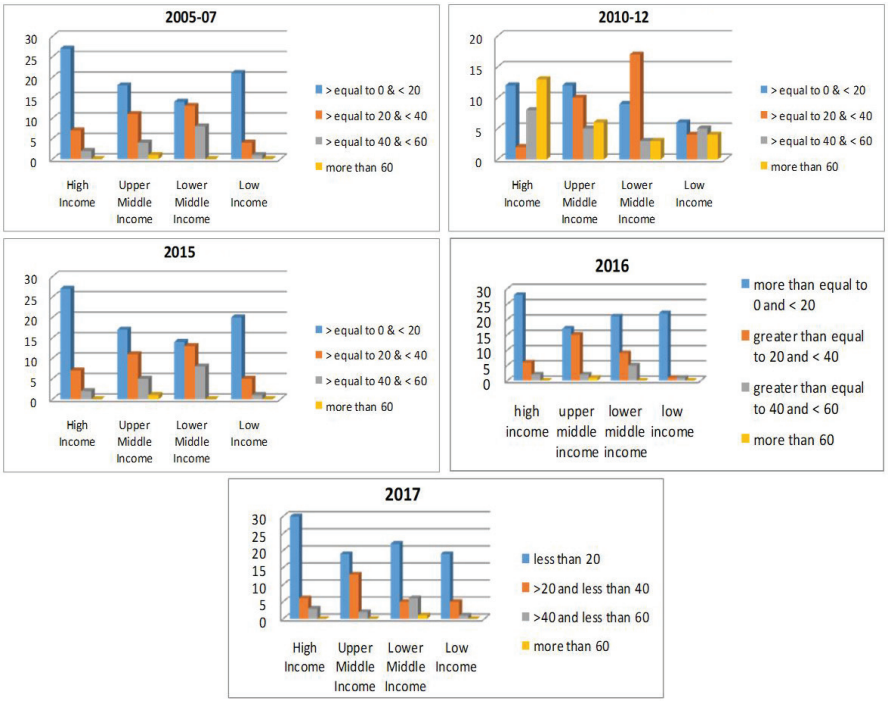

Fig. 1: Deviations of HDI and HI Ranks According to Income Group
Source: Calculated and plotted by authors.

understand if there is any concentration of high/low deviation of scores in any income groups we can make a frequency distribution table by dividing the deviation of HI and HDI ranks into four groups (class intervals). These are 'greater than equal to 0 and 20', 'greater than equal to 20 and 40', 'greater than equal to 40 and 60', and 'greater than 60' (Appendix 1). Plots are presented in Figure 1.

There is no such difference in the pattern of deviations among the countries across income groups, which is almost the same variation as for the countries taken altogether. The pattern of deviation between HI and HDI does not differ significantly for higher- or lower-income countries. No new light can be thrown upon the discussion relating to HI and HDI from this angle.

In Economics, students are always concerned with marginal changes. Under the circumstances, one gets tempted to check whether the marginal changes in HDI lead to any change in HI. Since the marginal changes are concerned with objective variables, we concentrate here on the study of the effect of marginal changes of HDI scores on changes in HI score. For the purpose, we run a regression of the HI scores on changes in HDI scores for two periods of changes (first, change of HDI scores of 2016 from 2015 and second, the same of 2017 from 2016). The purpose of taking these two periods lies in the fact that we have data for three successive years unlike data for 2005-07 or 2010-12. We assume this would better represent the changes.

Table 11: Regression Between Changes in HI and HDI Scores from 2015 to 2016

Regression Statistics	
Multiple R	0.137382
R Square	0.018874
Adjusted R Square	0.010897
Standard Error	0.208689
Observations	125

ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	1	0.103047	0.103047	2.366126	0.126563			
Residual	123	5.356765	0.043551					
Total	124	5.459812						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000783	0.018925	0.041385	0.967056	–0.03668	0.038245	-0.03668	0.038245
X Variable 1	–1.37192	0.891887	–1.53822	0.126563	–3.13735	0.393516	-3.13735	0.393516

Source: Calculated by authors.

Table 12: Regression Between Changes in HI and HDI Scores from 2016 to 2017

Regression Statistics	
Multiple R	0.030487
R Square	0.000929
Adjusted R Square	–0.00719
Standard Error	0.166085
Observations	125

ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	1	0.003156	0.003156	0.114427	0.735736			
Residual	123	3.392844	0.027584					
Total	124	3.396						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.012895	0.015004	0.859435	0.391773	–0.0168	0.042594	–0.0168	0.042594
X Variable 1	0.255417	0.755066	0.338271	0.735736	–1.23919	1.750023	-1.23919	1.750023

Source: Calculated by authors.

Tables 11 and 12 represent the regression results, with null hypothesis H_o: there is *no linear relationship* between changes in HI and HDI, i.e. $\beta = 0$ and alternative Hypothesis H_1: *there is a linear relation* between changes in HI and HDI, i.e. $\beta \# 0$. The Null hypothesis is tested against the alternative hypothesis at 95 per cent confidence limits. Here in both tables 11 and 12, p value > 0.05, so it can be concluded that there is no linear relationship between these changes, i.e. Null hypothesis is not rejected.

Results and Conclusion

Regressions somehow reveal some positive linear relation between HI and HDI scores, i.e. as HDI increases, HI increases.

The rank correlations do not suggest any unambiguous relation between HI and HDI ranks. The study also reveals that there are deviations of the rank of HI between years and deviations of HDI rank as well. Even after income group wise separation of countries, the deviation pattern of HI and HDI ranks does not differ among the groups.

Regressions of change in HI score on change in HDI score do not suggest any relationship between the two. That is, changes in the HDI score do not exactly reflect any change in HI score.

Among the three results obtained one somehow reveals some relation between HI and HDI scores indicating that there might be some positive relation between the two. However, with the two other results in hand, we

cannot unambiguously conclude that they have any relation between them. HI is measured by reported scores of individuals selected for the sample. While having these HI scores, scores are also reported by these individuals on various other parameters like social support, freedom of life choices, income, healthy life expectancy at birth, perception about corruption, perception about donation, and generosity. The World Happiness Report then tried to analyze how much of the happiness scores are explained by these parameters. Our point of departure lies here. The concept of happiness, as built up, nowhere contains the objective economic or social parameters. The entire thing has been created on the basis of the perception of people. In this chapter, we tried to build up a causal relationship between the subjective perception of happiness and the objective economic variable HDI among others. Finally, our analysis cantered around HI and HDI only for obvious reasons. As Sen (1983) says on happiness as a measure of development, 'a grumbling rich man may well be less happy than a contented peasant, but he does have a higher standard of living than that peasant.' It means that life satisfaction is not necessarily synonymous with human development. The difference could be a problem for proponents of subjective well-being who feel that indicators of life satisfaction are indicative of broad development. Our findings suggest that we cannot force any relation between the two study variables. This results we try to interpret here may have far-reaching implications: impoverished people expressing happiness might inadvertently diminish society's will to fight poverty. This may have detrimental effects on the development of the society with the policy framers focusing more on the happiness of the people highlighting other factors rather than on development, specifically on human development.

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APPENDIX

A1: Calculation of Deviation of HDI and HI ranks (2005-07)

Country	*Income Group*	*Happiness Score*	*HDI Value*	*HI Rank*	*HDI Rank*	*d*	*mod d*	d^2
Australia	High Income	7.28399992	0.936	9	3	6	6	36
Austria	High Income	7.199999809	0.903	12	16	-4	4	16
Belgium	High Income	6.936999798	0.913	18	14	4	4	16
Canada	High Income	7.427000046	0.92	5	10	-5	5	25
Chile	High Income	6.670000076	0.84	22	33	-11	11	121
Cyprus	High Income	5.68900013	0.86	53	27	26	26	676
Czech Republic	High Income	6.505000114	0.882	25	22	3	3	9
Denmark	High Income	7.52699995	0.926	3	8	-5	5	25
Estonia	High Income	5.428999901	0.866	55	25	30	30	900
Finland	High Income	7.406000137	0.915	6	13	-7	7	49
France	High Income	6.574999809	0.898	23	19	4	4	16
Germany	High Income	6.75	0.933	21	4	17	17	289
Greece	High Income	4.856999874	0.866	81	25	56	56	3136
Hungary	High Income	4.800000191	0.834	83	34	49	49	2401
Iceland	High Income	7.56099987	0.927	2	7	-5	5	25

Country	*Income Group*	*Happiness Score*	*HDI Value*	*HI Rank*	*HDI Rank*	*d*	*mod d*	d^2
Ireland	High Income	6.940000057	0.929	17	5	12	12	144
Israel	High Income	7.277999878	0.901	10	17	-7	7	49
Italy	High Income	5.947999954	0.876	39	23	16	16	256
Japan	High Income	5.986999989	0.905	37	15	22	22	484
Latvia	High Income	5.09800005	0.841	71	32	39	39	1521
Lithuania	High Income	5.833000183	0.852	45	29	16	16	256
Luxembourg	High Income	6.946000099	0.899	16	18	-2	2	4
Malta	High Income	6.302000046	0.871	30	24	6	6	36
Netherlands	High Income	7.377999783	0.926	7	8	-1	1	1
Norway	High Income	7.521999836	0.948	4	1	3	3	9
Poland	High Income	5.790999889	0.855	49	28	21	21	441
Portugal	High Income	5.102000237	0.842	70	31	39	39	1521
Slovakia	High Income	5.994999886	0.851	36	30	6	6	36
Slovenia	High Income	5.84800005	0.889	44	20	24	24	576
Spain	High Income	6.328999996	0.885	29	21	8	8	64
Sweden	High Income	7.363999844	0.929	8	5	3	3	9
Switzerland	High Income	7.586999893	0.942	1	2	-1	1	1
Trinidad and Tobago	High Income	6.168000221	0.783	32	46	-14	14	196
United Kingdom	High Income	6.867000103	0.918	19	12	7	7	49
United States	High Income	7.118999958	0.92	14	10	4	4	16
Uruguay	High Income	6.485000134	0.8	26	42	-16	16	256
Albania	Upper Middle Income	4.959000111	0.776	75	51	24	24	576
Argentina	Upper Middle Income	6.573999882	0.822	24	36	-12	12	144
Azerbaijan	Upper Middle Income	5.211999893	0.758	62	55	7	7	49
Belarus	Upper Middle Income	5.813000202	0.805	48	40	8	8	64
Bosnia and Herzegovina	Upper Middle Income	4.948999882	0.755	76	57	19	19	361
Botswana	Upper Middle Income	4.331999779	0.706	104	72	32	32	1024
Brazil	Upper Middle Income	6.982999802	0.757	15	56	-41	41	1681
Bulgaria	Upper Middle Income	4.217999935	0.807	109	39	70	70	4900
China	Upper Middle Income	5.139999866	0.743	66	61	5	5	25

Country	*Income Group*	*Happiness Score*	*HDI Value*	*HI Rank*	*HDI Rank*	*d*	*mod d*	d^2
Colombia	Upper Middle Income	6.477000237	0.742	27	64	-37	37	1369
Costa Rica	Upper Middle Income	7.225999832	0.788	11	45	-34	34	1156
Croatia	Upper Middle Income	5.758999825	0.827	50	35	15	15	225
Dominican Republic	Upper Middle Income	4.885000229	0.729	78	69	9	9	81
Ecuador	Upper Middle Income	5.974999905	0.743	38	61	-23	23	529
Gabon	Upper Middle Income	3.895999908	0.694	118	75	43	43	1849
Iran	Upper Middle Income	4.68599987	0.789	88	44	44	44	1936
Iraq	Upper Middle Income	4.677000046	0.668	90	84	6	6	36
Jamaica	Upper Middle Income	5.709000111	0.73	52	68	-16	16	256
Kazakhstan	Upper Middle Income	5.855000019	0.797	43	43	0	0	0
Lebanon	Upper Middle Income	4.839000225	0.752	82	58	24	24	576
Mauritius	Upper Middle Income	5.477000237	0.782	54	48	6	6	36
Mexico	Upper Middle Income	7.186999798	0.767	13	53	-40	10	100
Montenegro	Upper Middle Income	5.191999912	0.809	65	38	27	27	729
Morocco	Upper Middle Income	5.013000011	0.655	73	86	-13	13	169
Panama	Upper Middle Income	6.785999775	0.781	20	49	-29	29	841
Paraguay	Upper Middle Income	5.877999783	0.702	42	73	-31	31	961
Peru	Upper Middle Income	5.823999882	0.745	47	60	-13	13	169
Romania	Upper Middle Income	5.124000072	0.805	68	40	28	28	784
Russia	Upper Middle Income	5.71600008	0.813	51	37	14	14	196
Serbia	Upper Middle Income	5.123000145	0.78	69	50	19	19	361

Country	*Income Group*	*Happiness Score*	*HDI Value*	*HI Rank*	*HDI Rank*	*d*	*mod d*	d^2
South Africa	Upper Middle Income	4.642000198	0.692	91	78	13	13	169
Suriname	Upper Middle Income	6.269000053	0.722	31	71	-40	40	1600
Thailand	Upper Middle Income	6.454999924	0.741	28	65	-37	37	1369
Turkey	Upper Middle Income	5.331999779	0.783	58	46	12	12	144
Angola	Lower Middle Income	4.032999992	0.572	112	99	13	13	169
Armenia	Lower Middle Income	4.349999905	0.748	103	59	44	44	1936
Bangladesh	Lower Middle Income	4.693999767	0.592	87	95	-8	8	64
Bhutan	Lower Middle Income	5.252999783	0.603	61	93	-32	32	1024
Bolivia	Lower Middle Income	5.889999866	0.681	40	82	-42	42	1764
Cambodia	Lower Middle Income	3.819000006	0.571	120	100	20	20	400
Cameroon	Lower Middle Income	4.251999855	0.548	108	103	5	5	25
Congo (Brazzaville)	Lower Middle Income	3.989000082	0.613	114	91	23	23	529
Egypt	Lower Middle Income	4.193999767	0.691	110	79	31	31	961
El Salvador	Lower Middle Income	6.130000114	0.674	33	83	-50	50	2500
Georgia	Lower Middle Income	4.296999931	0.771	105	52	53	53	2809
Ghana	Lower Middle Income	4.632999897	0.585	92	96	-4	4	16
Guatemala	Lower Middle Income	6.123000145	0.645	34	88	-54	54	2916
Honduras	Lower Middle Income	4.788000107	0.609	84	92	-8	8	64
India	Lower Middle Income	4.565000057	0.627	95	90	5	5	25
Indonesia	Lower Middle Income	5.399000168	0.686	56	80	-24	24	576
Jordan	Lower Middle Income	5.191999912	0.733	64	67	-3	3	9

Country	*Income Group*	*Happiness Score*	*HDI Value*	*HI Rank*	*HDI Rank*	*d*	*mod d*	d^2
Kenya	Lower Middle Income	4.419000149	0.578	102	98	4	4	16
Kyrgyzstan	Lower Middle Income	5.285999775	0.666	59	85	-26	26	676
Laos	Lower Middle Income	4.875999928	0.593	79	94	-15	15	225
Lesotho	Lower Middle Income	4.897999763	0.511	77	109	-32	32	1024
Mauritania	Lower Middle Income	4.43599987	0.514	101	107	-6	6	36
Moldova	Lower Middle Income	5.888999939	0.693	41	76	-35	35	1225
Mongolia	Lower Middle Income	4.874000072	0.737	80	66	14	14	196
Nicaragua	Lower Middle Income	5.828000069	0.652	46	87	-41	41	1681
Nigeria	Lower Middle Income	5.268000126	0.527	60	106	-46	46	2116
Pakistan	Lower Middle Income	5.193999767	0.551	63	102	-39	39	1521
Philippines	Lower Middle Income	5.072999954	0.693	72	76	-4	4	16
Sri Lanka	Lower Middle Income	4.270999908	0.766	107	54	53	53	2809
Tunisia	Lower Middle Income	4.738999844	0.728	86	70	16	16	256
Ukraine	Lower Middle Income	4.681000233	0.743	89	61	28	28	784
Uzbekistan	Lower Middle Income	6.002999783	0.698	35	74	-39	39	1521
Vietnam	Lower Middle Income	5.360000134	0.684	57	81	-24	24	576
Yemen	Lower Middle Income	4.077000141	0.483	111	118	-7	7	49
Zambia	Lower Middle Income	5.129000187	0.583	67	97	-30	30	900
Afghanistan	Low Income	3.575000048	0.493	127	115	12	12	144
Benin	Low Income	3.339999914	0.508	129	111	18	18	324
Burkina Faso	Low Income	3.586999893	0.412	126	128	-2	2	4
Burundi	Low Income	2.904999971	0.418	130	125	5	5	25
Central African Republic	Low Income	3.677999973	0.357	123	130	-7	7	49

Country	*Income Group*	*Happiness Score*	*HDI Value*	*HI Rank*	*HDI Rank*	*d*	*mod d*	d^2
Chad	Low Income	3.667000055	0.407	124	129	-5	5	25
Comoros	Low Income	3.95600009	0.502	115	113	2	2	4
Congo (Kinshasa)	Low Income	4.517000198	0.444	97	121	-24	24	576
Ethiopia	Low Income	4.512000084	0.451	99	120	-21	21	441
Guinea	Low Income	3.655999899	0.443	125	122	3		0
Haiti	Low Income	4.518000126	0.493	96	115	-19	19	361
Liberia	Low Income	4.571000099	0.432	94	123	-29	29	841
Madagascar	Low Income	3.680999994	0.514	122	107	15	15	225
Malawi	Low Income	4.291999817	0.47	106	119	-13	13	169
Mali	Low Income	3.994999886	0.418	113	125	-12	12	144
Mozambique	Low Income	4.971000195	0.432	74	123	-49	49	2401
Nepal	Low Income	4.513999939	0.566	98	101	-3	3	9
Niger	Low Income	3.845000029	0.347	119	131	-12	12	144
Rwanda	Low Income	3.464999914	0.51	128	110	18	18	324
Senegal	Low Income	3.904000044	0.492	117	117	0	0	0
Sierra Leone	Low Income	4.506999969	0.413	100	127	-27	27	729
Tajikistan	Low Income	4.785999775	0.645	85	88	-3	3	9
Tanzania	Low Income	3.780999899	0.528	121	105	16	16	256
Togo	Low Income	2.838999987	0.495	131	114	17	17	289
Uganda	Low Income	3.930999994	0.505	116	112	4	4	16
Zimbabwe	Low Income	4.610000134	0.529	93	104	-11	11	121

Source: Calculated and presented by author on the basis of the data collected from World Happiness Reports, Human Development Reports & World Bank Data.

A2: Calculation of deviation of HDI and HI ranks (2010-12)

Country	*Income Group*	*Happiness Score*	*HDI Value*	*HI Rank*	*HDI Rank*	*d*	*mod d*	d^2
Australia	High Income	7.35	0.931	9	3	6	6	36
Austria	High Income	7.369	0.897	7	16	-9	9	81
Belgium	High Income	6.967	0.908	17	14	3	3	9
Canada	High Income	4.42	0.911	92	12	80	80	6400
Chile	High Income	3.623	0.828	118	33	85	85	7225
Cyprus	High Income	4.578	0.853	89	26	63	63	3969
Czech Republic	High Income	7.257	0.874	11	23	-12	12	144
Denmark	High Income	5.661	0.931	43	4	39	39	1521
Estonia	High Income	4.963	0.862	71	24	47	47	2209
Finland	High Income	4.273	0.912	99	10	89	89	7921
France	High Income	5.809	0.889	38	19	19	19	361
Germany	High Income	7.389	0.928	6	5	1	1	1

Country	*Income Group*	*Happiness Score*	*HDI Value*	*HI Rank*	*HDI Rank*	*d*	*mod d*	d^2
Greece	High Income	4.114	0.856	105	25	80	80	6400
Hungary	High Income	3.847	0.835	115	31	84	84	7056
Iceland	High Income	4.341	0.92	96	7	89	89	7921
Ireland	High Income	4.772	0.911	83	13	70	70	4900
Israel	High Income	5.348	0.895	57	17	40	40	1600
Italy	High Income	4.643	0.876	87	21	66	66	4356
Japan	High Income	7.076	0.899	15	15	0	0	0
Latvia	High Income	5.222	0.833	63	32	31	31	961
Lithuania	High Income	4.931	0.836	72	30	42	42	1764
Luxembourg	High Income	4.898	0.892	73	18	55	55	3025
Netherlands	High Income	4.885	0.923	74	6	68	68	4624
Norway	High Income	5.507	0.946	49	1	48	48	2304
Poland	High Income	7.143	0.85	12	27	-15	15	225
Portugal	High Income	5.779	0.837	40	29	11	11	121
Slovakia	High Income	3.959	0.844	113	28	85	85	7225
Slovenia	High Income	4.813	0.885	79	20	59	59	3481
Spain	High Income	6.06	0.875	32	22	10	10	100
Sweden	High Income	4.151	0.912	104	11	93	93	8649
Switzerland	High Income	4.401	0.938	94	2	92	92	8464
Trinidad and Tobago	High Income	4.38	0.779	95	44	51	51	2601
United Kingdom	High Income	5.345	0.915	58	9	49	49	2401
United States	High Income	7.082	0.916	14	8	6	6	36
Uruguay	High Income	6.355	0.797	28	40	-12	12	144
Albania	Upper Middle Income	5.55	0.771	46	48	-2	2	4
Argentina	Upper Middle Income	6.562	0.82	23	35	-12	12	144
Azerbaijan	Upper Middle Income	4.604	0.752	88	54	34	34	1156
Belarus	Upper Middle Income	5.504	0.804	50	36	14	14	196
Botswana	Upper Middle Income	4.813	0.693	78	70	8	8	64
Brazil	Upper Middle Income	3.97	0.748	112	56	56	56	3136
Bulgaria	Upper Middle Income	6.849	0.792	19	41	-22	22	484
China	Upper Middle Income	4.056	0.729	108	62	46	46	2116

Country	*Income Group*	*Happiness Score*	*HDI Value*	*HI Rank*	*HDI Rank*	*d*	*mod d*	d^2
Colombia	Upper Middle Income	6.587	0.735	22	60	-38	38	1444
Croatia	Upper Middle Income	4.297	0.821	98	34	64	64	4096
Dominican Republic	Upper Middle Income	6.29	0.713	29	68	-39	39	1521
Ecuador	Upper Middle Income	7.693	0.734	1	61	-60	60	3600
Gabon	Upper Middle Income	5.426	0.687	54	73	-19	19	361
Iran	Upper Middle Income	4.775	0.784	82	43	39	39	1521
Iraq	Upper Middle Income	7.355	0.666	8	79	-71	71	5041
Jamaica	Upper Middle Income	4.817	0.726	77	66	11	11	121
Kazakhstan	Upper Middle Income	6.021	0.788	33	42	-9	9	81
Lebanon	Upper Middle Income	6.515	0.751	25	55	-30	30	900
Mauritius	Upper Middle Income	5.76	0.772	41	47	-6	6	36
Mexico	Upper Middle Income	4.247	0.756	101	53	48	48	2304
Montenegro	Upper Middle Income	5.477	0.803	51	38	13	13	169
Morocco	Upper Middle Income	7.088	0.645	13	82	-69	69	4761
Mozambique	Upper Middle Income	5.791	0.423	39	114	-75	75	5625
Panama	Upper Middle Income	7.655	0.776	2	45	-43	43	1849
Paraguay	Upper Middle Income	6.853	0.695	18	69	-51	51	2601
Peru	Upper Middle Income	5.292	0.736	61	59	2	2	4
Romania	Upper Middle Income	4.985	0.8	70	39	31	31	961
Russia	Upper Middle Income	5.822	0.804	37	37	0	0	0
Serbia	Upper Middle Income	5.464	0.771	52	49	3	3	9

Country	*Income Group*	*Happiness Score*	*HDI Value*	*HI Rank*	*HDI Rank*	*d*	*mod d*	d^2
Suriname	Upper Middle Income	6.267	0.715	30	67	-37	37	1369
Togo	Upper Middle Income	6.221	0.472	31	109	-78	78	6084
Turkey	Upper Middle Income	6.371	0.771	27	50	-23	23	529
Venezuela	Upper Middle Income	7.039	0.776	16	46	-30	30	900
Angola	Lower Middle Income	5.589	0.554	45	94	-49	49	2401
Armenia	Lower Middle Income	4.316	0.742	97	58	39	39	1521
Bangladesh	Lower Middle Income	4.804	0.575	80	90	-10	10	100
Bolivia	Lower Middle Income	5.857	0.668	36	78	-42	42	1764
Cambodia	Lower Middle Income	3.706	0.56	117	93	24	24	576
Cameroon	Lower Middle Income	4.067	0.535	107	97	10	10	100
Congo (Brazzaville)	Lower Middle Income	6.416	0.582	26	87	-61	61	3721
Egypt	Lower Middle Income	4.69	0.68	86	76	10	10	100
Georgia	Lower Middle Income	4.561	0.757	90	52	38	38	1444
Ghana	Lower Middle Income	6.764	0.577	20	89	-69	69	4761
Guatemala	Lower Middle Income	4.187	0.616	102	84	18	18	324
Honduras	Lower Middle Income	5.435	0.6	53	86	-33	33	1089
India	Lower Middle Income	5.142	0.607	64	85	-21	21	441
Indonesia	Lower Middle Income	5.523	0.681	48	75	-27	27	729
Jordan	Lower Middle Income	7.301	0.727	10	65	-55	55	3025
Kenya	Lower Middle Income	5.374	0.566	56	92	-36	36	1296
Kyrgyzstan	Lower Middle Income	5.671	0.658	42	80	-38	38	1444

Country	*Income Group*	*Happiness Score*	*HDI Value*	*HI Rank*	*HDI Rank*	*d*	*mod d*	d^2
Laos	Lower Middle Income	4.403	0.579	93	88	5	5	25
Lesotho	Lower Middle Income	5.042	0.505	67	103	-36	36	1296
Mauritania	Lower Middle Income	4.113	0.508	106	101	5	5	25
Moldova	Lower Middle Income	5.964	0.693	34	71	-37	37	1369
Mongolia	Lower Middle Income	4.758	0.729	84	63	21	21	441
Nicaragua	Lower Middle Income	4.439	0.639	91	83	8	8	64
Nigeria	Lower Middle Income	7.512	0.519	3	98	-95	95	9025
Pakistan	Lower Middle Income	5.248	0.538	62	96	-34	34	1156
Philippines	Lower Middle Income	4.7	0.685	85	74	11	11	121
Sri Lanka	Lower Middle Income	4.847	0.759	75	51	24	24	576
Ukraine	Lower Middle Income	6.519	0.745	24	57	-33	33	1089
Uzbekistan	Lower Middle Income	5.623	0.69	44	72	-28	28	784
Vietnam	Lower Middle Income	5.533	0.675	47	77	-30	30	900
Yemen	Lower Middle Income	4.054	0.507	109	102	7	7	49
Zambia	Lower Middle Income	5.006	0.574	69	91	-22	22	484
Afghanistan	Low Income	4.04	0.487	110	106	4	4	16
Benin	Low Income	3.528	0.5	119	105	14	14	196
Burkina Faso	Low Income	3.981	0.401	111	117	-6	6	36
Burundi	Low Income	4.259	0.414	100	116	-16	16	256
Central African Republic	Low Income	7.477	0.344	5	118	-113	113	12769
Ethiopia	Low Income	5.865	0.438	35	111	-76	76	5776
Guinea	Low Income	6.672	0.435	21	112	-91	91	8281
Haiti	Low Income	5.091	0.486	66	107	-41	41	1681
Liberia	Low Income	4.787	0.429	81	113	-32	32	1024
Madagascar	Low Income	5.34	0.509	59	100	-41	41	1681

Country	*Income Group*	*Happiness Score*	*HDI Value*	*HI Rank*	*HDI Rank*	*d*	*mod d*	d^2
Malawi	Low Income	5.426	0.461	55	110	-55	55	3025
Nepal	Low Income	5.299	0.554	60	95	-35	35	1225
Niger	Low Income	4.156	0.34	103	119	-16	16	256
Rwanda	Low Income	5.101	0.503	65	104	-39	39	1521
Senegal	Low Income	5.033	0.481	68	108	-40	40	1600
Sierra Leone	Low Income	3.715	0.419	116	115	1	1	1
Tajikistan	Low Income	7.48	0.646	4	81	-77	77	5929
Thailand	Low Income	3.892	0.728	114	64	50	50	2500
Zimbabwe	Low Income	4.827	0.516	76	99	-23	23	529

Source: Calculated and presented by author on the basis of the data collected from World Happiness Reports, Human Development Reports & World Bank Data.

A3: Calculation of Deviation of HDI and HI Ranks (2015)

Country	*Income Group*	*Happiness Score*	*HDI Value*	*HI Rank*	*HDI Rank*	*d*	*mod d*	d^2
Australia	High Income	7.28399992	0.936	9	3	6	6	36
Austria	High Income	7.199999809	0.903	12	16	-4	4	16
Belgium	High Income	6.936999798	0.913	18	14	4	4	16
Canada	High Income	7.427000046	0.92	5	10	-5	5	25
Chile	High Income	6.670000076	0.84	22	33	-11	11	121
Cyprus	High Income	5.68900013	0.86	53	27	26	26	676
Czech Republic	High Income	6.505000114	0.882	25	22	3	3	9
Denmark	High Income	7.52699995	0.926	3	8	-5	5	25
Estonia	High Income	5.428999901	0.866	55	25	30	30	900
Finland	High Income	7.406000137	0.915	6	13	-7	7	49
France	High Income	6.574999809	0.898	23	19	4	4	16
Germany	High Income	6.75	0.933	21	4	17	17	289
Greece	High Income	4.856999874	0.866	81	26	55	55	3025
Hungary	High Income	4.800000191	0.834	83	34	49	49	2401
Iceland	High Income	7.56099987	0.927	2	7	-5	5	25
Ireland	High Income	6.940000057	0.929	17	5	12	12	144
Israel	High Income	7.277999878	0.901	10	17	-7	7	49
Italy	High Income	5.947999954	0.876	39	23	16	16	256
Japan	High Income	5.986999989	0.905	37	15	22	22	484
Latvia	High Income	5.09800005	0.841	71	32	39	39	1521
Lithuania	High Income	5.833000183	0.852	45	29	16	16	256
Luxembourg	High Income	6.946000099	0.899	16	18	-2	2	4
Malta	High Income	6.302000046	0.871	30	24	6	6	36
Netherlands	High Income	7.377999783	0.926	7	9	-2	2	4

Country	*Income Group*	*Happiness Score*	*HDI Value*	*HI Rank*	*HDI Rank*	*d*	*mod d*	d^2
Norway	High Income	7.521999836	0.948	4	1	3	3	9
Poland	High Income	5.790999889	0.855	49	28	21	21	441
Portugal	High Income	5.102000237	0.842	70	31	39	39	1521
Slovakia	High Income	5.994999886	0.851	36	30	6	6	36
Slovenia	High Income	5.84800005	0.889	44	20	24	24	576
Spain	High Income	6.328999996	0.885	29	21	8	8	64
Sweden	High Income	7.363999844	0.929	8	6	2	2	4
Switzerland	High Income	7.586999893	0.942	1	2	-1	1	1
Trinidad and Tobago	High Income	6.168000221	0.783	32	46	-14	14	196
United Kingdom	High Income	6.867000103	0.918	19	12	7	7	49
United States	High Income	7.118999958	0.92	14	11	3	3	9
Uruguay	High Income	6.485000134	0.8	26	42	-16	16	256
Albania	Upper Middle Income	4.959000111	0.776	75	51	24	24	576
Argentina	Upper Middle Income	6.573999882	0.822	24	36	-12	12	144
Azerbaijan	Upper Middle Income	5.211999893	0.758	62	55	7	7	49
Belarus	Upper Middle Income	5.813000202	0.805	48	40	8	8	64
Bosnia and Herzegovina	Upper Middle Income	4.948999882	0.755	76	57	19	19	361
Botswana	Upper Middle Income	4.331999779	0.706	104	72	32	32	1024
Brazil	Upper Middle Income	6.982999802	0.757	15	56	-41	41	1681
Bulgaria	Upper Middle Income	4.217999935	0.807	109	39	70	70	4900
China	Upper Middle Income	5.139999866	0.743	66	61	5	5	25
Colombia	Upper Middle Income	6.477000237	0.742	27	64	-37	37	1369
Costa Rica	Upper Middle Income	7.225999832	0.788	11	45	-34	34	1156
Croatia	Upper Middle Income	5.758999825	0.827	50	35	15	15	225
Dominican Republic	Upper Middle Income	4.885000229	0.729	78	69	9	9	81
Ecuador	Upper Middle Income	5.974999905	0.743	38	62	-24	24	576

Country	*Income Group*	*Happiness Score*	*HDI Value*	*HI Rank*	*HDI Rank*	*d*	*mod d*	d^2
Gabon	Upper Middle Income	3.895999908	0.694	118	75	43	43	1849
Iran	Upper Middle Income	4.68599987	0.789	88	44	44	44	1936
Iraq	Upper Middle Income	4.677000046	0.668	90	84	6	6	36
Jamaica	Upper Middle Income	5.709000111	0.73	52	68	-16	16	256
Kazakhstan	Upper Middle Income	5.855000019	0.797	43	43	0	0	0
Lebanon	Upper Middle Income	4.839000225	0.752	82	58	24	24	576
Mauritius	Upper Middle Income	5.477000237	0.782	54	48	6	6	36
Mexico	Upper Middle Income	7.186999798	0.767	13	53	-40	40	1600
Montenegro	Upper Middle Income	5.191999912	0.809	64	38	26	26	676
Morocco	Upper Middle Income	5.013000011	0.655	73	86	-13	13	169
Panama	Upper Middle Income	6.785999775	0.781	20	49	-29	29	841
Paraguay	Upper Middle Income	5.877999783	0.702	42	73	-31	31	961
Peru	Upper Middle Income	5.823999882	0.745	47	60	-13	13	169
Romania	Upper Middle Income	5.124000072	0.805	68	41	27	27	729
Russia	Upper Middle Income	5.71600008	0.813	51	37	14	14	196
Serbia	Upper Middle Income	5.123000145	0.78	69	50	19	19	361
South Africa	Upper Middle Income	4.642000198	0.692	91	78	13	13	169
Suriname	Upper Middle Income	6.269000053	0.722	31	71	-40	40	1600
Thailand	Upper Middle Income	6.454999924	0.741	28	65	-37	37	1369
Turkey	Upper Middle Income	5.331999779	0.783	58	47	11	11	121
Angola	Lower Middle Income	4.032999992	0.572	112	99	13	13	169

Country	*Income Group*	*Happiness Score*	*HDI Value*	*HI Rank*	*HDI Rank*	*d*	*mod d*	d^2
Armenia	Lower Middle Income	4.349999905	0.748	103	59	44	44	1936
Bangladesh	Lower Middle Income	4.693999767	0.592	87	95	-8	8	64
Bhutan	Lower Middle Income	5.252999783	0.603	61	93	-32	32	1024
Bolivia	Lower Middle Income	5.889999866	0.681	40	82	-42	42	1764
Cambodia	Lower Middle Income	3.819000006	0.571	120	100	20	20	400
Cameroon	Lower Middle Income	4.251999855	0.548	108	103	5	5	25
Congo (Brazzaville)	Lower Middle Income	3.989000082	0.613	114	91	23	23	529
Egypt	Lower Middle Income	4.193999767	0.691	110	79	31	31	961
El Salvador	Lower Middle Income	6.130000114	0.674	33	83	-50	50	2500
Georgia	Lower Middle Income	4.296999931	0.771	105	52	53	53	2809
Ghana	Lower Middle Income	4.632999897	0.585	92	96	-4	4	16
Guatemala	Lower Middle Income	6.123000145	0.645	34	88	-54	54	2916
Honduras	Lower Middle Income	4.788000107	0.609	84	92	-8	8	64
India	Lower Middle Income	4.565000057	0.627	95	90	5	5	25
Indonesia	Lower Middle Income	5.399000168	0.686	56	80	-24	24	576
Jordan	Lower Middle Income	5.191999912	0.733	65	67	-2	2	4
Kenya	Lower Middle Income	4.419000149	0.578	102	98	4	4	16
Kyrgyzstan	Lower Middle Income	5.285999775	0.666	59	85	-26	26	676
Laos	Lower Middle Income	4.875999928	0.593	79	94	-15	15	225
Lesotho	Lower Middle Income	4.897999763	0.511	77	109	-32	32	1024
Mauritania	Lower Middle Income	4.43599987	0.514	101	108	-7	7	49

Country	*Income Group*	*Happiness Score*	*HDI Value*	*HI Rank*	*HDI Rank*	*d*	*mod d*	d^2
Moldova	Lower Middle Income	5.888999939	0.693	41	76	-35	35	1225
Mongolia	Lower Middle Income	4.874000072	0.737	80	66	14	14	196
Nicaragua	Lower Middle Income	5.828000069	0.652	46	87	-41	41	1681
Nigeria	Lower Middle Income	5.268000126	0.527	60	106	-46	46	2116
Pakistan	Lower Middle Income	5.193999767	0.551	63	102	-39	39	1521
Philippines	Lower Middle Income	5.072999954	0.693	72	77	-5	5	25
Sri Lanka	Lower Middle Income	4.270999908	0.766	107	54	53	53	2809
Tunisia	Lower Middle Income	4.738999844	0.728	86	70	16	16	256
Ukraine	Lower Middle Income	4.681000233	0.743	89	63	26	26	676
Uzbekistan	Lower Middle Income	6.002999783	0.698	35	74	-39	39	1521
Vietnam	Lower Middle Income	5.360000134	0.684	57	81	-24	24	576
Yemen	Lower Middle Income	4.077000141	0.483	111	118	-7	7	49
Zambia	Lower Middle Income	5.129000187	0.583	67	97	-30	30	900
Afghanistan	Low Income	3.575000048	0.493	127	115	12	12	144
Benin	Low Income	3.339999914	0.508	129	111	18	18	324
Burkina Faso	Low Income	3.586999893	0.412	126	128	-2	2	4
Burundi	Low Income	2.904999971	0.418	130	125	5	5	25
Central African Republic	Low Income	3.677999973	0.357	123	130	-7	7	49
Chad	Low Income	3.667000055	0.407	124	129	-5	5	25
Comoros	Low Income	3.95600009	0.502	115	113	2	2	4
Congo (Kinshasa)	Low Income	4.517000198	0.444	97	121	-24	24	576
Ethiopia	Low Income	4.512000084	0.451	99	120	-21	21	441
Guinea	Low Income	3.655999899	0.443	125	122	3	3	9
Haiti	Low Income	4.518000126	0.493	96	116	-20	20	400
Liberia	Low Income	4.571000099	0.432	94	123	-29	29	841
Madagascar	Low Income	3.680999994	0.514	122	107	15	15	225

Country	*Income Group*	*Happiness Score*	*HDI Value*	*HI Rank*	*HDI Rank*	*d*	*mod d*	d^2
Malawi	Low Income	4.291999817	0.47	106	119	-13	13	169
Mali	Low Income	3.994999886	0.418	113	126	-13	13	169
Mozambique	Low Income	4.971000195	0.432	74	124	-50	50	2500
Nepal	Low Income	4.513999939	0.566	98	101	-3	3	9
Niger	Low Income	3.845000029	0.347	119	131	-12	12	144
Rwanda	Low Income	3.464999914	0.51	128	110	18	18	324
Senegal	Low Income	3.904000044	0.492	117	117	0	0	0
Sierra Leone	Low Income	4.506999969	0.413	100	127	-27	27	729
Tajikistan	Low Income	4.785999775	0.645	85	89	-4	4	16
Tanzania	Low Income	3.780999899	0.528	121	105	16	16	256
Togo	Low Income	2.838999987	0.495	131	114	17	17	289
Uganda	Low Income	3.930999994	0.505	116	112	4	4	16
Zimbabwe	Low Income	4.610000134	0.529	93	104	-11	11	121

Source: Calculated and presented by author on the basis of the data collected from World Happiness Reports, Human Development Reports & World Bank Data.

A4: Calculation of Deviation of HDI and HI Ranks (2016)

Country	*Income Group*	*Happiness score*	*HDI Value*	*HI Rank*	*HDI Rank*	*d*	*mod d*	d^2
Australia	High Income	7.313	0.938	8	3	5	5	25
Austria	High Income	7.119	0.906	11	16	-5	5	25
Belgium	High Income	6.929	0.915	16	14	2	2	4
Canada	High Income	7.404	0.922	6	10	-4	4	16
Chile	High Income	6.705	0.842	21	33	-12	12	144
Cyprus	High Income	5.546	0.867	54	27	27	27	729
Czech Republic	High Income	6.596	0.885	24	22	2	2	4
Denmark	High Income	7.526	0.928	1	8	-7	7	49
Estonia	High Income	5.517	0.868	57	25	32	32	1024
Finland	High Income	7.413	0.918	5	13	-8	8	64
France	High Income	6.478	0.899	28	19	9	9	81
Germany	High Income	6.994	0.934	14	4	10	10	100
Greece	High Income	5.033	0.868	77	26	51	51	2601
Hungary	High Income	5.145	0.835	72	34	38	38	1444
Iceland	High Income	7.501	0.933	3	6	-3	3	9
Ireland	High Income	6.907	0.934	17	5	12	12	144
Israel	High Income	7.267	0.902	10	18	-8	8	64
Italy	High Income	5.977	0.878	38	23	15	15	225
Japan	High Income	5.921	0.907	41	15	26	26	676
Latvia	High Income	5.560	0.844	53	32	21	21	441
Lithuania	High Income	5.813	0.855	47	29	18	18	324

Country	*Income Group*	*Happiness score*	*HDI Value*	*HI Rank*	*HDI Rank*	*d*	*mod d*	d^2
Luxembourg	High Income	6.871	0.904	18	17	1	1	1
Malta	High Income	6.488	0.875	26	24	2	2	4
Netherlands	High Income	7.339	0.928	7	9	-2	2	4
Norway	High Income	7.498	0.951	4	1	3	3	9
Poland	High Income	5.835	0.86	45	28	17	17	289
Portugal	High Income	5.123	0.845	74	31	43	43	1849
Slovakia	High Income	6.078	0.853	34	30	4	4	16
Slovenia	High Income	5.768	0.894	49	20	29	29	841
Spain	High Income	6.361	0.889	30	21	9	9	81
Sweden	High Income	7.291	0.932	9	7	2	2	4
Switzerland	High Income	7.509	0.943	2	2	0	0	0
Trinidad and Tobago	High Income	6.168	0.785	33	50	-17	17	289
United Kingdom	High Income	6.725	0.92	20	12	8	8	64
United States	High Income	7.104	0.922	12	11	1	1	1
Uruguay	High Income	6.545	0.802	25	42	-17	17	289
Albania	Upper Middle Income	4.655	0.782	86	51	35	35	1225
Argentina	Upper Middle Income	6.650	0.822	23	36	-13	13	169
Azerbaijan	Upper Middle Income	5.291	0.757	63	57	6	6	36
Belarus	Upper Middle Income	5.802	0.805	48	41	7	7	49
Belize	Upper Middle Income	5.956	0.709	40	72	-32	32	1024
Bosnia and Herzegovina	Upper Middle Income	5.163	0.766	69	55	14	14	196
Botswana	Upper Middle Income	3.974	0.712	113	71	42	42	1764
Brazil	Upper Middle Income	6.952	0.758	15	56	-41	41	1681
Bulgaria	Upper Middle Income	4.217	0.81	105	38	67	67	4489
China	Upper Middle Income	5.245	0.748	65	60	5	5	25
Colombia	Upper Middle Income	6.481	0.747	27	63	-36	36	1296
Costa Rica	Upper Middle Income	7.087	0.791	13	45	-32	32	1024

Country	*Income Group*	*Happiness score*	*HDI Value*	*HI Rank*	*HDI Rank*	*d*	*mod d*	d^2
Croatia	Upper Middle Income	5.488	0.828	59	35	24	24	576
Dominican Republic	Upper Middle Income	5.155	0.733	71	67	4	4	16
Ecuador	Upper Middle Income	5.976	0.749	39	59	-20	20	400
Gabon	Upper Middle Income	4.121	0.698	110	76	34	34	1156
Iran	Upper Middle Income	4.813	0.796	83	44	39	39	1521
Iraq	Upper Middle Income	4.575	0.672	89	85	4	4	16
Jamaica	Upper Middle Income	5.510	0.732	58	68	-10	10	100
Kazakhstan	Upper Middle Income	5.919	0.797	42	43	-1	1	1
Mauritius	Upper Middle Income	5.648	0.788	52	46	6	6	36
Mexico	Upper Middle Income	6.778	0.772	19	53	-34	34	1156
Montenegro	Upper Middle Income	5.161	0.81	70	39	31	31	961
Namibia	Upper Middle Income	4.574	0.645	90	90	0	0	0
Panama	Upper Middle Income	6.701	0.785	22	48	-26	26	676
Paraguay	Upper Middle Income	5.538	0.702	55	75	-20	20	400
Peru	Upper Middle Income	5.743	0.748	50	61	-11	11	121
Romania	Upper Middle Income	5.528	0.807	56	40	16	16	256
Russia	Upper Middle Income	5.856	0.815	44	37	7	7	49
Serbia	Upper Middle Income	5.177	0.785	68	49	19	19	361
South Africa	Upper Middle Income	4.459	0.696	93	79	14	14	196
Suriname	Upper Middle Income	6.269	0.719	32	70	-38	38	1444
Thailand	Upper Middle Income	6.474	0.748	29	62	-33	33	1089

Country	*Income Group*	*Happiness score*	*HDI Value*	*HI Rank*	*HDI Rank*	*d*	*mod d*	d^2
Turkey	Upper Middle Income	5.389	0.787	60	47	13	13	169
Turkmenistan	Upper Middle Income	5.658	0.705	51	73	-22	22	484
Angola	Lower Middle Income	3.866	0.577	116	100	16	16	256
Armenia	Lower Middle Income	4.360	0.749	97	58	39	39	1521
Bangladesh	Lower Middle Income	4.643	0.597	87	96	-9	9	81
Bhutan	Lower Middle Income	5.196	0.609	66	94	-28	28	784
Bolivia	Lower Middle Income	5.822	0.689	46	82	-36	36	1296
Cambodia	Lower Middle Income	3.907	0.576	115	101	14	14	196
Cameroon	Lower Middle Income	4.513	0.553	91	104	-13	13	169
Congo (Brazzaville)	Lower Middle Income	4.236	0.452	103	122	-19	19	361
Egypt	Lower Middle Income	4.362	0.694	96	80	16	16	256
El Salvador	Lower Middle Income	6.068	0.679	35	84	-49	49	2401
Georgia	Lower Middle Income	4.252	0.776	102	52	50	50	2500
Ghana	Lower Middle Income	4.276	0.588	100	97	3	3	9
Guatemala	Lower Middle Income	6.324	0.649	31	88	-57	57	3249
Honduras	Lower Middle Income	4.871	0.614	82	92	-10	10	100
India	Lower Middle Income	4.404	0.636	95	91	4	4	16
Indonesia	Lower Middle Income	5.314	0.691	61	81	-20	20	400
Jordan	Lower Middle Income	5.303	0.735	62	66	-4	4	16
Kenya	Lower Middle Income	4.356	0.585	98	99	-1	1	1
Kyrgyzstan	Lower Middle Income	5.185	0.669	67	86	-19	19	361

Country	*Income Group*	*Happiness score*	*HDI Value*	*HI Rank*	*HDI Rank*	*d*	*mod d*	d^2
Laos	Lower Middle Income	4.876	0.598	80	95	-15	15	225
Mauritania	Lower Middle Income	4.201	0.516	106	110	-4	4	16
Moldova	Lower Middle Income	5.897	0.697	43	77	-34	34	1156
Mongolia	Lower Middle Income	4.907	0.743	79	65	14	14	196
Nicaragua	Lower Middle Income	5.992	0.657	36	87	-51	51	2601
Nigeria	Lower Middle Income	4.875	0.53	81	107	-26	26	676
Pakistan	Lower Middle Income	5.132	0.56	73	103	-30	30	900
Philippines	Lower Middle Income	5.279	0.696	64	78	-14	14	196
Sri Lanka	Lower Middle Income	4.415	0.768	94	54	40	40	1600
Sudan	Lower Middle Income	4.139	0.499	109	116	-7	7	49
Tunisia	Lower Middle Income	5.045	0.732	76	69	7	7	49
Ukraine	Lower Middle Income	4.324	0.746	99	64	35	35	1225
Uzbekistan	Lower Middle Income	5.987	0.703	37	74	-37	37	1369
Vietnam	Lower Middle Income	5.061	0.689	75	83	-8	8	64
Yemen	Lower Middle Income	3.724	0.462	121	120	1	1	1
Zambia	Lower Middle Income	4.795	0.586	84	98	-14	14	196
Afghanistan	Low Income	3.360	0.494	128	118	10	10	100
Benin	Low Income	3.484	0.512	127	111	16	16	256
Burkina Faso	Low Income	3.739	0.42	119	126	-7	7	49
Burundi	Low Income	2.905	0.418	130	127	3	3	9
Chad	Low Income	3.763	0.405	118	129	-11	11	121
Comoros	Low Income	3.956	0.502	114	113	1	1	1
Congo (Kinshasa)	Low Income	4.272	0.612	101	93	8	8	64
Ethiopia	Low Income	4.508	0.457	92	121	-29	29	841

Country	*Income Group*	*Happiness score*	*HDI Value*	*HI Rank*	*HDI Rank*	*d*	*mod d*	d^2
Guinea	Low Income	3.607	0.449	125	123	2	2	4
Haiti	Low Income	4.028	0.496	112	117	-5	5	25
Liberia	Low Income	3.622	0.432	124	124	0	0	0
Madagascar	Low Income	3.695	0.517	122	109	13	13	169
Malawi	Low Income	4.156	0.474	108	119	-11	11	121
Mali	Low Income	4.073	0.421	111	125	-14	14	196
Nepal	Low Income	4.793	0.569	85	102	-17	17	289
Niger	Low Income	3.856	0.351	117	130	-13	13	169
Rwanda	Low Income	3.515	0.52	126	108	18	18	324
Senegal	Low Income	4.219	0.499	104	115	-11	11	121
Sierra Leone	Low Income	4.635	0.413	88	128	-40	40	1600
Tajikistan	Low Income	4.996	0.647	78	89	-11	11	121
Tanzania	Low Income	3.666	0.533	123	105	18	18	324
Togo	Low Income	3.303	0.5	129	114	15	15	225
Uganda	Low Income	3.739	0.508	120	112	8	8	64

Source: Calculated and presented by author on the basis of the data collected from World Happiness Reports, Human Development Reports & World Bank Data.

A4: Calculation of deviation of HDI and HI ranks (2017)

Country	*Income Group*	*Happiness Score*	*HDI Value*	*HI Rank*	*HDI Rank*	*d*	*mod d*	d^2
Australia	High Income	7.284	0.939	10	3	-7	7	49
Austria	High Income	7.006	0.908	13	19	6	6	36
Belgium	High Income	6.891	0.916	17	17	0	0	0
Canada	High Income	7.316	0.926	7	12	5	5	25
Chile	High Income	6.652	0.843	20	36	16	16	256
Cyprus	High Income	5.621	0.869	55	30	-25	25	625
Czech Republic	High Income	6.609	0.888	22	25	3	3	9
Denmark	High Income	7.522	0.929	2	11	9	9	81
Estonia	High Income	5.611	0.871	56	28	-28	28	784
Finland	High Income	7.469	0.92	5	15	10	10	100
France	High Income	6.442	0.901	30	22	-8	8	64
Germany	High Income	6.951	0.936	16	5	-11	11	121
Greece	High Income	5.227	0.87	73	29	-44	44	1936
Hong Kong S.A.R. of China	High Income	5.472	0.933	60	7	-53	53	2809
Hungary	High Income	5.324	0.838	64	37	-27	27	729
Iceland	High Income	7.504	0.935	3	6	3	3	9
Ireland	High Income	6.977	0.938	15	4	-11	11	121
Israel	High Income	7.213	0.903	11	21	10	10	100

Country	*Income Group*	*Happiness Score*	*HDI Value*	*HI Rank*	*HDI Rank*	*d*	*mod d*	d^2
Italy	High Income	5.964	0.88	40	26	-14	14	196
Japan	High Income	5.920	0.909	43	18	-25	25	625
Latvia	High Income	5.850	0.847	46	34	-12	12	144
Lithuania	High Income	5.902	0.858	44	32	-12	12	144
Luxembourg	High Income	6.863	0.904	18	20	2	2	4
Malta	High Income	6.527	0.878	26	27	1	1	1
Netherlands	High Income	7.377	0.931	6	10	4	4	16
New Zealand	High Income	7.314	0.917	8	16	8	8	64
Norway	High Income	7.537	0.953	1	1	0	0	0
Poland	High Income	5.973	0.865	39	31	-8	8	64
Portugal	High Income	5.195	0.847	74	34	-40	40	1600
Singapore	High Income	6.572	0.932	25	9	-16	16	256
Slovakia	High Income	6.098	0.855	35	33	-2	2	4
Slovenia	High Income	5.758	0.896	52	23	-29	29	841
Spain	High Income	6.403	0.891	32	24	-8	8	64
Sweden	High Income	7.284	0.933	9	7	-2	2	4
Switzerland	High Income	7.494	0.944	4	2	-2	2	4
Trinidad and Tobago	High Income	6.168	0.784	34	54	20	20	400
United Kingdom	High Income	6.714	0.922	19	14	-5	5	25
United States	High Income	6.993	0.924	14	13	-1	1	1
Uruguay	High Income	6.454	0.804	27	45	18	18	324
Albania	Upper Middle Income	4.644	0.785	91	53	-38	38	1444
Algeria	Upper Middle Income	5.872	0.754	45	63	18	18	324
Argentina	Upper Middle Income	6.599	0.825	23	39	16	16	256
Azerbaijan	Upper Middle Income	5.234	0.757	71	60	-11	11	121
Belarus	Upper Middle Income	5.569	0.808	57	44	-13	13	169
Belize	Upper Middle Income	5.956	0.708	42	74	32	32	1024
Bosnia and Herzegovina	Upper Middle Income	5.182	0.768	75	58	-17	17	289
Brazil	Upper Middle Income	6.635	0.759	21	59	38	38	1444
Bulgaria	Upper Middle Income	4.714	0.813	87	42	-45	45	2025

Country	*Income Group*	*Happiness Score*	*HDI Value*	*HI Rank*	*HDI Rank*	*d*	*mod d*	d^2
China	Upper Middle Income	5.273	0.752	67	64	-3	3	9
Colombia	Upper Middle Income	6.357	0.747	33	68	35	35	1225
Costa Rica	Upper Middle Income	7.079	0.794	12	48	36	36	1296
Croatia	Upper Middle Income	5.293	0.831	66	38	-28	28	784
Dominican Republic	Upper Middle Income	5.230	0.736	72	70	-2	2	4
Ecuador	Upper Middle Income	6.008	0.752	37	64	27	27	729
Gabon	Upper Middle Income	4.465	0.702	100	76	-24	24	576
Iran	Upper Middle Income	4.692	0.798	90	47	-43	43	1849
Iraq	Upper Middle Income	4.497	0.685	99	85	-14	14	196
Jamaica	Upper Middle Income	5.311	0.732	65	73	8	8	64
Kazakhstan	Upper Middle Income	5.819	0.8	51	46	-5	5	25
Mauritius	Upper Middle Income	5.629	0.79	54	50	-4	4	16
Mexico	Upper Middle Income	6.578	0.774	24	56	32	32	1024
Montenegro	Upper Middle Income	5.237	0.814	70	41	-29	29	841
Namibia	Upper Middle Income	4.574	0.647	93	91	-2	2	4
Panama	Upper Middle Income	6.452	0.789	29	51	22	22	484
Paraguay	Upper Middle Income	5.493	0.702	59	76	17	17	289
Peru	Upper Middle Income	5.715	0.75	53	67	14	14	196
Romania	Upper Middle Income	5.825	0.811	48	43	-5	5	25
Russia	Upper Middle Income	5.963	0.816	41	40	-1	1	1
Serbia	Upper Middle Income	5.395	0.787	62	52	-10	10	100

Country	*Income Group*	*Happiness Score*	*HDI Value*	*HI Rank*	*HDI Rank*	*d*	*mod d*	d^2
South Africa	Upper Middle Income	4.829	0.699	84	79	-5	5	25
Thailand	Upper Middle Income	6.424	0.755	31	61	30	30	900
Turkey	Upper Middle Income	5.500	0.791	58	49	-9	9	81
Turkmenistan	Upper Middle Income	5.822	0.706	50	75	25	25	625
Afghanistan	Low Income	3.794	0.498	122	118	-4	4	16
Benin	Low Income	3.657	0.515	123	114	-9	9	81
Burkina Faso	Low Income	4.032	0.423	115	127	12	12	144
Burundi	Low Income	2.905	0.417	131	129	-2	2	4
Central African Republic	Low Income	2.693	0.367	132	131	-1	1	1
Chad	Low Income	3.936	0.404	118	130	12	12	144
Congo (Kinshasa)	Low Income	4.280	0.457	108	123	15	15	225
Ethiopia	Low Income	4.460	0.463	101	121	20	20	400
Guinea	Low Income	3.507	0.459	127	122	-5	5	25
Haiti	Low Income	3.603	0.498	125	118	-7	7	49
Liberia	Low Income	3.533	0.435	126	125	-1	1	1
Madagascar	Low Income	3.644	0.519	124	112	-12	12	144
Malawi	Low Income	3.970	0.477	117	120	3	3	9
Mali	Low Income	4.190	0.427	109	126	17	17	289
Mozambique	Low Income	4.550	0.437	95	124	29	29	841
Nepal	Low Income	4.962	0.574	82	103	21	21	441
Niger	Low Income	4.028	0.354	116	132	16	16	256
Rwanda	Low Income	3.471	0.524	129	109	-20	20	400
Senegal	Low Income	4.535	0.505	97	115	18	18	324
Sierra Leone	Low Income	4.709	0.419	88	128	40	40	1600
Tajikistan	Low Income	5.041	0.65	79	89	10	10	100
Tanzania	Low Income	3.349	0.538	130	106	-24	24	576
Togo	Low Income	3.495	0.503	128	116	-12	12	144
Uganda	Low Income	4.081	0.516	114	113	-1	1	1
Zimbabwe	Low Income	3.875	0.535	119	107	-12	12	144
Angola	Lower Middle Income	3.795	0.581	121	101	-20	20	400
Armenia	Lower Middle Income	4.376	0.755	103	61	-42	42	1764
Bangladesh	Lower Middle Income	4.608	0.608	92	95	3	3	9

Country	*Income Group*	*Happiness Score*	*HDI Value*	*HI Rank*	*HDI Rank*	*d*	*mod d*	d^2
Bhutan	Lower Middle Income	5.011	0.612	80	94	14	14	196
Bolivia	Lower Middle Income	5.823	0.693	49	84	35	35	1225
Cambodia	Lower Middle Income	4.168	0.582	110	100	-10	10	100
Cameroon	Lower Middle Income	4.695	0.556	89	105	16	16	256
Congo (Brazzaville)	Lower Middle Income	4.291	0.606	106	96	-10	10	100
Egypt	Lower Middle Income	4.735	0.696	86	81	-5	5	25
El Salvador	Lower Middle Income	6.003	0.674	38	86	48	48	2304
Georgia	Lower Middle Income	4.286	0.78	107	55	-52	52	2704
Ghana	Lower Middle Income	4.120	0.592	112	97	-15	15	225
Guatemala	Lower Middle Income	6.454	0.65	27	89	62	62	3844
Honduras	Lower Middle Income	5.181	0.617	76	93	17	17	289
India	Lower Middle Income	4.315	0.64	104	92	-12	12	144
Indonesia	Lower Middle Income	5.262	0.694	69	82	13	13	169
Jordan	Lower Middle Income	5.336	0.735	63	71	8	8	64
Kenya	Lower Middle Income	4.553	0.59	94	98	4	4	16
Kyrgyzstan	Lower Middle Income	5.004	0.672	81	87	6	6	36
Lesotho	Lower Middle Income	3.808	0.52	120	110	-10	10	100
Mauritania	Lower Middle Income	4.292	0.52	105	110	5	5	25
Moldova	Lower Middle Income	5.838	0.7	47	78	31	31	961
Mongolia	Lower Middle Income	4.955	0.741	83	69	-14	14	196
Myanmar	Lower Middle Income	4.545	0.578	96	102	6	6	36

Country	*Income Group*	*Happiness Score*	*HDI Value*	*HI Rank*	*HDI Rank*	*d*	*mod d*	d^2
Nicaragua	Lower Middle Income	6.071	0.658	36	88	52	52	2704
Nigeria	Lower Middle Income	5.074	0.532	77	108	31	31	961
Pakistan	Lower Middle Income	5.269	0.562	68	104	36	36	1296
Philippines	Lower Middle Income	5.430	0.699	61	79	18	18	324
Sri Lanka	Lower Middle Income	4.440	0.77	102	57	-45	45	2025
Sudan	Lower Middle Income	4.139	0.502	111	117	6	6	36
Tunisia	Lower Middle Income	4.805	0.735	85	71	-14	14	196
Ukraine	Lower Middle Income	4.096	0.751	113	66	-47	47	2209
Vietnam	Lower Middle Income	5.074	0.694	77	82	5	5	25
Zambia	Lower Middle Income	4.514	0.588	98	99	1	1	1

Source: Calculated and presented by author on the basis of the data collected from World Happiness Reports, Human Development Reports & World Bank Data.

Inter-linkage Between Credit and Housing Prices in India: Some Preliminary Findings

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Abstract

This chapter attempts to characterise the credit-house price linkage in the Indian context. While linking the loan and housing markets through mortgage loans is a common phenomenon in many advanced countries, recently significant co-movement between credit and housing price cycles is being observed in India as well. The chapter provides a brief overview of recent developments in India's housing and credit markets and develops a framework for analyzing the relation between the two. It also examines evidence on housing prices and credit at both the national and sub-national levels, carrying out panel causality tests using data on thirteen Indian cities. The results indicate that causality from house prices to credit is more prominent and real estate prices do influence lending by banks. These results are consistent with the theoretical model in Arora et al. (2018) wherein financial intermediaries learn from actual house price movements and form expectations for future movements' in house price. While they may be explained through wealth and collateral effects on borrowing, they are also consistent with speculative lending behaviour by financial intermediaries as shown by Arora et al. (2018).

Introduction

Analyses of macro-economic crises have repeatedly highlighted the nexus between the real estate and financial sectors, be it the Asian crisis of 1997 or the sub-prime crisis in the US and the consequent financial meltdown that unfolded in the more recent past. One of the main insights into these experiences is that there may be a systematic link between housing prices and the credit market in both industrialised as well as emerging market economies. A large body of theoretical and empirical literature examines this issue in the context of the industrialised countries (Cerutti et al., 2017, Bordo and Jeanne, 2002; Reinhart and Rogoff, 2008, 2009, Mendoza and Terrones, 2008, Breuckner, 2012; Hott, 2011 and Goodhart and Hofmann, 2008). Recently (since 2010 onwards), researchers have also analyzed this interlinkage between credit and housing prices for emerging market economies like Che, et al (2011) try to identify the linkages between property prices and bank lending in twenty regional financial centres in

China. Finding long-run causality between property prices and bank lending for each financial centre, the paper concludes that bank lending does play an important role in pushing up property prices.

However, the literature on emerging economies remains sparse, with a dearth of rigorous empirical analyses especially for India. This chapter addresses the gap in the literature as it examines empirical evidence on the inter-linkage between credit and housing prices in the context of India based on sub-national data from thirteen cities. The empirical findings provide useful evidence for informing policies that may be critical for overall financial stability. The chapter is organised as follows: First, a framework is developed for analyzing the relation between housing price and credit and the reasons for variations in this relationship across different cities by drawing on theoretical perspectives in the existing literature (Section 2). This is followed by an analysis of stylised facts pertaining to the credit-house price linkage in the Indian scenario based on quarterly data from selected Tier 1 and Tier 2 Indian cities from 2007 to 2018 (Section 3). This discussion provides the necessary backdrop for the empirical analysis and the main conclusions that follow from the results obtained (Section 4).

Analytical Framework

Housing prices, the quantum of housing supply, and terms of credit are outcome variables determined in the housing and credit markets, respectively. Analyses of the linkage between credit and housing price, therefore, require a clear understanding of demand and supply-side factors affecting these two markets.

Home buyers and firms are important players who generate demand for housing and commercial property, for self-consumption as well as investment for resale. Real estate companies and landowners are key agents on the supply side, whose decisions affect the quantum and the cost of owning property. Fundamental economic factors affecting the housing market from the demand and supply sides include the real interest rate, the rate of income growth, actual cost of owning a house, opportunity cost of funds invested in buying a house (in terms of return on the capital had it been used for investing in alternative assets), rates of return on investments in housing projects, and expectations regarding future growth in housing prices.[1] Lower real interest rates can boost housing demand by reducing the cost of debt financing and the opportunity cost of buying a house. On the supply side, this may lead to an expansion in housing supply by lowering

[1] This discussion draws on Himmelberg et al. (2005).

the cost of funds and leading to the expectation of higher property prices and higher returns on housing projects. Land availability can be a critical constraint affecting outcomes in the housing market. The shortage of land (either real or created by speculative investment in the land) can lead to an excessive increase in its cost, which in turn can lead to wide divergence between costs of construction and property price.

The demand for credit by firms (both public and private) and households may be viewed as 'derived' demand, influenced by decisions to purchase capital goods and assets (including housing). Financial intermediaries are key players in the credit market as their decisions impact both the quantum of credit as well as its allocation across sectors. The overall macro-economic scenario, including monetary policy, financial buoyancy (reflected in equity prices and prices of other financial assets) and investment climate, affect both firms' demand for credit and the supply of credit by the financial system. These affect the housing markets especially through the rate of income growth and expectations regarding future movements in asset (housing) prices.

Natural linkages exist between real estate and credit markets. Housing, just like other capital goods, is typically financed by borrowing and property serves as important collateral against which loans may be secured. So the rise in housing prices and demand for credit can go hand-in-hand. At the same time, the supply of credit affects outcomes in the housing market via agents' ability to purchase houses and the ability of real estate companies to construct them, both being linked to credit availability or cost of credit.

Causality may run from the credit to the housing market. When borrowers are credit constrained, institutional reforms that lead to an expansion in credit supply can contribute to rise in house prices by creating a higher demand for housing, especially in the short run when housing supply is unchanged. Low cost of borrowing under monetary easing, raises the present discounted value of asset returns, leading to a rise in demand for assets (including housing) and putting upward pressure on asset prices. This may also spur investment by debt-financed real estate companies, leading to a rise in housing supply with a dampening effect on the growth in housing prices in the long run.

In turn, house prices can affect the demand for and the supply of credit. Booming housing prices may lead to higher credit demand due to collateral and wealth effects as well as positive house price expectations of home buyers and investors. It can also lead to an enhanced supply of credit owing to positive house price expectations of lenders.

Expectations about house prices play a very important role in the interlinkage between house prices and credit, influencing both demand and supply sides of housing and credit markets. So far as borrowers are concerned, the expectation of house price appreciation and capital gains from house ownership effectively lowers the user cost of housing and contributes to increasing in housing demand (Himmelberg et al., 2005). In the short run, this can lead to a rising in housing prices, which in turn can affect decision-making by real estate firms and bring forth an increase in housing supply in the longer run. The expected rise in housing price also raises the demand for credit, via housing loans as well as debt-financed investment by real estate companies. On the credit supply side, house price expectations of financial intermediaries can encourage imprudent, speculative lending as was demonstrated during the sub-prime crisis in the US.

Theoretical models have shown that under reasonable assumptions, speculative lending behaviour fuelled by house price expectations of financial intermediaries can lead to financial instability. For instance, Arora, et al. (2018) show that interlinkage between the housing and loan markets inherently generates potential instability in the system. Any negative shock to income or employment can lead to defaults which, if sufficiently widespread, may result in bank failures with disastrous consequences for the entire financial system. Falling value of collateral affects banks' asset values and thus their capacity to lend. The dwindling supply of loans may in turn adversely affect the demand for housing leading to further collapse in housing prices.

In this way, a two-way feedback loop is created between loan and housing markets which are pro-cyclical in nature. In a booming economy, it is expected that credit and house prices would be on an upswing, feeding on to each other. Whereas a negative shock can have cumulative effects and induce a downturn in asset prices, collateral values, and borrowing capacities (of both firms and households). This way the cycles in credit and housing prices move together. Overall when causality runs from credit to housing prices, this indicates the presence of a credit constraint on the supply side. Whereas, in the case of credit growth fuelled by growth in housing prices, the role of expectations and operation of a borrowing constraint (owing to the inadequacy of collateral) on the demand side is indicated.

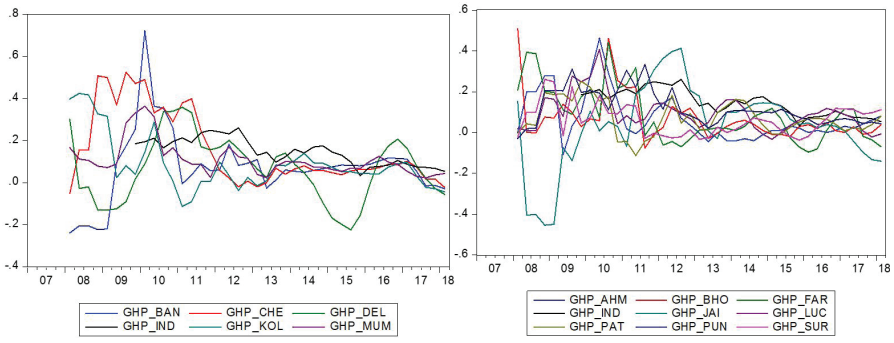
These arguments capture the linkage between credit and housing prices in general in the aggregate. However, this link may differ across cities at the sub-national level. In a setup like India, the terms of credit, governed by lending policies of banks set at the national level within the overall guidelines of the central bank, is unlikely to show much variation across cities. As such,

the real interest rate which affects the opportunity cost of funds invested in housing is likely to be more or less similar across the nation. However, the demand for credit and house price are both likely to vary widely at the sub-national level as these would be affected by factors such as the level of economic activity, the actual cost of owning a house, expected capital gain due to house price appreciation, and the initial level of the house price. For instance, rates of property tax, maintenance cost, and returns from renting a property may vary significantly across cities. In particular, there can be wide variation in expected rates of house price appreciation across cities owing to, *inter alia,* differences in land price dynamics. Expected appreciation lowers the user cost of housing and spurs demand for housing (Himmelberg et al., 2005). Therefore, urban-centric economic growth that leads to a high demand for land in around urban centres and high expected appreciation in housing prices also gives the rise to higher demand for credit. Empirical evidence bears this out—'superstar cities' experience high long-run rates of house price growth and cities with higher price-to-rent ratios have the highest expected growth rates of prices and rents (Gyourko, et al., 2004; Sinal and Souleles, 2005). Therefore, long-run growth in house prices in excess of real construction costs suggests is suggestive of the correspondingly high rate of appreciation of the underlying land, which may be an important reason for inter-city differences in housing prices, price expectations, and credit demand.

The central insight from the earlier discussion is that even when faced with similar lending conditions (captured by real interest rate, say), underlying differences in price expectations can lead to different outcomes with respect to user cost of housing and housing prices across cities. Since expected appreciation lowers user cost of housing, cities, where expected house price appreciation is high, have relatively lower user costs than areas where expected house price appreciation is low. Any given change in real interest rates, then, operates on a lower user cost base in high price growth cities, yielding a larger percentage effect. Himmelberg et al. (2005) provide a specific example to demonstrate this point. It is shown that if expected real rate of appreciation on housing was 2.8 per cent rather than 1.8 per cent, the predicted user cost would have been 4 per cent instead of 5, and the potential house price-to-rent ratio would be 25 instead of 20; with an even higher rate of expected price growth, say 3.8 per cent, the predicted user cost would be 3 per cent and the implied price-to-rent ratio would be even higher at 33.3. Apart from the importance of expectations, the example brings out how differing price expectations may lead to widely different outcomes across cities.

The Indian Scenario

India is urbanising rapidly and estimates suggest that by 2050 India's urban and semi-urban areas will account for over half of its population that is over 900 million people. This will generate a huge demand for land, inter alia, for catering to housing needs. In India, real estate is a very popular form in which households hold their wealth with evidence indicating more than 90 per cent of household wealth in India is tied up in land or buildings (Anand and Thampi, 2016). Indeed, between 2001 and 2011 there was a sharp uptick in urbanisation and the 2000s decade witnessed rapid growth in the real estate sector with expansion in both residential housing as well as in the market for commercial real estate. This period also saw rapid growth in housing prices across India, in both Tier 1 and Tier 2 cities (Figure 1). The All India trend closely reflects that in the Tier 1 cities, where except Delhi, the trends have been very similar especially since 2013 when the growth in house prices tapered off. Whereas, house prices in Tier 2 cities show greater diversity, compared to the All India trend, especially during the slowdown phase.



Tier 1 Cities Tier 2 Cities

Fig. 1: Quarter on Quarter Growth of Housing Prices in Tiers 1 and 2 cities and All India

Source: Authors' calculations; *data source:* The National Housing Bank.

Tier 1 cities include Mumbai, Delhi, Bangalore, Kolkata, Chennai and Tier 2 cities are Ahmedabad, Lucknow, Jaipur, Faridabad, Patna, Bhopal, Surat, and Pune.

Several factors contributed to the buoyancy in the real estate sector. These include initiatives by the government such as repeal of the Urban Land (Ceiling and Regulation) Act that gave a boost to the urban land market; fiscal incentives provided to households in the form of income tax relief on home loans and to real estate companies as exemption on profits and enhanced depreciation allowances for real estate companies (Thingalaya et al., 2009). Policy push for affordable housing, with the Pradhan Mantri

Awas Yojana (PMAY-Urban) aiming to achieve 'Housing for All' by 2022, has also contributed to buoyancy in the real estate market (FICCI and JLL, 2018).

However, house price growth has been slowing down since 2013 and prospects for a robust recovery in the housing sector do not appear bright at the moment. The slowdown has been prolonged in the wake of recent policy initiatives such as demonetisation, and the implementation of RERA, the introduction of GST and the Benami Transactions Act. The implementation of RERA has contributed to the creation of a conducive environment for the return of equity participation in this sector and these reforms have placed India at 35th position in 2018 up from 40th on the Global Real Estate Transparency Index (FICCI and JLL, 2018). Residential housing markets slowed down post-RERA and GST-introduction and showed some signs of revival in 2018, driven by affordable (40 lakh range) housing. However, large and mid-sized formal developers have largely been unsuccessful in supplying affordable housing to low-income customers as they tend to be more expensive and construct large projects that are further away from the city in less desirable locations. These distant locations also may lack infrastructure and require large investments, which further shrink the already low margins of such projects. Moreover, real estate developers are over-leveraged, as currently, debt structures dominate fund inflows in residential markets. This explains the relatively poor performance of real estate giants despite the recovery in real estate markets, especially in the affordable housing segment.

Commercial spaces have also been an important driver of growth for the real estate sector. Here information technology (IT) occupies the maximum office space, with large domestic players like Infosys, TCS, and multinationals like Accenture, Cognizant, and IBM continuing to expand across cities despite a slowdown in the residential housing segment (FICCI and JLL, 2018). In particular, the NCR of Delhi, Bengaluru, Hyderabad, and Pune are beneficiaries of the IT and consulting companies' real estate occupancy and these are also seeing the expansion of non-IT office space. The shopping mall sector is also showing healthy growth in these cities; even though vacancy rates are often high, the expansion is based on the expectation that prospects remain sound.

The rise in property prices was accompanied by a significant increase in bank credit for private housing mortgages; between 2001 and 2005, the share of personal loans in total bank credit increased by 10 percentage points and over half of this increase was accounted for solely by housing mortgages (Nagaraj, 2013). Within overall credit given to the private

non-financial sector at all India level, the component of credit given to households although small has been rising over time (Figure 2).

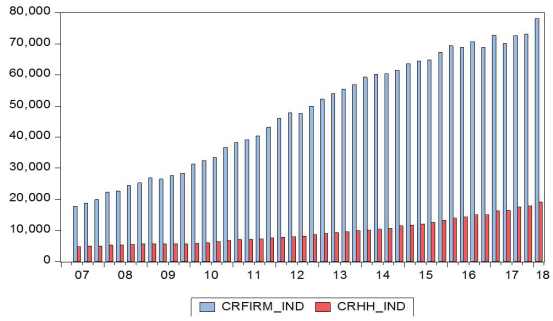


Fig. 2: Credit to Households and Firms in India: Q1 2007 to Q1 2018 (in Billion Rs)

Source: Authors' calculations; *data source:* Bank for International Settlements (BIS)

From April 2004, banks were allowed to treat direct loans to home buyers under priority sector lending, giving a boost to the supply side of the housing finance market. Private banks have also entered the housing loan market apart from public sector banks that already existed. Banks often created a specialised housing finance subsidiary to concentrate on this market segment. Apart from these, specialised housing finance companies are the other players supplying housing finance in the Indian context. Indeed rapid expansion of the housing loan business of banks and intense competition among them in this segment kept interest rates at competitive levels and opened up the possibility of indiscriminate lending by banks.

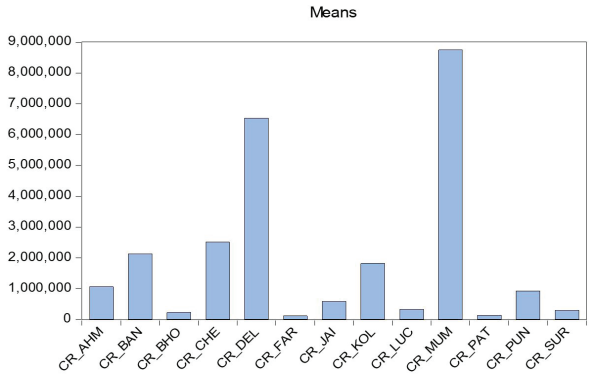
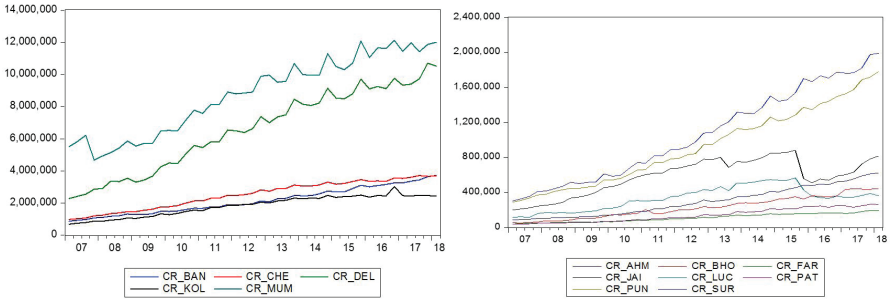


Fig. 3: Average Bank Credit in Tier 1 and Tier 2 Cities (2007-18) (in Billion Rs.)
Source: Authors' calculations; *data source:* Reserve Bank of India.

Tier 1 cities include Mumbai, Delhi, Bangalore, Kolkata, Chennai and Tier 2 cities are Ahmedabad, Lucknow, Jaipur, Faridabad, Patna, Bhopal, Surat, and Pune.

However, the picture is not uniform across India, with signs of a regional bias discernible in the distribution of loans. Home loans are relatively more concentrated in the Western and Southern regions at the expense of the Eastern, North-Eastern, and Central regions (Thingalaya, 2009). Further, there is a marked urban bias, with a concentration of home loan disbursals among relatively developed districts within regions. Available data also shows sharp differences across Tier 1 and Tier 2 cities in terms of credit disbursal (Figure 3).

Average credit volume is far higher in Tier 1 cities, with Mumbai at the top, followed by Delhi. Over time the pattern (moving averages) of credit disbursal in both city groups shows a similar rising trend, with Delhi and Mumbai being on top among the Tier 1 and Ahmedabad and Faridabad topping the Tier 2 cities (Figure 4). However, in terms of the sheer volume of credit, the Tier 1 cities, especially Mumbai and Delhi, are way ahead of the rest.



Tier 1 Cities Tier 2 Cities

Fig. 4: Credit Overtime in Tier 1 Cities (in Billion Rs.)

Source: Authors' calculations; *data source:* Reserve Bank of India.

Tier 1 cities include Mumbai, Delhi, Bangalore, Kolkata, Chennai and Tier 2 cities are Ahmedabad, Lucknow, Jaipur, Faridabad, Patna, Bhopal, Surat, and Pune.

Evidence of co-movement in house price and credit cycles is evident in the data in the Indian context, with both credit to firms as well as households and the house price showing cyclical co-movement (Figure 5). While such co-movement between the total credit and house price is visually apparent in graphical representations, this chapter formally attempts to identify the direction of causality between the two series using rigorous empirical analysis, carried out in the next section (Kundu, 2019).

Differences are also discernible in the credit-house price linkage across Tier 1 and Tier 2 cities (Figure 6).

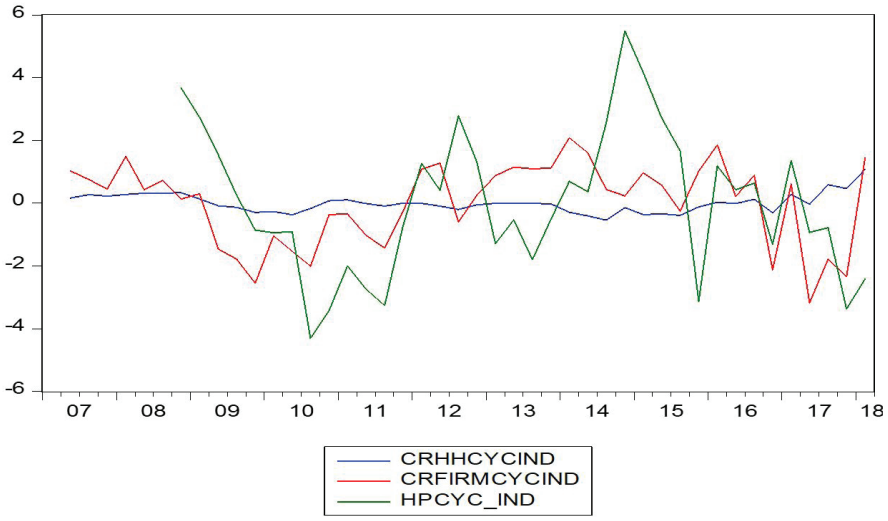
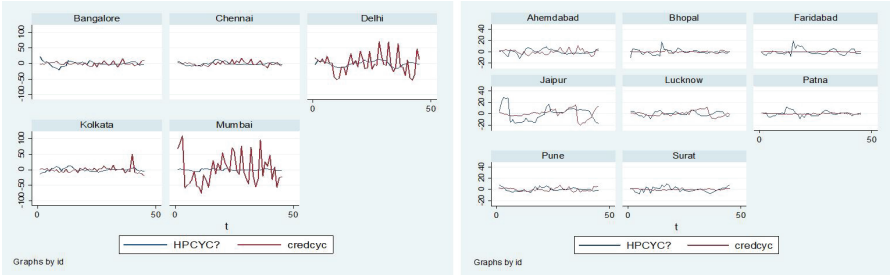


Fig. 5: Cycles in Credit to Households, Firms, and House Price for India
Source: Authors' calculations; data source: Bank for International Settlements (BIS). The data series is de-trended using the Hodrick-Prescott filter.



Tier 1 Cities Tier 2 Cities

Fig. 6: Cycles in Credit and Housing Prices in Tier 1 and Tier 2 cities

Source: Authors' calculations; *data source:* Reserve Bank of India and National Housing Bank. The data series is de-trended using the Hodrick-Prescott filter.

Tier 1 cities include Mumbai, Delhi, Bangalore, Kolkata, Chennai and Tier 2 cities are Ahmedabad, Lucknow, Jaipur, Faridabad, Patna, Bhopal, Surat, and Pune.

There are signs of co-movement in cycles of house price and credit in Delhi and Mumbai, although the credit data also displays a strong seasonal pattern. In the case of Delhi, it is visually quite apparent that house price movements occur first and seem to be causing changes in credit. However, relatively little sign of such co-movement is observed in the Tier 2 cities. The analytical framework also suggests interlinkage between the real estate market and loan market is expected to be stronger in Tier1 cities since bank credit is much higher on an average in Tier 1 cities as shown in Figure 3.

Even with similar terms of credit (real interest rates), higher house price expectations in Tier 1 cities (linked with rapid urbanisation and prospects of urban-centric growth picking momentum), is likely to affect (lower) the user cost of housing and trigger higher rise in housing prices and hence the growth in credit.

Apart from the factors discussed earlier, variation in the price of land is an important factor contributing to differences in property prices across regions and cities. It has been argued that the complex regulatory framework governing land transactions, especially the transfer of agricultural land for non-agricultural usage, is not conducive to the optimal allocation of land. Rather, it creates an artificial demand by encouraging speculative investment in land, which leads to an excessive increase in the cost of land, which in turn can lead to a wide divergence between the costs of construction and the price of housing (Singh, 2018). Additionally, there is a wide variation in the tax regime governing property transactions across states in India.

The brief analysis of the Indian real estate scenario and credit-house price linkage in the Indian context provides the backdrop for comprehending the results of the empirical analysis that follows.

Empirical Analysis, Results, and Discussion

A panel data set is created using quarterly data on thirteen Indian cities covering the period from the first quarter of 2007 to the first quarter of 2018. Panel time-series techniques are used rather than city-wise time series data as the panel data helps to overcome the problem arising due to lack of sufficiently long time series data on housing prices in Indian cities. Table containing results of the empirical analysis is provided in the Appendix.

Panel unit root tests on house prices (Appendix Table A1) and credit (Appendix Table A2) reveal that both series have unit roots that can be eliminated by taking first differences. Thus, both credit and house price series are nonstationary and integrated of Order 1. Thereafter, the Johansen-Fisher panel co-integration test between the two variables rejects the null hypothesis of no co-integration (Appendix Table A3). There is clear evidence, therefore of a long run relation between credit and house prices in the Indian context. In fact, the results of the co-integration tests are unchanged even when they are carried out separately for the group of Tier 1 and Tier 2 cities.[2]

[2] These results are not reported in the paper but are available from the authors on request.

Pair wise Granger Causality Tests suggest that causality runs from housing prices to credit in Indian cities and not the other way round (Appendix Table A4). Similar results are obtained when panel Granger Causality Tests are performed separately for the group of Tier 1 and Tier 2 cities.[3]

The main finding from this study on Indian cities reveals that long-run linkages between housing prices and credit do exist in the Indian context, with causality running from house price to credit, rather than the other way around. That is, real estate prices do influence the credit market in Indian cities corroborating the evidence visible especially for Tier 1 cities where financial markets are more developed and urban-centric growth is likely to keep house price expectations and actual house prices high and fast-growing.

An interesting feature of the results obtained herein is that the house price–credit linkage in the empirical analysis applies to the Tier 1 cities that are financially more developed as well as to the Tier 2 cities, which are less so. This can be understood in terms of certain trends discernible in the case of the Tier 2 cities. Available evidence indicates that retail investors are increasingly looking at Tier II and III cities as these have more scope for the growth. In fact, between 2013 and 2017, pan-India suburbs rents grew faster by 18 per cent, as compared to 13 per cent and 0.3 per cent for the more developed Secondary Business Districts (SBDs) and Central Business Districts CBDs), respectively.

There are several takeaways from these results, as the observed pattern of causality may be the outcome of different processes. In terms of the framework developed in the chapter, causality from house price to credit indicates the operation of wealth and collateral effects on borrowing and indicates the absence of a credit constraint in the Indian scenario. Also, causality running from house price to credit indicates the role of certain factors other than credit availability in influencing housing prices in the Indian context. Since economic agents typically form expectations about future house price by learning from previous trends, house price expectations are often proxied by the past housing prices in the literature (Brueckner, 2012). Therefore, the result that housing prices are *causing* credit is indicative of the role of expectations in driving credit.

In light of the 'user cost'-driven explanation for the behaviour of house price, this finding highlights the likely role of expectations regarding housing prices. Expected appreciation in housing price, lowers user cost

[3] These results are not reported in the paper but are available from the authors on request.

and fuels demand for housing, rise in house prices followed by a rise in credit demand. It also points to the likely role of other factors, especially land prices, in affecting the cost of ownership and hence, the price of a house. Finally, these results are also consistent with the theoretical model in Arora et al. (2018) wherein financial intermediaries learn from actual house price movements and form expectations for future movements' in house price. In this case, too causality running from housing price to credit would be observed empirically. While these results help in characterising the broad trends emerging in the Indian scenario, more detailed analysis is called for in identifying the exact set of causal factors at play in the current context.

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APPENDIX

Data Sources

This study uses quarterly data on credit at all India level from the Bank of International Settlements. Credit given to the private non-financial sector includes credit to non-financial corporations (both private and public sector) and credit to households and non-profit institutions serving households (NPISH). Three types of data on credit at all India level are analysed. These are credit (in billions of the Indian Rupee) given to: (a) households and NPISH; (b) non-financial corporations (firms); and (c) aggregate private non-financial sector consisting of aggregates (a) and (b). In terms of financial instruments, credit covers loans, debt securities, currency, and deposits. Quarterly data on housing prices at all India level is obtained from the Reserve Bank of India.

City-level quarterly data on the Housing Price Index is obtained from the National Housing Bank and data on bank credit given by scheduled commercial banks city wise is obtained from the Reserve Bank of India. The cities are classified according to the Sixth Pay Commission and Tier 1 cities include Mumbai, Delhi, Bangalore, Kolkata, Chennai and Tier 2 cities are Ahmedabad, Lucknow, Jaipur, Faridabad, Patna, Bhopal, Surat, and Pune.

Co-movements between cycles around the trend in housing prices and credit in Indian cities are analyzed. The data series is de-trended using the Hodrick-Prescott filter with a lambda value of 1,600 and graphing techniques are used to study co-movement in housing prices and credit.

Empirical Results

Table A1: Summary of Panel Unit Root Tests on House Price and its First Difference

Panel unit root test: Summary Series: HP Date: 08/08/19 Time: 12:39 Sample: 2007Q1 2018Q1 Exogenous variables: Individual effects Automatic selection of maximum lags Automatic lag length selection based on SIC: 0 to 5 Newey-West automatic bandwidth selection and Bartlett kernel				
Method	*Statistic*	*Prob.***	*Cross-Sections*	*Obs*
Null: Unit root (assumes common unit root process)				
Levin, Lin, and Chu t*	–2.55421	0.0053	13	560
Null: Unit root (assumes individual unit root process)				
Im, Pesaran, and Shin W-stat	0.35447	0.6385	13	560

ADF-Fisher Chi-square	28.3741	0.3403	13	560
PP-Fisher Chi-square	23.7027	0.5930	13	572
Notes: ** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.				

Panel unit root test: Summary
Series: D(HP)
Date: 08/08/19 Time: 12:40
Sample: 2007Q1 2018Q1
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 4
Newey-West automatic bandwidth selection and Bartlett kernel

Method	*Statistic*	*Prob.***	*Cross-Sections*	*Obs*
Null: Unit root (assumes common unit root process)				
Levin, Lin, and Chu t*	–21.0396	0.0000	13	553
Null: Unit root (assumes individual unit root process)				
Im, Pesaran, and Shin W-stat	–20.4338	0.0000	13	553
ADF Fisher Chi-square	336.361	0.0000	13	553
PP Fisher Chi-square	366.910	0.0000	13	559
Notes: ** Probabilities for Fisher tests are computed using an asymptotic Chi. square distribution. All other tests assume asymptotic normality.				

Table A2: Summary of Panel Unit Root Tests on Bank Credit and its First Difference

Panel unit root test: Summary
Series: CR
Date: 08/08/19 Time: 12:45
Sample: 2007Q1 2018Q1
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 8
Newey-West automatic bandwidth selection and Bartlett kernel

Method	*Statistic*	*Prob.***	*Cross-Sections*	*Obs*
Null: Unit root (assumes common unit root process)				
Levin, Lin, and Chu t*	3.67031	0.9999	13	527
Null: Unit root (assumes individual unit root process)				
Im, Pesaran, and Shin W-stat	6.04241	1.0000	13	527
ADF Fisher Chi-square	13.6541	0.9773	13	527
PP Fisher Chi-square	9.42755	0.9988	13	572

Panel unit root test: Summary Series: D(CR) Date: 08/08/19 Time: 12:46 Sample: 2007Q1 2018Q1 Exogenous variables: Individual effects Automatic selection of maximum lags Automatic lag length selection based on SIC: 0 to 7 Newey-West automatic bandwidth selection and Bartlett kernel				
Method	*Statistic*	*Prob.***	*Cross-Sections*	*Obs*
Null: Unit root (assumes common unit root process)				
Levin, Lin, and Chu t*	-14.3234	0.0000	13	528
Null: Unit root (assumes individual unit root process)				
Im, Pesaran, and Shin W-stat	-13.0356	0.0000	13	528
ADF Fisher Chi-square	226.042	0.0000	13	528
PP Fisher Chi-square	493.254	0.0000	13	559
Notes: ** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.				

Table A3: Summary of Johansen Fisher Panel Co-integration Tests

Series: CR HP Date: 08/08/19 Time: 18:38 Sample: 2007Q1 2018Q1 Included observations: 585 Trend assumption: Linear deterministic trend Lags interval (in first differences): 1 4 Unrestricted Cointegration Rank Test (Trace and Maximum Eigenvalue)				
Hypothesised No. of CE(s)	*Fisher Stat.** *(from trace test)*	*Prob.*	*Fisher Stat.** *(from the max-Eigen test)*	*Prob.*
None	80.01	0.0000	64.25	0.0000
At most 1	55.27	0.0007	55.27	0.0007
* Probabilities are computed using asymptotic Chi-square distribution.				
Individual cross-section results				
Cross Section	*Trace Test*		*Max-Eigen Test*	
	Statistics	*Prob.***	*Statistics*	*Prob.***
Hypothesis of no cointegration				
_AHM	15.5152	0.0497	14.4712	0.0464
_BAN	17.6089	0.0237	11.5994	0.1266
_BHO	4.8230	0.8273	4.5545	0.7967
_CHE	24.9835	0.0014	13.3844	0.0685

_DEL	5.8799	0.7097	5.1944	0.7171
_FAR	8.5526	0.4084	8.4447	0.3353
_JAI	42.9852	0.0000	40.6584	0.0000
_KOL	17.9002	0.0213	15.3329	0.0338
_LUC	8.3635	0.4274	5.5423	0.6724
_MUM	5.9193	0.7051	5.0206	0.7392
_PAT	11.3445	0.1912	11.3071	0.1395
_PUN	6.7819	0.6031	6.7609	0.5178
_SUR	19.5609	0.0115	11.9249	0.1135
Hypothesis of at most 1 cointegration relationship				
_AHM	1.0440	0.3069	1.0440	0.3069
_BAN	6.0095	0.0142	6.0095	0.0142
_BHO	0.2685	0.6043	0.2685	0.6043
_CHE	11.5991	0.0007	11.5991	0.0007
_DEL	0.6855	0.4077	0.6855	0.4077
_FAR	0.1079	0.7426	0.1079	0.7426
_JAI	2.3268	0.1272	2.3268	0.1272
_KOL	2.5673	0.1091	2.5673	0.1091
_LUC	2.8212	0.0930	2.8212	0.0930
_MUM	0.8987	0.3431	0.8987	0.3431
_PAT	0.0374	0.8466	0.0374	0.8466
_PUN	0.0210	0.8848	0.0210	0.8848
_SUR	7.6360	0.0057	7.6360	0.0057
Notes: ** MacKinnon-Haug-Michelis (1999) p-values				

Table A4: Panel Granger Causality Tests

Pairwise Granger Causality Tests Date: 08/08/19 Time: 13:00 Sample: 2007Q1 2018Q1 Lags: 4			
Null Hypothesis:	*Obs*	*F-Statistic*	*Prob.*
HP does not Granger Cause CR	533	6.43557	5.E-05
CR does not Granger Cause HP		0.17084	0.9533

Pairwise DumitrescuHurlin Panel Causality Tests Date: 08/08/19 Time: 13:02 Sample: 2007Q1 2018Q1 Lags: 4			
Null Hypothesis:	*W-Stat.*	*Zbar-Stat.*	*Prob.*
HP does not homogeneously cause CR	6.04981	1.93385	0.0531
CR does not homogeneously cause HP	5.02827	0.82598	0.4088

Demographic Dividend in India: A State-Level Analysis

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Abstract

The guiding principles of sustainable development imbibe a human rights-based approach, equality in health, education and economic opportunities, accountability in delivering social services, and sustainable consumption of natural resources. Human capital investment in health (reproductive health), education, and infrastructure can contribute in multiple ways to promote a sustainable demographic dividend. The objective of the paper is to examine linkages between demographic variables and various facets of social development and policy environment. A balanced panel data set of nineteen major Indian states have been incorporated in the analysis. The data ranges from 2006 to 2015 where yearly analysis has been done. An econometric analysis is done to see the impact on the growth rate of real Net State Domestic Product per-capita on initial Net State Domestic Product per-capita, the initial level of working-age share and the rate of growth of working-age share, and other control variables that affect and determine the economic growth. The findings of the paper are that there is a paradox of the demographic dividend that exists among different Indian states. The Southern States and the Western States are experiencing the demographic dividend advantage while other Indian states have not been able to capitalise the benefits on a sustainable basis. The demographic window of opportunity on the other hand is closing down for the Southern States due to population ageing and is open for other states like Bihar, Rajasthan, Jharkhand, Haryana, Uttar Pradesh, etc.

Keywords: *Demographic dividend, Human capital, Education policy, Economic growth.*

Introduction

The demographic dividend is a lifetime opportunity a nation experiences when working-age population or productive population grows at a faster pace than the dependent population or unproductive population contributing to the process of economic growth. Seizing the demographic dividend is neither automatic nor guaranteed. It requires a favourable policy environment and institutions in health, education, family planning, labour market, trade, etc. To reap the maximum benefits of the demographic dividend, India has to productively employ its working-age population. Given the deficit in human capital and lack of sufficient formal sector jobs, it is a huge challenge to skill, absorb, and deploy millions of people entering the labour force every year. The demographic dividend can turn into a

demographic liability or demographic disaster in the absence of appropriate employment opportunities and quality human capital.

The study has been undertaken to highlight the pattern and prospects for a demographic dividend at a regional level, drawing insights from population analysis at state and national levels. The study is useful for policymakers as well as the private sector and society to achieve the prospects of a demographic dividend in India. The dividend is a one-time opportunity that will not last indefinitely. It has long-term implications for national development that leaders have a responsibility to harness; otherwise, the dividend will not materialise and can lead to adverse effects.

Objectives

Following are objectives of the present study:

- Examine the relationship between working-age ratios and economic growth in different Indian states.
- Examine linkages between demographic variables and various facets of social development and policy environment.
- Identify the factors that influence demographic dividends at the state level on a sustainable basis.

Literature Review

The demographic dividend is the window of opportunity for every nation, whether developing or developed, experiences once in a lifetime. The developed nations seize the opportunity easily since they have strong institutions and policies that accelerate the pace of economic development. There are some developing nations that lose this window of opportunity since they do not invest sufficiently in the process of human capital formation. This is possible even if a nation has an advantage of a young population and low dependency ratio. Hence, to capitalise the demographic dividend we need to reduce the gap between the potential demographic dividend and the actual demographic dividend.

The potential demographic dividend gets created with favourable demographics and a decline in fertility. This induces parents to invest more on a child's health, education, and employability skills that would help children become productive citizens for the nation. It also results in women actively participating in the labour force and investing sufficiently on the child's care. The savings of households increase as they do not spend a major proportion of income on their children. The actual demographic dividend gets capitalised by making labour force productively absorbed and employed

in the labour market. This raises the standard of living of workers, increases the worker-population ratio, and increases Gross Domestic Product (GDP). The economic dividend also depends on the availability and accessibility of quality health facilities, quality education, infrastructure, reduced fiscal deficit, adequate social and capital expenditure, gender equality, and employment opportunities for the youth. Accumulated wealth and savings directed into productive investments help us capitalise the second demographic dividend.

The potential demographic dividend and the window of opportunity in India are huge and if capitalised shall also meet the shortfall of other ageing economies. According to the Indian Labour Report:

> India's labour force which was 472 million in 2006 is expected to be around 526 million in 2011 and 653 million in 2031. The growth rate of the labour force would be larger than the population until 2021. Around 300 million youth will enterthe labour force by 2025 and 25% of the world's workers will be Indians.

On the other hand, by 2030 the European Union is likely to experience a shortfall of approximately 20 million skilled workers. Here countries like India can prepare for international competition for skilled labour in the future. India can benefit more from the spillover of knowledge through improved communication channels than other countries. It has the absorptive capacity to make efficient use of new technological knowledge and expertise acquired by expatriates.

Concept of Sustainable Development

Rio Declaration, Principle 8 (UN, 1992) states that:

> Sustainable development as a means to ensure human well-being, equitably shared by all people today and in the future, requires that the interrelationships between population, resources, the environment, and development should be fully recognized, appropriately managed and brought into harmonious, dynamic balance. To achieve sustainable development and a higher quality of life for all people, States should reduce and eliminate unsustainable patterns of production and consumption and promote appropriate policies, including population-related policies, in order to meet the needs of current generations without compromising the ability of future generations to meet their own needs.

The guiding principles of sustainable development imbibe a human rights-based approach, equality in health, education and economic

opportunities, accountability in delivering social services and sustainable consumption of natural resources. Human capital investment in health (reproductive health), education, and infrastructure can contribute in multiple ways to promote sustainable demographic dividend. Education improves the productivity of an individual, helps in research and innovation, and increases intellectual and emotional intelligence. Health increases one's life expectancy and improves our decision-making abilities. This enhancement of human capital can help countries seize first and second demographic dividend on a sustainable basis.

Sustainable Demographic Dividend

Sustainable Demographic Dividend is the benefit a nation or an economy experiences with the long-term fortunes of the family. The wealth of nations, government, business, and civil society is tied to family and hence family values and cultures play a vital role in shaping it. Marriage and fertility contribute to long-term economic growth, the better quality of work-force, and productivity and profits of all sectors of the modern economy.

According to the International Report from Social Trends Institute titled 'The Sustainable Demographic Dividend' marriage and fertility matter since:

- Children raised in intact, married families are more likely to acquire the human and social capital they need to become well-adjusted and productive workers.
- Men who get and stay married work harder, work smarter, and earn more money than their unmarried peers.
- Nations wishing to enjoy robust long-term economic growth and viable welfare states must maintain sustainable fertility rates of at least two children per woman.
- Key sectors of the modern economy—from household products to insurance to groceries—are more likely to profit when men and women marry and have children.

India has the benefit of a quality marriage environment that stays in the long run relative to other nations in the world. A friendly family environment, affordable health, quality education, and work-family balance is essential to maximise the demographic dividend on a sustainable basis. Marriage is an important generator of human, social, and financial capital since it contributes to a productive work-force for a nation. Children who get a better family environment become productive citizens in the future. An increase in divorce, non-marital child bearing, delayed or foregone marriage

has a negative effect on the child. Hence, the Sustainable Demographic Dividend of a nation depends on the health and well-being of the family. Large sectors of an economy flourish with more juvenile products, healthcare, household products, child-care products, and this adds on to the economic dividend of any nation. India enjoys a unique advantage in terms of favourable demographics and strong family values that can be harnessed in the right policy environment.

The study identifies research gaps that were prevalent in the existing literature and attempts to quantify the demographic dividend among Indian states. Contrary to Aiyar and Mody (2011) we have used continuous panel data from 2006–15 in our empirical analysis. We have chosen this period since it is only during this decade that India shall witness the maximum potential for capitalising demographic dividend (*Economic Survey*, 2011). Our findings conclude that the quality of secondary education plays a significant role in capitalising demographic dividends and bridges the gap between education and employment. We also have introduced the concept of Sustainable Demographic Dividend and its relevance and advantage in India's context.

Research Methodology

An attempt has been made to assess the impact of age structure on economic growth. A theoretical model of estimation has been derived and borrowed from Barro and Sala-i-Martin(1995)and was used in various papers (Bloom and Canning, 2004; Aiyar and Mody, 2011).

From the derived theoretical model per-capita income has been decomposed into a share of working-age population (WP/L), the rate of growth of working-age population (WP/P) and income per worker (Y/L). The generic form of the equation is as follows:

$$g\_NSDPpc_{i,t} = \beta_1 NSDPpc_{i,\,t-1} + \beta_2 WAS_{i,\,t-1} + \beta_3 g\_WAS_{i,\,t-1} + \gamma' X_{it} + f_i + \eta_t + \varepsilon_{i,\,t} \quad \ldots(1)$$

$g\_NSDPpc_{i,t}$ is the growth rate of NSDP per-capita for different states i in the year t

$NSDPpc_{i,t-1}$ is the initial per-capita income

$WAS_{i,t-1}$ is the working-age share which is equivalent to Working Population (15-59)/Total Population

$g\_WAS_{i,t-1}$ is the growth in the share of the working-age population in the year t

X_{it} represents control variables that might impact labour productivity.

f_i is a time-invariant fixed effect capturing state-specific effects.

η_t is time dummy capturing effects in the year t.

The main regressors are log Net State Domestic Product per-capita, Log Working-Age Share, and the rate of growth of Working-Age Share over time *t* in state *i*. All regressions are estimated with heteroskedasticity robust standard errors. After carrying out Hausman Fixed Random Effect Test, it was concluded that the fixed effect model will be suitable for analyzing the impact of the working-age population on the rate of growth of Net State Domestic Product per capita for all states. There may be endogeneity between growth in the ratio of working-age to the total population and the economic growth of different states. After checking for endogeneity it was found that Wu-Hausman F-test values are 0.018 (p = 0.89) and hence, we cannot reject the null hypothesis that variables are exogenous. Similarly, the Durbin chi-square test also supports that variables are exogenous. Hence, we do not carry out instrumental analysis in this case.

Data Sources

A balanced panel data set of nineteen major Indian states has been incorporated in the analysis. The data ranges from 2006 to 2015 where yearly analysis has been done. Data has been sourced from Indiastat.com, Census of India, Central Statistical Organization, and the Reserve Bank of India, the Ministry of Human Resource Development, the Ministry of Health and Family Welfare, the Government of India, and the Ministry of Finance, the Government of India, and Publication Statistics of School Education, and U-DISE-NUEPA.

The nineteen Indian states that are included in our empirical analysis are Andhra Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, and Uttar Pradesh. Due to the unavailability of data, states like West Bengal and other north-eastern states of Arunachal Pradesh, Manipur, Meghalaya, Mizoram, and Nagaland are not included in the analysis. The newly carved states like Chhattisgarh and Jharkhand have been included in the analysis.

Data on the growth of working-age population share has been calculated by using the following equation:

$$\alpha = (WAS_1 - WAS_0 / WAS_0) * 100 \quad ...(2)$$

Where α is the growth rate in working-age share.
WAS_1 is the working-age share of the present year
WAS_0 is the working-age share of the previous year

Table 1: The Impact of Demography on the Rate of Growth of Net State Domestic Product Per Capita

Dependent Variable: Rate of Growth of Net State Domestic Product per Capita						
Variable	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Model 6*
Log NSDP pc	31.427*** (6.388)	43.560*** (9.044)	32.722*** (6.532)	41.210*** (7.445)	39.445*** (6.575)	23.320*** (5.924)
Log WAS	34.764 (22.765)	83.626** (36.167)	40.677* (23.595)	56.803*** (27.201)	65.989*** (24.038)	19.612 (22.471)
Rate of growth of WAS	–0.194 (0.354)	–0.418 (0.437)	–0.222 (0.355)	–0.592 (0.482)	–0.431 (0.398)	0.328 (0.330)
Control Variables						
Fertility			–0.006 (0.006)			
Log Gross Enrollment ratio (Secondary)		–5.390** (2.614)				
Population Doctor ratio				0.00003 (0.00009)		
Number of Government Allopathic Doctors					–0.00001 (0.00001)	
Infant Mortality Rate						–0.088 (0.092)
State Dummies	YES	YES	YES	YES	YES	YES
Time Dummies	YES	YES	YES	YES	YES	YES
R^2	0.419	0.420	0.423	0.487	0.492	0.463
Number of Observations	171	133	171	126	146	159

Standard errors in parentheses

Note: ***, ** and * denote statistical significance at 1 per cent, 5 per cent, and 10 per cent, respectively.

Table 1 explains the impact of working-age share and the rate of growth of working-age share on the growth of Net State Domestic Product per capita taking state and time dummies together. It was found that working-age share if taken from 15 years to 59 years has a large, positive, and significant impact on the growth rate of Net State Domestic Product per capita. States with a higher working-age population have greater potential to grow at a faster pace since the young population gives a boost to savings/GDP ratio and investment/GDP ratio contributing to faster economic growth. States with a low working-age population share loose that advantage of infusing higher savings and investment in the economy.

The variable log NSDP per capita has been found to have a high, positive, and significant impact on the rate of growth of NSDP per capita in

all the models that were estimated. This shows that there exists divergence among Indian states which means that states with high initial income experience faster growth rates and states with low initial income experience slower growth rates.

Contrary to the various studies like Aiyar and Mody that were undertaken it was found that the rate of growth of working-age share has a negative and insignificant impact on the rate of growth of NSDP per capita. A negative relationship shows that, with a 1 per cent increase in the rate of growth of the working-age population, there would be 0.1–0.4 percentage points, the decline in the growth rate of NSDP per capita. This is because the benefits of the demographic dividend are not obvious and guaranteed. It depends on policies, institutions, and governance. The quantum of dividends is large but a large part of the working-age population is either unemployed or underemployed or is not considered employable in the majority of the Indian states. This further reduces the per-capita income growth where an unemployed and unproductive youth becomes a liability to the nation rather than an asset. If these complementary factors are not present there is an equal probability of dividends turning into a disaster.

The Paradox of Demographic Dividend

States like Andhra Pradesh, Delhi, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Maharashtra, Punjab, and Tamil Nadu have experienced relatively higher benefits of demographic dividend during 2006—15. Among them, Andhra Pradesh, Delhi, Haryana, Karnataka, and Kerala were dominating in terms of the magnitude of demographic dividend. States like Bihar, Uttar Pradesh, Madhya Pradesh, Jharkhand, Assam, Odisha, and Rajasthan are lagging and have not yet capitalised the benefits of demographic dividend. Bihar, Uttar Pradesh, Madhya Pradesh, and Jharkhand are at the bottom in terms of demographic dividend rankings during 2006–15. States like Chhattisgarh and Jammu and Kashmir have partially capitalised the benefits of demographic dividend and there is much potential underutilised.

The paradox of Demographic Dividend is that the 'Starter states' like Bihar, Uttar Pradesh, Madhya Pradesh, Jharkhand, Assam, and Rajasthan have maximum potential and longest window of opportunity left with them. But due to lack of congenial environment and favourable conditions, they have lost a large part of demographic dividend and shall continue to lose in the coming decades if they do not bring in revolutionary changes in their policies and its execution. The 'Mature states' like Kerala and Tamil Nadu have benefitted most in terms of demographic dividends due to

better health, education, employability, and governance. But these states population have started ageing and their window is closing down.

Among the 'Medium potential states' except Odisha, all other states are grabbing the window of opportunity. These states are Delhi, Gujarat, Haryana, Himachal Pradesh, Karnataka, and Maharashtra have been going through their best phase of demographic lifespan and can maximise the benefits of demographic dividend in the future. India started getting the advantage of a potential demographic dividend since the 1980s. Since the majority of 'Starter states' were not able to enjoy the benefits out of favourable demographics there is a negative relationship between the rate of growth of working-age share and rate of growth of NSDP per capita indicating that demographic dividend is not coming.

In Model 1 as depicted in Table 1, it was found that the level of working age share and the rate of growth of working age share has insignificant impact on NSDP per capita growth.

In Model 2 as depicted in Table 1, it was found that the level of working-age share has a positive, large, and significant impact on economic growth per-capita but the rate of growth of working-age share has a negative and insignificant influence on NSDP per capita growth. The gross enrollment ratio of the secondary sector has been incorporated to assess the role of education on the demographic dividend. It is found to have a negative and statistically significant impact on per-capita economic growth. This can be attributed to the bad quality of secondary education at the state level. Hence, we do not reap the benefits of the education dividend due to a lack of quality education and infrastructure. It raises serious questions on possibilities of grabbing the window of opportunity where secondary education plays a significant role.

In Model 3, we have incorporated the fertility rate as an additional variable that is negatively associated with the rate of growth of states. Hence, a drop in fertility induces the working-age population to grow faster and contributes to a higher productivity thereby leading to higher rate of growth of NSDP per capita. In Model 4, it is found that working-age share has positive, large, and significant impact on the growth of NSDP per capita. During 2006–15, a 1 per cent increase in the working-age population improves the NSDP per capita growth by 56.8 percentage points. Population Doctor Ratio is a crucial indicator of health since the lower it is the higher would be the health status of different states in India. It is not found to be significant. A high R^2 of 0.48 reflects that the model is estimated accurately. In Model 5, we have found that a 1 per cent increase in working-age share increases the per-capita income growth by around 66

percentage points. We have also found that the coefficient of a number of Allopathic doctors is negative. The health parameters are showing that there is a scarcity of quality doctors that needs to be addressed. The health sector has been one of the most neglected sectors for decades and has been vital in its contribution towards the formation of human capital.

In Model 6, the infant mortality rate is found to be negatively related to per-capita income growth. This is obvious since a drop in infant mortality rate would lead to a healthy baby boom generation reaching the working age thereby initiating the process of demographic dividend. Since health and education were neglected by the Indian government in terms of quality, standards, infrastructure, and allocation of funds the negative effects have spilled over giving birth to an unhealthy and uneducated population, which is no longer a gift to our nation.

Limitations and Scope for the Further Research

The employment dimension is better captured by indicators such as labour force participation rate, work-force participation rate, and unemployment rate. Similarly, good proxy indicators of health and education are life expectancy, nutrition, skills, educational attainment, and human development index. Due to the lack of continuous data on these indicators of employment, health, and education for the years 2006 to 2015, we did not use them in our empirical tests. The study was also unable to control the effect of inter-state migration. Certain studies point that migration in Indian states is not elastic with income differentials due to many barriers like local labour unions, linguistic and cultural differences (Cashin and Sahay, 1996). There is scope for further research for conducting a study incorporating the effects of migration.

Conclusion

Indian economists and planners need to give serious attention to its educational budget which is around 3.8 per cent and is lowest among Brazil, Russia, India, China, and South Africa (BRICS) nations. Giving natural priority to secondary education and increasing the budget allocation could play a vital role in the human capital formation of the nation. Similarly, India can maximise the sustainable demographic dividend by promoting family planning programmes. It is cost-effective and has multiple benefits in economic and social terms. It contributes to the process of human capital accumulation. Children born and brought up in a good family environment are more secure and productive and hence, are an asset for the nation. The

critical policy areas essential to capitalise the demographic dividend include public health, family planning, education, and economic policies that promote labour market flexibility and openness to trade and savings. In the absence of the right social and economic policies and institutions, this dividend can turn out to be a disaster. This can lead to mass unemployment and a crisis in the economy. Hence, capitalising this window of opportunity at the right time is very essential.

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Analyzing Fiscal Sustainability in Jharkhand Economy

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Abstract

India is de facto decentralised federal democracy and has many attributes of a highly centralised country including a quasi-federal constitution and a high concentration of active taxing powers at the central level. In this scenario, the concept of fiscal sustainability plays a crucial role since the dependency ratio between these two levels of government determines the financial health at both the levels of the economy. The economists refer to solvency as a government's ability to service its debt obligations without explicitly defaulting on them. This study employs the Domar Stability Framework (1944) to assess the fiscal sustainability of Jharkhand at the micro-level. It is worth mentioning that the Fiscal Sustainability Analysis is a precondition for pursuing budgetary policies. There is a need for a study on Jharkhand, a newly constituted state which came into existence after economic reforms. The objective of the study is to assess the fiscal sustainability of Jharkhand Economy within Domar Stability Framework (1944). The research focused on 2001-02 to 2010-11, i.e. for 10 years after the formation of Jharkhand in 2000.

Keywords: *Fiscal sustainability, Fiscal federalism, Domar stability framework, Jharkhand economy.*

Introduction and Background of the Study

India is *de facto* decentralised federal democracy with 1.5 billion populations residing in 29 states. It has many attributes of a highly centralised country including a quasi-federal constitution and a high concentration of active taxing powers at the central level. The essence of the federal form of government is that the Constitution should spell out distinctly and separately the function to be performed by the respective governments. In this scenario, the concept of fiscal sustainability plays a crucial role since the dependency ratio between these two levels of governments determines the fiscal health at both the levels of the economy. The another definition

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I declare that this paper is an original report of my research, has been written by me, and has not been published or sent for publication or accepted for publication anywhere. The research work is entirely my own work and is a part of my dissertation which I have carried out during my post-graduation for the partial fulfillment of my degree in the Department of Economics at the Central University of Kerala. The collaborative contributions have been indicated clearly and acknowledged. Due references have been provided on all supporting literatures and resources.

provided by (Burnside, Eichenbaum, & Fisher, 2004, pp. 89-117) define fiscal sustainability as 'fiscal policies that the government relate to the concept of solvency'. The economists refer solvency as a government's ability to service its debt obligations without explicitly defaulting on them. The fiscal balances in most states of India have reached an alarming level by the end of the last century. In fiscal federalism structure, this would impact the budgetary policies at the central level. As a result, when huge fiscal deficits both at central and state governments reached an unsustainable proportion, a need arises to restore the fiscal discipline. Consequently, the Fiscal Responsibility and Budget Management Act (FRBMA) was enacted in 2003 as a mechanism to check the level of major fiscal indicators. The FRBMA set numerical and time-bound objectives to attain fiscal sustainability. Several states of India passed the state version of FRBMA after the recommendations of the Twelfth Finance Commission. The FRBMA is an incentive to control the unsustainable fiscal indicators and bring down the enormous fiscal deficit within the sustainable limit. The main objectives of the legislation were to eliminate revenue deficits and reduce fiscal deficit to or below 3 per cent of the Gross Domestic Product (GDP).

The state governments and policymakers were concerned with the unsustainable fiscal health of sub-national-level government. There is a sizable volume of literature on public finance which is a significant area of concern in the research on public finance and contemporary policy debate in India. Various competent authorities such as the Finance Commission, the Reserve Bank of India (RBI), and the Comptroller and Auditor General of India (CAG) in their recent reports have repeatedly warned against the unstable financial practices of states (Rajaraman I., A Study of Debt Sustainabilty at state Level in India, 2005). The Indian fiscal policies were being tested to its limit by the impact of the global financial crisis that erupted around September 2008. The situation was hard to cope with that was affecting the Indian economy through three channels—contagion risks to the financial sector, the negative impact on exports, and the impact on exchange rates (Kumar & Soumya, 2010). The critical elements of the required policy package are well-known—setting out and implementing a credible plan to bring debt ratios down over the medium term.

It was now vital that the process of fiscal consolidation to be restored in every year. This seems to be a delicate process where the fiscal constriction is achieved without impacting the growth process adversely. The fiscal sustainability is attained along with a high growth process. The Thirteenth Finance Commission in its report showed its concern to restore fiscal discipline and the need to return to the path of fiscal prudence and provided

a road map charting a set of desired fiscal deficit targets. The budget of 2010-11 adopted a calibrated exit policy targeting a fiscal deficit of 5.5 per cent of GDP in 2010-11 from a level of 6.5 per cent (inclusive of bonds in place of securities) in 2009-10 (Government of India, 2011). It now appears that fiscal discretion and the desire to limit the public debt through better revenue and expenditure outcomes have been fairly standardised in the Indian policy matrix. This is probably partly attributable to the anchoring role played by the FRBMA and the deficit reduction roadmaps put forward by the Thirteenth Finance Commission. Despite the temporary deviation from stringent fiscal consolidation targets necessitated by the global financial crisis, Indian budgetary policy is being steered rapidly back to the path of prudence.

In this context, a state-specific study on fiscal sustainability becomes pertinent. The present study is an attempt to discuss the various issues related to sub-national fiscal sustainability in one of the Indian states, Jharkhand. The State's significant tax revenues are from Value Added Tax (VAT), comprising about 80 per cent of the State's tax revenues. The State is in the process of strengthening its debt and investment management capacities. A Debt Management and Investment Cell (DMIC) was established recently. The fiscal situation deteriorated because revenue expenditures exceeded revenue receipts. The interest payments, subsidies, and pension accounts for a significant portion of the total revenue expenditure. After the implementation of the FRBMA, circumstances at the state level improved because revenue (tax) receipts increased and spending reduced. While State expenditure has declined drastically, revenue expenditure (such as interest and pension payments) has not changed that much.

Research Issues

The significance of Fiscal Sustainability Analysis is to provide some signal as to whether a policy mix is sustainable. Even when a government is solvent and is likely to remain solvent, its fiscal policies may be costly. The fundamental building block of Fiscal Sustainability Analysis is government budget constraints. There is a need to identify that fiscal sustainability is a pre-condition for financial and monetary stability as well as external vulnerabilities (Pattnaik, Prakash, & Misra, 2011). The primary lessons learned from the 1990s crisis call for the urgency on the sustainability aspect related to fiscal policies. It is the responsibility of the state and policymakers to consider the sustainability concept while designing a budgetary plan as an institutional framework and mechanism to implement prudent fiscal policy in India. There are significant research issues such as unsustainable

debt paths that may eventually lead to sharp adjustments if not to crises, i.e. to generalised failure of economic agents to meet their obligations.

The study by (Misra & Khundrakpam, 2008) recognised that if any deviation from the self-imposed targets prescribed in the budgetary legislation reported, fiscal strain at both national and sub-national level increase. Therefore, it is required that both central and state governments responsibly adhered to the recommendation made by the respective finance commission bills. Remarkably, the fiscal correction mechanisms work faster for the states as compared with the centre. The major study by (Sen & Dash, 2013) study on financial imbalances and indebtedness across the Indian states is an only major study that analyses the fiscal sustainability of Jharkhand by using trend analysis methods. It is an aggregate level study that considers all the 28 states, including Jharkhand.

This study seeks to fill this research gap by providing a theoretical and empirical analysis of fiscal sustainability for the Jharkhand economy. It should be analyzed over time since the inception of Jharkhand in November 2000. This study employs the Domar Stability Framework (1944) to assess the fiscal sustainability of Jharkhand at the micro-level. Fiscal Sustainability Analysis is a pre-condition for pursuing budgetary policies and there is a need for study on Jharkhand, a newly constituted state which came into existence after economic reforms.

Objectives of the Study

The objectives of the study have been narrowed down enabling each research problem for scientific discussion. The objective of the current study is to assesses the fiscal sustainability of Jharkhand Economy within the Domar Stability Framework (1944).

Significance and Scope of the Study

The fiscal sustainability has attracted a considerable amount of importance and attention at the academic level as well as policymakers' level, especially after the 1990s crisis. The 1991 reforms were the significant reforms undertaken in the fiscal policies of India, which strengthened and expanded its economy, focusing on liberalisation, privatisation, and globalisation. Successive Finance Commissions addressed the significance of sustainability at the national and sub-national levels. At the sub-national level, the most prominent issues are the vertical and horizontal imbalances. The vertical imbalance is the imbalance created between the centre and sub-national while assigning the fiscal responsibilities such as sharing of taxation and

expenditure activities. Another aspect is the horizontal imbalance, which arises among states due to differences in revenue resource mobilisation and expenditure patterns across the states.

The need for this study arises since fiscal sustainability is an economic arrangement that involves multiple dimensions. For instance, the enactment of the Medium-term Fiscal Policy Framework (MTFP) to restrain the major fiscal indicators such as revenue deficit, fiscal deficit, primary deficit, etc., involve issues related to public finance. Higher tax rates and high borrowings to finance the previous debt ultimately result in the loss of credibility for the government. The primary aim of this study is to provide an analysis of the way Fiscal Policy is related to the sustainable concept as introduced in various theoretical and empirical works of literature. The motivation for the choice of this research topic emanates from the significant current changes in the fiscal policies of India, the enactment of FRBMA, MTFP Framework, and its implications on restoring the budgetary discipline.

The study is significant as it examines the level to which the states made it successful in achieving the targets in the earlier period specifically after the enactment of FRBMA and other institutional reforms initiated at the state level. The various recommendations of successive Finance Commissions explore the alternative adjustments process of achieving fiscal sustainability process and explain the consequences each of these adjustments would have on the economy of the state. Further, the study by (Sen & Dash, 2013)) explores the behaviour of fiscal policies as pursued by the central government can explain the vertical imbalance created at the national level. Moreover, it can provide further insights into the existence of horizontal imbalance at the sub-national level, if there is a pattern in the method of fiscal adjustment undertaken by different groups of states.

In this background, it is relevant to observe that the attainment of fiscal sustainability is the priority of Indian policymakers since July 1991. It is essential to analyze the course of fiscal adjustments that require reforms. Accordingly, the authorities have pursued fiscal correction and consolidation process during the early 1990s. Recently, the fiscal adjustment programme has been further strengthened both at the national and sub-national levels through the enactment of financial legislation to ease out the vertical and horizontal imbalances.

There is a sizable volume of literature on the sustainability issue of budgetary policies in India and around the world but the available literature lacks study on Jharkhand economy. There was no study on fiscal sustainability within Domar Stability Framework for the Jharkhand economy. In a recent study by (Kaur, Mukherjee, & Ekka, 2018) which covered 20 Indian states,

however, Jharkhand is not included in the study. Sen and Dash (2013) is the only major study which analyses the fiscal sustainability of Jharkhand by using trend analysis methods. This study seeks to fill this research gap by providing a theoretical and empirical analysis of the fiscal sustainability for Jharkhand economy.

Theoretical and Empirical Literature Review

The importance of fiscal sustainability to achieve economic efficiency can be examined based on the existing stock of definitional and empirical literature published in different books, journals, committee reports, and government websites. This is divided into three sections to categorise the literature review based on theory, definition, and empirical studies. The studies considered next could be used as baseline definitional and empirical studies on the topic of fiscal sustainability.

Fiscal Sustainability: Different Approaches

The Theory of Fiscal Federalism plays a vital role in the revenue expenditure as the central government revenue plan expenditure is dominated by the sharing of resources with the state and local government level. In his book (Musgrave, 1959) advocated an increased role for states with the process of decentralisation of the fiscal activities. The staunch expenditure such as interest payments, pension schemes, administrative expenses, subsidies, etc. dominates the expenditure pattern of the state. Accordingly, the budgetary activities of the states are primarily determined by the volume of devolution of resources from the centre and the expenditure pattern on the various fiscal operations of the state.

The observation by (Oates, 1999, pp. 1120-1149) on the theory of fiscal federalism added that it is the responsibility of central governments to use the central budget as an instrument to alleviate the demand shocks and maintain stabilisation. There is always a constraint on the state and local government while formulating the fiscal policies. In a conference paper (Moges, 2005, pp.42-65) outlined three broad issues related to decentralisation, which linked to fiscal sustainability. The three primary functions are, firstly, assignment of revenue mobilisation and expenditure responsibilities between the national and sub-national level, secondly, the authority and control for the collection of taxes and other fiscal revenues to finance the public expenditure, and thirdly, to design a proper mechanisms for inter-governmental transfers to avoid any mismatch between revenue-generating power and pattern of spending across the lower levels of the

government. The dynamism of these functions determines the shape of the macro-economic stability and growth performance of the public sector in the national economy.

Fiscal sustainability means that current fiscal policies which are in operation can be continued unaltered without hampering the objectives of economic theory (Rath A., 2006). It is a severe issue of emerging economies like India since the inadequate sources of revenue mobilisation, fragile capital markets, rising public debt, increased government spending renounce themselves to vulnerable market conditions. In India, population ageing and increased expenditure on pension and healthcare fuelled the apprehension for fiscal sustainability.

There are two concepts related to fiscal sustainability. One, the idea of sustainability refers to solvency, the ability of the government to service its debt obligations in perpetuity without explicit default. Two, the concept of fiscal sustainability relates to the government's ability to maintain its current policies while remaining solvent.

Initially (Domar, 1944, pp. 798-827) developed the first framework to assess fiscal sustainability based on Keynes´ method to public debt. It analyzed the budgetary sustainability in terms of growth rate and average annual interest rate, 'which states that a necessary condition for sustainability is that the growth rate of income must exceed the interest rate.' The initial study on fiscal sustainability by (Domar, 1944, pp. 798-827) defined all the necessary conditions for fiscal sustainability. However, the model did not incorporate critical variables such as interest rate and the rate of GDP growth. In later years, a new model was developed by (Buiter W., 1985) and (Blanchard, 1990). In a joint research (Burnside, Eichenbaum, & Fisher, 2004, pp. 89-117), authors attempted to define fiscal sustainability in terms of the consistency of fiscal policies over a more extended period. The current policies should be consistent with the previous plans to maintain solvency in the economy.

Fiscal sustainability was also defined in the context of both static and inter-temporal budget constraints. A study by (Akyüz, 2007) detected that the inter-temporal budget constraint was often formulated to satisfy the conditions for solvency. The ability of the public sector to finance the current expenditure with its revenue resources and new borrowings such as the issuance of the government securities can satisfy the static budget constraint. In an IMF working paper (Tanner, 2013) also included the concept of solvency to describe fiscal sustainability. The study emphasizes that 'inter-temporal solvency' is the pre-requisite condition. It implies that the government in the present form must have adequate and enough

revenue mobilisation to organise the needs of debt obligations and prevent either default or restructuring revenue sources. The study present that a 'sustainable policy' is the one which considers the consistency in the policy over a longer duration of time. An unsustainable situation arises when a debt restructuring process requires primary adjustment. In a study by (Pattnaik, Bose, Bhattacharyya, & Chander, 2005) observed that a higher degree of centralisation improves revenue mobilisation while a higher degree of decentralisation enhances the effectiveness of expenditure management. A top-down approach rather than bottom-up is required to handle the progression of expenditure management that is to be consistent with the overall framework of fiscal management. The study listed a set of formal rules such as fiscal responsibility legislation, to put in the state-specific characteristics as well as to provide the limited scope for the informal rules.

Review of Empirical Research

This section provides the literature review on the various empirical works conducted by applying a range of econometrics and mathematical tools to assess fiscal sustainability across the world.

The study by (Buiter, 1985) was the foremost study in area of fiscal sustainability. The study build a framework and suggested that a policy is sustainable if the ratio of public sector net worth to output at its current level is maintained.

There are stacks of empirical literature across the world on the assessment of fiscal sustainability. Sen and Dash's (2013) research on fiscal imbalances and indebtedness across the Indian states gives a comprehensive knowledge about the condition of fiscal sustainability prevailing in three states—Kerala, Punjab, and West Bengal. This study developed the results within the framework of Domar stability and empirically found that fiscal sustainability in these three states is unstable, particularly in the revenue account.

In a recent study by Kaur et al. (2018) assessed the debt stance of the state governments in India, during the period 1997–98 and 2003–04 within the purview of the Domar Stability Framework. The study employing panel data framework covers 20 Indian states from 1980–81 to 2015–16. The research is based on the premise of 'empirical estimation of inter-temporal budget constraint and fiscal policy response function in a panel data framework.' The study concludes that at the state level, the debt standing achieve sustainability in the long period. The authors, however, highlighted that the rise in contingent liabilities of states and specifically where a larger portion of these liabilities with the state power distribution companies, debt

restructuring of these liabilities results in an adverse impact on the debt status.

Das (2016) examined the structure of the expenditure of the sub-national governments to determine the impact on the level of debt employing Domar Stability Framework. The study is based on a panel data analysis for 17 non-special category Indian states from 1980 to 2013. The study postulates that along with budget structure, the state-specific fiscal indicators play a critical role in determining the position of the state borrowing.

In an research paper at Reserve Bank of India, the authors (Rangarajan, Basu, & Jadhav, 1989) introduced multiple fiscal deficit indicators to assess fiscal sustainability in India. The work of (Rangarajan et al., 1989) was extended by (Shah & Patnaik, 2005) to develop time-series data for 1950-51. The study by (Seshan, 1987) attempted to focus on domestic debt, which scaled a new low point in the Indian economy. In a research study (Buiter & Patel, 1992) used annual data from 1970-71 to 1987-88, to verify that in India, discounted public debt is non-stationary. The study applied four alternative tests to time series data of 18 years and identified that debt requires the large-scale mobilisation of seigniorage or inflation tax to convert the primary deficit into a primary surplus. Rajaraman & Mukhopadhyay (2005) focused on public debt not owned by the RBI as the authors consider public debt as the under deemed face value of the accumulated stock of government non-monetary financial liabilities. (Misra & Khundrakpam, 2008). The sustainability criteria as proposed in the framework of Domar sustainability condition, the study by (Pattnaik, Bose, Bhattacharyya, & Chander, 2005) analyzes the sustainability of the public expenditure of the central government. The author obtained empirical results that show the debt/GDP ratio should be stable in the Medium-term Framework to maintain sustainability.

Pattnaik, S. Raj, & Chander (1990 cited Chelliah 1991 pp. 1-74) in an empirical survey validated that to attain stability in primary deficit. In a working paper by (Bagchi, 2002), the author observed that the central government failed to prevent the shortcomings in the inter-governmental transfer, which subsequently led to the problem of deficits at the sub-national level. In a research by (Rao, 1998) highlighted differences in the revenue generation across the states.

Prasad, Prakash, & Goyal (2004) tested fiscal sustainability at centre and state level and found that at the individual level fiscal policy is unsustainable; however, there is fiscal sustainability when both are taken together. In the study by (Sanhita & Sethi, 2011) attempted to analyze the role of the FRBMA in attaining fiscal sustainability. It focused on the Ordinary Least

Squares (OLS) Method applied to time series data from 1980-81 to 2008-09 to study the effectiveness and feasibility of the FRBMA on the fiscal deficit at the central and state level. The regression result suggests that there is no significant effect of the FRBMA on the ratio of Gross Fiscal Deficit (GFD) to GDP ratio.

Summary of Literature Review

The research study by Buiter (1985), Blanchard (1990), Rangarajan & Srivasatva (2005), Burnside, Eichenbaum, & Fisher (2004), Misra & Khundrakpam (2008), Rajaraman (2006), Pattnaik et al. (2011), Sen & Dash (2013) provides a good insight into theories of fiscal sustainability and diverse methods to assess it. These studies discussed the feasibility and benefits of each approach to testing different fiscal indicators. The pieces of research explore the success and prospects of assessing fiscal sustainability. It is worthwhile to mention that at the sub-national level also there is a stack of relevance literature. In the new scenario, the importance of decentralization raises the feasibility of fiscal sustainability at the sub-national level.

Economic Profile of Jharkhand[1]

Jharkhand became the twenty-eighth state of India and was founded on 15 November 2000. It was carved out of the tribal-dominated areas of Bihar. Jharkhand's governance and accountability are marked by a particularly challenging political and administrative context. The complexities of caste and ideology are further compounded by the political dynamics between tribal and non-tribal interests in this resource-rich state. Many of the institutions of public financial accountability are understandably fragile and only just becoming operational. Panchayati Raj Institutions (rural local government) are not in operation, posing a severe challenge to improving the quality of governance at the provincial level.

The Government of Jharkhand's overall accounting classification is in order with the uniform countrywide system of classification of accounts prescribed by the President on the advice of the Comptroller and Auditor General of India. The existing system has a uni-dimensional coding structure that flows in one direction from fund to sector/sub-sector to functions/programmes to schemes/economic classification. The system meets the requirements of the international standard for the classification system of Government Finance Statistics. Jharkhand has immense economic

[1] Jharkhand Public Financial Management and Accountability Study, June 2007, Financial Management Unit, South Asia Region, World Bank.

opportunities; however, unmet expectations. These economic opportunities can be opened with a comprehensive set of reforms such as:

- The first set of reform mechanisms should be able to generate improvements in growth and government tax and non-tax revenues within a short period.
- Build a Mid-term Fiscal Programme to move towards the FRBMA Targets: A multi-year perspective in fiscal planning, expenditure policy, and budgeting is on the anvil. The JFRBMA, passed in April 2007, is a call for introducing a Medium-Term Fiscal Framework. It requires forward estimates of fiscal aggregates on a rolling basis and targets for reducing the state's deficits quite substantially by 31 March 2009.[2]
- A multi-year perspective is an essential ingredient of fiscal planning. Expenditure policy decisions are having multi-year implications aligned with the availability of resources in the medium-term outlook to achieve aggregate budgetary targets.
- In the central and state governments in India, a process for preparing Five Year Plans is also established. The forecasts of revenues estimate of expenditures, and projections of deficits are made while developing the Five-Year Plan.
- Currently, the state's significant tax revenues are from Value Added Tax (VAT), comprising about 80 per cent of the state's tax revenues.
- The state is in the process of strengthening its debt and investment management capacities. A Debt Management and Investment Cell (DMIC) was set up under the USAID-assisted REFORM Project. Although reforms have been attempted occasionally to improve fiscal responsibility, they have been piecemeal. The budgetary situation deteriorated over the years because the revenue expenditures have exceeded revenue receipts. After the JFRBMA was implemented, circumstances at the state level improved because revenue (tax) receipts increased and spending reduced. While state expenditure has declined drastically, revenue expenditure (such as interest and pension payments) has remained the same.

Data Source and Methodology

This study on the fiscal sustainability of Jharkhand is based on secondary data sources. The primary sources of has been retrieved from the RBI database, Planning Commission, Government of India, Department of Economic Affairs, Ministry of Finance, Department of Finance, and

[2] Department of Finance, Government of Jharkhand.

Government of Jharkhand. The study focused on ten Financial Years (FY), i.e., from FY 2001-02 to FY 2010-11. This study uses the Domar Stability Framework. The accounting approach is analyzed with Domar Stability Condition to analyse the debt/GDP ratio. The approach is substantiated with the graph that relate the debt/GSDP ratio to make the visualisation of the concept.

Domar Stability Framework

It is an accounting approach and considers the debt/GDP ratio to analyze the fiscal sustainability for the Jharkhand economy. This condition is based on the growth rate of GDP at current market price, interest payments, and outstanding liabilities. This approach helps to identify changes in performance – either improvements or worsening – over time. This study applies the concept of fiscal stability using debt dynamics framework to judge the deficit level that keeps outstanding debt stock in steady-state position. In the long-run, steady-state condition of debt path with the rate of interest and growth of output, it is possible to determine the sustainability condition.

Domar Stability Condition is the earliest approach to test fiscal sustainability. Domar developed it in 1944. This is an accounting method and is used for convenience in handling time-series data. This method provides a well-built base to judge the fiscal sustainability based on Outstanding Debt and Interest Payments. Domar Stability Condition is explained through the following mathematical equations:

$$g - r > 0 \text{ (Interest Spread)} \quad (1)$$

$$r = IP_t/OD_{t-1} \quad (2)$$

A mathematical rearrangement would yield the following ratio:

$$[(g^* OD_{t-1}) - IP_t]/OD_{t-1} \quad ...(3)$$

where g = Growth rate of GDP at current market prices
r = Average interest rate
IP = Interest payment
T = Time period

Interest Spread = Growth rate – Average interest rate

OD = Outstanding Debt (Outstanding Liabilities = internal debt + loans from the centre + small savings + deposits and advances + contingency fund + reserve fund + remittances + suspense and miscellaneous)

Equation 3 represents the condition stable debt/GDP ratio derived after the mathematical arrangement of equations 1 and 2.

Equations 1 and 2 explain the condition for the stable debt-GDP ratio (d/g) if the nominal GDP growth rate exceeds the nominal interest rate in the government's outstanding debt.

Domar (1944) has provided the concept of fiscal stability and explains that if the government expenditure exceeds tax revenue and real interest rate exceeds real output growth of the economy, the debt-output ratio would relentlessly increase. It implies that if the real interest rate remains higher than the real growth rate, even if the primary deficit remains zero, the interest burden on the existing debt would be rendered into larger growth in the debt GDP ratio. According to Domar Stability Condition, the more significant the gap between the interest rate and the growth rate, the higher will be the d/g ratio. Therefore, the Domar Stability Condition is satisfied, when the growth rate is higher than the interest rate, the debt-ratio converge to d*, irrespective of the magnitude of the primary deficit and the level of debt can be maintained in the long run. The underlying reason is that the high growth rate ensures that the primary deficit and interest are continuously kept in check to fulfil the condition of the constant debt and income ratio. Thus, to stabilize the debt-GDP ratio d/g ratio, the rate of interest rate should be lower than the output growth. In the short run, this would lead to the increased public debt due to high-interest rate and imply serious consequences in the form of 'crowding out effect' and pressure on the absorptive capacity of the market (Kannan & Singh, 2007). In this study, the Domar Stability Condition has been tested for market-related borrowings and administered interest rates. The average interest rate is calculated as a ratio of interest payments to the previous year's outstanding liability. The Domar Stability Condition is tested for each year to assess fiscal sustainability. Table 1 summarised the implications for the different rates of the growth and interest rate

Table 1: The Dynamics of Public Debt Depending on the Interest Rate, the Growth Rate of GDP, and the Primary Budget Balance

g-r	S	s < 0 (primary deficit)	S > 0 (primary surplus)
g - r > 0 (strong economic growth)		public debt will converge to a stable level d*, where d* > 0	public debt will converge to a stable level d*, where d* < 0 (public savings)
g - r < 0 (slow economic growth)		public debt will increase indefinitely, without converging to a stable level	undefined situation

Source: Created by the author based on Domar Stability Framework.

There is the unavailability of data for 2001-02 as Domar Framework requires data on previous year outstanding liabilities. Jharkhand was formed

in November 2000 and therefore its outstanding obligations for 2000-01 were computed under the fiscal account of undivided Bihar. In recent years, interest payments have been one of the significant components of revenue expenditure of states, so much so that the Twelfth Finance Commission felt obliged to indicate a prudent limit for it.

Analysis and Interpretation

The research problems that developed require analysis in the proper framework for empirical evidence. The Fiscal Sustainability Analysis is one of the preconditions for fiscal to be consistent over a while. The research problem under study discussed whether a sustainable debt path may eventually lead to sharp adjustments in fiscal policies. It is worth mentioning that the Fiscal Sustainability Analysis is a precondition for pursuing budgetary policies.

Domar Stability Condition

The study has retrieved a database from the RBI database on the Indian economy for a period of 10 years to frame the table for Domar Stability Framework. The study provided Table 2 and Figure 1 to give a distinctive picture of the debt/growth ratio of Jharkhand for time-series data from 2001-02 to 2010-11. The table analyzed according to the Domar Stability

Table 2: Domar Condition for Debt Sustainability for Jharkhand Economy

Year/ Indicator	*GSDP Growth Rate (g) (in %)*	*Interest Payments (in Crore INR)*	*OD (in Crore INR)*	*R = (IP_t/ OD_{t-1})*	*g–r*	*PD/ GSDP**	*Debt/ GSDP*
2001-02	4.14	78,884	8,563.89	–	–	(–)2.83	28.46
2002-03	7.13	94,650	10,278.13	11.052	(–)3.922	(–)3.78	31.31
2003-04	8.36	99,104	8,635.2	9.64	(–)1.282	(–)1.82	23.64
2004-05	40.78	77,196	13,534.58	8.93	31.84	(–)5.42	25.51
2005-06	1.91	71,953	16,455.6	5.316	(–)3.406	(–)7.86	30.84
2006-07	9.91	77,741	17,629.6	4.724	5.185	(–)7.65	30.13
2007-08	25.42	1,98,183	18,292	11.24	14.178	(–)5.69	24.59
2008-09	4.58	2,13,694	19,599.74	11.682	(–)7.102	(–)2.11	25.71
2009-10	14.61	2,23,598	21,690.8	11.408	3.201	(–)2.07	24.9
2010-11	14.82	21,602	27,336.8	0.99	13.824	(–)0.11	25.16

* PD/GSDP = Primary deficit/GSDP

Source: RBI Database on Indian Economy, available at http//: dbie.rbi.org.in, accessed on February 25, 2014.

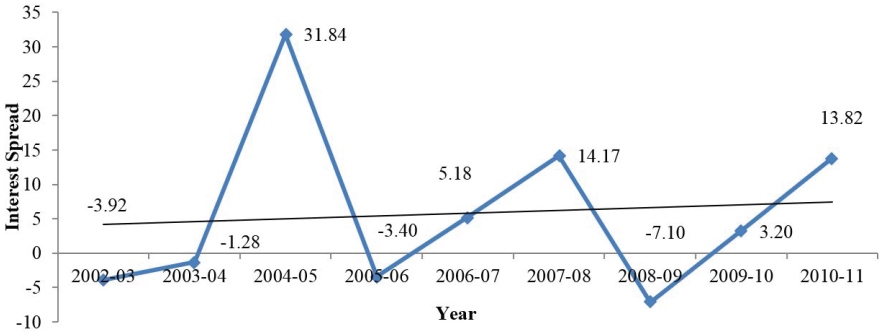

Fig. 1: Trend in Interest Spread

Source: RBI Database on Indian Economy, available at http//: dbie.rbi.org.in, accessed on February 25, 2014.

Framework graph visualise the concept in a more precise way. Table 2 and Figure 1 provide a picture of debt/growth ratio of Jharkhand for a time series data from 2001-02 to 2010-11. Figure 1 presents a trend analysis of Interest Spread from FY 2002-03 to FY 2010-11.

Findings of Domar Stability Framework

Figure 1 provides a visual summary of the data presented in Table 2 and can be analyzed according to Domar Stability Framework. The following points can be inferred from Table 2 and Figure 1:

1. The assessment of Figure 1 shows that there is no increasing or decreasing trend in g-r. It is not consistent over some time. Considering that stock of debt and consequently interest costs are steadily increasing and forming a significant part of the state's expenditure, the state should enhance its capacities for debt planning and forecast its interest costs realistically so that they do not adversely impact the state's fiscal position.
2. The Domar Stability Condition attained in all the years, with the exception in the fiscal years, i.e. 2002-03, 2003-04, 2005-06, and 2008-09. During 2002-03, the interest spread is (–)3.92. The underlying reason for the previous FY 2001-02 was that this was the first year for Jharkhand and the policies framed were based on undivided Bihar. Moreover, the distribution of assets and liabilities of the Composite State of Bihar between the successor states of Bihar and Jharkhand was not completed and the impact thereof on the state's financial position was not clear. In FY 2002-03 GSDP grew at 7.13 per cent while the average interest rate was 11.052 per cent. In FY 2002-03, there was a high rate of fiscal deficit, (–)4.53 per cent whereas the accepted level is below 3

per cent according to the provisions of JFRBMA. It demonstrates that the state economy was not fully capable of handling fiscal management effectively.

3. The FY 2005-06 recorded a high fiscal deficit and revenue deficit.[3] Moreover, there was a similar position for the difference between the growth rate and average interest rate which stood at (–)3.40 per cent. It represents that the fiscal policy of Jharkhand economy was unsustainable. It is a real contrast to the previous FY 2004-05, according to the Domar Stability Condition the Jharkhand economy has attained the highest point in the decade. It shows the strong economic growth according to conditions stated in Table 2. The difference between the growth rate and the average interest rate was 31.84 per cent. According to the requirements stated in Table 2 public debt will converge to a stable level d*, where d* > 0 since PD/GSDP is at (–)5.42 per cent in FY 2004-05.
4. However, in the next FY, 2005-06, the ratio declined acutely and recorded (–)3.40 per cent, a massive decline of 36 percentage points. The interest payments were very high as a percentage of revenue. Although in FY 2005-06 there was noticeable underspending on the expenditure side at the aggregate level, the decreasing observed variation was mainly on account of disbursements under Loans and Advances of Rs. 37,470 million. The importance of being able to reduce interest payments in undertaking fiscal adjustment cannot be minimised. The link between the reduction in interest payments and the extent of fiscal correction achieved is seen to be unclear in the case of Jharkhand because the state government did not rely on expenditure contraction to deliver the fiscal adjustment.
5. Domar Stability Condition achieved in the next two consecutive FYs 2006-07 and 2007-08, follows an increasing trend. JFRBMA was implemented in FY 2007-08 and it took corrective measures to control the imbalance in the fiscal indicators. However, afterward, it declined again in FY 2008-09.
6. The most important conclusion is that the Domar Stability Condition was violated in every alternate year. The study finds that given the interest rate spread, the increased debt/GSDP ratio, and increased the rate of primary deficit, results in unstable policy. The debt sustainability condition states that quantum rate[4] together with the primary deficit is zero, the debt/GSDP ratio would be constant or debt would stabilize.8

[3] Department of Finance, Government of Jharkhand.

[4] Quantum Spread: Debt Stock * Interest Rate.

However, the primary deficit in the Jharkhand economy never reached a positive level and debt continues to be an increasing trend.

7. The increasing trend of interest payments and public debt create disturbance for fulfilling Domar Stability Condition. Although in FY 2004-05, the interest rate spread was high, and if the debt is taken together with the primary deficit and debt stock, it is difficult to achieve the stability condition. The framework assesses that a high rate of the debt/GSDP ratio is a reason for fiscal unsustainability even if the interest rate spread is positive. It underlined the importance of borrowings, debt in attaining fiscal sustainability.
8. The positive interest rate spreads imply high economic growth, but if the borrowings and debt are not constrained, then it can slow down economic growth. In the case of the Jharkhand economy, it is evident in FY 2005-06. The fiscal surplus cannot be maintained for a more extended period, and eventually, the FY 2005-06 marked the period with a high level of fiscal, revenue, and primary deficits. It provides reasons for whether the economy can continue with the currents set of budgetary and economic policies.

The present study provides an insight into the fiscal sustainability of Jharkhand based on Domar Stability Framework (1944) and hence, its impact on its growth trajectory is perceived. Disaggregated data is used in the empirical analysis to identify the financial indicators that registered the highest and lowest level over the period. Jharkhand reported a surplus in the initial years; however, the surplus decreased continuously. The FY 2004-05 budget showed a high rate of the deficit. The last few years witnessed a deterioration in the state of public finance. The stated strategy for the fiscal consolidation process in Jharkhand was to achieve the JFRBMA target based on higher revenue mobilisation and containment of non-productive expenditures. Once the FRBMA targets are met, the continuance of efforts towards revenue mobilisation and reduction in non-productive spending would provide room for expansion of developmental expenditure. The state has considerable dependence on revenue from royalties and sales tax from coal and steel**.** However, the demand for value-based estimation for royalties is yet to meet. It is an accounting approach and considers the interest rate spread and debt stock as primary criteria to test the fiscal sustainability.

The study draws essential conclusions based on Domar Stability Framework. These are summarised as follows:

- The Framework assessed that a high rate of the debt/GSDP ratio is a reason for financial unsustainability even if the interest rate spread is

positive. The importance of borrowings, debt, plays a crucial role in attaining fiscal sustainability.

- The positive interest rate spreads imply high economic growth, but if the borrowings and debt are not constrained, then it can slow down economic growth. In the case of Jharkhand economy, it is evident in FY 2005-06. The fiscal surplus cannot be maintained for a more extended period.
- It provides substantial reasons whether the economy can continue with the current sets of budgetary and economic policy. The variance in primary fiscal expenditure in FY 2005-06 narrowed down drastically. Although in FY 2005-06 there was noticeable underspending on the expenditure side at the aggregate level, the declining variance was mainly on account of disbursements under Loans and Advances of Rs. 37,470 million. This sharp rise was on account of repayment of central dues of Rs 28,560 million of the Jharkhand State Electricity Board by the Government of Jharkhand.
- In FY 2006-07, there is a vast improvement and fiscal deficit stood at merely 0.79 per cent, an increase of 7.17 percentage points. However, since 2002-03 it never attained the fiscal surplus, and after FY 2006-07 the fiscal deficit remains consistent with a slight fluctuating rate. In some years it is exhibiting an increasing trend and in the next consecutive year it is showing a declining trend. As an average for the period 2005-08, RBI reports a fiscal deficit/GSDP ratio of 8.8 per cent—'*Jharkhand turned from a revenue surplus to a revenue deficit state*.' An attempt at fiscal reform could not be sustained and during 2009-10 Jharkhand could not meet the target of revenue balance on account of the impact of revised pays and pensions, higher need for public spending, and a decrease in the flow of revenue receipts because of the economic slowdown. Not so surprisingly, Jharkhand registered an increase in the fiscal deficit by 0.79 percentage points. It could afford a slight increase since the target ratio was 3 per cent or less for all states.
- The JFRBMA was passed in May 2007. Without getting into timelines, this effectively requires the fiscal deficit/GSDP ratio to be no more than 3 per cent and the revenue deficit to be eliminated. It means that JFRBMA must address both revenue and expenditure to reduce the degree of fiscal deficit.
- Jharkhand is an exception state with a very high rate of revenue expenditures. Like the fiscal account revenue account also recorded the highest level of revenue deficit in FY 2005-06. The Government of Jharkhand in its memorandum to the Twelfth Finance Commission

accepted that the revenue deficit in 2001-02 and 2002-03 has been Rs 305 crore and Rs 572 crore, respectively. It indicated that the government was virtually clueless about the expected revenue and expenditure; otherwise, the projected surplus would not have turned into a deficit. It affirmed the fact that revenue deficit was a significant factor in pushing fiscal deficit at the highest level in FY 2005-06.

- The Jharkhand economy witnessed the revenue surplus for the next 2 years before dipping again below the negative axis in FY 2009-10. The state has achieved the target set in the FRBMA by eliminating the revenue deficit into a huge surplus, Rs 946 crore, which further improved to Rs 1,195 crores in 2007-08. However, the surge in the revenue account continues, vis-à-vis, revenue receipts which started in 2008-09 continued and the fiscal situation of revenue surplus could not be retained during 2009-10 as there was revenue deficit of –0.01 per cent; however, again in 2010-11 Jharkhand economy registered a revenue surplus and reached 0.72 per cent.[5] As an average for the period 2005-08, RBI (2010) reports a revenue deficit/GSDP ratio of 2.2 per cent.
- It appears that Jharkhand, with low revenue deficits in the first period itself, was not mainly motivated to undertake revenue account adjustments during the reform period, which resulted in relatively small adjustments seen in the second period as compared to the first. The underutilisation of funds under the grants continue to persist on several factors including implementation progress, issuance of utilisation certificates as well as the efficiency of the central process. On the revenue side, the most important items of expenditure are salaries, pensions, and interest payments. Any such increases in salaries need to be compensated by gains made through efficiencies in expenditure. While immediate interest payments cannot be touched, future interest payments can be curbed by reducing future debt.
- In FY 2007-08 with the passage of the FRBMA, the Jharkhand economy witnessed positive results in fiscal health. The measures and recommendations of successive finance commissions, MTRFs, FRBMA provided an institutional framework and bound the government to prudent fiscal policies. These institutional reforms aimed at institutionalising a Medium-term Fiscal Framework within a stipulated timeframe for encouraging a gradual reduction in fiscal and revenue deficits. These policies helped to accelerate the wheels of the

[5] Finances of the State Government, 2010-11, CAG.

economy and significant fiscal indicators declined sharply. The fiscal deficit declined to reach 3.55 per cent. The revenue recorded a surplus which stood at 1.42 per cent.The Debt/GSDP ratio continues to follow a constant trend and remains in the range of 23 per cent to 32 per cent. The Government of Jharkhand did not follow an organised set of budgetary and fiscal policies otherwise the revenue surplus in the initial years of the formation of Jharkhand would not turn into revenue deficits and within the fifth year of formation, Jharkhand economy witnessed the slowest phase in the economy. All the major fiscal indicators reached the highest level in FY 2005-06.

- There is a vast literature body where authors have suggested for fiscal corrective measures in terms of controlled expenditure patterns and expanded revenue base. It should be a time bounding process and continuous effort. The quality of fiscal policies should be considered to ensure that it helps to reduce the debt and borrowings and enhance the revenue collection capacity. The fiscal adjustment process might lead to unnecessary administrative costs in the perspective of growth and welfare. With the fiscal imbalances turning unsustainable, the objective of restoring stability accorded priority and the fiscal reforms programme was undertaken to correct the economic imbalances. A common feature across all these phases was the adoption of debt/GSDP ratio management as prescribed in FRBMA, and successive Finance Commission as the critical operating fiscal policy instrument to pursue the objectives.

Conclusion

From the findings, it is revealed that during the post-FRBMA and JFRBMA period Jharkhand economy improves its fiscal condition. These institutional reforms provided a roadmap for the Jharkhand economy to restore its fiscal discipline. These time-bound numerical objectives were implemented to rein the deficits registered in major budgetary indicators. It was a consistent and appropriate measure to bring evenness in the fiscal indicators to attain fiscal sustainability in the economy. The two approaches reinforce each other. The recommendations of successive Finance Commissions proved to be a successful attempt to restrict the ceilings of deficits and debts in the economy.

Policy Implications

The fiscal sustainability is essential for good governance and stabilised economy. The fiscal sustainability is the correct instrument to analyze

whether the existing fiscal policies are consistent with the present scenario of the economy or do the policies need any other mechanism to control the malaise generated due to unsustainable policy. The simple rule for any sustainable budget is that revenue should exceed the expenditure. The size and disposition of resource mobilisation and expenditure patterns determine the sustainability condition of deficits and domestic debts—the fiscal sustainability achieved through appropriate fiscal policies and framework. There are major issues in revenue augmentation. Jharkhand is home to major industries and mining activities are one of the significant economic activities pursued by most Public Sector Enterprises (PSEs) like Bharat Coking Coal Limited (BCCL), Coal India Limited (CIL), Steel Authority of India Ltd. (SAIL). The bulk of the stock transferred to central government and the higher Input Tax Credit (ITC) claim by PSEs units pocketed into the share of the central government. The notion timely revision of royalties by the central government on major minerals other than coal cost state government a loss of Rs 450 crores in 2012. Jharkhand received the trivial share of mineral revenue and accounts only 4.38 per cent along with lower royalty share (e.g. Rs. 916.16 crore in 2004-05), limits the scope for the initiative by the state government. The mineral tax and royalties are beyond the purview of state government and cannot make any claim over the mineral production and related activities.[6] There are various measures to enhance the revenue collection capacity like improvement in fixing and collection of minimum user charges, expanding the coverage of these user charges to non-merit goods as well implementing progressive cost recoveries mechanisms. At the same time, there is a need to control unnecessary expenditure obligations, such as administrative services, transfer payments, subsidies, etc. The implementation of Value-Added Tax (VAT) raises the urgency to integrate the various stages of commodity taxations between the national and sub-national levels.

On the expenditure side, the focus should be on the comprehensive management of public expenditure that needs explicit recognition of macro-economic linkages of government policies. For instance, the pension payments need to take a closer look while reforming the expenditure pattern on non-plan expenditure.

The sustainability issue of public debt should be considered while developing the framework for granting loans by the central government to state government according to the formal definitions. A comprehensive approach to consider assets and liabilities of PSEs would add quality

[6] Department of Finance, Government of Jharkhand.

dimensions in the fiscal adjustment process. The overall conclusion drawn for attaining fiscal sustainability and mainly to reduce the debt/GSDP ratio is as follows:

1. The state government dependency on the central government for transfers and loans should be curtailed down to a minimum level. The state government should concentrate on increasing their revenue as outlined by various measures listed earlier.
2. The primary focus should be curbing down the revenue deficit. The high magnitude of fiscal deficit continues to pose a challenge for the state government after 2003-04. After the enactment of JFRBMA in 2007-08, the focus channelized consistently to control revenue deficit.
3. The central priority is to put amended JFRBMA in the right situation to ensure high growth. It should be a time-bound and continuous effort.

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APPENDIX

Trend Analysis of Fiscal Indicators

Trend in Fiscal Deficit

Fiscal deficit can be defined as the excess of total disbursements from the consolidated fund of India, excluding repayments of debt, over total receipts into the consolidated fund of India, excluding the debt receipts during an FY.[7] It is one of the significant fiscal indicators to measure fiscal sustainability. Fiscal deficit/surplus is the difference between total revenue account and capital account minus the non-debt capital.

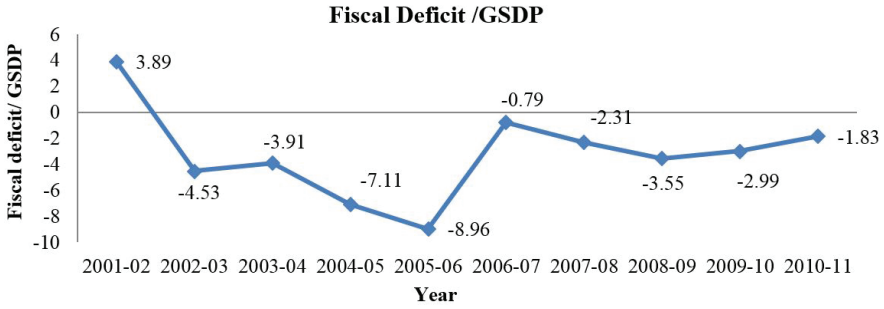

Fig. 2: Trend in Fiscal Deficit

Source: Database, Planning Commission, India.

The graph presented in Figure 2 shows that since the 2002-03 Fiscal deficit/GSDP remains below the negative axis. Only in 2001-02, there was a presence of fiscal surplus. However, in the very next FY 2002-03, there was a sharp decline in the fiscal surplus, and it reduced to –4.53 per cent, a decline of 8.42 in percentage points. In the successive FYs, except in 2003-04, it recorded a margin increased of 0.55 percentage points. Afterward, it continued to decline and it reached the highest level at –8.96 per cent in the FY 2005-06. The fiscal deficits of the state have been rising at an alarming rate. The variance in primary fiscal expenditure in FY 2005-06 had narrowed down drastically. Although in FY 2005-06 there was noticeable underspending on the expenditure side at the aggregate level, the decreasing variance was mainly on account of disbursements under Loans and Advances of Rs 37,470 million. This sharp rise was on account of repayment of central dues of Rs 28,560 million of the Jharkhand State Electricity Board by the Government of Jharkhand. However, in the next FY 2006-07, it showed vast improvement and fiscal deficit stood at merely 0.79 per cent, an increase of 7.17 percentage points. However, since 2002-

[7] FRBM Bill, published on the website of the Ministry of Finance, GoI.

03 it never attained the fiscal surplus, and after FY 2006-07 the fiscal deficit remained to be consistent with slight fluctuating rate. In some years it exhibited an increasing trend and in the next consecutive year, it is showing a declining trend.

The highest level of fiscal deficit recorded was 8.96 per cent in the FY 2005-06. As an average for the period 2005-08, RBI reports a fiscal deficit/GSDP ratio of 8.8 per cent, '*Jharkhand turned from a revenue surplus to a revenue deficit state.*' An attempt at fiscal reform could not sustain and during 2009-10 Jharkhand could not meet the target of revenue balance on account of the impact of revised pays and pensions, higher need for public spending, and a decrease in the flow of revenue receipts because of the economic slowdown. Not so surprisingly, Jharkhand registered an increase in the fiscal deficit by 0.79 percentage points; it could afford a slight increase since the target ratio was 3 per cent or less for all states. The JFRBMA was passed in May 2007. Without getting into timelines, this effectively required the fiscal deficit/GSDP ratio to be no more than 3 per cent and the revenue deficit to be eliminated. It means that JFRBMA must address both revenue and expenditure to reduce the degree of fiscal deficit.

Trend in Revenue Deficit

Revenue deficit can be defined as the difference between the revenue receipts and revenue expenditure which indicates an increase in liabilities of the concerned government without a corresponding increase in the assets of that government. Revenue account is the basis on which annual plans for a state prepared; hence, the importance of this estimation cannot be overemphasized.

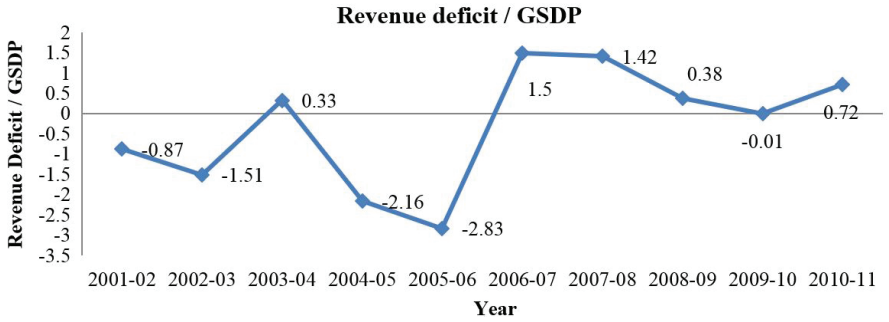

Fig. 3: Trend in Revenue Deficit

Source: Database, Planning Commission, India.

The graph presented in Figure 3 show the trend in revenue deficit from 2001-02 to 2010-11. Jharkhand has recorded revenue surplus like fiscal surplus in the formation FY 2001-02 and stood at only 0.87 per cent and

even managed to register a revenue surplus during FY 2003-04 but the fiscal scenario for Jharkhand changed and revenue account declined for consecutive two periods before registering the considerable improvement and it again attained the revenue surplus in FY 2006-07. Jharkhand is the exception state with a very high rate of revenue expenditures. Like fiscal account revenue account also recorded the highest level of revenue deficit in FY 2005-06. The Government of Jharkhand in its memorandum to the Twelfth Finance Commission accepted that the revenue deficit in 2001-02 and 2002-03 has been Rs 305 crore and Rs 572 crore, respectively. It indicated that the government was virtually clueless about the expected revenue and expenditure; otherwise, the projected surplus would not have turned into a deficit. It affirmed the fact that revenue deficit was a significant factor in pushing fiscal deficit at the highest level in FY 2005-06. The Jharkhand economy witnessed the revenue surplus for the next 2 years before dipping again below the negative axis in FY 2009-10. The state has achieved the target set in the FRBMAA by eliminating the revenue deficit into a huge surplus, Rs 946 crore, which further improved to Rs 1,195 crores in 2007-08. However, the surge in the revenue account continue, vis-à-vis, revenue receipts which started in 2008-09 continued, and the fiscal situation of revenue surplus could not be retained during 2009-10 as there was revenue deficit of –0.01 per cent, however, again in 2010-11 Jharkhand economy registered a revenue surplus and reached 0.72 per cent.[8] As an average for the period 2005-08, RBI (2010) reports a revenue deficit/GSDP ratio of 2.2 per cent.

It appears that Jharkhand, with low revenue deficits in the first period itself, was not mainly motivated to undertake revenue account adjustments during the reform period, which resulted in relatively small adjustments seen in the second period as compared to the first. The underutilisation of funds under the grants continued to persist on several factors including implementation progress, issuance of utilisation certificates as well as the efficiency of the central process. On the revenue side, the most important items of expenditure are salaries, pensions, and interest payments. Any such increases in salaries need to be compensated by gains made through efficiencies in expenditure. While immediate interest payments cannot be touched, future interest payments can be curbed by reducing future debt.

The Thirteenth Finance Commission has proposed this, that with a revenue deficit target of 0 per cent and a tax/GSDP ratio of 12 per cent, this means that non-tax revenue/GSDP must be about 11 per cent. Grants from

[8] Finances of the State Government, 2010-11, CAG.

the centre can be assumed to contribute 3.5 per cent of this. Therefore, non-tax revenue/GSDP (net of grants) must be at least 7.5 per cent and even if one ignores mining royalties, provided that appropriate user charges imposed. A large chunk of fiscal reform should be targeted at increasing non-tax revenue/GSDP. Therefore, if the revenue deficit target addressed, Jharkhand should quickly move to a fiscal surplus.

Trend in Primary Deficit

The primary deficit can be defined as the difference between the fiscal deficit and interest payments. It shows the extent to which the fiscal deficit is constituted of interest payments and writing off the debt only. It exhibits those borrowings which have taken to finance the interest payments incurred on the previous year as loans and advances. The reason for examining variations in ratios based on the primary deficit is that debt service payments during the year may change due to interest rate movements.

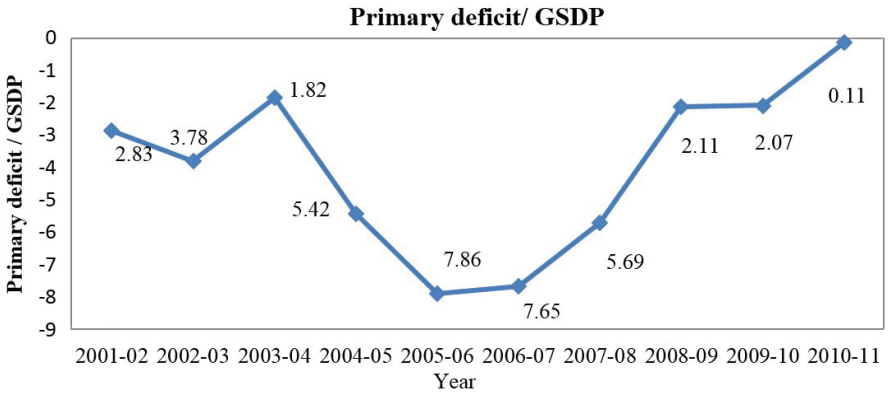

Fig. 4: Trend in Primary Deficit

Source: Database, Planning Commission, India.

As an average for the period 2005-08, RBI (2010) reports the primary deficit/GSDP ratio of 7.0 per cent (Figure 4). The smaller interest payments in the second FY 2002-03 convert the marginal reduction into fiscal deficits to an increase in primary deficits and primary deficits declined to 3.83 per cent. Jharkhand showed an increased fiscal deficit in the second FY 2002-03. It is no surprise that the same is seen in primary deficits too. Jharkhand had a primary deficit close to zero in FY 2003-04. After FY 2003-04, it was on an increasing trend and touched the highest point in the FY 2005-06. This represents the similarity found in previous indicators. The reasons were the high fiscal and correspondingly high revenue deficit. It reinforced the slowdown process that is visible in FY 2005-06. After FY 2005-06, only

interest payments showed a declining trend. In FY 2008-09, it declined more than 3 percentage points, exactly 1 year after the implementation of the JFRBMA. The strategy of JFRBMA to reinstate the major fiscal deficits has already produced positive results and this is evident in all the graphs of fiscal indicators from FY 2007-08 to FY 2008-09. The major improvement is shown in FY 2010-11 when primary deficit touched zero level and there was a reduction in the debt/GSDP ratio and it declined in the interest rate on the borrowings and loans of the Government of Jharkhand.

The persistence of significant primary and revenue deficits of the government sectors over the years is a major concern and would lead to an unsustainable accumulation of public debt. Interest payments can only aggravate the situation of the higher revenue and fiscal deficit. The decline in the interest payment is necessary to reduce the differences in revenue and fiscal balance.

Trend in Debt/GSDP Ratio

The debt/GSDP ratio determines the sustainability of fiscal policies. Fiscal sustainability of a state government is judged by the fiscal liabilities position also, besides the deficits. This is obviously because liabilities provide the stock figure, which annual deficits add to. A small amount of liabilities can allow high levels of deficit for some time without affecting sustainability too much, while a high level of liabilities reduces the tolerance for deficits drastically. It is for this reason that the Twelfth Finance Commission had recommended a prudent maximum level of state indebtedness at 25 per cent of GSDP.

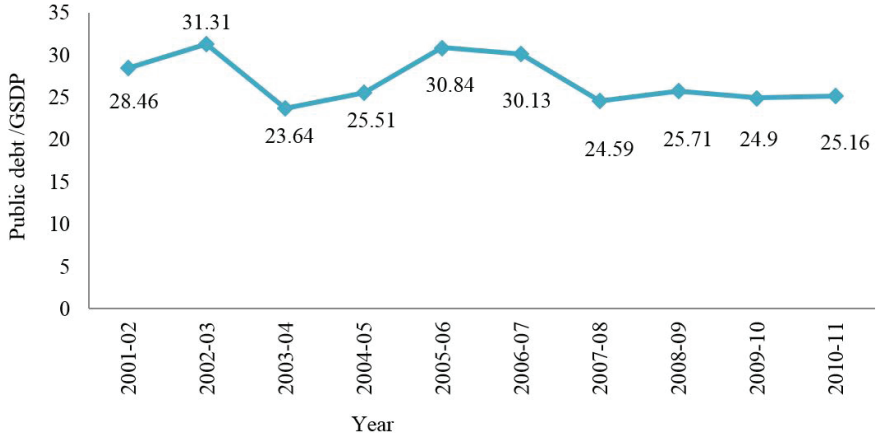

Fig. 5: Trend in Debt/GSDP Ratio
Source: Database, Planning Commission, India

The graph presented in Figure 5 shows that the debt/GSDP ratio between 23 per cent and 32 per cent. It is not exhibiting a significant variation in the percentage points. In FY 2002-03, it was 28.465 and reached the highest level of the decade in FY 2002-03 at 31.31 per cent. A similar pattern from another graph can be seen here also as in 2005-06 the debt/GSDP ratio was again at the highest level and reached 30.84 per cent. Public debt continues to be responsible for pushing other deficit indicators such as the fiscal deficit, revenue deficit, and primary deficit to a higher level. The public debt of the state has been rising. The widening of fiscal deficit and consequent rise in debt stocks since FY 2002-03 have resulted in mounting expenditure on interest payments. According to the Memorandum of 31 March 2003, the state had a massive debt of Rs 12,000 crore, which was almost 35.5 per cent of the GSDP of the state. The payment of interest on borrowings has increased from Rs 565 crore in FY 2001-02 to Rs 1,168 crore in FY 2002-03. The interest burden kept on increasing even in the second half of decades despite a softer interest rate regime reflecting the impact of sizeable outstanding liabilities contracted at higher interest rates during the early part of the decade and a return to rising deficits. The persistent rise in interest payments since the FY 2004-05 has remained a cause of serious concern as they increasingly absorbed a more significant portion of revenue receipts.

Trends in Interest Payments

Interest payments are the cost of borrowing and debts. It is one of the vital measures to show the direction and magnitude of the revenue channelized to finance the only cost of borrowing and the payment of the actual loan.

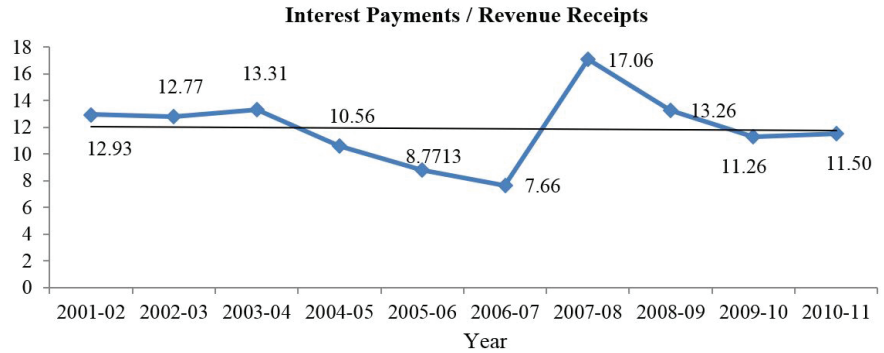

Fig. 6: Trends in Interest Payments
Source: Database, Planning Commission, India.

The graph presented in Figure 6 provides an interesting observation. It was constant in the initial three FYs since the formation of Jharkhand.

Afterward, it continued to be in declining trend till FY 2006-07 and touched the lowest level in 2006-07. However, in FY 2007-08 it gained 10 percentage points and reached the summit level of the decade at 17.06 per cent of total revenue receipts. The continuous rise in interest payments since 2006-07 has remained a point of serious concern as they increasingly absorbed a more significant portion of revenue receipts. It implies in an accounting sense if interest payments or repayments of loans or both exceed total gross borrowings, it is argued that there is a debt trap. A debt trap is a vicious trap that starts from the government's borrowings and interest payments on these borrowings drive the government to again apply for the loan. The importance of being able to reduce interest payments in undertaking fiscal adjustment cannot be minimised.

Findings

The trend analysis is just a progress report to show the path, direction, and magnitude of fiscal indicators. It shows whether it is following the increasing, constant, or decreasing trend. It visualises the period during which fiscal indicators touched the lowest and highest level and the extent to which the magnitude changes the direction of fiscal indicators. The significant findings of trends analysis are the following:

- The first year FY 2001-02 for Jharkhand economy was moderate as the state economy performed well with revenue deficit was reported at 0.87 per cent. The primary deficit reported at 2.83 per cent was also low, and the debt/GSDP ratio stood at 28.46 per cent.
- The FY 2005-06 was the critical year in the Jharkhand economy. This FY marked the slowdown in the Jharkhand economy. All the major fiscal indicators fiscal deficit, revenue deficit, primary deficit, and the debt/GSDP ratio reached the highest level. The fiscal deficit stood at 8.96 per cent, revenue deficit at 2.83 per cent, primary deficit whooping at 7.86 per cent, the debt/GSDP ratio at 30.84 per cent, and interest payments was Rs.71,953 crore.
- The financial position of the state has been progressively under strain. The number of loans and advances, mainly loans to the power sector has jumped drastically in 2005-06 leading to a spike in the fiscal deficit. Another reason was the sharp rise on account of repayment of central dues of Rs 28,560 million of the Jharkhand State Electricity Board by the Government of Jharkhand.
- In FY 2007-08 with the passage of the FRBMA, the Jharkhand economy witnessed positive results in fiscal health. The measures and

recommendations of successive finance commissions, MTRFs, FRBMA provided an institutional framework and bound the government to prudent fiscal policies. These institutional reforms aimed at institutionalising a Medium-term Fiscal Framework within a stipulated time frame for encouraging a gradual reduction in fiscal and revenue deficits. These policies helped to accelerate the wheels of the economy and significant fiscal indicators declined sharply. The fiscal deficit declined and stood at 3.55 per cent and the revenue surplus recorded at 1.42 per cent, and the primary deficit declined to standing point of 5.69 per cent.

- The debt/GSDP ratio continues to follow a constant trend and remains in the range of 23 per cent to 32 per cent. The Government of Jharkhand did not follow an organised set of budgetary and fiscal policies otherwise the revenue surplus in the initial years of the formation of Jharkhand would not turn into revenue deficits, and within the fifth year of formation, Jharkhand economy witnessed the slowest phase in the economy. All the major fiscal indicators reached the highest level in FY 2005-06.
- The earlier-mentioned points reiterate that there is a fluctuating trend in all these indicators. There is no constant trend as sometimes it is increasing and otherwise it is declining. A visual concept can be concluded that fiscal policies are not sustainable at different points of time.