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**TOPICS OF INTEREST (INCLUDE BUT ARE NOT LIMITED TO):**
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This issue presents articles covering strategic information technology and applications for business enterprises, universities, research libraries, citizen journalists, and both national and international affairs. The articles cover critical aspects of organizational strategies for organizations along with one article covering technological developments enabling strategies with enormous international implications for individuals and countries. The range of strategic applications and their impacts is represented by the variety of articles and coverage of this issue.

The first article, *Citizen Journalism: How Technology Transforms Journalism Business through Citizen-Reporters in Nigeria*, describes the effects of technology on journalism and the international implications. These are apparent in the recent developments in the Middle East, demonstrating the power of technology to transform communication channels, media sources, events, and the fundamental nature of journalism. Technological advances now allow citizens to record and instantly publicize information and images for immediate distribution on ubiquitous communication networks using social media such as Twitter, Facebook, and Youtube. These technologies are enabling non-journalists to become “citizen reporters” (also known as “citizen journalists”), who record and report information over informal networks or via traditional mass media channels. Against the background of media repression in Nigeria, the article reports on a study examined the impacts of technology on the journalism business as a way of understanding how citizen-reporters impact the journalism business in Nigeria. Specifically, the focus of the study was on Nigerian citizen-reporters (bloggers, social media, online news, and online discussion groups), their roles, and the impacts on Nigeria’s political struggle, free press, and free speech. In addition, the study collected information on the technology and media modalities used, audience composition, and the changes to news reporting and distribution.

The next three articles focus on increasing market share and competitive strategies. In *Capability Development of Customers: A Globally Viable Business Strategy for the Coming Age* Sharma, Madan, and Seth recommend organizational application of a capability concept to customers as a way to expand the business and market. Through exploration of examples from around the world, Sharma et al. explore the applicability of ‘capability’ development as a globally viable business strategy. To examine its
application in organizations, the authors cover the capability development in the microfinance area in India.

The emergence of Business Intelligence is explored by N. P. Singh and Mohammad Jaffer Nayem M in *Critical Analysis of Expansion Strategies of SAP, IBM, Oracle and Microsoft in the Area of Business Intelligence*. The authors describe strategies for increasing the market share of large vendors, specializing in BI application and infrastructure, and BI pure play vendors. As an introduction, the paper begins with the history of the BI industry since 2002 and includes a discussion of the underlying dynamics with a discussion of the growth strategies of four vendors: SAP, IBM, Oracle and Microsoft. The article concludes with a discussion of customer reactions to the new BI paradigm, impact of the acquisition on BI market and concluding remark on the acquisition of pure play vendors by big four.

In the 21st century marketplace, efficient and effective business processes are key to successful operations for many organizations. The issue begins with important and surprising findings on the representational techniques used in business process redesign. In the article, *Representation Type Preferences in Operational Business Process Redesign: A Quasi-Experimental Field Investigation*, Kock reports the results of a quasi-experimental field study focusing on business process redesign groups in four different US organizations which used two different representations of business processes: 1. representation activity flow (or workflow) view of business processes and 2. communication flow view. The results suggests that communication flow-oriented representations of business processes are perceived to be more useful than the more commonly used activity flow-oriented representations: identification of opportunities for process improvement, application of process redesign guidelines, visualization of process changes, and development of generic information technology solutions to implement new business processes. Important implications for managers and researchers stemming from these results are discussed.

Finally, in academia, efficiency, fund exploitation and estimation are fundamental to the success of university research and universities themselves. Therefore, it is key to have accurate methods for assessing research. Liu, Huang, Qian, and Huang discuss the deficiencies in the current methods in their article, *Studies on Utilizing the Three Famous International Index Systems to Evaluate Scientific Research Level of Higher Learning Institutions*, and instead, use comprehensive factor analysis to estimate research level, efficiency, fund exploitation, and other aspects in the widely accepted indices used to evaluate the scientific research level of higher learning institutions by many country’s science and technology field currently. Because these methods are not scientific enough and do not properly evaluate the efficiencies of the universities, the authors using a comprehensive factor analysis method to understand the relationships among variables in popular indices including the Science Citation Index (SCI), Index to Scientific & Technical Proceeding (ISTP), and The Engineering Index (EI).

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Caroline Howard (PhD) is an author, editor, consultant, and educator. She has published a number of articles on technology and learning. Her books include the first and 2nd editions of the Encyclopedia of Distance Learning (2005 and 2009), Winning the Net Game: Becoming Profitable Now that the Web Rules have Changed (Entrepreneur Press, 2002), The Design and Management of Effective Distance Learning Programs (2002), and Distance Learning and University Effectiveness: Changing Educational Paradigms for Online Learning (2005). Caroline holds an MBA from The Wharton School, University of Pennsylvania and a PhD in management information systems from the University of California - Irvine where she received honors for her teaching and research.
Citizen Journalism: How Technology Transforms Journalism Business through Citizen-Reporters in Nigeria

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ABSTRACT

Recent national and international developments are demonstrating the power of technology to transform communication channels, media sources, events, and the fundamental nature of journalism. Technological advances now allow citizens to record and instantly publicize information and images for immediate distribution on ubiquitous communication networks using social media such as Twitter, Facebook, and Youtube. These technologies are enabling non-journalists to become “citizen reporters” (also known as “citizen journalists”), who record and report information over informal networks or via traditional mass media channels. Against the background of media repression in Nigeria, the article reports on a study that examined the impacts of technology on the journalism business as a way of understanding how citizen-reporters impact the journalism business in Nigeria. Specifically, the focus of the study was on Nigerian citizen-reporters (bloggers, social media, online news, and online discussion groups), their roles, and the impacts on Nigeria’s political struggle, free press, and free speech.

Keywords: Cell Phones, Censorship, Citizen Journalism, Handheld Technologies, Internet, Propaganda, Mobile Technologies, Social Media, Social Networks

INTRODUCTION

Recent national and international developments are demonstrating the power of technology to transform communication channels, media sources, events, and the fundamental nature of journalism. Technological advances now allow citizens to record and instantly publicize information and images for immediate distribution on ubiquitous communication networks using social media such as Twitter, Facebook, and Youtube. These technologies are enabling non-journalists to become “citizen reporters” (also known as “citizen journalists”), who record and report information over informal networks or via traditional mass media channels.

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Citizen journalism is not new as people have been chronicling activities since cave dwellers pictorially depicted bison on their cave walls, and technology has facilitated mass communication since the Guttenberg press (Bentley, 2006). However, more than any prior technology, the Internet has revolutionized communications (Leiner, Cerf, Clark, Kleinrock, Lynch, & Wolff; 2003).

The universal availability of the Internet and mobile technologies has dramatically expanded the population of those who can broadcast information, blurring the distinctions between professional reporters and citizen journalists (Papandrea, 2007). Technology has greatly impacted news reporting, consumption, and creation (Gillmor, 2004) as people depend more on the Internet and alternative media sources for their news and other information (Marshall, 2005; Pisani, 2005; Papandrea, 2007). The influence of elites and institutions is giving way to wider public participation and greater interactivity as blogs, Twitter broadcasts, media forums and networks broadcast instantaneous, unfiltered news to the millions. Every citizen with access to the appropriate technology can now practice journalism, and no training nor is professional affiliation required for citizens to report news stories, record video, and broadcast information (Marshall, 2005).

Not only do technologies increase the information disseminated and allow more people to participate in public conversations, technology enabled citizen journalists can actually determine events and, therefore, change the course of history. In disasters and other emergency situations, citizen broadcasts provide early warnings, assist in locating people who need assistance, and transmit other critical information. Much of the video on catastrophes, such as Katrina and Tsunami, was captured and broadcast internationally by citizens using handheld devices (Marshall, 2005). Citizen reporters have recorded revealing behavior by public figures, arguably altering political careers, election results, and decision making. In other words, citizens using technologies are transforming the face of news reporting, developing news channels, and even creating the news itself.

The power of citizen journalism to determine events is powerfully demonstrated in the current Middle Eastern uprisings. Developments in the region and beyond provide strong evidence of the influence of a technology equipped populous and demonstrate how citizen journalists can alter the course of history. Flew (2008) explains how having access to alternative sources of news and information is enormously important in countries that are not democracies, are young democracies, or where there is a pattern of direct or indirect state control over media sources. (Flew, 2008). According to Zakaria (2011), “technology — satellite television, computers, mobile phones and the Internet — has played a powerful role in informing, educating and connecting people in the region. Such advances empower individuals and disempower the state” (Zakaria, 2011, p. 8).

Prior to pervasive handheld technologies, repressive governments regulated the media messages received by their populations through control of networks and communication channels. Thus, they could shut down networks and manipulate information flows to keep their populations uninformed through media censure, propaganda, and stopping the communications needed to gather the support required for successful revolt. Now technology may allow citizens to freely express previously suppressed views enhancing their free speech, human rights, and political freedom (Flew, 2008).

Access to multiple networks and media enables the populous to distribute information in spite of government efforts to curtail communications, and in the case of Egypt, facilitated the continuing of demonstrations that removed a dictatorship and transformed history.

While citizen journalism was originally seen as a threat to professional news sources (Koch, 1998; Moretzsohn, 2006), now many news organizations make use of citizen journalists to their advantage (Pisani, 2005). With technology fundamentally changing the reporting and creation of news, traditional media organiza-
tions are being forced to either be a part of the transformation or become irrelevant (Gillmor, 2004). In 1998, Koch lamented that American bookstores were inundated with books written by professional journalists “bemoaning the death of journalism as we know it” (p. 2). Alternatively, Koch (1998) speculated that citizen journalism could also be seen as the dawn of a new era that would change the media landscape for the better. The record of the past thirteen years seems to confirm his speculation. Despite the initial concerns expressed about citizen news writers by some scholars and journalists, media organizations depend on citizen newsmen to boost news gathering, reporting, and distribution. Prior to the emergence of social media, handheld technologies, and global networks, images and information were lost during the time it took for professional journalists to travel to the locations where news was transpiring. Now, these events are frequently captured live and transmitted to informal networks or broadcast via traditional media channels. Today, information collected by citizen journalists is used to supplement the information collected by paid journalists, providing previously unavailable content on unexpected and other events outside the traditional coverage.

Against the background of media repression in Nigeria, this study focuses on how technology is revolutionizing their journalism. The study examined the impacts of technology on the journalism business as a way of understanding how citizen-reporters impact the journalism business in Nigeria. Specifically, the focus of the study was on Nigerian citizen-reporters (bloggers, social media, online news, and online discussion groups), their roles, and the impacts on Nigeria’s political struggle, free press, and free speech. The study was guided by the following research questions:

3. What are the impacts of citizen-reporters on democracy, free speech, and the public sphere in Nigeria?

In addition, the study collected information on the technology and media modalities used, audience composition, and the changes to news reporting and distribution.

LITERATURE REVIEW

The literature provides insights into the changing face of journalism, the impacts, and the specific ways that news is being reported and consumed. The differences between professional and citizen journalism were recognized early by Bowman and Willis (2003), who call the traditional methods of news reporting a top-down news model based on “transmit push” with media organization control. Bowman and Willis (2003) describe citizen-reporting as a “bottom-up” news model, a peer-to-peer, social network called “Intercast” where “participants are peers and have the ability to change roles and news is often unfiltered by a mediator before getting to its audience” (Bowman & Willis, 2003, p. 10). Jost and Hipolit (2006) describe the impact of this shift, describing how citizen journalism is reducing the influence of elites and institutions to enable wide public participation and greater interactivity.

There are other ways that citizen journalism differs from traditional media. First, the consumers have different habits. In a survey of people registered as authors on MyMissourian.com, Bentley (2006) found that citizen journalism participants had moderate consumption of local media and lower consumption of national sources. The participants in the study were interested in alternative political opinions and community building (Bentley, 2006).

The motivations of the organizations and journalists also differ from traditional. A study by Schaffer (2007) conducted in-depth interviews with founders, owners, or operators of a diverse group of 31 citizen media sites and an online survey of readers, contributors, and
operators of the nearly 500 citizen media sites that could be identified at the time. Based on findings from the 191 respondents, Schaffer (2007) describes how success on these sites is not measured by traditional metrics like unique visitors, page views or revenues, but was frequently defined as impact on their community. Over half reported that they did not need to make money to continue the site, and there is a high degree of optimism that citizen news sites are here to stay. Schaffer (2007) concludes that “citizen journalism ranks low on revenue and readers. It ranks high on perceived value and impact. While it aspires to report on community, it aspires even more to build community” (p. 7).

Unlike traditional media, citizen media site are likely to lack financial support, quality control, and a formalized code of conduct. Much of the literature on citizen journalism emphasizes the possible credibility problems that can arise and expresses concern about the negative impacts on journalism if citizens engage in reporting without the training and ethical codes of professional journalists. For example, Moretzsohn (2006) speculates that information provided by citizen journalists is not perceived as legitimate or credible due to the lack of training. Burns (2008) explains that citizen-reporting has increased the information and people reporting, but like open source software it lacks quality control as the news audience to produsage, who participate in news production and decide what is published as news.

Researchers (Burns, 2008; Allan & Thorsen, 2009; Lewis, Kaufhold, & Lasorsa, 2010) advocate quality control and gate keeping ensuring the credibility of the news contributed to the mainstream media by citizen reporters. Since gate keeping can imply control over the selection of stories that are fit to print, Burns (2008) recommends “gate watching” that involves the review of content but leaves it to users to decide for themselves what they wish to print. By combining the two, credibility problems can be addressed without severely restricting the flow of information. Similarly, Lih (2004) proposes participatory journalism that enables the news audience to participate in the process of rationalizing content, formulating the news, and contributing knowledge. Wikipedia is an example of a site where content is created collaboratively and the audience checks for quality control (Brookover, 2007).

An alternative perspective on media credibility is presented by Sweetser, Porter, Chung, and Kim (2008) who believe that the lack of trust of the professional media contributes to the shift in news consumption. They point to online news due to statistics that show that more people believe bloggers (5.8%) than believe traditional media (4.4%). Similarly, blogs are frequently seen “as a source of information for the public” and according to statistics from the American Life Project report that 8% of American Internet users write blogs while 34% of those online read blogs (Brookover, 2007).

Studies have also analyzed the differences in the impacts of citizen and traditional journalism. Flew (2008) observed that citizen journalism can advance the cause of democracy and human rights. The impacts observed recently in the Middle East were also evident in South Korea’s Oh My News and Qatar-based Al Jazeera where citizen journalism created a new public sphere (Flew, 2008). Jost and Hipolit (2006) observed that citizen reporters reduce the influence of the elites and institutions, thus allowing wider public participation and greater interactivity. Reviewing blogging from around the globe, Jost and Hipolit (2006) describe how the increasing number of bloggers who use new technologies to contribute news and images without journalism training will change politics, business, and popular culture for the better by reducing the influence of elites and the institution—thus allowing wider public participation and greater interactivity.

METHODOLOGY

This research is a phenomenological, qualitative study examined the experiences of Nigerian journalists, citizen-reporters, and their audi-
ences to determine how technology impacts news delivery in the country. To investigate the impacts of technology on citizen news correspondents in Nigeria, the study combined observations and analysis of Nigerian citizen media websites and Nigerian print media online editions with interviews of Nigerian citizen and print journalists. National daily newspapers were covered, mostly Lagos-based (Lagos is the commercial nerve of Nigeria) and English publications. These publications include The Guardian, Punch, Tribune, This Day, Vanguard, The Nation, Champion, Daily Independent, Compass, and Next. The study reviewed tools used commonly by Nigerian citizen-reporters including the Global System for Mobile Communications (GSM), Facebook, Twitter, MySpace, news blogs, online news websites, mailing lists (distributing Nigerian news), and online discussion groups.

The study participants included ten respondents from each of three groups: Nigerian-citizen-reporters, traditional reporters, and readers of Nigerian online news selected by two journalism organizations in Nigeria (Journalists for Democratic Rights (JODER) and International Press Center (IPC)). Print journalists had less than ten years of active journalism practice in Nigeria’s print media, citizen-reporters were required to be involved in citizen-reporting in relation to Nigeria, and readers of Nigerian online news were regular readers of Nigerian online. Each of the participants for the study was interviewed for about one hour, during which each participant relayed their lived experiences with citizen reporting. To complement the interviews with the citizen-reporters, print journalists, and their news audiences, the researcher reviewed 10 Nigerian citizen journalism news websites and 10 Nigerian print media websites to determine how media technologies and media modalities in digital technologies transform news gathering, reporting, and distribution in Nigeria. However, television and radio broadcast media were not studied. Therefore, only newspapers that circulate nationwide (daily) in the country were selected.

FINDINGS AND DISCUSSION

The three categories of participants, citizen reporters, print journalists, and news audience, agreed on ways that technology enables citizen journalists and transforms the journalism. An interesting finding was that the websites were international in that the sites offered Nigerians living at home and abroad an opportunity to contribute and read Nigerian news. It is strange to note that most of the operators of Nigerian citizen-media sites were based outside Nigeria. In fact, it turned out that out of the ten websites, seven were operated from United States, while the other three were based in Nigeria. For the sites based in the United States, the operators received their news from Nigeria using social media tools. The news is published using open source software is used, and then, news from the sites are then circulated to Nigerians, around the world, through social media tools like Facebook, Twitter, MySpace, and YouTube. The ten online media professional publications were editions that were a part of larger Nigerian media organizations. These sites published only major stories that were also published in the print editions, but these sites added video content online which is unprecedented.

Like the other two groups of participants, citizen media reporting sites use GSM, Facebook, MySpace, Twitter, and YouTube. In general participants appear to have similar experiences with citizen-reporting. All viewed it as a vehicle for transformation in the business of news delivery in Nigeria and believe citizen-reporting to be revolutionizing the journalism profession. The citizen reporters tend to be anti-government and were very active on the sites, responding to posts and engaging in debate.

Conversely, there were differences between the participants particularly on ethics. The citizen-reporters did not express being bound by journalistic ethics, because they do not claim to be journalists. On the other hand, print journalists stated that anyone reporting news should abide by the ethical standards of the journalism profession.
Since both citizen-reporters and print journalists reported that lack of access to the Internet, need for emerging media technologies, and power outages presented major challenges as they all used World Wide Web, GSM, Facebook, MySpace, Twitter, and YouTube as the most significant technologies used for citizen-reporting in Nigeria.

CONCLUSION

The findings from the study support the paradigm shift in news reporting discussed earlier. Nigerian citizens without any tie to any media organizations are contributing news items directly to mainstream media using available technologies. This reporting avoids traditional “gatekeepers” and allows Nigerians the opportunity to post news stories without censure or editing. Participants believed that everyone can be a journalist and that with social citizen-reporting is transforming news gathering, reporting, and distribution. As evidence of the possible transformational impacts, it appears that citizen journalism in Nigeria produce a more vibrant and inclusive press with less control and oversight of new. Citizen reporting is also building new online communities that boost democratic efforts.

Also, there is still suppression of information in Nigeria in spite of citizen journalistic efforts. Journalists, critical of the government, have been assassinated, and Reporters Without Borders (2010), a press freedom organization, reported 58 cases of abuse of authority and violence against Nigerian journalists in 2009 and about 20 in the first quarter of 2010. On April 24, 2010, three Nigerian journalists were killed by unknown gunmen and two foreign journalists were kidnapped in March (Reporters Without Borders, 2010). While difficult to enforce, an Islamic court banned the debate on Facebook, Twitter, or any blog regarding the order to amputate served on a Nigerian citizen (Reporters Without Borders, 2010). This ban demonstrates existing mistrust of social interactivity that exists still in Nigeria and an indication that citizen journalism does not yet mean free flow of information in Nigeria.

The current research was based on a small sample in the print media only in Nigeria, therefore further research is needed to confirm the findings and generalize to other media types, countries, and communities. If the impacts of technology through the citizen reporter were studied in relation to radio and television journalism in Nigeria, the results may have been different. Quantitative research, using a larger sample of participants from these media sources along with TV and radio, is needed to confirm the findings on Nigerian journalism.

REFERENCES


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Caroline Howard (PhD) is an author, editor, consultant, and educator. She has published a number of articles on technology and learning. Her books include the first and 2nd editions of the Encyclopedia of Distance Learning (2005 and 2009), Winning the Net Game: Becoming Profitable Now that the Web Rules have Changed (Entrepreneur Press, 2002), The Design and Management of Effective Distance Learning Programs (2002), and Distance Learning and University Effectiveness: Changing Educational Paradigms for Online Learning (2005). Caroline holds an MBA from The Wharton School, University of Pennsylvania and a PhD in management information systems from the University of California - Irvine where she received honors for her teaching and research.

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Rick Livingood currently is the Faculty Chair for the Department of Information Technology in the School of Business and Technology at Capella University. Dr. Livingood has been involved in areas of technology since high school days. His first software program was written in FORTRAN II on an IBM 1620 using punched cards. Dr. Livingood has a broad background in technology and business. His past positions have included radio broadcaster, VP of Finance and Operations, Director of Information Technology, IT Auditor, and IT Consultant. For over 12 years, he supported military and corporate customers with technology infrastructure, software development, and implementation services. He has worked with Department of Defense organizations such
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Capability Development of Customers: A Globally Viable Business Strategy for the Coming Age

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ABSTRACT

This paper identifies the application of capability concept (Sen, 2000) as a globally viable business strategy for the coming age which can be used to expand markets into all levels of the social stratum. ‘Capability’ development is proposed as a way to propel business and expand markets to all levels of the social stratum. The article describes how Information and Communication Technology will create the buying power at the bottom of the pyramid and convert this stratum into a market as well as achieve social development. The paper examines these recommendations through an exploration of their application to the business strategies of two microfinance firms in India.

Keywords: Business Strategy, Capability, Development, ITC, SKS Microfinance

INTRODUCTION

“Peoples all over the world have high hopes that new technologies will lead to healthier lives, greater social freedoms, increased knowledge and more productive livelihoods” (Human Development Report, 2001, Making New Technologies Work for Human Development)

In the last two decades the world economic scenario has changed because of the information and communication technology. The World Development Report 2000-2001 states “the global forces of integration, communication and technological advance have proceeded apace, bringing significant advances to some. Since, the 1980s the paradigm of social and economic development has shifted from industrialization to information. The industrial revolution of the 18th century mobilized people in factories and cities, but the information technology revolution of today is pulling people into cyberspace. Even further, we are moving on from IT to ICTs and from IT to IS (Heeks, 2001). The digital revolution has already produced remarkable advances in information collection, speed and
volume of information transmission, modes of reception and access. Further, the innovations in software and hardware technology and architecture standards have come up to provide tools to develop integrable, scalable and robust solutions (Gupta et al., 2003). New information systems products and services are emerging in such fields as health care, education, public policy, entertainment, human resource administration, manufacturing, operations, financial administration and transportation. “From now on, what is important is each individual’s quality of digital life.

An apt slogan is 4A’s for everyone-supporting individuals Anywhere, Anytime, with Any device and Any solution. As usability of Information rises with the development of IT, technology conversion- where more than two technologies are used to develop yet a new technology- will determine future progress. There is a need to focus on integrating IT with other technologies leading to next generation of new technologies” (Lee, 2003).

Dr. A.P.J. Abdul Kalam, in his keynote address to the International Conference on e-Governance at IIT Delhi on December 18th 2003, suggested a highly integrative role of e-Governance and the usage of Information and communication Technology for the countries like India, simultaneously emphasizing on the need for the monitoring of the implementation process and system as well (http://www.iitd.ac.in/iceg/). e-Governance on one hand is perceived to reap the benefits of seamless connectivity and innumerable advantages on the part of beneficiaries and generate awareness and bring an information base to strengthen the rural poor, socially as well as economically. This is evident through the success of selected case studies of IT projects being implemented in rural areas of India (Xavier & Pillai, 2003).

Moreover, the usage of ICTs yields benefits due to the acceptance by users and other stakeholders as a mutual understanding for collective action (Habermas 1984), which will develop and the prospects of sustainability of this process will rise, subsequently leading the situation towards ‘Network Readiness’(Heeks, 2001). Here, comes in the situation where same infrastructure not only can be utilized for an integrative usage by linking all the government networks, but also by networking all the other private and NGO services and organizations (Xavier & Pillai, 2003; Prahalad, 2002) for seamless connectivity (Abdul Kalam) for overall poverty alleviation (Mani, 2003) and subsequently for looking this population i.e. rural poor people as a prospective market (Prahalad, 2002) which, will lead not only towards entrepreneurship development, but also will yield in the form of bigger buying power of this part of the population.

But they have bypassed others”. The increasing usage of the technology may give the upliftment of peoples life’s and better opportunity for their sustainable development refers to the “capability” (Sen, 2000) development of the customer through the effective usage of information and communication technology led business opportunity development. By referring to the example called e-Choupal which is implemented by ITC (Indian Tobacco Company) by providing business opportunity to the rural masses, this paper is proposing for the usage of “Information and Communication Technology” led business opportunity development as the main criterion on the impact of developing market.

Thus, the paper approaches with a proposition that if the impact of ICTs on reducing inequality of market transaction supporting the socio-economic development. We actually may come to see the exact picture of the extent to which the ICT led business opportunity development has affected every aspect of market, transforming not only the way that business is conducted but also providing the new dimensions or alternatives through which to enhance the capabilities. Development through ICT has become one of the most important forces and movement towards better and more just society. In the words of Amartya Sen, “we have good reason to buy and sell, to exchange and to seek lives that flourish on the basis of transaction. To deny that freedom of transaction would be itself a major falling of a society.
THE CONCEPT OF CAPABILITY APPROACH:

All the world’s economic policies and public policies are focused on income levels for people and the GNP per capita for a country. The policy makers always talk about the importance of economic growth, which means economic growth of the country. However, the capability approach may be questioned, if economic growth is regarded as the only thing that counts, as there are many important aspects of human welfare that cannot be captured by looking at incomes and growth only. The capability approach says that we have to make a clear distinction between the means or inputs and the ends of the quality of life. So, the income can be an important means for some aspects of well-being (e.g. for the health care sector, for education, etc.), but not for all capabilities (e.g. long-term unemployed are more often socially isolated and depressed, for which there are no simple monetary solutions. In this way, economic growth is important as it provides the means for some important capabilities, but it does not tell us anything about other capabilities. ‘Capability’ is primarily a reflection of the freedom to achieve valuable ‘functionings’. It concentrates directly on freedom as such rather than on the means to achieve freedom, and it defines the real alternative we have. In this sense it can be read as a reflection of substantive freedoms (Sen, 1992). The ‘Capability Approach’ is defining the quality of life and human advantage, independently of the preferences of an individual. In this approach, Amartya Sen brought together a range of ideas that were hitherto excluded from (or inadequately formulated in) traditional approaches to the economics of welfare.

Initially Sen argued for:

- the importance of real freedoms in the assessment of a person’s advantage,
- individual differences in the ability to transform resources into valuable activities,
- the centrality of the distribution of welfare within society,
- the multi-variate nature of activities that give rise to happiness,
- against excessive materialism in the evaluation of human welfare.

Subsequently, and in collaboration particularly with political philosopher Martha Nussbaum, development economist Sudhir Anand and economic theorist James Foster, Sen has helped to make the capabilities approach predominant as a paradigm for policy debate in human development where it inspired the creation of the UN’s Human Development Index (HDI). The HDI is a popular measure for capturing the multidimensionality of human development, as it also accounts for health and education. Furthermore, since the creation of the Human Development and Capability Association in the early 2000s, the approach has been much discussed by political theorists, philosophers and a range of social sciences, including those with a particular interest in human health.

The approach emphasizes functional capabilities (“substantive freedoms”, such as the ability to live to old age, engage in economic transactions, or participate in political activities); these are construed in terms of the substantive freedoms people have reason to value, instead of utility (happiness, desire-fulfilment or choice) or access to resources (income, commodities, assets). Poverty is understood as capability-deprivation. It is noteworthy that the emphasis is not only on how human beings actually function but on their having the capability, which is a practical choice, to function in important ways if they so wish. Someone could be deprived of such capabilities in many ways, e.g. by ignorance, government oppression, lack of financial resources, or false consciousness.

This approach to human well-being emphasises the importance of freedom of choice, individual heterogeneity and the multi-dimensional nature of welfare. In significant respects, the approach is consistent with the handling of choice within conventional microeconomics/consumer theory although its conceptual foundations en-
able it to acknowledge the existence of claims, like rights, which normatively dominate utility based claims (Sen, 1979).

According to this approach, the proper evaluative space in questions of justice, equality, and development is not income, not resources, not primary goods, not utility (i.e., happiness or the sum of pains and pleasures) or preference satisfaction. Its proponents argue that the focus should be on human capabilities. Capabilities have been described as “what people are effectively able to do and be,” (Robeyns, 2005) or the (positive) freedom that people have “to enjoy valuable beings and doings.” (Sabine, 2005)

These beings and doings are called “function-ings” by Sen. Functionings “together constitute what makes a life valuable” (Robeyns, 2005) and are “constitutive of a person’s being.”

The life of a person may be seen as consisting of a set of interrelated functionings. Functionings on the other hand together constitute what makes a life valuable. Functionings include working, resting, being literate, being healthy, being part of community, being respected and so forth.

It is important to clarify the distinction between functionings and capability.

“A functioning is an achievement, whereas a capability is the ability to achieve. Functionings are, in a sense, more directly related to living conditions, since they are different aspects of living conditions. Capabilities, in contrast, are notions of freedom, in the positive sense: what real opportunities you have regarding the life you may lead (Sen, 1987).”

CAPABILITY DEVELOPMENT OF THE CUSTOMER

The development of the capability on the part of the customer if looked upon with the perspective of information and communication technology will bring every aspect of market and social development. If an organization lets the development of the opportunity for the development of the capability of its customers it implies that they want its customer to experience freedom.

BUSINESS OPPORTUNITY

Business strategies and activities meet the needs of the enterprises and its stakeholders while protecting, sustaining and enhancing the human and natural resources that will be needed in the future.

DEVELOPMENT

Development as perceived by (Todaro, 1993) is a multidimensional process involving major changes in social structure, popular attitudes and national institutions, as well as the acceleration of economic growth, the reduction of inequality and the eradication of absolute poverty. Development represents the entire gamut of change by which an entire social systems, tuned to the diverse needs and desires of individuals and social groups within that system moves away from condition of life widely perceived as unsatisfactory and towards a situation or condition of life regarded as materially & spiritually better” (Todaro, 1993).

INFORMATION AND COMMUNICATION TECHNOLOGY

Technologies significantly affect human as well as other animal species’ ability to control and adapt to their natural environments. The human species’ use of technology began with the conversion of natural resources into simple tools. The prehistoric discovery of the ability to control fire increased the available sources of food and the invention of the wheel helped humans in travelling in and controlling their environment. Recent technological developments, including the printing press, the telephone, and the Internet, have lessened physical barriers to communication and allowed humans to inter-
act freely on a global scale. However, not all technology has been used for peaceful purposes; the development of weapons of ever-increasing destructive power has progressed throughout history, from clubs to nuclear weapons.

Information and communication technology (ICT) is the convergence of communications, computing and information technologies. This convergence has resulted in the development of new and improved services delivered over a diverse range of technological platforms. Today, ICT encompasses telecommunications - fixed and wireless, broadcasting, multi-media, software development, electronic publishing, information storage and retrieval, email, distance learning, telemedicine, postal services, electronic commerce, the Internet and much more. In the years to come, we can anticipate an ever expanding cornucopia of ICT products and services that will continually transform our lives and the world in which we live.

Role of Information and Communication Technologies (ICTs) has been exemplified through various efforts and ventures established throughout the country. Some of the prominent efforts (wherein ICTs are being used for the rural and the poor/Bottom of the Pyramid Markets which are being made in the areas ranging from the dissipation of the information to online trading of commodities to telemedicine to education and many others are taking a larger shape as in the case of ITC’s e-choupal, Narayan Hrudayalaya in Karantaka,Nabanna, e Seva (e services) of West Godavari District, Andhra Pradesh eSwasthya - health in a card. Hindustan Lever’s Shakti,LOKVANI’ a multiutility and services based IT enabled effort of the district administration of Sitapur (Hamel, 2009). Information and communication technology affect the opportunity for migration and how they affect its outcomes. As IOM (2005a) states, migration is not only influenced by ICTs, ICTs have become global drivers of migration. Castles (2007) explains this by suggestion that new communication technologies coupled with development in transportation innovations and social changes linked to ICTs are validating and reinforcing human capabilities of rapid information sharing (Castells, 2000). Awareness of proximity between countries and regions through media images and personal experiences of the world mean that ICTs are in fact “bringing the world closer together” (Pries, 2005, p. 167). In the present era the information and communication technology have enable to change the people life that they live, acquire knowledge. The take up of social computing and new participative approaches impact public services such as government, the health sector and education and training (Osimo, 2008; Ala-Mutka, 2008; Punie, 2008; Redecker, 2009). Collaborative development and sharing of media content (e.g. blogging, podcasting, Wikipedia, Flickr, YouTube) and social networking (e.g. MySpace, Facebook, SecondLife) are transforming social capital, which has implications for inclusion (Zinnbauer, 2007; Cachia et al., 2007; Cachia, 2008). In this way information and communication technologies (ICT) uses as instrument for poverty alleviation in developing countries. The successful experience of East Asian countries has lent support to an ‘ICT -led’ development thesis implying that poor countries can adopt ‘leapfrogging’ strategies. According to this view ICTs represent a ‘window of opportunity’ for developing countries (Hobday, 1997) to progress from a situation of ‘zero’ or ‘limited’ technology to widespread adoption of ‘sophisticated’ technologies, without going through the stages of technological adaptation and learning experienced in developed countries.

E-CHOUPAL

e-Choupal, which physically consists only of a computer with an Internet connection, is established in a village. It resides in the local sanchalak’s living room. The computer is installed at his place and farmers of adjacent 5-6 villages can now use this facility. Sanchalak takes an oath to serve the rural community without any discrimination and to spend a
part of his earning on community welfare. Between sanchalak and ITC there is one more intermediary called as Sanyojak and he looks after 40-50 such choupals. Today’s e-choupal services reach out to more than a million farmers in nearly 40000 villages through 6500 kiosks across seven states.

**Performance and Motivation**

The sanchalaks indicated three equally weighted motivational factors in relation to e-Choupals:

- They saw it as a means to help society.
- They saw it as a profitable business.
- They saw it as a means of getting access to functional computers (Prahalad, 2005)

**THE SOCIAL IMPACT OF E-CHOUPLAS:**

A major impact of the e-Choupal system comes from bridging the information and service gap of rural India. Agricultural research centres (such as the Indian Council for Agricultural Research), universities, and other agencies in India have developed several practices and technologies to improve productivity and crop quality. The impediment to implementation has been affordable, large-scale dissemination of this knowledge. The e-Choupal system leverages technology that can reach a wide audience literally at the click of a mouse. The constant presence of Sanchalaks, who themselves are farmers who apply these techniques, ensures that the practices actually make their way from the Web site to the field. Some areas about which information and services are provided by the e-Choupal Web site and e-Commerce system include:

- **Weather.** This is a very popular section on the Web site because it provides localized weather information at the district level. Other public sources generally provide only aggregated state-level weather information. E-Choupal’s weather information is intelligently coupled with advice on the activities in the agricultural lifecycle. One farmer observed that prior to e-Choupal, unreliable weather information would result in prematurely planted seeds that would be washed out by early rains. The availability of accurate rain information has cut losses due to weather by more than half.
- **Agricultural Best Practices.** Scientific practices organized by crop type are available on the Web site. Additional questions are answered through FAQs and access to experts who responds to e-mails from the villages.
- **Customized Quality Solutions.** After sale of a crop is completed, ITC performs laboratory testing of the sample collected. Based on these results, farmers are given customized feedback on how they can improve crop quality and yield.
- **Intelligent Product Deployment.** Inputs such as fertilizers and pesticides are not generic in the application. The optimal application is relative to the soil and crop. Determining the parameters requires services such as soil testing. Past providers brought inputs but not the information and services required to make them effective. ITC’s “full-service” approach corrects this by coupling the input sale to the information on the Web site and services such as soil testing.

The collective impact of better information and new services can be gauged by the fact that prior to e-Choupal, soy cultivation was on the decline, productivity was stagnant and farmers saw no future in it. In Khasrod, soy production declined from a high of 100% to 50% of farmers planting soy and was expected to decline further. Since ITC’s involvement, soy is seen as profitable again and nearly 90% of farmers are planting the crop.

A second major area of impact stems from the ability of e-Choupal system to open a window on the World and thus impact the future of the villages in which they operate.
Computers are bringing the same resources to villages as they brought to urban India, and their impact is no less dramatic. This, coupled with higher incomes and changes in farmers’ attitudes, is causing several shifts in the social fabric of village life.

Some accounts from villages include:

- Children are using computers for schoolwork and games. A particularly poignant story is that of Khasrod, where 2,000 local students used the local e-Choupal to print the grade sheets, saving them days of waiting and travel time.
- Sanchalaks used the Internet to chat extensively among themselves about the status of operations and agriculture in their villages.
- Villagers access global resources to learn about agriculture in other parts of the world and are taking action to compete in the world outside, not merely in the local mandi.
- Youngsters in the village use computers to research the latest movies, cell-phone models, and cricket news.

The e-Choupal model demonstrates that a large corporation can play a major role in recognizing markets and increasing the efficiency of an agricultural system, while doing so in ways that benefit farmers and rural communities as well as shareholders. The case also shows the key role of information technology—in this case provided and maintained by a corporation, but used by local farmers—in helping bring about transparency, increased access to information, and rural transformation. Critical factors in the apparent success of the venture are ITC’s extensive knowledge of agriculture, the effort ITC has made to retain many aspects of the existing production system, including maintenance of local partners, the company’s commitment to transparency, and the respect and fairness with which both farmers and local partners are treated.

ITC’s e-Choupal initiative began by deploying technology to re-engineer procurement of soya and other crops from rural India. It has gone on to serve as a highly profitable distribution and product design channel. The effort holds valuable lessons in rural engagement and demonstrates the magnitude of the opportunity while illustrating the social and development impact of bringing global resources, practices, and remuneration to the Indian farmer.

SKS MICROFINANCE

SKS Microfinance is an Indian non-governmental organization specializing in microfinance (Wikipedia, n.d.). It was founded in 1998 by Vikram Akula in Hyderabad, to provide small loans to poor women in rural areas. It currently has over 550 branches in 14 states across India. The initialism in its name stands for “Swayam Krushi Sangam,” or self-help organization.

GROWTH

It is one of the largest and fastest-growing microfinance organizations in the world, with total disbursements exceeding $730 million to about 2,420,670 million women.

In Andhara Pradesh, SKS has crossed the 700,000 membership mark. SKS operates in 24 districts of Andhra Pradesh through 231 branches. It has provided collateral free loans worth Rs. 1,188 crore and outstanding amount to Rs. 405 crore.

Orissa has crossed the 200,000 membership milestone. The company started operation in the state in 2006 Ganjam. The Company has since extended collateral free loans worth Rs. 266 crore and outstanding amount to Rs. 117 crore. SKS currently operates in 22 district through 95
branches. SKS has crossed the 100,000 member milestone in Uttar Pradesh and Bihar.
SKS has also started operations in NCR< Delhi through four branches and the membership reached 1216 clients.

**TECHNOLOGY**

SKS is one of the first microfinance institutions in the world to have a fully-automated management information system. SKS also has pioneered the use of smart card technology at the village-level and is currently working with VISA International on a pilot project to develop and deploy wireless point of sale devices that would automate field operations and significantly reduce transaction costs.

**PRINCIPLES**

SKS works on three inter-linked principles to scale microfinance. This includes using a for-profit methodology to access capital, drawing on best practices from the business world to speed growth, and deploying technology to overcome high delivery costs.

David Schappell of Unitus, a nonprofit venture-capital firm devoted to microfinance, likens SKS to the small coffee shop that became Starbucks

**A TATA INITIATIVE**

A remarkable initiative from the Tata Group (TATA, 2005) that has changed the lives of thousands of adults in different parts of India is the ‘computer-based functional literacy’ (CBFL) programme. It is a new-age solution to an age-old problem, and one that has the potential to lift our country’s literacy rate in record time. Born of the Tata Group’s ever-enduring commitment to community causes and bred by its expertise in information technology, this is a project as novel in methodology as it is ambitious in scope.

**SOFTWARE THAT CRACKS A HARD NUT:**

There may not be a single-shot solution to resolve India’s adult illiteracy problem, but the innovative computer-based functional literacy (CBFL) programme initiated by the Tata Group has the potential to do just that.

The programme has been developed by Tata Consultancy Services, Asia’s largest software enterprise, and it operates under the aegis of the Tata Council for Community Initiatives. The CBFL project uses a mix of methods to teach an uneducated person to read in a fraction of the time it takes to do this by conventional means. They are:

- teaching software
- multimedia presentations
- printed material

The project employs animated graphics and a voiceover to explain how individual alphabets combine to give structure and meaning to various words. The TCS course, which uses puppets as the motif in the teaching process, has been designed from material developed by the National Literacy Mission, established by the Indian government in 1988 with the aim of eradicating adult illiteracy in the country. The mission’s lessons, outstandingly researched and formulated, are tailored to fit different languages and even dialects.

**FUNCTIONAL LITERACY:**

“A functional literacy approach is a method used to teach people how to read well enough to function in a complex society. Functional literacy incorporates reading materials that relate directly to community development and to teaching applicable or useful life skills”

UNESCO (de Castell, 1971) defines functional literacy as the following; “A person is literate when he has acquired the essential knowledge and skills which enable him to en-
gage in all those activities in which literacy is required for effective functioning in his group of community” (p. 44).

**THE RESULTS**

Those coming through the programme can acquire a 300-500 word vocabulary in their own languages and dialects. This is enough for everyday requirements, such as reading destination signs on buses, straightforward documents and even newspapers. And it sets these people on the path to acquiring the other literacy skills, including writing and arithmetic ability.

**INDIVIDUAL BENEFITS**

The CBFL programme is currently operational in Andhra Pradesh, Tamil Nadu, Madhya Pradesh, Maharashtra, Uttar Pradesh and West Bengal. This remarkable initiative has now crossed Indian shores and will soon be implemented in South Africa, where a version in the Northern Sotho language — one of 11 in the country — is scheduled to start running in the Lephalale municipality of Northern Province. The lead for this project extension was taken by Zaneli Mbeki, the wife of South African President Thabo Mbeki.

The first lady had, in May 2002, visited some CBFL centres near Hyderabad during an official visit to India and been more than impressed by the project and its methodology. She requested Tata Consultancy Services to develop the programme in a South African language, a challenge the organization came to grips with in quick time.

The CBFL programme has helped more than 20,000 people learn reading, and it has introduced them to the world of the written word. It promises to deliver the education elixir to many, many more. That’s the bigger picture, but it is in the individual voices that the benefits of the initiative shine through.

**CONCLUSION**

This paper has proposed capability as a tool for customer development, hence market development. Professor C.K. Prahalad (2004) in his book ‘Fortune at the Bottom of the Pyramid’ has categorically advocated the development of the bottom of the pyramid markets i.e. more than 5 billion people are the customer. If they are customer and develop their capability through the usage of Information and Communication Technology which will create the buying power at bottom of pyramid and converts this stratum into a market as well as social development. This paper provided examples of ITC executed through their unique business venture e-Choupal to develop the capability of its customer through providing freedom, where as project like TATA literacy which not develops the market directly but definitely develops there capability.

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Vinay Sharma, Ph.D from U.P.Technical University, Uttar Pradesh. MBA from Philippine Christian University. Has around 17 years of Experience, in the areas of Business Opportunity, Development, Market Development, Brand Development, IT enabled Services and Teaching for past eight years. Presently working as Assistant Professor, with the Department of Management Studies at Indian Institute of Technology, Roorkee, Uttarakhand, a 165 years old and one of the oldest Institute of Technology in India.
the nation’s premier most institutions he has a considerable experience of working with various organizations in the fields of Social Development, Media and Information Technology along with having worked with the largest read newspaper of India. His areas of interests include Poverty Alleviation through Business Development, Market Development and Technology wherein he has designed and proposed a specialized model recognized by the name “Affordability for the Poor and Profitability for the Provider” for the provision of health to the rural and the poor population in India through an extensive research which, has been acknowledged at various platforms and published in the form of a book bearing the same name published by VDM publishing house Germany. The model and his research concentrates on development of health leading to business opportunity development which leads to co-creation of value and that subsequently leads to the capability development of the people at the bottom of the pyramid.

He is an associate and a member of the founding group of the Network of Asia Pacific Schools and Institutes of Public Administration and Governance constituted by Asian Development Bank in December 2004 and the Member of Editorial Board of the Journal of NAPSIPAG called Journal of Administration and Governance. Vinay Sharma teaches Marketing and the allied subjects and has been a founding HOD of Department of Management Studies of an Institution at Lucknow and also has been an Associate Dean of College of Management and Economic Studies, of a University at Dehradun where he was also the member of the prestigious Academic Council of the University. He has published and presented papers, Chaired sessions at national and international platforms especially in his areas of interest. He has edited an internationally circulated journal and is a member of Editorial Board of Gurukul Business Review and Chinese Public Administration Review published by Rutgers University USA and is also the member of academic and advisory councils of prestigious institutions.

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Critical Analysis of Expansion Strategies of SAP, IBM, Oracle and Microsoft in the area of Business Intelligence

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ABSTRACT

Business Intelligence (BI) industry has emerged as a high growth area. Recognizing this fact, both pure play vendors as well as big application and infrastructure vendors are trying different strategies to increase their market shares. The paper starts with a discussion of BI industry since 2002 to understand the underlying dynamics of the BI industry. It is followed by analysis of BI growth strategies of big four application and infrastructure vendors—SAP, IBM, Oracle, and Microsoft—to get a bigger pie of the market. The paper also analyzes the customer reactions to the new BI paradigm, impact of the acquisition on BI market and concluding remarks on the acquisition of pure play vendors by big four.

Keywords: Application & Infrastructure Vendors, Business Intelligence, Consolidation, IBM, Microsoft, Oracle, Pure Play Vendors, SAP

INTRODUCTION

The matured state of an industry is characterized by its five characters. First, the industry consists of large number of players in the market - some of them being small but niche (pure play vendors) whereas others big who derive the market. Second, the industry is experiencing proclivity of consolidation within and outside its domain. Third, the industry has passed through emerging and growth phase. Fourth, industry has low price to earnings ratios (P/E) and high dividend yields. Fifth, the key strategy of industry is based on cost-cutting to stay ahead of margin erosion (Stone, 1992; Grant, 2005). Further, mature industries have less scope for product and process innovation but have considerable opportunities for strategic innovation and differentiate through complementary services such as strategic co-innovation by WIPRO, Satyam Mahindra, Infosys (Indian IT Company) with IBM/Cognos, Microsoft, Oracle/Hyperion, SAP/BO, SAS, Informatica (www.wipro.com/resource-center/wipro.../business_intelligence.pdf (Sahni & Carter, 2008). The BI industry falls in the category of mature industry because it has

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almost witnessed these five characters and also strategic innovation during the last two decades.

Since the 80’s when the term “Business Intelligence (BI)” was coined for a category of software tools developed to help business decision making, the market as well as sophistication in the features of BI software tools has grown tremendously. Vesset et al. (2005) put the revenues of BI industry at $5.7 billion for the year 2005. Swoyer (2008) reported that growth rate for 2006 and 2007 was in double digit and the market size easily topped $7 billion figure at the end of 2007. Weier (2009) reported a growth rate of 22 percent in 2008 for a market of size $8.8 billion at the end of that year. According to Forrester Research the BI market will touch the figure of $12 billion by 2014. However, Business insights (2010) predicted that by 2013 BI market will be $13 billion. Whatever may be size of the market, it will certainly be dominated by SAP, IBM, Microsoft, Oracle and SAS. The share of different vendors is presented in Table 2. The amount of BI buyouts is given in Table 3. Based on this data it can be inferred that BI industry will grow better than overall growth of IT spending.

Nagel (2010), Whitney (2010), and many others have analyzed the data of surveys conducted by Gartner of Chief Information Officers (CIOs) of corporate. These surveys identified 10 top business priorities and 10 top technology priorities. The finding of these surveys mentioned that CIOs will focus on technologies that are quick to set up and do not demand upfront capital expenditure. BI is ranked at 5th place followed by virtualization, cloud-computing, web 2.0 and networking among such technologies. It also mentioned in these reports that at least six to seven information system solution priorities of businesses have roots in BI technologies. To mention, use of analytics in attracting and retaining new customers, managing change initiatives, targeting customers and markets, and expanding current customer relationships will need implementation of BI technologies. These factors will augment growth of BI more than the growth of IT as a whole. In India it is ranked as number one technology for the year 2010 by CIOs. BI growth in India is attributed to the need of consolidating reporting systems according to Nallayam (2010).

These facts prove that many companies (both supply and demand side) see BI as a good investment even during tough economic times. Companies are investing in BI to pinpoint new revenue-generating opportunities; improve operational efficiencies and visibility of the processes across the organization, and Optimizing the return on overall information technology (IT) investments in customer relationship management and enterprise resource planning segments.

Agostino (2004), Chou and Tripuramallu (2005), and many other researchers have emphasized the need of integration of BI with ERP. The justification given by them was obvious. ERP systems are implemented with an objective to integrate corporate data from various sources so that employees, external partners, suppliers, and distributors can make better use of the integrated data. But ERP systems lack analytical capabilities. The gap is filled by BI systems.

In the context of present day needs, the corporate have two additional objectives. The first one is to distribute data within and outside the boundaries of the business organizations. The second one is the usage of analytical functions at all level in the organization. Organizations need to distribute the real time analytic capability to all operational levels, targeted at specific business needs via key performance indicators (KPIs), and dynamic reporting functionalities. ERP systems are not designed to provide all such functionalities. Therefore, there seems to be two objectives of the big application vendors in acquiring BI companies, the first one to provide analytical capabilities at operational level with other additional capabilities and second to expand in fast growing BI segment of application software industry.

By adding BI systems, an infrastructure software vendor provides tools to integrate data from various sources, provides analytical and reporting capabilities at all level and
Table 1. Major vendors of BI industry & their pedigree

<table>
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<tr>
<th>Year</th>
<th>2H02</th>
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Table 2. Worldwide business intelligence vendor share from 2003-2008

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<th>2006</th>
<th>2007</th>
<th>2008</th>
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<td>123.9 (2.72)</td>
<td>152.0 (3.02)</td>
<td>181.8 (3.24)</td>
<td>1214 (19.51)</td>
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<td>730.1 (14.50)</td>
<td>835.0 (14.89)</td>
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<td>-</td>
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<td>SAS</td>
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<td>Cognos</td>
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</table>

continued on following page
The paper critically analyzes the market expansion strategies of the big application & infrastructure software providers (big four) in the area of BI domain, i.e., SAP, IBM, Oracle and Microsoft in the subsequent sections. In addition, it also presents the impact of these acquisitions in the BI market and views of the BI customers.

### RESEARCH METHODOLOGY

The analysis of strategies of big four vendors in this article is based on mainly secondary data. The main sources of data are research articles, white papers, press releases available from different sources with respect to acquisition of BI companies by four big players as it had

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**Table 2. continued**

<table>
<thead>
<tr>
<th>SN</th>
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**Table 3. The size of BI vendors buyouts**

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</thead>
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<td>1</td>
<td>SAP</td>
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<tr>
<td>2</td>
<td>IBM</td>
<td>Cognos</td>
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<td>November 2007</td>
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<tr>
<td>3</td>
<td>Oracle</td>
<td>PeopleSoft</td>
<td>US$10.3 Billion</td>
<td>December 2004</td>
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<td>4</td>
<td>Oracle</td>
<td>Seibel</td>
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<td>September 2005</td>
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<td>5</td>
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<td>Hyperion</td>
<td>US$3.3 Billion</td>
<td>March 2007</td>
</tr>
<tr>
<td>6</td>
<td>Microsoft</td>
<td>ProClarity</td>
<td>US$50 Million</td>
<td>April 2006</td>
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<td>7</td>
<td>IBM</td>
<td>SPSS</td>
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<td>July 2009</td>
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<td>SAP</td>
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<td>May 2010</td>
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happened over a period of time since 2002. The data collected for the purpose is part of the public domain. The seven propositions of growth strategies of four vendors are analyzed on a scale from 1 (not at all true) to 10 (exactly true) points.

- **Proposition 1.** Acquire a company to add customer base that increases market share and revenue (Wailgum, 2008).
- **Proposition 2.** Acquire a company to add engineering skills. (New)
- **Proposition 3.** Acquire a company to add new product line that fills a market gap (Wailgum, 2008).
- **Proposition 4.** Acquire a company to have new technology that improves core capabilities (Wailgum, 2008).
- **Proposition 5.** Acquire a company to compete in the market. (New)
- **Proposition 6.** Acquire a company to achieve innovation through products and technical skill integration (provided products are designed to be integrated) and (New)
- **Proposition 7.** Acquire a company to beat internal innovation stagnation. (New)

The output of the analysis is structured in the form of qualitative statements linked to seven propositions. The analysis also includes affect of acquisition on employees of both companies, customers of old products, internal innovation processes and industry as a whole.

The BI industry consists of large number of small and big companies which have their BI products in the market. However, it was not feasible to collect the data of large number of companies whose market share is in only decimal points, or which provide very niche products, or focus on specific geographic regions / industries and have different channel strategies with small market share from each channel. The sampling for short listing the companies for empirical qualitative data collection was done on the basis of Gartner’s Magic Quadrant for BI Platforms which automatically omit large number of companies from that stratum and only include large companies.

**MAJOR BI COMPANIES**

The Gartner’s Magic Quadrants for BI Platforms accommodated 23 companies in its four quadrants from second half of 2002 to 2009. These companies are arranged in groups of companies which were subsequently absorbed into the acquirer company of that group as given in Table 1. The companies in column for 2009 of Table 1 have assimilated either directly or indirectly all companies mentioned in previous years in the same group. In addition to 23 companies as shown in Table 1 there are 10 more BI companies with significant market share. This can be seen from revenue data of BI companies given in Table 2. The consolidation of BI companies can be attributed to three basic factors. The first, companies are acquired by big vendors as part of their business level strategy to continuously upgrade their competitive advantages in the specific product market (Ireland et al., 2003). The second, the companies are compelled to look for sell out because of heavy losses in business. The third, companies have a huge basket of products and dilute its efforts in one or more segment. These factors are detailed in the following along with specific BI companies in question.

The maximum number of companies that make it to the Magic Quadrant were 16 in 1Q06 (first Quarter of 2006) and a minimum of 12 in 2H03 (second half of 2003). The reduction is attributed to integration of BI vendors and large application vendors.

A number of companies disappeared from the Magic Quadrant over the years. A case in point is the exclusion of Sagent and Computer Associates International in 2H03.

Agosta (2003) mentioned that Group1 Software, a data quality vendor had acquired Sagent Technologies Inc. (www.sagent.co.uk), which was part of Gartner quadrant in 2H02 and was set up in 1995. It was mainly dealing in data warehousing technology. It was compelled by a
net loss of $22.2 million in 2002 for a fire sale of its assets and products to Group1 software. The deal was for US$17 million.

Computer Associate International (CA) visibility diminished in the market after 2002. Burton et al. (2002) said that CA’s license revenue stream came from hundreds of product lines including BI. The company had comprehensive enterprise BI suites and BI platform product line. But it would have struggled in the stand-alone BI market because of fierce competition. Hence, CA diluted its attention from the BI product line in favor of other products and ceased to be part of Gartner quadrant.

The consolidation in BI industry gained much ground from 2007 onwards with big ticket buy-outs. Oracle absorbed Hyperion in Mar’07, SAP took Business Objects into its folds in Oct’07 and IBM completed its acquisition of Cognos in Nov’07. The process is on, industry will witness more buy outs in the next few years. However, after these major buy-outs, BI industry will have a very prominent space for pure play vendors that will feed best of breed features to the BI solutions of big vendors.

GROWTH STRATEGIES OF APPLICATION & INFRASTRUCTURE VENDORS IN BI DOMAIN.

The big four (Oracle with three and SAP, IBM and Microsoft with one big ticket acquisition) emerged as the prominent BI players who have concentrated on the inorganic path to grow and to be competitive. Earlier, the acquired companies in turn had become big ticket due to their previous acquisitions as well as their focus on bringing out superior products / solutions organically.

Just after the above mentioned big ticket acquisitions, Weier (2007a) quoted CEO of SAS Institute, Jim Goodnight saying as “Acquisitions have nothing to do with innovation and creativity. It’s adding numbers to the bottom line so the CEO looks better. IBM and SAP acquire because they’re so stagnant and they’re unable to grow themselves.”

Apart from the big four, there are companies whose emphasis is on organic growth on the back of their vast installed base and technically superior products. SAS Institute, Information Builders, MicroStrategy and QlikTech are prominent in this category of companies. All (2007) quoted the name of QlikTech as one best-of-breed vendor which is happy with its growth numbers (77% in 2005, 80% in 2006, 85% in 2007, 47% in 2008, and 33% in 2009). QlikTech with its radically different products wants to grow on its own instead of looking outside. The study of these companies is out of scope of this research paper.

The acquisitions and subsequent assimilation of acquired products of the big four have been studied in detail in the following sections of research paper.

SAP

SAP has been selling its BI application along with its widely used operational enterprise system, SAP Enterprise Resource Planning software - SAP R/3. The customers were significantly benefited by such a bundled system of BI and ERP functionalities. The major factor for this possibility of bundled system was SAP’s substantial knowledge base which was created by developing sophisticated software systems for the world’s top companies over a period of time. It has made easy for SAP to integrate business content from its operational system with its BI products along with shortened implementation time. Just before its complete rethinking of BI road map with the acquisition of Business Objects, SAP marketed its BI applications under the SAP Net Weaver suite. The latest version 7.0 was released in June 2006.

SAP’s Acquisition of Business Objects (BO)

SAP acquired Business Objects in October, 2007 in a deal worth US$6.8 billion. BO was
a strong player in BI domain with more than 46000 customers across the world. Researchers have analyzed the reasons for this to happen. The prominent ones are listed in the following.

Greenbaum (2007) said that the reasons for SAP buying BO are:

SAP has excelled at amassing a tremendous amount of knowledge – in the form of business processes and about how companies in a wide range of industries run their businesses. But the system lags in delivering top-notched analysis.

SAP saw a tremendous overlap between SAP and BO customer bases.

SAP’s inability to take the domain knowledge and turn that into pre-built, highly-verticalized, analytical solutions that anticipate problems, identify them to the relevant users, and suggest or direct corrective action due to too much growth of back office transaction systems.

Stagnated growth due to market saturation, business users are looking for more value, more innovation, and more competitive differentiation from their ERP systems.

Innovative start-ups have convinced the industry about the utility of verticalized analytical software.

SAP has something else to sell to existing customers in the form of advanced analytics to tap the fertile, untapped ground for business-level analysis.

SAP is making the point that when the transactional knowledge gained is married to the top notch analytical tools, the clients can expect their enterprise to beat their competitors by using the knowledge faster and smarter.

Howlett (2007) said that Outlook Soft and Business objects were competitor in the area of planning engine. SAP has already acquired the Outlooksoft. With acquisition of Business Objects, SAP may create some potential areas for consolidation.

Kelly (2009b) said that SAP and Business Objects had a number of overlapping BI technologies. According to him SAP acquired Business Objects to develop a new BI product roadmap by integrating two overlapping technologies.

Mahowald (2009) said that SAP is looking at On Demand Model for its BI customers. The new product SAP Business Objects OnDemand offerings will provide an opportunity to the customer to create BI capabilities using SaaS (Software as a Service) Model. This may generate more revenue in Small & Medium Enterprise segment.

Henschen (2009) reported that SAP decided to standardize its Business Intelligence offerings on Business Objects technology which is superior to its earlier technology. It will phase out its corresponding products. It has chosen Business Objects XI as its flagship BI platform against Net Weaver, the original platform of SAP BI. SAP has released Business Objects XI 3.1, with capabilities to integrate with Microsoft SQL Server and Windows Server in October 2008. Additional new products are being introduced by SAP such as BusinessObjects Explorer to create a new breed of informed executives (Datamonitor, 2009).

In addition to BO, SAP has acquired about 28 companies with a view to add best of breed features in to its BI and other products.

It can be inferred that SAP acquired Business Objects to develop new best of breed integrated products based on superior technology with super sophisticated analytical & reporting capabilities around superior BI platform of Business Object to gain competitive advantage in BI domain. Further, the acquisition drive of SAP can be attributed to two additional factors. First, SAP Net Weaver strategy was not highly successful. Secondly, Business Objects techies were highly successful in integrating desperate BI product suites (Crystal Decisions products integration was a great success for business Objects). The recent release of SAP Business Objects Explorer which is capable of integrating data of non-SAP sources in SAP
Business Warehouse is an example of its present integration capabilities and future BI roadmap (Ericson, 2009).

**Business Objects’ Acquisition of Crystal Decisions and others**

Crystal Decisions with each new version of its BI product Crystal Enterprise improved its position in the BI market till it was acquired by Business Objects in December 2003. BO achieved a prominent position in BI market after acquiring Crystal Decisions and achieving a critical market mass by focusing its offerings to many industries, applications and original equipment manufacturer (OEM).

In addition to Crystal Decisions, BO had consolidated its product basket through acquiring a number of niche technology companies since 2004. These companies include SRC Software, Infommersion, Medience, Firstlogic Inc., ALG Software, Nsite Software, Inc., Cartesis, Insight etc. The acquisition of Crystal Decisions was also part BO’s consolidation strategy.

Business Objects XI, the latest product of BO continues with the Crystal Reports after acquisition of Crystal Decisions. Later on Crystal Report has become a de facto report writer of the industry. Since SAP has adopted the BO platform as its flagship BI platform, it has continued with the Crystal Reports for its report management. The acquisition of BO added more customers, engineering skills, improved core capabilities, provided competitive advantage, and scope to beat internal innovation stagnation for SAP.

**IBM**

CBR (2005) said that IBM Corp has been a strong player in backend BI infrastructure like Data Warehouse, Relational Database Systems, ETL tools, and query software’s. The only front end tool in its BI portfolio was OfficeConnect, used to transfer and present BI data in Excel. In 2004 IBM acquired a small company like Alphablox Inc. In addition it has acquired Systems R&D another BI domain company in 2005. These acquisitions were an indication that IBM wanted to be a serious player in BI industry. Its BI strategy largely has been to use its technology partners’ products as per the client requirements as a consequence of its consulting assignments.

However, the long term goal of IBM was to draw its BI portfolio under the umbrella of “Information on Demand” strategy. It is a new paradigm under which IBM would combine its consulting expertise with solutions from its own portfolio. The strategy would encompass areas of information, data and content management to guide companies to increase business value. It was not possible without a major buy. Therefore, IBM has gone for acquiring Cognos.

**IBM’s Acquisition of Cognos**

IBM announced its agreement with Cognos for its acquisition to public on November 12, 2007. As mentioned earlier, IBM acquired Cognos as part of “Information on Demand” strategy spanning 25 acquisitions in all (Press Release, 2008). The deal was of US$5 billion in cash and brought in large companies such as BMW, Bank of America, and Dow Chemical as new customers to IBM (Gardner, 2007).

Kelly (2009a, 2009b, 2009c) mentioned that IBM and Cognos had virtually no competing technologies to reconcile as opposed to SAP and Business Objects. As part of “Information on Demand” strategy, IBM integrated Cognos into the overall BI product framework. It included integrating Cognos with DB2 and making available it on System z mainframe. Savage (2008) said that with these features IBM clients can now access and analyze information stored on System z mainframes rather than downloading it to a data store on another server. Until now, Cognos had targeted low and mid range servers. The latest version, Cognos 8.4, which entered the market in October 2008, added the flash based dashboards also to IBM’s BI platform.

The acquisition of Cognos has pushed IBM to the leaders’ category in 2009 and emerged as a serious competitor to the other established players of BI products such as SAP.
SAS Institute, Oracle, Information Builders, MicroStrategy and QlikTech. The acquisition also includes IBM strategy to develop large number of offerings around Cognos. To mention, its announcement in February, 2008 about its future strategies which includes (1) 10 new and enhanced IBM solutions for banking, retail, healthcare, government, life sciences and manufacturing industries, (2) Six pre-integrated IBM-Cognos product offerings that enable companies to use business intelligence to improve overall business performance, (3) Information on Demand Infrastructure Services to help clients in planning, designing and deploying a resilient enterprise data, storage and content management environment and many more (IBM, 2008).

**Cognos’s Acquisition of Applix**

Applix Inc.’s BI portfolio had popular products known as MOLAP database server- Applix TM1 and front end tools- Applix Executive Viewer and Applix Web. These three products were part of the portfolio of Applix Business Analytics Platform. The customer base of Applix was 3000 spread across 50 countries just before it was taken over by Cognos on October 25, 2007. Cognos branded the products of Applix under its own brand name. The value of the acquisition was US$ 399 million. Cognos paid $17.87 a share for Applix, which closed at $14.87 at the time of deal. There were four major factors for the Applix deal by Cognos. These were (1) It has doubled the customer base of Cognos, (2) It has added financial performance analytics capabilities to the Cognos existing BI suite, (3) With Applix technology and another buyout of Celequest, Cognos can compete with SAP and Oracle in usage on in-memory technology (Ferguson, 2007). (4) It will be stronger in Corporate Performance Management (CPM) offerings.

**IBM’s Acquisition of SPSS**

IBM acquired SPSS to add new predictive analytics and data mining software that models customer interactions to retain, detect fraud and predict risk. It fits in to IBM’s information on demand software portfolio for financial services, health care, retail and the public sector (Dignan, 2009).

In the nutshell, these buyouts means addition to the customer base, new product line to fill the market gap, addition of engineering skills, new technology to improve core capabilities, competitive advantage in the market, and new product innovation through integration/consolidation for IBM.

**Oracle**

Oracle has consistently been a part of top notch BI players since 2002 due to its relational database products. Morris et al. (2005) said that the majority of Oracles’ BI earning was because of its database and infrastructure software play rather than the business analytics tools play. The Oracle was not present in the fastest growing BI market till 2005.

**Oracle’s Acquisition of Hyperion**

Oracle acquired Santa Clara, Calif.-based Hyperion Solutions Corporation for US$3.3 billion on 1st March, 2007. Hyperion was a prominent player in BI platforms since 2007. Hyperion itself had grown through a series of deals (Sorkin, 2007). Notable among them is merger of Arbor Software that brought the popular Essbase database software program into its fold. Angus (2007) said that Hyperion had shifted its focus from BI to Business Performance Management (BPM) over time. Being platform-agnostic, the company had partnered Microsoft as well as Oracle in various applications and database infrastructure. However, Oracle was a closer partner than Microsoft.

According to an Oracle release (www.oracle.com) dated 16th July, 2008, the acquisition of Hyperion has extended its business intelligence product strategy. Unlike SAP and BO, Hyperion brought with it complementary products to Oracle’s portfolio. This included a platform-agnostic enterprise planning system, financial analytics and an OLAP server. The combination of the three systems is named...
“Oracle Enterprise Performance Management” now. It covers end-to-end BI needs of the clients including planning, operational analytics, BI tools, reporting tools and data integration. Later on Oracle released the integrated BI suite under the name “Oracle Business Intelligence Enterprise Edition Plus”. The suite included reporting and analysis tools from both Oracle and Hyperion.

Brown (2007) sighted four reasons for Oracle buyout of Hyperion. These are (1) Strategy to migrate Oracle PeopleSoft EPM and Oracle CPM into the superior Hyperion System 9, (2) Hyperion language is well understood by the CFO. Means it sells well in to Finance department. Oracle sells IT to the IT department. Buyout could be a highly valuable combination, (3) It brings in 12000 customer of Hyperion, and (4) It is a well thought move to expand Oracle’s offerings to SAP customers who were client of independent Hyperion.

Evelson et al. (2007) said that buyout focused mainly on Hyperion’s strong financial application business, and also to improve oracle position in business intelligence domain. Kobielus (2007) reported that by acquiring Hyperion oracle will expand its share in the financial CPM market. It will also be strengthening its best of breed status in BI, DW, CPM, and Master Data Management (MDM) domain. At the same time it will challenge SAP for leadership in business application market.

**Oracle’s Acquisition of Siebel Systems**

According to Ragsdale et al. (2005), Siebel was the last pure-play enterprise-class CRM vendor that pushed the envelope of CRM functionality, integration, and partnerships. It was acquired by Oracle in January, 2006. The deal was valued at US$5.85 billion but net payout by Oracle was US$3.6 billion. Oracle offered $10.66 for each share of Siebel stock, a nearly 17 percent premium over the company’s share of $9.13. Siebel has attained status in the eco-system of CRM. It is evident from the following to two quotes.

1. Schwartz (2003) quoted Lawrence Barbetta, the then group VP at Siebel - “the platform is the next generation of business intelligence platform since it spanned multiple data sources, targeting even non technical users within the enterprise making it a companywide analytics platform.” He also mentioned that Siebel BI platform has competed with SAP and Oracle in the enterprise resource planning suites. These quotes are link with the formal launched of Siebel Customer Analytic Applications 7.7 and Siebel Enterprise Analytic Platform 7.7 in 2003.

2. Schlegel et al. (2007) wrote “Siebel Business Analytics had one of the more innovative and comprehensive sets of functionality among the BI platform vendors, including some advanced analysis and data-mining functionality, packaged industry-specific analytical applications. However, Siebel’s pricing was expensive and suited primarily for large organizations with large user populations.”

Kawamoto and Kane (2005) said that the acquisition of Seibel by Oracle was primarily for its CRM applications that were to be made into the center piece of the Oracle CRM suite. It was evident from the launch of new set of business intelligence (BI) packages encompassing the business analytics technology from Siebel Systems Inc., by Oracle. It was the first step toward Fusion (Beal, 2006). Beal also said that even if CRM was the main aim of the acquisition, the “hidden jewel” was Siebel’s Analytics which gave the company its 25% of license revenues. Its history as a non-application-specific product line allowed it to merge with Oracle Fusion Middleware easily.

**Oracle’s Acquisition of PeopleSoft**

PeopleSoft offered its Enterprise Warehouse system as part of its enterprise resource planning (ERP) system. It had less impact in the market as it has approximately 230 installations till 2H03 (Dresner et al., 2003) in comparison to
5000 installations of SAP’s Business Warehouse worldwide. The lack of impact in the market was a possible factor for the sell out. Two more critical factors which led to the PeopleSoft to lose its prominent place and its ultimate marriage with Oracle were:

The first, PeopleSoft shifted towards best of the breed offerings rather than BI tools as part of enterprise wide systems. In incorporating best practices in BI implementation, Peoplesoft had gone blindly with tools which come as part of ERP systems rather than evaluating alternatives. For specific analytical capabilities such as user-driven planning models and specialized data mining are needed, PeopleSoft has not considered an appropriate additional BI platform (Friedman et al., 2003).

It is said that the phasing of the model of implementing BI platform as part of ERP implementation which has reached at the trough of disillusionment (Buytendijk et al., 2003) would crash under the weight of over inflated expectations. The people soft model was in the same boat.

As a consequence of development in the industry, in January 2005, PeopleSoft was acquired by Oracle after a long and hostile battle for control which lasted for 2 years. This led to a slow consolidation of product lines of Oracle, PeopleSoft and J D Edwards (which was acquired by PeopleSoft earlier). The value of the deal was US$10.3 billion and expected to boost Oracle’s earnings by US$400 million (Kerstetter, 2004). The PeopleSoft merger had made Oracle 2nd largest vendor in the database software domain of the software industry. The three acquisitions all together have pushed Oracle position to the Leaders category in 2007.

Hyperion and Oracle offerings were not having any overlap. On the other hand, there was an overlap between Oracle & Seibel and Oracle & PeopleSoft offerings. In that sense Hyperion buyout offered more to Oracle (Kawamoto & LaMonica, 2007) in comparison to PeopleSoft and Seibel. As a result of consolidation, the BI suites of the companies were brought under Oracle Fusion Middleware (OFM) portfolio of software products by oracle. Gains of Oracle include additional customer base, additional revenue, new technology (more in case of Hyperion) to improve core capabilities, competitive advantage in the market, innovation through integration

**Microsoft**


Similar analysis of Microsoft BI strategies were carried out by Montalbano (2006) and Howson (2006). Montalbano (2006) quoted Keith Gile, a principal analyst with Forrester Research Inc. that “Microsoft’s investment in BI was fairly new, and there had not been a link between the back-end data mining and reporting services in the SQL Server database and the front-end interfaces business customers use”. Howson (2006) said that “the addition of Reporting Services in 2004 broadened the company’s portfolio but was decidedly developer oriented not business user-oriented in its target market. Later on SQL Server 2005 (December 2005 Release) introduced Report Builder as a solution for business users”.
Microsoft’s Acquisition of ProClarity

Microsoft and ProClarity had a close, strategic partnership for providing the BI solutions on the Microsoft platform even before the acquisition. It is evident from the Product fact sheet of ProClarity Analytics 6 (ProClarity, 2005). The ProClarity Analytics 6 included Microsoft SQL Server Analysis Services and Reporting Services, SharePoint Portal Server, Excel, PowerPoint and Business Scorecard Manager in to its offerings to its customers.

What it is for Microsoft & ProClarity?
Montalbano (2006) quoted Keith Gile saying that the acquisition in April, 2006 “filled a gaping hole” for Microsoft and positioned it more competitively as a BI vendor. MS Office is a great consumer tool for BI, but it’s not a great producer tool for developers. It is not a mechanism for building, but surfacing the results. ProClarity is a good tool to produce BI results. It is strong at building queries, dashboards and analysis on top of the Microsoft platform”. The combination will be a better product for performing two roles, i.e., tool to produce and consumer surfacing tool.

The ProClarity business analysis software is now available as Microsoft Office PerformancePoint Server 2007 suite. It consists of a variety of applications- ProClarity Analytics Server, ProClarity Viewer Web Part for SharePoint Server, ProClarity 6.3 for Reporting Services, ProClarity Desktop or Web Professional, ProClarity Web Standard, ProClarity Software Development Kit (SDK) (www.microsoft.com).

Weier (2007b) reported that release of Office PerformancePoint Server 2007 makes an end of ProClarity brand after 14 months of its buyout by Microsoft. Microsoft BI offerings now consist of three components. These are (1) Microsoft Office (Business User Experience) (2) Microsoft Office SharePoint Server 2007 (Business productivity Infrastructure), and (3) Microsoft SQL Server 2008 (Data Infrastructure & BI Platform). ProClarity acquisition strengthened the last two components of BI offerings. Microsoft acquisition was small acquisition in comparison to SAP, IBM and Oracle. The main gains of the Microsoft were filling the gaps in product portfolio to compete in the growing BI market and augmenting internal innovations through integration. It will put Microsoft to a competitive position against traditional pure-play BI vendors in all segments of the BI market (Smalltree, 2006). Enderle (2006) mentioned that ProClarity merger will be relatively painless and it will result in high probability of meeting the expectations set when the deal was proposed.

CUSTOMER REACTIONS TO THE NEW BI PARADIGM

Customers (internal and external) are the foundation of the successful business strategies of any company. As a part of the strategy companies must have ability to build and maintain relationships with the best customers for maximum value creations. In the face of large number of acquisition by four big vendors in the last decade, customers have felt the heat. Some of these consolidations have witnessed resignation, frustration among internal customers and fear for more investment to acquire new products and lack of support for old products is witnessed by external customers. Few examples are mentioned in the following.

SAP and Business Objects: The customers expected that combined entity SAP+BO will extend better support in digging values from their large volumes of data. They expected superior reporting tools & ad hoc query capabilities due to the BO acquisition. Their major concerns were the new product road map of the company and its effect on the support to the existing product which is already deployed and concerned of additional investment as reported by Lau (2007), Manchester (2008), Kelly (2009a, 2009b, 2009c) and Kanaracus (2008). Manchester (2008) and Kanaracus
(2008) highlighted the confusion among the BO customers during the transition phase of the product support when the old system was transferred to SAP’s main support system. They were not able to access SAP’s online support site. Kanaracus (2008) further mentioned that SAP had to make its strategic acquisition in future as painless for its customers.

Kelly (2009a, 2009b, 2009c) and Lau (2007) pointed out the concerns of the customers who have implemented SAP BI two three years before BO acquisition at the assurance from SAP that they are buying best in the world. They now need to invest heavily in SAP’s new BI products based on Business Objects or continue with SAP’s old Net Weaver BI products which the company would no longer enhance.

IBM and Cognos: Kelly (2009a) said that customers are mostly positive about the combined entity of IBM and Cognos. There should be minimal impact on Cognos’ customers as there is very little overlap between Cognos and IBM product baskets except their OLAP products. The Cognos customers do not have to wait for product roadmaps to be in place like SAP. IBM is also known for maintaining and enhancing legacy products. It does not mean it will not face internal politics which will impact the customers also to certain extent.

Oracle and Hyperion: Oracle’s purchase of Hyperion means that Oracle has rounded out its suite of business intelligence (BI) products with a strong multidimensional product (Essbase) and a powerful financial analysis capability. The Oracle BI suite will be easier to sell to customers looking to limit their number of vendors. We are seeing this vendor limitation initiate becoming more important. The enhanced suite will hurt Business Objects, Cognos, Microstrategy, and Informatica.

Oracle’s ability to integrate the Hyperion products and the Hyperion workforce will cause concern for Hyperion customers. While Oracle will continue to cash the maintenance and support checks, it’s not clear if they will continue to enhance the Hyperion products. Layoffs and voluntary resignations will have an impact on new development and support and support has never been Oracle’s strong point.

No customer looks forward to converting to a new tool, especially if the new tool provides little new usable function. Customers will be wondering if they will be asked to convert to an Oracle alternative. If they have to convert, they may choose to move to one of the pure-play alternatives such as Business Objects, Cognos, or Microstrategy. Oracle ability to integrate Hyperion products and workforce a concern of Hyperion customers. Oracle has clarified on support but not on enhancement of Hyperion products. Oracle is working on Hyperion’s integration capabilities with Microsoft Office. The Hyperion customers are not planning to convert to new tools as it provides only little new functionality. They do not want to convert to new oracle initiatives (Adelman, 2007). Hyperion’s customers are in a wait-and-watch mode and not updating to latest versions readily to get a clear idea about the way Oracle would fully unveil its BI road map. It is mix reaction of the customers since only few converted to new products.
to convert, they may choose to move to one of the pure-play alternatives such as Business Objects, Cognos, or Microstrategy. Oracle's ability to integrate the Hyperion products and the Hyperion workforce will cause concern for Hyperion customers. While Oracle will continue to cash the maintenance and support checks, it's not clear if they will continue to enhance the Hyperion products. Layoffs and voluntary resignations will have an impact on new development and support and support has never been Oracle's strong point.

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Microsoft and ProClarity: The customer reaction is quite positive for Microsoft and ProClarity due to their long partnership in offering products and complementing each other in filling the gaps.

Recent, BI platform user survey conducted by Gartner also reported that pure-play vendors provide a better overall customer satisfaction than mega-vendors (Sallam, 2010).

The Shift: Large Application & Infrastructure Vendors Marry Pure-Play Vendors

The spate of acquisitions of pure-play vendors by the four large application & infrastructure vendors mentioned above can be attributed to the following factors:

To get rid of the shortcomings of transaction-based ERP systems (Greenbaum, 2007).

To overcome the weaknesses of the tools-based BI systems (Greenbaum, 2007).

"ERP systems lag in delivering top-notched analysis to the customers who have created large databases" (Greenbaum, 2007).

"Inability to take the domain knowledge that exists within a vendor like SAP and turn that into pre-built, highly-verticalized, analytical solutions that anticipate problems, identify them to the relevant users, and suggest or direct corrective action due to too much growth of back office transaction systems" (Greenbaum, 2007).
In case of IBM, it has a strong backend BI infrastructure (Data Warehouse, Relational database, ETL tools, query software) without a complementary suite of front end tools (Except for OfficeConnect with MS Excel interface). With the new “Information on Demand” strategy, the company wants to draw it BI portfolio closer to its other data management technologies (CBR, 2005).

Oracle’s strategy of diversification of its revenue streams led to its foray into business analytics area. Its buying out of Peoplesoft and Seibel and the subsequent acquisition of Hyperion would contribute a large chunk of its revenue and it would not be dependent on its primary area of database and infrastructure software (Morris et al., 2005).

Microsoft until now concentrated on the Server market through its series of SQL Servers. In the meantime, it was working with partners who would provide front end analytic solutions. With the potential of the BI market increasing, it wants to foray into this market and prompted Microsoft to acquire its own strategic partner ProClarity. It is expected to consolidate Microsoft position as a serious BI vendor of future years (Montalbano, 2006).

The analysis of the secondary data collected with respect to seven propositions is summarized in Table 4.

### IMPACT OF THE ACQUISITIONS

The three vendors SAP, IBM, and Oracle will retain the brand name of their strategic buyouts. Their product offerings will be known as SAP Business Objects, IBM Cognos, and Oracle Hyperion. On the other hand, ProClarity will lose its brand to Microsoft. Even the SAP BO offerings are evolving to be SAP-centric (Schiff, 2008). However, the biggies may be selective. To mention, Oracle retained the name of a product as “Oracle's JD Edwards EnterpriseOne” which was created by PeopleSoft and J.D. Edwards (Kristine, 2010) but not of PeopleSoft.

Swoyer (2008) said that in the year 2007 Business Objects was number one in terms of overall BI platform revenue with nearly 20 percent of the entire market, followed by SAS Institute Inc. (15 percent), the former Cognos (14 percent), Microsoft (11 percent) and Oracle (9.4 percent). With SAP’s acquisition of Business Objects, the combined entity accounted for more than a quarter (26.3 percent) of global BI revenues. IBM’s BI tally to that of Cognos

### Table 4. Analysis of the secondary data collected with respect to seven propositions

<table>
<thead>
<tr>
<th>Proposition</th>
<th>SAP</th>
<th>IBM</th>
<th>Oracle</th>
<th>Microsoft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquire a company to add customer base that increases market share and revenue.</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Acquire a company to add engineering skills. (new)</td>
<td>9</td>
<td>8</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>Acquire a company to add new product line that fills a market gap</td>
<td>7</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Acquire a company to have new technology that improves core capabilities.</td>
<td>8</td>
<td>9</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Acquire a company to compete in the market.</td>
<td>9</td>
<td>9</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>Acquire a company to achieve innovation through products and technical skill integration (provided products are designed to be integrated)</td>
<td>8</td>
<td>8</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Acquire a company to beat internal innovation stagnation.</td>
<td>9</td>
<td>9</td>
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</table>
catapulted the pair into a “virtual tie” with SAP. It resulted in overall third place for SAS an independent vendor in the BI domain. Meanwhile, combination of Oracle and Hyperion was in a virtual tie with Microsoft for fourth place overall.”

Siebel’s acquisition by Oracle has multiple long-term implications for the CRM market and the CRM ecosystem such as (1) end of the road for standalone applications at enterprise level, (2) focus of vendors on pre-integrated CRM, ERP, and supply chain software as their offering. The reason is bottom line for CRM successful implementations. It requires deeper links between customer data and business processes across the enterprise.

The increasing market shares of the big four will leave fewer choices to the customers and create a lock in situation (Daniel, 2007). The application (BI + others) of BI vendor will become more integrated and customers may be pushed into buying the whole stack that may not be required by them. It may in turn reduce return on investment for the user which in turn will make applications less attractive. It may become out of reach for small customers.

The acquisition of these vendors by big players will stop development of best of breed features as efforts will be diverted towards integration of these buyouts with the products of acquiree. The scarce resources will be consumed by integration activities. The development of new best of breed features will take a back seat. To mention, SQLBI (2008) reported that Microsoft acquisition of ProClarity stopped most of its development because of the need to integrate it with PerformancePoint.

The worst negative impact of the inorganic growth strategies is losing best of breed and useful functionality in the process of consolidation of old products in to new offerings in the face of business compulsions.

CONCLUSION

The big four application vendors irrespective of the vast financial strength and a vast customer base were not able to cater to the ever changing BI needs of their clients completely. The gaping holes had to be filled in their BI product armor either organically or through acquisition and assimilation for the next stage of market expansion. The spate of big ticket acquisitions since 2007 highlights inorganic expansion strategy adopted by the big four vendors. The main contents of their strategy are - Expand BI technology offerings by integrating the more sophisticated and advanced acquired products from pure-play vendors, which in turn adding to the already large customer base. However, it does mean end of pure play vendors. SAS, MicroStrategy, Tibco Spotfire, QlikTech, Actuate, Panorama Software, and Board International are also growing and will continue to grow organically by developing new offerings to their client organizations in future. The pure play vendors will continue to occupy very special place in BI industry. ebizQ (2009) report about QlikView9 is quoted here of being an important pure play BI vendor.

“QlikView 9 from QlikTech is an ideal product for companies frustrated with failed attempts to implement BI from vendors such as SAP Business Objects, IBM Cognos and Oracle Hyperion.”

In addition, from the data given in Table 2 (7.2 million revenue in 2003 and 104 million revenue in 2008 for QlikTech), it can be inferred that users are attaching very high value to the products of pure play vendors. Other pure play vendors may not be growing at the rate of QlikTech but they are also growing at the same pace as the merged entities. These facts are ample proof of growth and importance of pure play vendors in BI domain of software industry, which may become acquisition targets in the next wave of market expansion. Industry will continue to grow with four biggies and niche pure play vendors in days to come. The size and composition of the industry may change but all players’ of BI eco-system will continue to be around. The four biggies and others vendors in BI domain will pursue their strategies to acquire
the abilities to embed harness and leverage the increased instrumentation, interconnectedness and available intelligence and resources of the people, devices, assets, systems, and networks. In turn the technology may make the planet safer for communities but on the other hand it may result in unhealthy environment for the same communities. Intelligence derived from these interconnected and instrumented sources may create a smarter planet in language of IBM (Mullins (2009)). Further, big vendor must continue to support old products not only to satisfy their customers but to build sustainable/better relations.

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Oracle’s purchase of Hyperion


**ENDNOTES**


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Representation Type Preferences in Operational Business Process Redesign: A Quasi-Experimental Field Investigation

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ABSTRACT

This paper reports on a quasi-experimental field study in which business process redesign groups in four different US organizations used two different business process representation types. One of the representation types emphasized an activity flow (or workflow) view of business processes, which appears to currently be the most prevalent in actual operational-level business process redesign projects; the other emphasized a communication flow view. The study suggests that, contrary to assumptions likely underlying most of the current business process redesign practice, communication flow-oriented representations of business processes are perceived by those involved in their redesign as significantly more useful in the following aspects than activity flow-oriented representations: identification of opportunities for process improvement, application of process redesign guidelines, visualization of process changes, and development of generic information technology solutions to implement new business processes. Important implications for managers and researchers stemming from these results are discussed.

Keywords: Business Process Redesign, Contrast Analysis, Data Triangulation, Field Research, Nonparametric Techniques, Organizational Communication, Quasi-experimental Research

INTRODUCTION

Business process redesign (or, simply, process redesign) approaches have become very popular in organizational circles, particularly since the emergence of the business process reengineering movement in the early 1990s (Hammer, 1996; Hunt, 1996; Reijers et al., 2003). In spite of being touted as a new and revolutionary idea, it can be argued that process redesign has a long history, dating back to Taylor’s (1911) scientific management movement.

Perhaps the similarity between today’s process redesign practices and those propounded by the scientific management method has extended to one aspect that, this paper argues, has negative implications for the modern practice of process redesign. That aspect is the focus of much of today’s process redesign approaches on what seem to be a “times-and-motions” view of business processes, which is reflected in an emphasis on modeling and understanding processes primarily as chronological sequences...
of interrelated activities (Harrington et al., 1998; Kock, 2003; Kock et al., 2009). It is argued in this paper that such focus, although appropriate for materials-handling processes, is problematic when the targets of process redesign efforts are information-intensive processes.

The main goals of this paper are to formalize a theoretical model that addresses the role of process representations in redesign projects. This is accomplished through the comparison of two approaches to process redesign. One is a communication flow-oriented approach, which is arguably well aligned with the information-intensive nature of most modern processes. The other is an activity flow-oriented approach, which reflects much of the current practice in connection with business process redesign.

RESEARCH BACKGROUND

The broad area of business process redesign and management has been a fertile area of research, with or without a strong focus on information technology (IT), particularly in the last 15 years (Baskerville & Smithson, 1995; Newkirk et al., 2008). Many important research issues have been addressed, and many relevant research questions have been successfully answered. Harmful misconceptions regarding process redesign have been exposed (Davenport & Stoddard, 1994), and the role of IT as an enabler of new redesigned processes has been identified and explained (Cunningham & Finnegan, 2004; Venkatraman, 1994). Key preconditions of process redesign success have been identified (Bashein & Markus, 1994; Clemons et al., 1995; Teng et al., 1998), approaches to assess success have been proposed (Berente et al., 2009; Börjesson & Mathiassen, 2004; Davenport, 1993), and related change management techniques have been studied and validated (Kettinger & Grover, 1995; Stoddard & Jarvenpaa, 1995). New methods and automated tools for process redesign have been proposed (Nissen, 1998), and successful approaches for implementation of new process designs have been identified (Grover et al., 1995).

In spite of the progress above, some areas of research in connection with process redesign have received relatively little attention. One such area is that of process representation approaches and their impact on the outcomes of process redesign projects (Katzenstein & Lerch, 2000). This area arguably needs its share of research attention, since the way processes are looked at is likely to strongly influence the way in which they are redesigned (Berente et al., 2009).

The above area of inquiry is related to that of requirements engineering, which is arguably one of the most important phases of a software project (Bhat et al., 2006). Broadly speaking, requirements engineering involves defining the characteristics needed by a piece of software from the users’ perspective. Requirements engineering is closely related to business process redesign because the introduction of a piece of software in an organization invariably leads to changes in the business processes of the organization (Ramos et al., 2005). Also, while not all business process change decisions are implemented through software systems (Sarker & Lee, 2002), many are. One key point derived from the requirements engineering literature, which is well aligned with the findings of this study, is that different approaches to requirements engineering lead to different business process redesign and IT implementation outcomes (Bleistein et al., 2006; Damian & Chisan, 2006).

Often what characterizes a requirements engineering approach and differentiates it from other approaches is where its main modeling emphasis lies, where modeling often refers to business process modeling. Some approaches place emphasis on the use of non-automated techniques to elicit requirements such as use scenarios (Laurenzi et al., 2006). Other approaches place emphasis on automated techniques, such as semantic analysis of natural language descriptions of requirements (Sawyer et al., 2005). Yet other requirements engineering approaches place emphasis on the use of multiple modeling techniques (Ebert, 2006).
Not unlike requirements engineering, business process redesign approaches are often distinguished by the elements that they emphasize at the business process modeling stage. The modeling stage is a critical stage in business process redesign, since business processes need to be first understood in order to be successfully modified (Dennis et al., 1999). There have been attempts to understand how different modeling approaches affect business process redesign (Keen, 1997; Kock, 2003; Ould, 1995). One such attempt led to the development of a limited version of the communication flow improvement model (CFI). The theoretical model, which serves as the theoretical anchor of this paper, is summarized in the next section.

THE CFI MODEL

The CFI model (Kock, 2003; Kock & Murphy, 2001) is concerned with how process redesign practitioners look at organizational processes, and how that affects the efficiency and success of process redesign projects. The model has been initially developed based on actual process redesign projects conducted over a period of six years, and later partially validated through projects conducted at defense contractors (Kock, 2003; Kock & Murphy, 2001).

The CFI model focuses on differences between two main types of process representations—those that place emphasis on how information exchanges take place in a process (or the communication flow), and those that place emphasis on how activities are carried out in sequence or in parallel in a process (or the activity flow). Figure 1 depicts a partial process and highlights the differences between communication flow and activity flow representations of processes.

Figure 1(a) focuses on the flow of communication in the process. There, plain rectangles represent organizational functions such as individuals, areas comprising groups of individuals, or organizations external to the process under consideration. Rectangles with rounded edges represent activities, with each activity being represented by the name of the activity, followed by the organizational function(s) that execute(s) the activity, within parentheses. “Drum”-like symbols represent information repositories, and arrows represent the flow of information in the process.

Figure 1(b) focuses on the chronological flow of activities in the process. There, organizational functions are shown at the top of each column, which contains the activities executed by each organizational function. Plain rectangles represent activities; the text inside the plain rectangles has the same meaning as the text inside rectangles with rounded edges in Figure 1(a). The arrows represent the chronological flow of execution of the activities.

The CFI model predicts that process redesign team members will favor activity flow representations early on in their projects, when the goal is primarily to analyze the process or processes that are being targeted for redesign, because those representations will be seen as more “natural” than communication flow representations. Later, at the redesign stage, though, when process redesign team members try to modify a process or processes with the goal of improving their quality and productivity, the model predicts that those team members will favor communication flow representations. The model also argues that those preferences reflect actual advantages of communication flow over activity flow representations.

It is important to note that the CFI model is a relatively narrow type of model, particularly regarding two main aspects. First, the model is concerned with operational-level process redesign projects, which differ substantially from strategic-level projects (Davenport & Stoddard, 1994; Earl, 1994). In operational-level process redesign projects (Harrington et al., 1998), the main focus is the quality and/or productivity improvement of local processes, which are usually housed in one single department or cut across a few related departments or areas (e.g., warehousing and distribution). Projects involving strategic-level process redesign (Hammer & Champy, 1993), on the other hand, are usually aimed at reengineering broad processes, often processes that cut across an
entire company. Second, the model is concerned with process redesign projects in which human beings produce representations of the processes and, based on those representations, come up with new process designs. That is, the model does not address nor dismiss the usefulness of process redesign techniques based on operations research, linear programming, and other traditional assembly-line and factory design techniques that can often be largely automated and that rely to a very little extent on subjective human judgment.

FORMALIZING THE CFI MODEL

The CFI model, as currently proposed (Kock, 2003; Kock & Murphy, 2001), lacks one important element that characterizes “good theory” (Popper, 1992; Stinchcombe, 1968): a formalized enunciation, which should make the model testable, and thus falsifiable.

The non-formalized version of the CFI model (Kock, 2003; Kock & Murphy, 2001) argues that one of the key reasons why individuals prefer activity flow representations of processes is because those types of representations are better aligned with the way human beings envision “action”. This view is consistent with previous research conducted by Ang and Gay (1993), Harrington et al. (1998), Sousa et al. (2002), and Zhu et al. (2004).

There is a range of options in connection with theoretical formalization through hypotheses. For example, one can focus on perceptions, intentions, and/or actual behavior. Trying to address all of these elements in a first attempt at formalizing a theoretical model through hypotheses is likely to lead to a set of hypotheses that is too broad, and thus difficult to test. Given this, the model formalization accomplished in the subsections below follows an approach that is similar to that adopted by Davis (1989) in his initial formalization of the technology acceptance model. That is, the focus of the formalization accomplished here is on perceptions (regarding different process representations approaches).

Also, the hypotheses are organized according to the three main stages of a typical business process improvement effort: business process modeling, business process redesign, and business process implementation. This theoretical structure is well-aligned with the way in which most business process improvement efforts are organized (Berente et al., 2009; Burke & Peppard, 1995; Cunningham & Finnegan, 2004). This theoretical structure also reflects
the applied nature of the CFI model (Kock & Murphy, 2001).

**Business Process Modeling**

It is reasonable to expect activity flow representations to be seen as easier to generate and understand, when compared with communication flow representations. The reason is that ease of generation and ease of understanding (or, more broadly, the ease of use of a representation), may be influenced by the “naturalness” of the representation. Activity flow representations seem to be more natural and easy to use than communication flow representations, because human beings tend to think in terms of actions rather than the flow of knowledge and information (Boaz & Almquist, 1997; Kock, 2005), even though this preference may not be particularly well aligned with the reality of business process (Berente et al., 2009; Dean et al., 1995). These predictions are embodied in hypotheses $H_1$ and $H_2$ below.

$H_1$. Process redesign group members will perceive communication flow representations of business processes as more difficult to generate than activity flow representations.

$H_2$. Process redesign group members will perceive communication flow representations of business processes as more difficult to understand than activity flow representations.

**Business Process Redesign**

Activity and communication flow representations are likely to vary in their usefulness to process redesign practitioners (Sousa et al., 2002; Zhu et al., 2004). The CFI model argues that the communication flow structure of processes is likely to account for a substantial amount of variation in the processes’ quality and productivity (Kock & Murphy, 2001). It logically follows from this that communication flow representations will then be more useful to those involved in process redesign tasks at the redesign stage of their tasks (Berente et al., 2009; Kock, 1999).

According to the model’s predictions in connection with different representation perception drivers at different process redesign stages, usefulness will be a stronger perception driver than ease of use in the redesign stage of the process redesign task. This stage involves two key activities (Kock, 1999; Kock & Murphy, 2001), namely the identification of opportunities for improvement, and the application of process redesign guidelines. This leads to hypotheses $H_3$ and $H_4$ below.

$H_3$. Process redesign group members will perceive communication flow representations of business processes as more useful in the identification of opportunities for improvement than activity flow representations.

$H_4$. Process redesign group members will perceive communication flow representations of business processes as more useful in the application of process redesign guidelines than activity flow representations.

**Business Process Implementation**

Communication flow representations are likely to be particularly useful at the beginning of the implementation stage of process redesign, especially given the heavy role that information technologies are likely to play on process redesign implementations (Davenport, 1993, 2000; Hammer & Stanton, 1995), and the consequent need to address the flow of communication in the processes targeted for redesign (Cunningham & Finnegan, 2004; Davenport & Short, 1990). The implementation stage of the process redesign task involves two key elements (Kock, 1999; Kock & Murphy, 2001), namely the visualization of process changes, and the development of generic IT solutions to implement the redesigned process (Cunningham & Finnegan, 2004).

According to the model’s predictions in connection with different representation perception drivers at different process redesign stages,
usefulness will be a stronger perception driver than ease of use in the implementation stage of the process redesign task, and this relative strength will be more pronounced than in the redesign stage. The above can be summarized in hypotheses $H_5$, $H_6$, and $H_7$, enunciated below.

$H_5$. Process redesign group members will perceive communication flow representations of business processes as more useful in the visualization of process changes than activity flow representations.

$H_6$. Process redesign group members will perceive communication flow representations of business processes as more useful in the development of generic IT solutions than activity flow representations.

$H_7$. The differences in perceptions hypothesized in connection with the implementation stage of the process redesign task will be farther apart than the perceptions hypothesized in connection with the redesign stage.

It is important to test the above hypotheses to assess the previous CFI model’s claim that process redesign group members rarely think of processes in terms of communication interactions at the outset of their process redesign efforts, rather thinking of processes in terms of chronological sequences of interrelated activities, or activity flows, because the latter are better cognitively aligned with the way human beings think of “action” (Boaz & Almquist, 1997; Kock, 2005). This claim provides an explanation for what seems to be a generalized preference for activity flow-based process redesign approaches (Harrington et al., 1998; Katzenstein & Lerch, 2000; Kock, 2003) and is thus central to the formalized version of the CFI model proposed here.

Nevertheless, the model also predicts that a communication flow focus is generally more effective than an activity flow one in the context of process redesign projects. The reason for this is essentially that the former would be more useful in more process redesign phases than the latter. In a process redesign project where both communication and activity flow representations are used, this would arguably translate into a “change of mind” after the beginning of a process redesign project, reflected in favorable perceptions toward, as well as preferences for, communication flow representations, as the project moves from process modeling to process redesign and implementation.

The above hypotheses assume that, when employing communication flow and activity flow representations during a process redesign project, the perception of process redesign group members about each type of representation will reflect a rational intention to achieve the best results possible (Paul et al., 1999; Stoddard & Jarvenpaa, 1995). This can be seen as a reasonable assumption in connection with the group-based projects investigated here because those were real (as opposed to simulated) projects involving individuals who knew they were responsible for the outcomes of their projects, whether those outcomes were “good” or “bad”.

**TESTING THE CFI MODEL**

Process redesign training and facilitation were provided by a researcher to the members of four process redesign groups involving consultants, employees and management from four different organizations based in Northeastern US. The facilitation was solely methodological (e.g., no specific process redesign suggestions were offered), and also “methodologically neutral” so as not to bias the perceptions of the subjects about the redesign approaches used. Two main approaches were used: one emphasizing activity and the other communication flows. To say that the facilitation of the groups was “methodologically neutral” means that the researcher did not present a particular approach as better than the other.

The process redesign groups conducted their work independently from each other. Two of the organizations were manufacturing companies; one was small, and the other midsized.
Both manufacturing organizations were private and for-profit. The other two organizations were service organizations, both midsized. One of the service organizations was private and for-profit, and the other public and not-for-profit.

To foster a multiple-perspective view of the target processes as well as avoid facilitation-induced bias, the researcher encouraged process redesign groups to generate both activity flow as well as communication flow representations of their target processes (see appendices B and C for examples), and to consider both types of representations when redesigning the target processes.

The Process Redesign Groups

The process redesign groups studied here lasted approximately 3 months each, had a “core” membership of 3 to 5 members (assigned nearly full-time to the process redesign projects), and had a “peripheral” membership of 5 to 10 members (which involved external advisors, consultants, and administrative support personnel assigned on a part-time basis to the process redesign projects).

All of the groups were cross-departmental (i.e., they involved members from more than one department) and targeted cross-departmental processes (i.e., processes that involved more than one department in their execution). The term “departments” is used here to refer to organizational units that aggregate employees with expertise in related organizational functions, e.g., marketing department, computer support department, and quality control department. The process redesign groups conducted their activities as follows.

Initially, each group decided on a process to be targeted for redesign. Then each process redesign group developed both activity flow and communication flow representations of their target processes. Following this, each process redesign group independently proposed several major process changes. Those changes were proposed without interference from the researcher. Both activity flow and communication flow representations of the new processes, with major changes incorporated into them, were then generated.

Next, each process redesign group developed a “generic” IT “solution” to implement the new process. These generic IT solutions were essentially product-independent computer-based infrastructure and system specifications, and were illustrated through rich pictorial representations (Checkland, 1981; Checkland & Scholes, 1990; Kock, 1999). The pictorial representations contained icons representing computers, databases and organizational functions responsible for executing individual activities of the new process.

The above steps were followed by the implementation of the recommended process changes in the implementation stage, which took from four to eight months to be completed. Process performance reviews were conducted approximately six months after the implementation of those changes. All of the four process redesign groups studied were generally successful in their projects.

Data Collection and Analysis

Three main types of research data were collected and compiled in connection with the process redesign groups: survey instrument answers (Drew & Hardman, 1985; Sekaran, 1984), participant observation notes (Creswell, 1994, 1998; Sommer & Sommer, 1991), and unstructured interview notes (Patton, 1980, 1987). Survey instrument answers were obtained through a survey administered to the “core” members of each process redesign group (3 to 5 members) at the end of the work of each process redesign group. Participant observation notes were generated based on direct observation of process redesign group members as well as other employees who were not directly involved in process redesign groups yet observed or were affected by the work of the groups. Unstructured interview notes were obtained through interviews conducted with the “core” members of each process redesign group, as well as with other employees who were not directly involved in process redesign groups yet interacted with...
group members or were directly affected by the work of the groups. Over forty unstructured interviews were conducted in total. Both participant observation and unstructured interview notes were generated at various times during the lifetime of each process redesign group. The data analysis in connection with the hypotheses was focused on the search for “patterns”. The identification of patterns in the survey instrument answers, which were obtained on a Likert-type scale, was conducted using paired-samples \( t \) tests (Green et al., 1997; Rosenthal & Rosnow, 1991) comparing the means for answers in connection with communication flow and activity flow representations. Patterns in participant observation and unstructured interview notes were identified either based on the observation that they occurred in the majority of the cases (Miles & Huberman, 1994), or when the sample size for the unit of analysis under consideration permitted, based on the result of a Chi-square goodness-of-fit test comparing the observed distribution with the expected (or chance) distribution (Siegel & Castellan, 1998).

In order to increase the robustness of the data analysis, the three sources of research data – survey instrument answers, participant observation notes, and unstructured interview notes – were extensively triangulated (Jick, 1979; Maxwell, 1996; Yin, 1994). As recommended by Maxwell (1996) and Sommer and Sommer (1991), the data set was thoroughly examined for patterns of evidence in support of and against each of the hypotheses, and all the evidence obtained was carefully summarized, compared and double-checked for inconsistencies.

The main unit of analysis used in this study was the individual, not the process redesign group. This applies to survey instrument answers, participant observation notes, and unstructured interview notes. Survey instrument answers were obtained from the core members of each process redesign group. Participant observation notes were generated based on direct observation of process redesign group members, as well as other employees not directly involved in process redesign groups but affected by the work of the groups. Unstructured interview notes were generated based on interviews with the core members of each process redesign group and with employees not directly involved in process redesign groups but affected by the work of the groups.

RESULTS
As previously mentioned, unstructured interviews with managers and employees suggested that all of the four process redesign groups studied were generally successful in their projects. The process changes recommended by them were implemented fully or partially and led to positive observable results, thus meeting general success criteria proposed in the process redesign literature (Burke & Peppard, 1995; Davenport, 1993; Hammer & Champy, 1993).

In this section, hypotheses-relevant results are grouped in three main categories, namely survey instrument answers, participant observation notes, and unstructured interview notes. Later in the section, the several hypotheses-relevant results, both in support and against the hypotheses, are summarized in a single table and compared against each other.

Survey Instrument Answers
Table 1 summarizes the results of a paired-samples \( t \) test applied on the survey instrument answers. In it, the “core” members of each process redesign group (3 to 5 members) answered the questions listed in Appendix A on a Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). Pairs of questions are used for each of the constructs listed below, with each question in a pair referring to one of the two types of process representation studied.

The leftmost column of Table 1 lists 6 constructs associated with business process representations: ease of generation (EASY-GEN); ease of understanding (EASYUND); usefulness in the identification of opportunities for improvement (OPPORTU); usefulness in the application of process redesign guidelines.
usefulness in the visualization of process changes (VISUAL); and usefulness in the development of generic IT solutions (ITSO-LUT). The measures for these constructs (one indicator per construct) are shown in Appendix A and reflect the constructs identified by Kock (1999) and Kock and Murphy (2001) based on grounded-theory research investigations (Glaser & Strauss, 1967; Strauss & Corbin, 1990, 1998).

Column “Mean – C” in Table 1 shows the means for answers referring to communication flow representations; column “Mean – A” refers to activity flow representations. On the right-hand sides of each of these columns are columns showing the standard deviations for each measure. The column “t” shows the t statistic for each pair of measures. Finally, the column “p (2-tailed)” shows the significance level for each t statistic based on a 2-tailed test.

The patterns of evidence listed below have been derived from Table 1. They are referred to by “SIA” (survey instrument answers) codes that are later used for data triangulation. The patterns of evidence SIA.H10, SIA.H20, SIA.H30 and SIA.H40 do not support hypotheses H1, H2, H3 and H4; that is, they provide support for the null hypotheses H10, H20, H30 and H40, respectively. The patterns of evidence SIA.H5, SIA.H6, and SIA.H7 provide support for the hypotheses H5, H6, and H7, respectively.

**SIA.H10.** On average, group members perceived communication flow representations as more difficult to generate than activity flow representations (see EASYGEN row in Table 1). The results of the paired samples t test (t(15)=-.61, p=.55) comparing perceptions for each representation were not statistically significant.

**SIA.H20.** On average, group members perceived communication flow representations as easier to understand than activity flow representations (see EASYUND row in Table 1). The results of the paired samples t test (t(15)=-.92, p=.37) comparing perceptions for each representation were not statistically significant.

**SIA.H30.** On average, group members perceived communication flow representations as more useful in the identification of opportunities for improvement than activity flow representations (see OPPORTU row in Table 1). The results of the paired samples t test (t(15)=2.38, p<.05) comparing perceptions for each representation were statistically significant.

**SIA.H40.** On average, group members perceived communication flow representations as more useful in the application of process redesign guidelines than activity flow representations (see APLLIC row in Table 1). The results of the paired samples t test (t(15)=2.76, p<.05) comparing perceptions for each representation were statistically significant.

**SIA.H5.** On average, group members perceived communication flow representations as more useful in the visualization of

<table>
<thead>
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<th></th>
<th>Mean - C</th>
<th>Std. deviation</th>
<th>Mean - A</th>
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process changes than activity flow representations (see VISUAL row in Table 1). The results of the paired samples t test \( (t(15)=3.64, p<.01) \) comparing perceptions for each representation were statistically significant.

**SIA.H6.** On average, group members perceived communication flow representations as more useful in the development of generic IT solutions than activity flow representations (see ITSOLUT row in Table 1). The results of the paired samples t test \( (t(15)=3.05, p<.01) \) comparing perceptions for each representation were statistically significant.

**PON.H1.** All groups generated activity flow representations of their targeted processes before they generated communication flow representations. This is seen as supporting hypothesis H1 based on the assumption that process redesign groups would generate first the process representation that they perceived as the least difficult to generate.

**PON.H4.** Of all the 37 process redesign decisions made by the four groups as a whole, 23 process redesign decisions (62.16%) were entirely based on communication flow representations of their target processes. The other 14 process redesign decisions were distributed as follows: 4 (10.81%) were entirely based on activity flow representations of their target processes, and 10 (27.03%) were based on both types of representations. This is seen as supporting H4 because a Chi-square goodness-of-fit test of the distribution of process redesign decisions \( (\chi^2(2, N=37)=15.3, p<.001) \) suggests a statistically significant preference for the use of communication flow representations when applying process redesign guidelines.

**PON.H6.** All groups developed “generic” IT “solutions” and respective rich pictorial representations entirely based on communication flow representations of their target processes. This is seen as supporting hypothesis H6 based on the assumption that process redesign groups would develop their “generic” IT “solutions” and rich pictorial representations based on the process representation that they perceived as the most useful for those tasks.

**Participant Observation Notes**

The patterns of evidence listed below have been derived from the participant observation notes generated based on direct observation of process redesign groups at work. These notes have been generated at various times during the lifetime of each process redesign group. They are referred to by “PON” (participant observation notes) codes that are later used for data triangulation. The patterns of evidence PON.H1, PON.H4 and PON.H6 provide support for the hypotheses H1, H4, and H6, respectively. These were the only patterns of evidence obtained from the analysis of participant observation notes that were relevant for testing the hypotheses – i.e., other patterns of evidence that emerged from the analysis but that were unrelated to the hypotheses are not listed below because they are not relevant for the study reported in this paper.

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**Unstructured Interview Notes**

The patterns of evidence listed below have been derived from the notes generated based on unstructured interviews, conducted at various times during the lifetime of each process redesign group. They are referred to by “UIN”
(unstructured interview notes) codes that are later used for data triangulation. The patterns of evidence UIN.H1₀ and UIN.H2₀ do not support hypotheses H1 and H2; that is, they provide support for the null hypotheses H1₀ and H2₀, respectively. The patterns of evidence UIN.H3, UIN.H4, UIN.H5 and UIN.H6 provide support for the hypotheses H3, H4, H5 and H6, respectively.

UIN.H1₀. There was no clear majority perception as to whether communication flow representations were easier or more difficult to generate than activity flow representations.

UIN.H2₀. There was no clear majority perception as to whether communication flow representations were easier or more difficult to understand than activity flow representations.

UIN.H3. Most group members perceived communication flow representations as more useful in the identification of opportunities for improvement than activity flow representations. They generally explained their perception by pointing out that communication flow representations had not “caged” them into thinking in an “artificially sequential” manner, which was necessary for the redesign of the flow of “data” or “information” within a process. The following quote provides an illustration of this perception: “The [activity flow] diagram does not visibly show any wasted effort … because the [communication flow diagram] does not show actual tasks it allows one to be more creative than being limited by a particular sequence. In the [communication flow diagram] sequences aren’t greatly represented … so you do not get in the mindset of following a specific sequence. We can see what is needed, where to get information from, and it’s up to us to define the sequence later.”

UIN.H4. Most group members perceived communication flow representations as more useful in the application of process redesign guidelines than activity flow representations. They generally explained their perception by pointing out that communication flow representations were better visual aids in the identification of problems in connection with the flow of “data” or “information”, which were more frequently observed, and where process redesign guidelines could be easily applied. This is illustrated by the following quote: “The workflow representation shows a chronological view. Thus, it is easier to conceptualize the process at first. This will give a quick picture in order to understand the process … [however] by utilizing the [communication] flow [representation], it was [easier] to see the excessive data flowing between the customer and the employees of ACD.”

UIN.H5. Most group members perceived communication flow representations as more useful in the visualization of process changes than activity flow representations. They generally explained their perception in the same way as they explained their perception that communication flow representations were more useful in the application of process redesign guidelines, as the following quote suggests: “It is easier to visualize the process changes using the data flow representations than the workflow representations. With the data flow, you see that different data stores are receiving data from the same functional unit and sending data to the same or different functions. Based upon the data flow representation, it is easy to determine that all of the data stores are not needed.”

UIN.H6. Most group members perceived communication flow representations as more useful in the development of generic IT solutions than activity flow representations. They generally explained their perception by pointing out that, since the generic IT solution automated the flow of communication within a process; the communication flow representation was particularly suited for its development. The following quote illustrates this: “[Communication flow representations give] a much better
guideline for development of generic IT solutions than workflow representations. In our case, we used the new communication flow representation and easily converted it to a generic IT solution. We had three main data stores. The first one was used for interaction between customer and ACD employees (in creation of RFS, MAS, SOP). This was easily changed to an asynchronous Web-based communication that was connected to a database management system. The second data store was used by the product technician for performing the test. This was replaced by the Automation system. The last data store stored manual results of lab which was replaced by the Lab Information Management System. This also provided the data needed for the Vice President to finalize the report for the customer and adhere to the ISO 9002 standard.”

Summary of evidence in support and against the hypotheses Table 2 summarizes evidence in connection with the hypotheses, showing individual patterns of evidence in support of and against the hypotheses. Evidenced against the hypotheses H1, H2 … is defined as evidence in support of the respective null hypotheses H10, H20 …

The evidence presented in Table 2 is grouped based on its source and indicated, as done earlier, by specific acronyms that indicate the source of each piece of evidence – survey instrument answers (SIA), participant observation notes (PON), and unstructured interview notes (UIN). Empty cells indicate that a thorough search revealed the absence of patterns of evidence from a particular source in connection with the respective hypotheses.

DISCUSSION

The patterns of evidence summarized in the previous section provide weak support for hypothesis H1, no support for hypothesis H2, and general support for hypotheses H3, H4, H5, H6 and H7. This is summarized in Table 3 for convenience. Since the hypotheses represent a grounded and formalized version of the CFI model, it can be concluded that the patterns of evidence also provide moderate support for the model, reinforcing some elements the model but not others.

Inconsistently with the model’s predictions, process redesign group members did not seem to perceive communication flow representations of processes as more difficult to understand than activity flow representations. Also inconsistently with the model’s predictions, process redesign group members did not seem to perceive communication flow representations of processes significantly more difficult to be generated than activity flow representations. Nevertheless, all groups spontaneously generated activity flow representations of their targeted processes before they generated communication flow representations.

The above findings may be seen as putting into question the CFI model’s assertion that activity flow representations are better aligned with the way humans are cognitively programmed to envision “action” in the physical sense, and its claim that such cognitive alignment is one of the reasons why activity flow representations and related process redesign guidelines are so widely used today. However, at least three other explanations could be invoked that can be seen as generally consistent with the model, and as indicating that substantial revisions of the key underlying assumptions of the model may not be warranted (at least not without additional empirical research).

The first alternative explanation is that even though activity flow representations are indeed seen as more natural and easy to use than their activity-oriented counterparts, the information-intensive nature of most processes today (Alter, 2008; Drucker, 1993; Kock & McQueen, 1996; Kock & Murphy, 2001) forces individuals into adapting their way of thinking about processes – toward thinking of processes as webs of communication interactions – and thus counterbalances that ease of use effect. This explanation is consistent with the perception by
process redesign group members in this study that communication flow representations are approximately 8% more difficult to generate than activity flow representations. Such difference, while statistically insignificant given the sample size, has a noteworthy effect size of about .31. One possible way in which this alternative explanation can be tested is by assessing whether workers involved in less information-intensive processes perceive communication flow representations to be more difficult to generate than activity flow representations to a larger extent than workers in more information-intensive processes. That is, in the test of the alternative explanation, information-intensiveness in the processes targeted for redesign would have to be measured and tested for moderating effects on other variables.

The second alternative explanation is that activity flow representations are indeed more natural and easy to use than communication flow representations, but the difference in degree of ease of use is relatively small, since communication flow representations usually depict action in a somewhat limited way. This is also consistent with the perception by process redesign group members that communication flow representations are approximately 8% more difficult to generate than activity flow representations. The effect size of about .31 associated with this difference would lead to statistical significance in a larger sample. This relatively small difference in degree of ease of use may be enough to account for the fact that all groups generated activity flow representations of their targeted processes before they generated communication flow representations.

The third alternative explanation is related to a methodological limitation associated with this study. Following a common design in quasi-experimental inquiry (Campbell & Stanley, 1963), the survey instrument was administered after each process redesign group completed its work. The problem with this approach is that perceptions associated with process representation ease of use might have been different at the completion of the process redesign task than they were at the analysis stage. In hindsight, perhaps a more appropriate design would have involved the administration of part of the survey instru-

<table>
<thead>
<tr>
<th>Survey instrument answers</th>
<th>Participant observation notes</th>
<th>Unstructured interview notes</th>
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<tbody>
<tr>
<td>H1</td>
<td></td>
<td>PON.H1</td>
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<tr>
<td>H10</td>
<td>SIA.H10</td>
<td>UIN.H10</td>
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<td>H2</td>
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<td>SIA.H20</td>
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<td>H3</td>
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<td>H30</td>
<td>SIA.H30</td>
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<td>H50</td>
<td>SIA.H50</td>
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<td>SIA.H60</td>
<td>UIN.H6</td>
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<td>H7</td>
<td></td>
<td></td>
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<tr>
<td>H70</td>
<td>SIA.H70</td>
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</table>

Table 2. Individual patterns of evidence in support of and against the hypotheses (Evidence against $H_1, H_2 \ldots = $ Evidence in support of the null hypotheses $H_{10}, H_{20} \ldots$)
ment, namely the questions in connection with ease of generation and understanding, right after the analysis stage. This alternative explanation would account for the apparent contradiction between: (a) the lack of statistical significance associated with the higher perceived difficulty of generating communication flow representations, and (b) the fact that all groups generated activity flow representations of their targeted processes before they generated communication flow representations.

Consistently with the CFI model’s predictions, process redesign group members perceived communication flow representations of business processes as more useful than activity flow representations in the following aspects: identification of opportunities for improvement, application of process redesign guidelines, visualization of process changes, and development of generic IT solutions. Also consistently with the CFI model’s predictions, the distribution of process redesign decisions suggested a statistically significant preference for the use of communication flow representations when applying process redesign guidelines, and all groups developed “generic” IT “solutions” and respective rich pictorial representations entirely based on communication flow representations of their target processes.

The above findings support the CFI model’s predictions that process redesign group members will prefer communication flow representations particularly as the project moves from process modeling to process redesign and implementation, arguably due to the heavy role that information technologies are likely to play on process redesign implementations, and the consequent need to address the flow of communication in the processes targeted for redesign.

It is clear that much more research is needed to further test and refine the CFI model. Notably, this study does not completely rule out the possibility that the widespread use of activity flow representations is more due to current habits reinforced by consulting companies and management gurus (Chuang & Yadav, 2000; Kock & McQueen 1996), than to a cognitive predisposition toward those types of representations, as argued by the CFI model. Another limitation of this study is related to the

Table 3. Assessment of the hypotheses

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Assessment</th>
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<tbody>
<tr>
<td>H1: Process redesign group members will perceive communication flow representations of business processes as more difficult to generate than activity flow representations.</td>
<td>Weak support</td>
</tr>
<tr>
<td>H2: Process redesign group members will perceive communication flow representations of business processes as more difficult to understand than activity flow representations.</td>
<td>Not supported</td>
</tr>
<tr>
<td>H3: Process redesign group members will perceive communication flow representations of business processes as more useful in the identification of opportunities for improvement than activity flow representations.</td>
<td>Supported</td>
</tr>
<tr>
<td>H4: Process redesign group members will perceive communication flow representations of business processes as more useful in the application of process redesign guidelines than activity flow representations.</td>
<td>Supported</td>
</tr>
<tr>
<td>H5: Process redesign group members will perceive communication flow representations of business processes as more useful in the visualization of process changes than activity flow representations.</td>
<td>Supported</td>
</tr>
<tr>
<td>H6: Process redesign group members will perceive communication flow representations of business processes as more useful in the development of generic IT solutions than activity flow representations.</td>
<td>Supported</td>
</tr>
<tr>
<td>H7: The differential perceptions hypothesized in connection with the implementation stage of the process redesign task will be stronger than the perceptions hypothesized in connection with the redesign stage.</td>
<td>Supported</td>
</tr>
</tbody>
</table>
relatively small sample size, and the fact that the participants were not randomly selected. The fact that the participants were involved in actual process redesign projects, and the possibility that they volunteered to do their work, may suggest that they form a biased sample. Similar research projects in the future should control for the effect of confounding variables associated with demographics and personal motivation-related factors. This would arguably require larger samples, and the use of more sophisticated quantitative analyses techniques such as structural equation modeling (Kline, 1998).

CONCLUSION

This paper develops and tests through a quasi-experimental field study a theoretically formalized version of the CFI model (Kock, 2003; Kock & Murphy, 2001). The study compares two key types of business process representations in the context of actual process redesign projects. The empirical evidence suggests that perceived usefulness in the identification of opportunities for improvement is about 22% higher in communication flow representations; perceived usefulness in the application of process redesign guidelines is about 23% higher; perceived usefulness in the visualization of process changes is about 34% higher; and perceived usefulness in the development of generic IT solutions is about 38% higher in communication flow representations, when compared with activity flow representations.

While the above findings are consistent with the formalized version of the CFI model proposed here, providing general support for the model, some other findings were not. Contrary to predictions based on the model, process redesign group members did not seem to perceive communication flow representations significantly more difficult to generate and to understand than activity flow representations. Interestingly, these findings may suggest that communication flow representations may be even more desirable than predicted by the model, since some of the disadvantages associated with them do not seem to be as significant as initially predicted.

This study suggests one key area of future research in connection with the CFI model, which is the investigation of the impact of using either communication flow or activity flow representations in process redesign projects, but not both (as in this study). This would provide the basis on which researchers could more clearly assess the advantages and disadvantages of one type of representation over and against the other, as this research design would be less likely to be influenced by interaction effects in connection with repeated-measures research designs (Drew and Hardman, 1985; Rosenthal & Rosnow, 1991) such as the one employed in this study. It seems, from the findings of this study, that communication flow representations may provide a complete and advantageous alternative to activity flow representations.

This study also provides support for a key assumption underlying the insipient field of information visualization (Eick, 2005); the assumption that visual representations of information should be heavily contingent on the usefulness of those representations in the context of specific tasks (Ferreira de Oliveira & Levkowitz, 2003; Keim, 2002), especially when the tasks in question have high degrees of complexity – the notion of task complexity is discussed in detail by Campbell (1988). This assumption has led to a proliferation of information visualization tools whose elements are often heavily contingent on the particular tasks being accomplished (Kroeker, 2004). The assumption contrasts with the general view that computer interfaces should be designed with an eye for the maximization of their ease of use (Kock, 2004), and is closely aligned with the notion that a high level of “fit” between computer interfaces and tasks is likely to be associated with high quality task outcomes (Zigurs & Buckland, 1998).

Another area of future research associated with this study relates to the development, refinement and investigation, based on the findings of this study, of methods and techniques...
that are related to but go beyond the scope of business process redesign. One area in which this line of inquiry may be fruitful is systems analysis and design (Dennis & Wixom, 2000), as there have been research studies in that past (Chuang & Yadav, 2000) suggesting that some new and increasingly popular systems analysis and design methods and techniques may suffer from the same problems associated with methods and techniques used in process redesign that rely too heavily on activity flow representations (and too lightly on communication flow representations).

One example of the above situation is the recent success of object-oriented programming, which has led to the emergence and increasing use of object-oriented methods and techniques for systems analysis and design. In spite of much industry support, the scope of use of object-oriented methods and techniques in systems analysis and design is still not very significant when compared with that of object-oriented methods and techniques in programming. Chuang and Yadav (2000) argue that this is due to object-oriented analysis’ excessive activity orientation, which they addressed by developing and validating, with positive conceptual results, a new methodology that applies modified object-oriented methods and techniques to the solution of systems analysis and design problems. This new methodology shifts the emphasis away from activities, as defined in this paper, and onto how communication takes place in processes.

This research has key implications for managers involved in operational-level process redesign projects. One key implication is that those managers should carefully analyze the focus of their projects, especially when the goal is to obtain quality and productivity improvements through the redesign of individual processes. A focus on activities and their flow may be advocated by proponents of popular activity flow-based methods. Among those proponents are large consulting companies and recognized management “gurus” such as Hammer (1996) and Harrington et al. (1998). Nevertheless, this study suggests that such focus is likely to contribute to less than optimal outcomes. Managers should strongly consider moving away from that focus and toward a focus on communication flows and process redesign related techniques. This is particularly important in broad projects that target primarily service processes, where the flow of materials is minimal, such as the recent organization-wide initiatives by large corporations and government branches to improve acquisition practices (Graves, 2001). In projects of such breadth and magnitude, even single-digit success rate increases can lead to savings in the range of millions of dollars.

REFERENCES


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APPENDIX A

Survey Instrument

The statements below were used for the “questions” in the survey instrument, which were answered on a Likert-type scale going from “strongly disagree” to “strongly agree” (range: 1 to 5).

1. Activity flow representations are easy to generate.
2. Communication flow representations are easy to generate.
3. Activity flow representations are easy to understand.
4. Communication flow representations are easy to understand.
5. Activity flow representations are useful in the identification of opportunities for improvement.
6. Communication flow representations are useful in the identification of opportunities for improvement.
7. Activity flow representations are useful in the application of process redesign guidelines.
8. Communication flow representations are useful in the application of process redesign guidelines.
9. Activity flow representations are useful in the visualization of process changes.
10. Communication flow representations are useful in the visualization of process changes.
11. Activity flow representations are useful in the development of generic IT solutions.
12. Communication flow representations are useful in the development of generic IT solutions.

APPENDIX B

Activity flow representation used

The partial functional timeline flowchart (Harrington, 1991; Harrington et al., 1998) below, generated by one of the groups, illustrates the activity flow representations used by the process redesign groups. Activity names were listed next to the representations.

APPENDIX C

Communication Flow Representation Used

The partial communication flow diagram (Kock, 1999, 2006; Kock & Murphy, 2001), generated by one of the groups, illustrates the communication flow representations used by the process redesign groups.
Figure 2. A functional timeline flowchart
Figure 3. Communication flow diagram
Studies on Utilizing the Three Famous International Index Systems to Evaluate Scientific Research Level of Higher Learning Institutions

Xun Liu, Beijing University of Technology, China
Changyu Huang, Beijing University of Technology and Chinese Academy of Sciences, China
Wei-Liang Qian, Beijing University of Technology, China
Yong-Chang Huang, Beijing University of Technology, Chinese Academy of Sciences, and CCAST, China

ABSTRACT

Science Citation Index (SCI), The Engineering Index (EI), and Index to Scientific & Technical Proceeding (ISTP) are widely accepted and used to evaluate the scientific research level of higher learning institutions by many countries’ science and technology field currently. After research, the authors point out the blemishes in this method and put forward the problems that need to be noticed, and then, under current conditions, bring forward brand-new standards and methods to estimate research level, efficiency, and fund exploitation. One shouldn’t over-emphasize the total amount of papers collected in SCI, EI & ISTP when evaluating the scientific research level of higher learning institutions, whereas using ‘comprehensive factor’ analysis method can make it more scientific and efficient.

Keywords: Citation Index, Combinative Factor, EI, ISTP, SCI

BRIEF INTRODUCTION OF SCI, EI AND ISTP

With the reform of the research system successively deepened in the world, the question how to evaluate the research result causes more and more extensive concerns of the society. Currently, scientific field has gradually accepted the data-evaluating method of citation analysis provided by《Science Citation Index》(SCI),《The Engineering Index》(EI) and《Index to Scientific & Technical Proceeding》(ISTP).
This is an objective, fair & quantitative evaluation method, and is also a general-accepted international method. When evaluating the research level of universities, one usually takes the total number of papers collected by SCI, EI and ISTP as the standard. Every year, some organizations would rank the universities and research institutions according to the total collected amount. Through studies, we think that this method lacks strict theoretical basis, is not scientific & rational enough and has already resulted in some mistakes in the attitude of many universities toward SCI, EI and ISTP. Therefore, we hold the view that we should appropriately make use of the three famous index systems to reasonably evaluate the research level of universities with objective attitudes.

SCI, edited and published by Institute for Scientific Information (ISI) in America, is a kind of Search Publication that reflects the relationship of scientific and technological literature and citation, and is also a tool to evaluate scientific & technological publications and papers with the method of metrology. SCI covers extensive fields, including mathematics, physics, chemistry, engineering, agriculture, forestry, medicine and so on, while life sciences, medicine, chemistry and physics possess the biggest proportion.

EI, the earliest article abstracts of engineering technique in the world, which started publication in October 1884, is edited and published by the Engineering Incorporation now. As one of the three famous indexical systems, EI is a large-scale indexical system mainly embodying engineering technique periodicals and conference literature. Now it has become the world-class authoritative indexical system and general-accepted international statistic source.

ISTP is a proceeding index database published by ISI, mainly including important literature of various conferences around the world. The ISTP covers many fields including life sciences, clinical medical, physics, chemistry, engineering technique, applied sciences, biology, environmental and energy science etc. Annually, the ISTP reports 4000 varieties of meetings and collects more than 200 thousand papers.

PROBLEMS OF USING THE SCI ETC. TO EVALUATE THE RESEARCH EFFICIENCY OF HIGHER LEARNING INSTITUTIONS

Currently, science & technology field and higher learning institutions of many counties pay great attentions to the papers collected by SCI, EI and ISTP. After researches, one can notice that, under the situation that the developments of periodicals are fast and their quantities are also improved continuously, there are some mistakes existing in the understanding of science and technology field and library & information field of many counties for SCI, EI & ISTP.

The statistics of quoted articles offered by SCI, EI & ISTP is very reliable and scientific to serve as the basis of estimating academic achievements. It provides firm basis for evaluating the science & technology level of scientific research organizations. But it should be noticed that there are still some disadvantages in SCI, EI & ISTP. The conception of quoted articles in SCI, EI and ISTP is based on the assumption that the authors have absorbed and used the references. However, the complexity and variability of motivation in quoting references make the assumption less rigorous. Therefore, there exist some uncertain reasons in estimating system of SCI EI, and ISTP which are completely founded on quoting analysis.

As well, it is inevitable that there are some problems in using SCI, EI and ISTP to estimate the scientific research level of scientific research organization and universities. On one hand, this method inspires many universities to make better researches and, as a result, the level of science & technology has been increased. It makes a firm foundation for universities’ modernization and internationalization. At the same time, it has aroused great impacts in the society that universities are graded according to the total number of articles embodied by SCI, EI & ISTP. However, researches have already proved that although it has some rationality in level grading of universities in this method and
has been checked by several years’ practice, it still has some disadvantages.

Higher learning institutions can be classified in different levels, including key universities, ordinary universities, research institutions and a large number of technical colleges. Therefore, employing diverse methods based on their actual situations is an advisable way. Only in this way can one see the development situation of a university and its developmental potential objectively and scientifically, which is indispensable for anyone to set appropriate destination for further investments or adjustments. Therefore, we believe the fact that it is not comprehensive, scientific or objective to take the total number of papers embodied by SCI, EI & ISTP as the only standard to evaluate higher learning institutions.

Take China as an example. From the statistics released by SCI, EI & ISTP, the top ten colleges and universities of China do not change greatly. Many colleges and universities have

### Table 1. Top ten colleges according to the amount of articles embodied by SCI

<table>
<thead>
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<th>Universities</th>
<th>Amount of embodied articles in 2002</th>
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<tbody>
<tr>
<td></td>
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</tr>
<tr>
<td>Tsinghua University</td>
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<tr>
<td>Jilin University</td>
<td>575</td>
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<tr>
<td>Nankai University</td>
<td>486</td>
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</table>

### Table 2. Top ten colleges according to the amount of articles embodied by EI

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<th>Universities</th>
<th>Amount of embodied articles in 2002</th>
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<td>Tianjin University</td>
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shown their strong scientific research capability, but the situation of personnel allocation and capital usage should also be noticed. In other words, these institutions must consider the ratio of input to output, that is, whether the valuable resources are adequately and efficiently utilized or not is more worthy to be concerned. Based on this consideration, we have introduced a brand-new evaluation standard, which is more scientific and effective for institutions of higher learning to evaluate their scientific and technological level.

EVALUATION ON EFFICIENCY OF UNIVERSITY BY COMPREHENSIVE FACTOR

Amounts of Embodied Articles in 2002

The top-ten universities in China according to the amounts of articles embodied by SCI, EI and ISTP are shown in the following tables.

The “Comprehensive Factor” Analysis Method

As shown from Table 1 to Table 3, many famous universities in China appear in the three tables and some universities have excellent records in all the three tables. In these tables, the only criterion of ranking is the total number of embodied articles of the universities, which reflects the emphasis on the total output value in current method. However, we think that a more effective ways should be employed, and then, put forward the “Comprehensive Factor” analysis method.

Essentially, the conception of “productive efficiency” is highlighted in the “Comprehensive Factor” analysis method. In fact, the importance of “productive efficiency” has long been accepted by people and “productive efficiency” has served as an evaluating standard in various fields in modern society. Thus, it is quite reasonable to adopt this conception in evaluating the scientific research level of institutions for higher learning. In short, productive efficiency is the ratio of output to input, i.e. the researched achievements obtained under the same conditions of human and money investment during the same period. Using this standard, after comparing the research efficiency between higher learning institutions, we can rate their scientific and technological research levels objectively.

Based on the basic idea above, there are two factors contributing most to scientific research in institutions of higher learning: human and money investments, which mean researchers &

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<td>Southeast University</td>
<td>575</td>
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<tr>
<td>Beijing University of Aeronautics &amp; Astronautics</td>
<td>486</td>
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</tbody>
</table>

Table 3. Top ten colleges according to the amount of embodied articles by ISTP
graduates and researching funds, respectively. As is known to all, teachers and graduates are the main forces of research in universities, and the researching fund is the necessary guarantee for engaging in scientific research, neither of which is dispensable. Therefore, we select the unit factors from the two above-mentioned aspects.

Through researches, we measure the scientific research efficiency of higher learning institutions from five aspects, including research payout, total of teachers and researchers, total of non-teachers and non-researchers, total of masters and total of doctors. In the five aspects, the research payout reflects the money investment; the total of teachers and researchers, masters and doctors represent the human investment while the total of non-teachers and non-researchers can serve as a reference for organizing efficiency. As a result, various comparisons can be carried out through these aspects.

Up to now, based on the amount of collected papers and the data about the five aspects above of higher learning institutions in that year, we can obtain the five unit factors as following: \( \eta_{am} \) means the number of embodied articles (piece) per research payout (ten thousand Yuan), \( \eta_{at} \) means the number of embodied articles (piece) per teacher & researcher (person), \( \eta_{aw} \) means the number of embodied articles (piece) per non-teacher & non-researcher (person), \( \eta_{ag} \) means the number of embodied articles (piece) per master (person), \( \eta_{ad} \) means the number of embodied articles (piece) per doctor (person).

From the five unit factors, we can obtain the Comprehensive Factor \( \eta_c \) by multiplying them, because their contributions to the result are parallel. Otherwise, if we take the algebraic average of the five factors, the effects of various aspects contributing to the result cannot be objectively reflected, for some aspects might be excessively emphasized or ignored. Then the efficiency of a higher learning institution can be comprehensively measured by the values of \( \eta_c \); the greater the value is, the higher the rank of efficiency should be.

As a necessary supplement to the comprehensive factor, the efficiency of human resource utilization, i.e. the researching ability, and that of money utilization should also be considered as ranking standards respectively. On one hand, it is necessary to rank higher learning institutions by their researching abilities, for the teachers, researchers and postgraduates are the main body of researching in higher learning institutions. Therefore, on the basis of Comprehensive Factor, we put forward the factor \( \eta_{ac} \), referring to the number of embodied thesis (piece) per person who has the ability to research (person), including the teachers, researchers and graduates (Though some excellent undergraduate students may also contribute to indexed papers, but their number is so smaller than that of the others that can be ignored). The greater \( \eta_{ac} \) is, the higher the rank should be, which represents its greater strengths in studying. On the other hand, the higher learning institutions should as well be ranked by \( \eta_{am} \) to measure the exploitation efficiencies of research funds which are the necessary guarantee for engaging in scientific research.

These factors are the primary ingredients responsible for research level and total number of collected papers of any higher learning institutions. Taking advantages of them, we can not only realize universities’ situations, but also find the problems in each aspect through analyzing relative unit factors. Concretely, one can rank and compare institutions according to each of the five unit factors. For example, the factor \( \eta_{aw} \ & \eta_{at} \) can reveal that whether the assigning proportion of personnel, consisting of researchers and non-researchers, is appropriate or not, and can serve as a firm evidence to adjust personnel assignment of higher learning institutions to further optimize the structure of institutions.

**Evaluate the Research Efficiency of Higher Learning Institutions by “Comprehensive Factor” Analysis Method**

Based on the thoughts and methods of the previous section, we are going to rearrange the research level of high learning institutions with the help of the data in 2002. First, we list the
information of those universities in the above five aspects in Table 4.

Secondly, from the information in Table 1 to Table 3, we can obtain the five unit factors (ηam, ηat, ηaw, ηag & ηad), ηac and the “Comprehensive Factor” ηs. Then, the universities are ranked according to the Comprehensive Factor with the results shown from Table 5 to Table 7. If the information of some universities is incomplete, we abandon it and do not take it into consideration, but this process obviously will not affect the results of analysis.

DISCUSSION ON “COMPREHENSIVE FACTOR” ANALYSIS METHOD

From the analytic results above, there are great differences between the result of this method and the former evaluation system. After computation, some universities, with a small Comprehensive factor, have a lower position than before, while some universities, with a large Comprehensive factor, change oppositely.

Take the University of Science & Technology of China as an example. The numbers of articles embodied by SCI & EI in 2002 are respectively 903 and 744 which respectively rank five and seven in the result of the conventional method. After the analysis by our method, ηam & ηac of articles embodied by SCI are 0.0467 & 0.1147, respectively, and ηs is 0.001906 which ranks the first. ηam & ηac of articles embodied by EI are 0.0197 & 0.0485, respectively, and ηs is 0.0000258 which is on the second position.

The differences of the two evaluation systems are majorly caused by the dissimilarities of the calculation principles of the two systems.
On one hand, using the Comprehensive Factor analysis method, we can evaluate the research level of a university more objectively and scientifically, and further compare the efficiencies of different universities. On the other hand, the differences can also arouse some deeper discussions.

**Difference Analysis**

It is valuable for us to think over the difference between evaluated results of the two systems, and the reason of these differences includes the following aspects.

### Abrupt Increase of Personnel Number Caused by the Combination of Universities

In last few years, many universities adopted the consolidation strategy to enhance their strengths, to improve the construction of subjects, and to amplify the influence of their universities; some universities have merged some other colleges of different types, such as medical or art colleges, while others have merged some local colleges such as technical colleges or private colleges. These actions have led to the fact that the number of students and teachers are increased abruptly and greatly.
Even though the merger of universities indeed promotes the reform and development of universities to a certain extent, some problems coming with it cannot be neglected. Through analyzing the Comprehensive factor, one can know that although the resources can be integrated and better utilized through combination of universities, the number of students and teachers increases so abruptly that the Comprehensive factor becomes smaller due to the abrupt increase of the denominator’s value in calculation. Therefore, enlarging the size of a university blindly will not necessarily improve the research abilities which cannot be enhanced by mechanically increasing the number of personnel without regarding the average quality.

Table 7. Sequencing results of universities by comprehensive factor (Articles embodied by ISTP)

<table>
<thead>
<tr>
<th>Name of universities</th>
<th>Position</th>
<th>ηam</th>
<th>ηam place</th>
<th>ηam</th>
<th>ηam</th>
<th>ηam</th>
<th>ηam place</th>
<th>ηam</th>
<th>ηam place</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tsinghua University</td>
<td>1</td>
<td>0.0156</td>
<td>1</td>
<td>0.3194</td>
<td>0.2695</td>
<td>0.1444</td>
<td>0.2715</td>
<td>0.0728</td>
<td>1</td>
</tr>
<tr>
<td>Zhejiang University</td>
<td>3</td>
<td>0.0072</td>
<td>6</td>
<td>0.1033</td>
<td>0.3029</td>
<td>0.0385</td>
<td>0.0780</td>
<td>0.0206</td>
<td>5</td>
</tr>
<tr>
<td>Harbin Institute of Technology</td>
<td>4</td>
<td>0.0068</td>
<td>7</td>
<td>0.0780</td>
<td>0.1407</td>
<td>0.0490</td>
<td>0.1247</td>
<td>0.0242</td>
<td>3</td>
</tr>
<tr>
<td>Huazhong University of Science &amp; Technology</td>
<td>5</td>
<td>0.0103</td>
<td>2</td>
<td>0.0771</td>
<td>0.0392</td>
<td>0.0373</td>
<td>0.0905</td>
<td>0.0197</td>
<td>7</td>
</tr>
<tr>
<td>Tianjin University</td>
<td>6</td>
<td>0.0096</td>
<td>3</td>
<td>0.0911</td>
<td>0.0976</td>
<td>0.1453</td>
<td>0.1437</td>
<td>0.1453</td>
<td>4</td>
</tr>
<tr>
<td>Xi’an Jiaotong University</td>
<td>7</td>
<td>0.0090</td>
<td>4</td>
<td>0.1031</td>
<td>0.1007</td>
<td>0.0367</td>
<td>0.0824</td>
<td>0.0201</td>
<td>6</td>
</tr>
<tr>
<td>Peking University</td>
<td>8</td>
<td>0.0084</td>
<td>5</td>
<td>0.0531</td>
<td>0.0148</td>
<td>0.0330</td>
<td>0.0775</td>
<td>0.0161</td>
<td>8</td>
</tr>
<tr>
<td>Beijing University of Aeronautics &amp; Astronautics</td>
<td>10</td>
<td>0.0043</td>
<td>8</td>
<td>0.0794</td>
<td>0.2019</td>
<td>0.0550</td>
<td>0.1143</td>
<td>0.0253</td>
<td>2</td>
</tr>
</tbody>
</table>

Lower Money Exploitation Efficiency Caused by Excessive Funds Concentration

Some prestigious universities, with a long history and many first-class teachers, attract great amounts of funds which provide strong support to their own research, but some objective reasons leading to the fact that these funds may not be fully utilized should not be ignored.

From Table 5 to Table 7, the ranking results have clearly shown that some universities have great payout of research funds, i.e. they have spent much money in researching activities, but the values of $\eta_{am}$ are small, and their ranks are low. This reflects that these funds invested on these universities cannot be adequately taken advantage of by the researchers and the rates of funds utilization are not high enough. So, a financial waste will inevitably happen. On the contrary, for some less prestigious universities, the lack of funds will hinder their due developments. From the above tables, it can be found that some universities have less money than those prestigious ones, but their $\eta_{am}$ are far larger, ranking in higher positions, which manifestly indicates the full exploitation of the funds.

As an obvious solution to the problems above, before making their investing budget, the governmental or private investors should evaluate the funds exploitation efficiency $\eta_{am}$ of the target institutions in the last few years. For the institutions with lower or declining efficiency $\eta_{am}$, the investment should be designedly decreased so that it can be diverted to the institutions with higher or increasing efficiency $\eta_{am}$ to provide forceful guarantee for further research and to excite its research potential.
Predominance of “Comprehensive Factor” Analysis Method

The adoption of the “Comprehensive factor” to assess the researching ability of higher learning institutions provides a more objective and trustful way through not only considering the total research achievement of a higher learning institution, but also taking the factors which may impact the research result into consideration, including the number of teachers and researchers, the number of graduate students and the expenditure for research.

Concretely, “Comprehensive factor” has the following advantages. First, the conception of “productive efficiency” is emphasized in “Comprehensive Factor” analysis method while the conventional methods only consider the “production amount”. This new method measures the research level in the perspective of efficiency, and adopts both exploitation efficiencies of money & human resources which obviously contribute to the research level of a higher learning institution, so that the consequence of evaluation will be more reliable than that of the former system. Second, we can rank the higher learning institutions by each of the five unit factors, which make the analytic results clearer than before. Thus, institutions can realize their own situations and further analyze the existent problems in each aspect. Third, it is favorable to objectively and effectively assess the scientific research abilities of ordinary universities and local colleges. We should pay more attention and provide more support to these institutions whose Comprehensive Factor is high enough. Fourth, even though the Comprehensive Factor analyzing method has taken many key factors contributing to the research efficiency into consideration, the calculation is so concise and straightforward that no complicated calculation methods are needed. Even more, from the ranking results of both “Production amount” and “Productive efficiency” method, we can find that the ranks in “Comprehensive Factor” analyzing method of those universities which magnify their sizes through merging other colleges are lower than those in the former “Production amount” system. This result is consistence with our well-established experiences in other areas, hence proves our analyzing method objective, scientific & effective and shows that this method has just well grasped the long-ignored essence of the existent problems in current evaluating methods.

CONCLUSION

After comparing and analyzing the criterion and results of the different systems, we can achieve some conclusions as below. First, the current methods of analysis, provided by SCI, EI & ISTP, are external, candid and quantificational to some extent. However, we cannot turn a blind eye to its limitation or neglect its existent problems. Second, the evaluating systems for higher learning institutions based on SCI, EI & ISTP as well inevitably have some fatal shortcomings and fail to be really objective or scientific. Therefore, it cannot unquestionably measure the efficiency and competence of one institution. Third, in light of these problems, based on the conception of “productive efficiency”, we put forward the analytical method named as “Comprehensive Factor”. Then, we analyzed the combination of the arranged data from SCI, EI & ISTP and the data about the investment of corresponding institutions, discussed the origins of the differences between the different evaluation systems and showed the predominance of “Comprehensive Factor” analytical method.

The advantages include more reliable criteria adopting efficiency instead of total amount, a clearer and more inspective analyzing method which can systematically check the potential problems in every considered aspect, and a concise and straightforward method needing no complicated calculation method. What is more, the problems of abrupt increase of personnel number caused by the combination of universities and lower money exploitation efficiency caused by excessive fund concentration have been perspicaciously revealed, which can serve
as a cogent evidence to prove our analyzing method objective, scientific and effective.

The development of institutions of higher education affects the education and scientific research level of one country, which is the key factor to improve the cultural literacy of the nationals. Moreover, the operating efficiency, capacity about scientific research and the use of funds in higher learning institutions are the key indicators to see whether an institution can satisfy the requirements of development and times. Therefore, we aim to better evaluate the operating situation of institutions and to bring forward better evaluation criteria for institution reform. On the basis of current system used to rank institutions by total numbers of embodied papers in SCI, EI & ISTP, we proposed a new analysis method named as “Comprehensive factors” which is more scientific, effective and objective. This method contains brand-new evaluation criteria to evaluate the level of research, operating efficiency, the use of funds and other aspects of an institution, which can serve as the criteria for a country, an education department, the local authorities and a financial sector to evaluate the institutions and as the reference to decide the investment of funds. And the concrete applications of the method proposed in this paper in China are first given, which shows the feasible property, advantage and superiority of the method. In addition, this method accords with the practical and realistic operating-style which can promote the reform and development of higher learning institutions and the development of scientific and technological research of any country. In all, the method employing “Comprehensive factors” has a far-reaching significance to inspect the research level and research performance of higher learning and researching institutions. The method developed here is very feasible, and is worthwhile to be popularized in research evaluation systems all over the world.

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