Trust and Tracing game

Sebastiaan Meijer & Gert Jan Hofstede

Information Technology group, Wageningen University
Bode 143, Postbus 9101, 6700 HB Wageningen, The Netherlands
E-mail: Sebastiaan.Meijer@wur.nl, Gertjan.Hofstede@wur.nl
Website: http://www.chaingame.org, http://www.info.wau.nl

Abstract

This paper introduces the Trust and Tracing game. The game is an operationalization of the Trader's Predicament, a variation of the Prisoners Dilemma aimed at asynchronous, serial transactions of products with invisible attributes. This type of transactions places the buyer in a dilemma, because he either needs to trust his supplier or needs to trace the good to reveal its real attributes. The game facilitates research on governance mechanisms within the branch of economics called New Institutional Economics. The configuration allows for research on three levels of integration: netchains, firms and individuals.

Keywords:
Netchains, games, transparency, trust, supply chain management.

Introduction

This paper introduces the Trust and Tracing game (T&T game). This game is a precursor of a larger game project called the ChainGame. This project aims at the development of a computer enabled trading environment, enabling game participants to manage a firm in a netchain. In this paper, we will describe the game itself, the theoretical fundament underlying the design and some experiences gained with sessions.

Gaming is an established tool for training purposes, because of its ability to expose people to a situation that simulates a real world dilemma. The Trust and Tracing game can be used for training, but is aimed towards research as well to get a grip on the dynamics of social coordination. It addresses research questions in the area of competition versus cooperation in trade netchains. Central dilemma is the decision to trust or to trace. Tracing means finding out a property (like quality) of goods after buying them. A buyer can request a trace at a facilitating agency. If the buyer trusts his supplier, there is no need to trace.

Networks and chains in the agricultural and food sector ("netchains") are facing ever more pressure to respond to demands from their customers and their legislative environment. With regard to consumer demands, efficient consumer response (ECR) practices not only apply to independent businesses, but to entire supply netchains as well. Optimization at the netchain level means there is a need to study what types of communication netchains need in order to enable adaptive behaviour. Practice tells us that creating an information infrastructure in a netchain is a necessary but not sufficient condition for this. Chains are not only informational

or economic but also social entities. Therefore, a practice-oriented research approach should integrate information-centered and social scientific concepts.

New institutional economics is a branch of economics that "… provides a theoretical framework for understanding the trade-off that continuously occurs at the microeconomic level between alternative modes for organizing transactions. (…) It also offers tools for analyzing interactions between organizational forms of supply of goods (or "governance mechanisms" (…)) and the institutional environment in which they are embedded." (Menard, 2000) Menard means with "continuously" a continuous dynamic that chances over a period of months to years. "Microeconomic" refers to the level of individual businesses.

Netchains are a form of market governance. One of the founders of new institutional economics is Williamson. He (Williamson, 1998) describes four levels of analysis for interactions between institutions. They range from the cultural background, via the legal system and business structure to day-to-day organization. He shows that economic organization of today depends on the heritage of the past, via the cultural and legal structures that exist in society. Smith and Bond (1993, p. 125 - 131) prove this by comparing several cross-cultural studies on competition versus cooperation in Prisoners Dilemma situation. They found all studies reporting significant differences in choosing between cooperation and competition between cultures. Even more interesting was the conclusion that all cultures reacted differently to variances in the environment. Some increased their competitiveness and some decreased.

The Trust and Tracing game is an operationalization of the theory on market governance in a new institutional perspective. It enables research into the interaction between the four levels of analysis of Williamson. It places participants in a serialized asynchronous Prisoners Dilemma-like situation. We call this situation the Trader's Predicament.

This paper firstly describes the theoretical background for the game. Then it describes how we operationalized this theory into the game. Thirdly, we describe our experiences with game sessions organized, followed by conclusions about the game. The fifth section describes directions for future research.

Theory

New Institutional Economics

Williamson (1998) distinguishes four levels of analysis of economics of institutions. They differ as to the time scope in which they will change.

The top level is the social embeddedness level. This is where norms and traditions are located. Religion plays a role here as well. We could call this the cultural background. Changes take place over several hundreds to thousand years. Theory at this level consists of anthropology, social psychology and sociology.

Second level is the institutional environment. The structures here determine "the rules of the game" within which economic activity is organized. Politicians have these formal rules secured in laws. Changes take place over decades to centuries. Theory at this level consists of economics of property rights and law.

The third level of analysis is where the institutions of governance are located. How to organize governance in the actual play of the economic game, given the constraints of the environment of the second level of analysis? Changes in governance structures take place over one to ten years. New institutional economics is the theory that applies on this level, with Transaction Cost Economics as one of the well-known supporting theories.

The fourth level shifts from discrete structural to marginal analysis. It worries about the short-term allocation of resources, pricing and quantity management. Neo-classical economics, game theory and agency theory apply as theory.

Each level influences the functioning of the levels below. (Williamson, 1998) As we said in the introduction, cultural backgrounds make people react differently when confronted with a competitive or negotiation task.(Smith and Bond, 1993) Menard (2000) emphasizes the relation between level two and three when he states:

"The question of what institutions are relevant for economic analysis then becomes that of identifying rules, standards and the accompanying devices that makes possible transactions and that make them more or less costly. (…) the legal framework, i.e. the political organization that defines the rules of the game (…) are key factors here."

Governance

The study of institutional mechanisms is one of three views available for studying governance of netchains. The other two perspectives are that of the performance and of the process in the netchain. (Trienekens, 1999) The institutional approach is the appropriate one to follow for the study of social interaction, because it pays attention to the communication, connections and legal relations between firms. The performance view aims at control via the appropriate awarding mechanisms, while the process view focusses on good interfacing between different processes. Both do not exclude communication and social interaction, but it is not their main point of focus.
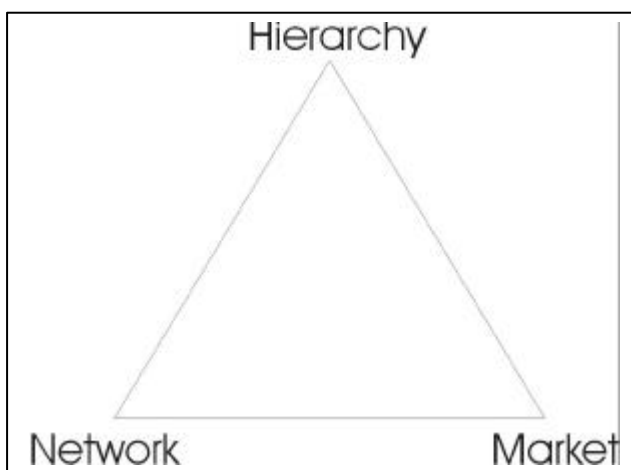

Figure 1: Market institutional mechanisms (Diederen and Jonkers, 2001)

Diederen and Jonkers (2001) describe the three forms of institutional mechanisms of Powell (1990) as the corners of a triangle. (See Figure 1) Traditional economic theory provided a huge amount of literature on market institutions. Management studies handled the mechanism of hierarchy. In both fields, there is an established framework of concepts available.

In reality, many sectors are neither hierarchies nor perfect markets in the economic sense of the word. Personal relationships between actors exist that enable them to avoid transaction costs associated with a neoclassical market. Uzzi (1997) documented this well for the New York fashion industry. He shows that the third governance mechanism occurs: networks of so-called embedded ties. There is a scarcity of theory on the working of this mechanism. Supply Chain Management is the field that aims at contribution of these theories, but it is a very young field. Current journals focus on establishing a framework of commonly shared concepts. (Omta *et al,* 2001)

Netchains

We already mentioned that "netchains" is the abbreviation for "networks and chains", a concept of linked companies. It combines the viewpoint of chains with that of networks. (Lazzarini *et al*, 2001)

The viewpoint of chains consists of a flow of goods from producer towards the consumer, a flow of money backwards and an information flow backward and forward (i.e. tracking and tracing). It pays strong attention to consumer orientation and chain responsiveness. The viewpoint of networks introduces relationships, alternative suppliers and buyers, and sectored collaboration.

Hofstede *et al* (2003) introduce a visualization of a netchain. (See figure 3) This netchain model supports:

Multiple markets on both supply and demand side
Possibility of trade between any of the actors
Steered flow of goods towards end consumer

A netchain is more than just companies trading with each other. They are linked by a certain extent of market coordination of the network type.
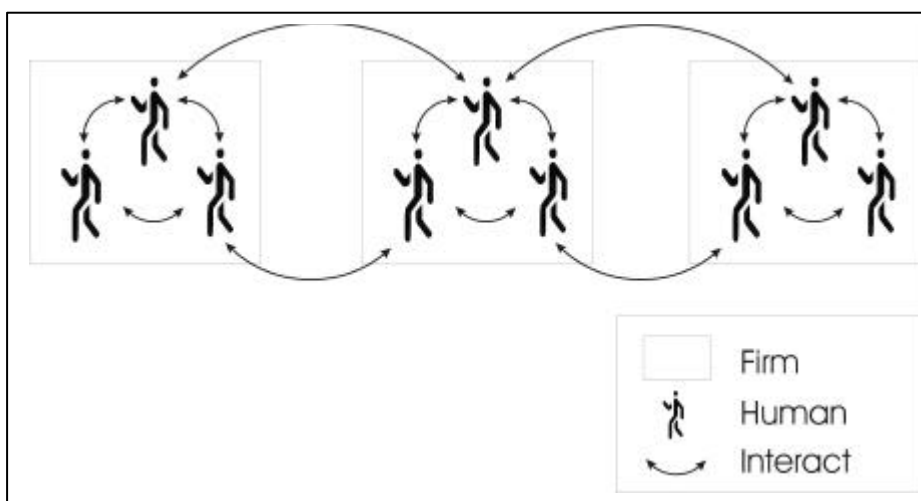

Figure 2: Three levels of integration in a netchain

Management Studies is interested in the influence of the individuals' behaviour on the performance of firms. Supply Chain Management studies the influence of the behaviour of firms on the performance of netchains. Figure 2 shows the relation between these objects of study. Within a firm people interact. Firms interact via people. There may be several connections between two firms, because several individuals may be involved for different

topics. Compare for instance daily contact of employees at the expedition with strategic discussion between members of a board of executives.

Figure 2 leads to the conclusion that individuals' behaviour has an influence on the performance of a netchain. In a simple situation with one-man's businesses, all decisions and communication stem from one person. Analysis of one-man's businesses in netchains could relate individual decision making to netchain performance.
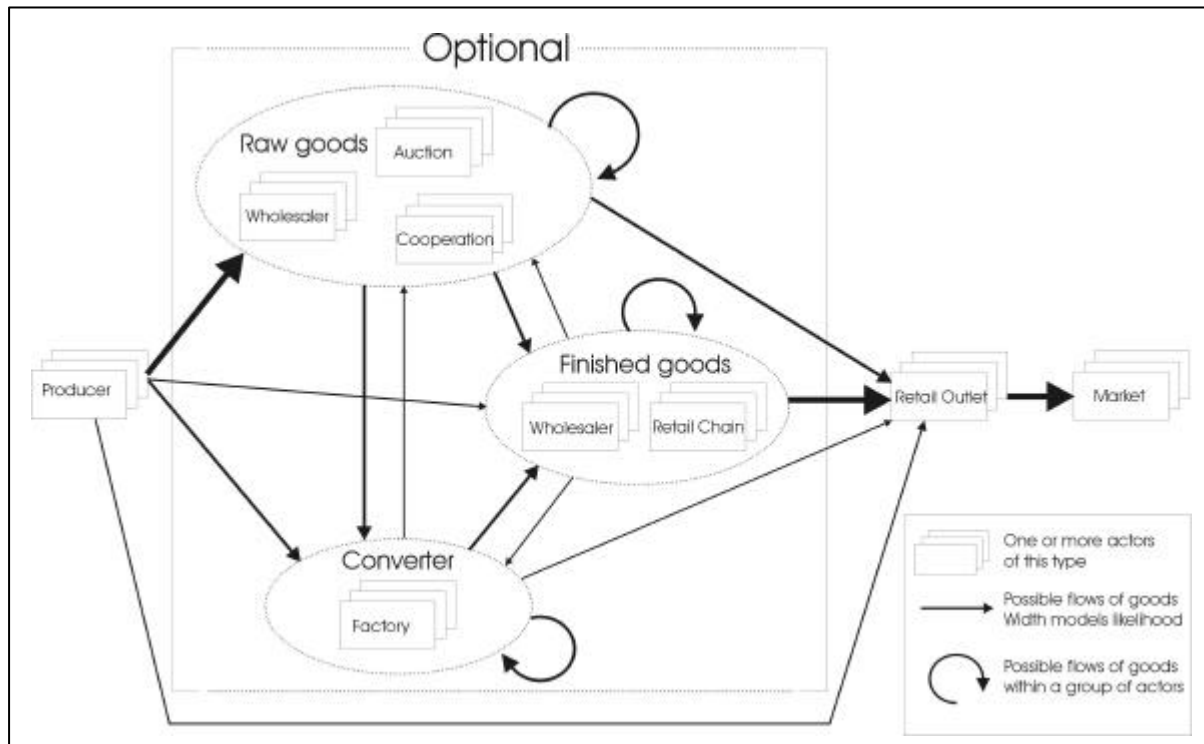

Figure 3: Conceptual netchain (Hofstede et al, 2003)

Transparency and trust

Transparency

Recently, the notion of transparency has come into fashion (Hofstede, 2002). It not only includes the ability to see where a product is in the netchain (tracking), or what happened to a product during its fabrication and transportation (tracing), but has a certain claim for honesty as well. Anybody can see what we produce and trade and how we do this, is the claim it makes. This claim can be targeted to consumers, netchain partners, governments or firms' shareholders.

Hofstede (2002, p. 75) gives the following definition of transparency:

Transparency of a netchain is the extent to which all the netchain's stakeholders have a shared understanding of, and access to, the product-related information that they request, without loss, noise, delay and distortion.

As a buzzword, 'transparency' is used for various purposes. (Hofstede, 2003) He distinguishes three aspects, each with a different time scope.

History transparency is needed to track and trace products. Netchains need this to respond quickly and effectively in case of crises. Netchains can use history transparency as a marketing device. Introduction of history transparency incorporates costs. When customers value a known quality and provenance high, they might be willing to pay more.

Everyday transparency deals with information exchange between business partners that enables them to coordinate their operations. Its main use is to help netchain partners signal exceptional circumstances in advance.

Strategy transparency involves sharing not only operational, but also strategic information. It might involve cooperative innovation or coordinated market actions.

Trust

The increasing use of the Web has led to quite a bit of literature about trust and its importance in the age of electronics communication. From this literature, it is apparent that trust is not the same thing to everyone. Rousseau *et al* (1998) show that economists, psychologists and sociologists tend to work with widely different conceptions of trust. We shall adopt the compromise definition presented by Rousseau *et al* (1998, p. 395)

Trust is a psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behaviour of another.

The keyword "vulnerability" relates to risk in business interactions. Trusting somebody means that you do not need to take the trouble of checking on them, accepting the chance that they might cheat on you. Trust without vulnerability is gratuitous. This implies trust can only increase gradually through being tested in situations of reciprocal interdependency and not being broken. In other words: if there is a risk involved in a transaction in which two people have interest, the willingness to accept this risk can grow by testing by trail-and-error.

From an economic point of view, trust can lower transaction costs, because there is no need for checking differences between stated and real properties of a certain good. Tracing is such a method for this check and is a tool of (history) transparency. This means that there is less need for transparency tools, once trust is established. Hofstede (2003) discusses the contradiction between trust and transparency and concludes that: "Trust and transparency in netchains can be contradictory, because trust emphasizes showing only the essentials and transparency may be construed as the art of hiding the essentials. This is the case is transparency is imposed from outside the netchain, or if the netchain is in fact institutionally a hierarchy and the leader imposes the transparency."

Transactions

In analysis, an appropriate unit of action would be the transaction, because the most important subject in economics is the value of the product traded. This value is apparent only when the product changes ownership. In transactions, at least two traders are involved: the seller and the buyer. The Trader's Predicament is a structured analysis of their possible behaviour with regard to truthfulness and trust.

Trader's Predicament

In order to give a better theoretical background to games with business interactions, Maarten de Jong (2002) conducted a research project. He shone a light on the non-economic side of transactions, merely paying attention to the difference between the intent and the content of a transaction. De Jong analyzed the ChainGame prototype in particular.

Analogous to a Prisoner's Dilemma payoff matrix (Axelrod, 1984), De Jong (2002) describes the 'Trader's Predicament': a situation where a seller and a buyer exchange goods for money. Unlike a PD scenario, this is not a symmetric event: the possible 'moves' for buyer and seller are not the same. Another difference is the serial character of trade. Similar to a real netchain, goods flow over several nodes, and intermediate nodes turn from buyer into seller when acquiring and reselling a certain good. The Trader's Predicament payoff matrix is shown in Table 1.

An important assumption of the Trader's Predicament is that goods have a certain invisible attribute of major importance. This could be the quality, for instance. A seller can lie about this. The only way for the buyer to find out about this attribute is to do a so-called trace. Such a trace reveals the real value of the attribute. In case of a difference between the truth and what the current owner believes it is, a trace can reveal who lied first about this product in the netchain and which intermediate nodes where not suspicious enough to trace themselves, and just sold the product again.

Table 1: Pay-off matrix Trader's Predicament.

Buyer → Seller?	1 Tracing	2 Trusting	3 Revoke contract
A. Truthful Cooperation	Cost of distrust Reward	Reward Reward	Withdrawal Cost of unsold lots
B. Untruthful Cooperation	Confirmation of distrust Unexpected fine	Reward (Potential unexpected fine) Reward	Justified withdrawal Cost of unsold lots
C. Deception	Confirmation of distrust Punishment	Suckers Payoff Temptation	Justified withdrawal Cost of unsold lots
D. Revoke Contract	No goods received Withdrawal	No goods received Withdrawal	No effect No effect

For the trust and tracing game, only columns 1 and 2 and rows A to C are relevant because the game does not have contracts. Truthful cooperation means the seller is honest about his product, and the information he provides is right. Untruthful cooperation means the seller is honest about his product as far as he knows, but this information is not the truth because his

supplier provided him wrong information. Deception means the seller lies about his product, and he does this on purpose.

In such a simple trading relationship, the buyer is at a greater risk than the seller: there is no possibility of the equivalent of thievery (i.e. receiving lots and not paying for them or receiving payment and not delivering lots), thus the temptation of defection lies fully with the seller. The seller's temptation lies in either delivering the lots not according to agreed specifications (e.g. lots of inferior quality, or not the specified quantity) or by deliberately harming the buyer by revoking a contract (leaving the buyer with an unfulfilled request and possible ensuing problems). The former can be done in many ways, which all are variations of the same concept: deception. The latter is not a way of acquiring profit and thus is not a 'real' temptation.

De Jong offers the following explanations of the pay-offs (columns 1 and 2 and rows A to C):

Confirmation of distrust: tracing the 'real' quality of received lots comes at a cost. This cost of distrust is – in this case – justified because the quality of the lots was less than specified. The consequences of the deception depend on environmental parameters (e.g. the seller might be fined and/or the buyer might receive some form of compensation).

Cost of distrust: tracing the 'real' quality of received lots shows distrust by the tracer (buyer) and comes at a cost that would have been unnecessary – in this case.

Punishment: the seller deceives the buyer who in turn discovers this by a trace. The amount of punishment depends on the parameters of the environment.

Reward: the trade goes well and both actors get what they agreed upon.

Reward (Potential unexpected fine): the seller received goods from his supplier that are not what he thinks they are, and has not traced the lots. Thus, he is unaware of the lesser quality of his lots. Because the buyer is trusting, the deception will remain undetected. An actor further down the chain might trace these lots, which can, depending upon how far the trace reaches back up the chain, result in an unexpected fine.

Suckers Payoff: the buyer's trust is misplaced as the lots he procures are of inferior quality. It depends on the situation whether the buyer is aware of this, as it is possible to pass on lots for a different quality than they really have.

Temptation: the temptation for a seller is to deliver lots of lesser quality than specified, essentially selling them for a price too high. If the buyer trusts the seller, the deception succeeds and the seller gains a larger profit than usual.

Unexpected fine: in a previous transaction, the seller apparently was deceived and bought lots of inferior quality without tracing them. He sold them without knowing the actual misinformation. If the current owner does conduct a trace, this can result in a fine for this seller, who failed to deliver the lots to specifications. The seller might pay the fine or he might trace the lots further back up the chain to find out where the deception has occurred, depending on the environmental conditions.

Trust and Tracing game

Introduction

Basic Data

Learning objectives: By playing the T&T game, players should experience the dilemma of choosing trust or tracing.

Research objectives: The T&T game should gain insight of the influence of transparency on trade networks passing goods with invisible quality attributes.

Game objectives: For traders: make as much profit as possible. For consumers: earn as many points as possible.

Target audience: Anybody with some background in trading.

Preparation time for participants: None.

Briefing and setup time: 15 minutes.

Playing time: 30 to 75 minutes.

Debriefing time: one hour.

Number of players: 12 to 100

Materials required for players: Instruction for each trader and consumer, identification labels for traders, game currency for everybody, goods to be traded for producers.

Materials required for game leader: Decryption key for identification labels, briefing instruction, debriefing instructions.

Equipment required: none.

Venue requirements: One separate table for each trader, enough room to walk for consumers.

Description

The Trust and Tracing game (T&T game) is an operationalization of the Trader's Predicament, leaving out the contractual part. It creates a trade environment with a simple configuration of a netchain. (Figure 4) Goods traded have a quality that is not visible. This way, the game enforces the asymmetrical, serial information situation the trader's predicament analyses.
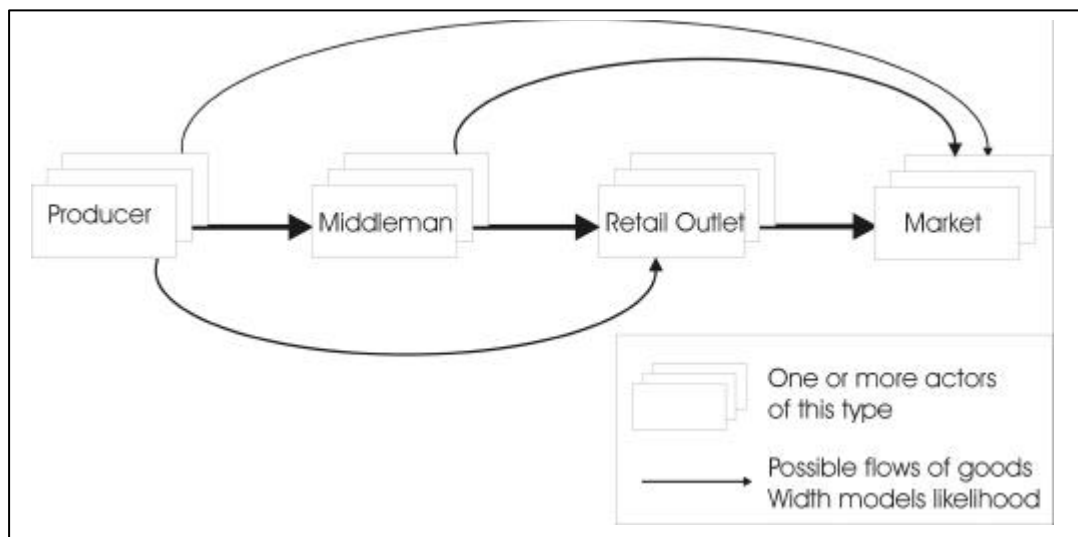
Figure 4: Typical setting of the T&T game

With the game, a researcher can investigate the differences in level three (governance) and four (marginal analysis) of the levels of analysis of new institutional economics that occur when one varies one of the levels above. The start of the game knows no governance mechanism other than an unstructured market. When playing this game in different countries, one could do cross-game comparisons of the influence of level one (Culture) on level three and four. By exposing the participants to a particular "law" one could model differences at level 2. Depending on the background knowledge of the participants, they could tend to one of the governance mechanisms at level three.

Participants can create a governance system themselves. If they just start trading in individual transactions, the game simulates a normal market. If some cooperate horizontally by merging their firms (for instance all producers to create a monopoly), this creates a hierarchy. If some participants cooperate vertically to form a controlled line of supply this would form a netchain.

There is a slight modification to the netchain model of Hofstede *et al* (2003) (Figure 3). The T&T game does not prohibit consumers to buy directly from middlemen or producers. This is neither stimulated nor discouraged.

The T&T game offers history transparency (Hofstede, 2003) by providing a way to trace the background of a particular item. Producers, middlemen and retailers put a label on the product traded (typically envelopes). The tracing agency is able to determine the real quality of the product by opening the envelope and looking at its inside. Inside, there is a small paper with the quality. Determining who lied is possible via the seller identity labels. The tracing agency writes every cheat found down on a board, as visible to all participants. The associated punishment gets subtracted from the end result at the end of the game. Tracing however costs money if there was no need to trace because the product was truthfully traded. If the trace revealed a lie, it does not cost any money to the requester. This simulates the transaction costs involved with asking for information in the real world.

Settings

Although the game is able to simulate a wide range of netchains, the most typically one used consists of three to four producers, middlemen and retailers and 5 to 10 consumers. This leads to a minimum of 14 participants required to play the game.

All teams can consist of several people. This makes the game very flexible in sizing. Maximum can go up to more than hundred. If the game leader decides to enlarge the teams, the analysis of the game gets more complicated. One-man teams are equal to one-man firms, leaving out the difference between individual decision-making and team (firm) performance. The performance of the netchain is therefore directly related to the individuals' decisions.

Rules

The teams in the game trade a good with three different types. Typically, we used envelopes with a different color. There were blue, green and yellow envelopes. Each of these envelopes comes in two qualities: low and high. The game leader provides every producer with a number of envelopes each type and quality. (typically seven low quality blue, seven high quality blue, etc) The quality is not visible on the outside. The game leader tells this once to the producer and instructs him to lay them on the desk in such a way that he remembers the quality.

All trading teams (producers, middlemen and retailers) receive 2 sets of labels. One set stands for "High Quality", one "Low Quality". Each label shows the name of the team and a number. This number contains the encrypted quality. When a team sells a good for high quality, they put a label from the High Quality set on the product, regardless of the real quality.

Non-consumers operate individually (team size = 1) or in multiplayer teams. Each team has the explicit objective to win the game by making as much profit as possible. It can achieve this either by being highly truthful and thus a favorable trading partner, or by cheating so that the trades would be more profitable.

Each team gets a reference table for the relative prices the products are worth. We used the values in table 2. For the consumers, these values are the points that each product is worth in the end. For producers these are reference prices. We multiplied these values by 2.5 for reference prices of the middlemen and again by 2.5 for the retailers.

Table 2: Relative values of products

Quality \ Product	Blue	Green	Yellow
Low	1	2	3
High	2	6	12

There is an award per chain role. The team that earned the most money wins this award. Products remaining in stock are worthless at the end of the game. There is an award for the consumers too. This award goes to the consumer. Each product they acquire is worth some points following table 2. Money left at the end of the game is worthless.

The game leader evaluates trust in a discussion with the participants afterwards. This reveals the reasoning and process of thinking of characteristic participants during the game.

After the instruction on how to play each person may go its route and optimize his own situation. The game leader does not prohibit netchain shortening. In case they want, consumers may go to the producers or middlemen directly.

Roles

There are five roles. The first three are trader roles, the other two are different.

Producers.
Each producer has a number of items of each product in the game. It has to be made very clear what the low quality and high quality products are. This should not be visible to the middlemen. Using a screen would be useful. Strategy is self-declared.

Middlemen.
These move products between the producers and the retailers. They have self-declared strategies.

Retailers.
These move between their own "office" where they interact with the middlemen, and the tables of the consumers. They take orders and then assign these to one or more middlemen or buy products and offer these to the consumers.

Consumers
These walk around in the consumer area. They are not part of teams. Each consumer plays him- or herself. They all have a certain amount of (game) money and try to gain as much value on products as possible.

Tracing Agents.
There is one special role: Tracing Agent. Tracing Agents' first objective is to provide a tracing possibility to the netchain. Teams or individuals can go to a tracing agent and ask for the real identity of the product in question.

Termination criteria

Some producers will run in an out of stock situation faster than others. The producers that do not sell fast could gain profits from this by monopolizing the market in the end of the game. This out-of-stock situation is from a different character than an out-of-stock situation in the real world in the aspect of the ability to replenish inventory. The game provides limited stock with no possibility to acquire new items for the producers. Therefore, end effects caused by this out-of-stock situation have to be diminished as much as possible.

To avoid these effects, the game leader has to observe the game closely. By experimentation, we found a good rule of thumb for ending. This is: wait until one producer has sold all its items and a second is negotiating about his last few products. This avoids domination of the supply market by one producer, but allows one producer to sell very fast without immediately terminating the game.

Variants

In the initial "Social Event" version, the non-customers operate in teams. Each team has the objective of achieving higher balance (measured in cash money) and / or trust as the other teams in their chain role. Trust is measured by asking the teams one level down in the chain, through questionnaire, at the end of the game. There will be a balance award per chain role and an overall trust award. Customers get their reward from the pleasure of eating the real food traded.

In this version, each product carries an "As-If-Barcode" (ABC) on a label attached. This code contains an encrypted description of the item. Each producer, middleman and retailer puts a (encrypted) seller identity label on the product when he sells it. The middle men and retailers put a line in their logs when they buy a certain good, stating the ABC, the seller and the quality they bought it for. By looking at the labels, the tracing agency is able to determine the real quality of the product and who lied about it. The owner of the product may go back to his provider, claiming half of the price they paid for it. Providers may do this with their providers as well.

Experiences

Sessions

At the moment of writing this paper, we played seven sessions with the Trust and Tracing game. Table 3 provides details of these sessions.

Each of the sessions started with some confusion about what to do, because there was no market governance mechanism established. Sessions 1, 3, and 7 where characterized by extensive negotiation between producers and middlemen and sometimes retailers to explore the market and look for cooperation possibilities. Sessions 2, 5, 6 and 7 ended up being completely controlled by the producers, who sold to the consumers directly. Sessions 1, 3 and 4 where controlled by the retailers who were pro-active towards their consumers, and turned the trade environment in a demand driven network.

Sessions 1, 3, 4 and 7 showed attempts at cooperation. In session 3 this led to an established netchain that performed extremely well. In session 7, all producers formed a monopoly. In the other sessions, the netchains suffered form people withdrawing because they did not commit themselves entirely to the netchain. Important note here is that in both sessions the participants where educated on netchain practices beforehand.

Discussion

The T&T game sessions show large parallels over games. The cultural differences between the games were non-existent because all participants were Dutch, except for session two. In this session, we observed major differences in attitude and performance of the different cultures.

The game construct focused participants enough to act within simulated trade environment. The degree of participation was high. Hardly anybody withdrew from the game in a way that disturbed the trade process. Some consumers were more active than others, but none were totally inactive.

Table 3: Session details Trust and Tracing game.

Nr	Version	Venue	Event	Players	N	Remarks
1	S.E.	Wageningen University	M.Sc. Course Supply Chain Management	M.Sc. students	18	Test session
2	S.E.	Huis ter Duin, Noordwijk	Fifth conference on supply chain management in agribusiness and food industry	Conference participants, internatio-nal group	125	Real food traded
3	Normal	Ministry of Agriculture, Expertise-Centre Ede	Workshop on chain innovation and coordination	Policy makers	23	
4	Normal	Wageningen University	High school conference Xperience Life	High school students	29	
5	Normal	Wageningen University	High school conference Xperience Life	High school students	22	
6	Normal	Wageningen University	Ph.D. workshop	Ph.D's and senior researchers	12	Demonstration session
7	Normal	University of Nijmegen	M.Sc course Supply Chain Management	M.Sc. students	18	

General tendencies observed from the first sessions are:

Producers will control the market if a normal market mechanism occurs

The netchain is hard to establish when participants do not commit themselves to the netchain.

The possibility of tracing is an argument that "hangs above the market". Sellers use the argument "If you don't trust me, you can ask a trace if you like." This convinces buyers to buy the product often.

Only a small portion of the products will get traced.

Consumers will bypass the retailers and middlemen if deliveries will take to long.

Retailers can control the market if they start working demand oriented. They should take orders first and then pass these on to their suppliers. Consumers will stay satisfied at the tables of the retailers.

Conclusion

The Trust and Tracing game is an operationalization of the Trader's Predicament. It enables research into governance mechanisms by providing a trade environment that allows for establishing several governance mechanisms. The game simulates uncertainty about the truthfulness of a supplier via a hidden quality attribute that can only be discovered by doing a trace. Sessions played showed various governance mechanisms to occur in the game, and various dominating parties. This depended structurally on the actions of the participants themselves.

Directions for future research

A computer-enabled simulator

Simulating in a computer environment has certain advantages over playing with paper based game versions. Internet enabling of a software game makes it possible to play games with participants who are geographically separated. For research in international supply netchains, this is a major advantage, because people from a certain country can play the role they have in real life as well. This makes cross-cultural confrontation more realistic.

Furthermore, modern business relies often on e-business and virtual teams. A computer-enabled simulator is able to simulate this very well. Finally yet importantly, software can use models of trade, communication and information during a game that match a real world trade environment much closer than a paper-based game can achieve. Logging data is very easy, so research and debriefing can be based on detailed information of each individual participant's actions. This makes a game more educational and observation more objective.

A con of distributed computer-enabled simulator is the facilities needed for coordination of debriefing. This requires a skilled debriefer on each location or technical solutions like a teleconference to ensure everybody understands

The first ChainGame prototype was an inspiring software tool. It suffered from software issues, prohibiting playing a number of game sessions with it. The trust and tracing game is a step towards a new version of the ChainGame. It is a partial operationalization of the conceptual model underlying the new game. The Ph.D. project aims at the development of this conceptual model and implementation in a computer-enabled simulator.

Data needed

The simulator needs benchmarking. To speed up the development, we focus on the development of a simulator of two or three specific cases. Simultaneously to this project, five Ph.D's each study a particular chain. These case studies take place within the same research framework as the development of the simulator, thus stimulating data and method interchange between researchers. For the simulator we need to model the essential properties of the different cases and the performance measurement system applied.

References

Axelrod, R.M., (1984): The evolution of cooperation, Basic Books

Diederen, P.J.M. with H.L. Jonkers (2001): Chain and Network Studies, Working Paper 2415, KLICT, The Netherlands

Hofstede, G.J. (2002): Transparency in netchains, in Van Amerongen, E. *et al* (eds), The challenge of global chains, proc. symp. Mercurius, Wageningen Academic Publishers, Wageningen, pages 73 – 89

Hofstede, G.J. (2003): Trust and transparency in supply chains: a contradiction?, Actes du 8ème colloque AIM, Grenoble, Mai 2003

Hofstede, G. J., M. Kramer, S. Meijer and J. Wijdemans (2003): A chain game for distributed trading and negotiation, accepted for publication in Journal on production planning and control

Jong, M. de (2002): The chain game: an action model, M.Sc. thesis Wageningen University, Information Technology Group.

Lazzarini, S.G., F.R. Chaddad and M.L. Cook (2001): Integrating supply chain management and network analysis: the study of netchains, Journal on Chain and Network Science 1, Nr. 1, pages 7 - 22

Menard, C. (2000): A new approach to the agro-food sector: new institutional economics, Invited lecture International conference on agro-food Industries, Wageningen, May 2000

Omta, S.W.F, J.H. Trienkens and G. Beers (2001): Chain and network science: a research framework, Journal on Chain and Network Science 1, Nr. 1, pages 1 - 6

Powell, W.W. (1990): Neither market, nor hierarchy: network forms of organization, Research in organizational behavior 12, pages 295 – 336

Rousseau, D.M., S.B. Sitkin, R.S. Burt and C. Camerer (1998): Not so different after all: a cross-discipline view of trust, Academy of Management Review 23, Nr 3, pages 393 – 404.

Smith, P.B. and M.H. Bond (1993): Social psychology across cultures, analysis and perspectives, Harvester Wheatsheaf, Hertfordshire

Trienekens, J.H. (1999): Management of processes in chains: a research framework, Wageningen University, Wageningen

Uzzi, B. (1997): Social structure and competition in interfirm networks: the paradox of embeddedness, Administrative Science Quarterly 42, pages 35 – 67

Williamson, O.E., (1998): Transaction cost economics: how it works; where it is headed, The Economist 146, No. 1, pages 23 – 58