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Individualism and Collectivism in Trade Agents

Gert Jan Hofstede[1], Catholijn M. Jonker[2], and Tim Verwaart[3]

[1] Wageningen University, Postbus 9109, 6700 HB Wageningen
gertjan.hofstede@wur.nl
[2] Delft University of Technology, Mekelweg 4, 2628 CD Delft
c.m.jonker@tudelft.nl
[3] LEI Wageningen UR, Postbus 29703, 2502 LS den Haag
tim.verwaart@wur.nl

Abstract. Agent-Based Modeling can contribute to the understanding of international trade processes. Models for the effects of culture and cultural differences on agent behavior are required for realistic agent-based simulation of international trade. This paper makes a step toward modeling of culture in agents. The focus is one of the five dimensions of culture according to Hofstede: individualism versus collectivism. The paper presents an analysis based on social science literature about national cultures. For cultural differentiation of agent behavior, rules are formulated for individualist versus collectivist agent behavior with respect to negotiations, cooperation or defection in the delivery phase of transactions, trade partner selection, and trust. Example computations demonstrate the feasibility in multi-agent simulations.

Keywords: culture, negotiation, deceit, trust, simulation.

1 Introduction

Agent-Based Economics (ABE) studies economic processes as interactions of individual actors [1]. Cultural differences are known to have their effects on international business interactions and on trust between business partners [2]. Gorobets and Nooteboom [3] argue on the basis of a multi-agent simulation that different economic systems could be viable in societies with different levels of trust. Models of culture-bound agents will advance the understanding through ABE of intercultural trade processes as well as differences in trade processes across cultures.

Culture has different aspects or dimensions [4]. The current paper focuses on the widely recognized distinction between individualistic and collectivistic cultures. Section 2 presents this distinction as it is described in the social sciences. Section 3 analyzes its effect on trade processes as the basis for the formal modeling in section 4. Section 5 presents example computations. The results and future directions of this research are discussed in section 6.

2 The Cultural Dimension of Individualism and Collectivism

People are gregarious by nature. But the life conditions of societies vary, and they have adapted accordingly. Hunter-gatherers live in small bands, usually consisting of a few

nuclear families. In agricultural societies, larger units have developed, and the people may live in extended families or clans. This is still the default model of social organization in most of the world, although it is being put under strain by urbanization. In modern, affluent industrial societies people tend to revert to nuclear families. The variation in basic group size and cohesion between societies has been shown by sociologists, e.g., in the distinction between *Gemeinschaft* (community) and *Gesellschaft* (society) that Tönnies introduced as early as 1887 [5]. In a *Gemeinschaft*, people share everything, both material and immaterial, whereas in a *Gesellschaft,* private property and other individual-centered institutions are possible. This variation has been confirmed by social psychological cross-national studies of practices or values, for instance the work of Triandis [6] and Hofstede [4]. These authors speak of the distinction between *individualism* and *collectivism* that serves as this section's caption. Another independent confirmation comes from the World Values Survey by political scientist Inglehart and colleagues. Minkov [7] showed that the individualist – collectivist continuum is visible in Inglehart's survey data. He names it universalism versus exclusionism.

Recently the dimension has also become the main ingredient of theories about cross-cultural business, e.g., in the work of Trompenaars [8] who posits a number of dimensions of culture that were shown by Smith *et al*. [9] to be correlated with the dimension of individualism versus collectivism. Trompenaars' dimensions relate to individual versus community, universalist versus particularist reasoning, affective versus neutral emotional style, specific versus diffuse communication, performance versus ascription, sequential versus synchronous time use, and control versus acceptance of nature, each mentioned in the same direction of the individualism – collectivism continuum. The relevance of this particular dimension of culture to the management literature lies in the fact that Anglo countries are at the extreme individualist end of the scale, and so business partners from almost any country they try to do business with are bound to have more collectivist cultures.

Variation along the dimension of collectivism versus individualism also affects value systems and the functioning of institutions aside from the family, such as education, religion, politics and trade. Hofstede [4] incorporates a host of other studies that confirm the occurrence of the dimension and its relevance to many societal phenomena. These include the kind of processes that occur in trade relations: whether to show one's cards or not, whether to confront the other party or not, how to distribute favors, and the like. Table 1 shows typical distinctions, relevant for trade.

Table 1. Some distinctions between norms in collectivist and individualist societies

Collectivist	Individualist
Maintain harmony, avoid confrontation	Speak your mind
High-context, implicit communication	Low-context, explicit communication
Use the word "we"	Use the word "I"
Show favor to in-group customers	Treat all customers equally
No business without a personal relation	Task is more important than a good relation
A relation brings rights and obligations	Mutual advantage is the basis of relations
Relations are given	Build and maintain relations actively
Save face for in-group	Keep self-respect
Responsible for group interests	Responsible for personal interests

Source: Hofstede [4].

One typical distinction between individualist and collectivist practices is that to collectivist mindsets, relations are more important than business – and so, business tends to be done among friends and family, in contexts that to individualistic mindsets do not seem fit for business. In an individualistic society there tends to be a strict separation between various spheres of life, e.g., family, business, and leisure. In a collectivistic society, one tends to do all of these things with the same extended group of people. The term "in-group" is often used to denote this kind of self-evident unit of social life at large as it exists in collectivist societies. Finding new trading partners and establishing a working relationship with them, is not easy in these societies. The usual way is to use existing business relationships. In the very collectivist Chinese culture, the term *guanxi* denotes the social network that allows extending business contacts [10]. The term consists of two Chinese characters: *guan* (gate) and *xi* (connection). In individualistic societies a roughly equivalent notion is *social capital*.

Individualism is associated with direct, low-context communication while collectivism is associated with indirect, roundabout, high-context communication. In psychological terms, people from individualistic societies are on average more extraverted. This was indeed found by Hofstede and McCrae [11].

According to Hofstede and Hofstede [12] the world's countries have a wide continuum of scores on the dimension. The rough pattern, exceptions omitted, is as follows: at the collectivist end of the scale we find Central America, Pakistan, Indonesia, and the South East Asian tigers with China. Moderately collectivistic are Latin America, Africa, Latin and Balkan Europe. Moderately individualistic are India, Arab countries, and Central Europe. Individualistic are West- and North Europe. The most individualistic countries of all are those of the Anglo world. Importantly, Hofstede's own data as well as replications show that countries' orientation on this dimensions shift towards more extreme individualism with increases in wealth, and towards more collectivist values with increasing poverty. Individualism can thus be interpreted as an adaptation to wealth. Yet the dependency is not complete. There exist cultures that remain rather collectivist despite wealth, such as Japan, or rather individualist despite poverty, such as India.

3   Individualism and Collectivism in Trade Processes

Figure 1 presents a model of trade processes. This model is based on the Trust and Tracing game [13], a human gaming simulation of supply chain processes. The participants negotiate contracts about commodities with invisible quality attributes. Before entering negotiations, agents have to select each other as partners, based on their trade goals (sell or buy?; which commodity?; which quality?) and knowledge about potential partners. Once a contract has been agreed upon, traders can either cooperate (deliver truthfully) or try and use an opportunity to defect. Upon delivery the receiver can either trust or put the delivery to the test, the latter usually at some cost where trust is for free. The delivery and trust decisions are based on personal preferences and cultural background, as well as beliefs about the trade partner and the trade environment. In future research the Trust and Tracing game trading game can serve as an instrument to validate the models presented in this paper.
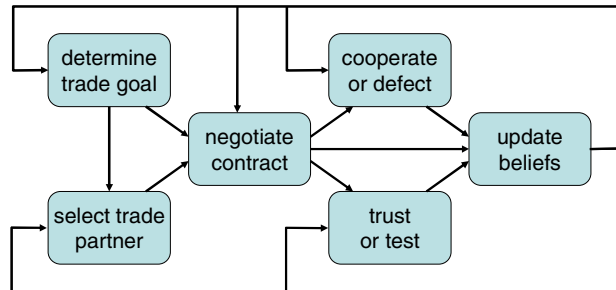
Fig. 1. Processes and internal information flows of trading agents

Experience from negotiation and delivery processes may change a trader's beliefs. In this paper we limit ourselves to beliefs about trade partners. We distinguish three beliefs. The belief about another agent's *fairness* represents an agent's expectation that a fair contract can be negotiated. The belief about another agent's *trustworthiness* represents an agent's expectation that the other will cooperate. The belief about *benevolence* represents an agent's expectation that the other will trust.

Table 1 in the previous section displays relevant distinctions for trade between individualistic and collectivistic societies. The remainder of this section analyses the effects of this dimension of culture on the trade processes depicted in Figure 1.

Negotiation behavior. To a collectivist mindset, negotiation has to be preceded by the formation of a relationship. If that goes wrong there will be no negotiation. During the negotiation, collectivist traders discriminate between in-group and out-group partners. They feel obliged to be more modest (or realistic, following their in-group's rules) in their first proposal to an in-group partner, are more hesitant to break off negotiations with in-group partners, and will try to maintain harmony as long as the opponent follows the in-group rules. When doing business with individualist traders the collectivists may be shocked by their opponent's explicit communication. Breaking the rules asks for a reaction. The style of that reaction may be furious, or they might never explicitly say anything, but just avoid the other from now on.

The first reply to a new proposal from an in-group partner will be modest, but there is no need to be modest to an out-group partner. If an out-group partner replies with no or small concession, negotiation is likely to be broken off, where an in-group partner or an acquainted relation would get a second chance.

In a collectivist mind the responsibility for in-group welfare and the compliance with in-group rules always play a prominent role. A collectivist will accept benefits for his in-group rather than his personal advantage as a convincing argument. Individualists have one thing in mind during negotiations: their own personal interest. This might be the material advantage of the deal in question, or the development of new trust relations with perspectives of future deals, or just the pleasant conversation during the negotiations, or the satisfaction of winning the game, but one thing stands for sure: individualists only pursue private interests. So individualist traders are not very modest in their negotiations, nor will they give in for the purpose of maintaining harmony. If they are not aware of the cultural differences when trading with collectivists, they may be upset by the lack of explicit communication, or they may upset their

opponents by being too explicit, or by talking business before the relationship has been established and acknowledged. They are not particularly patient or impatient negotiators, but behave patiently as long as it serves their interest.

Truthful or untruthful delivery. After an agreement has been reached, it comes to delivery. Traders can defect or cooperate in this phase. For instance, if the quality of the commodity is invisible at first sight, a supplier can be opportunistic and try to deliver a lower quality product than agreed upon. By doing so, in both collectivist and individualist societies deceivers takes the risk of serious damage to the relation with their partner if the deceit be revealed. However, in collectivist societies there is the extra sanction of shame, so there is damage to the relations with other possible customers as well. Furthermore, the shame will not be restricted to the deceiver, but will hit his relatives, friends, and business associates too. Therefore, a collectivistic supplier takes extra care not to deceive in-group business partners.

In collectivist societies the thresholds for opportunistic behavior, trust and forgiveness are based on group memberships and norms. In individualist societies these properties are based on personal relations and the personal interests in these relations. Traders in individualist societies do not have to fear the social sanctioning system in case their opportunistic behavior is revealed. For individualist traders, decisions to deceive, to trust, and to forgive are motivated by personal interest in the relation, be it in the framework of the current transaction or in the long run. Their personal relations represent their social capital.

Trust or Distrust. Being aware of the sanctioning mechanisms in case of deceit, and for the sake of maintaining harmony, traders in collectivist societies show trust toward in-group suppliers. Following the rules of their societies, and trying to maintain harmony, they also tend to show trust toward out-group partners when they have had long lasting relations. Not being trusted by a business partner puts pressure on the perceived relation. Especially in collectivist societies, showing distrust does serious damage to relations.

Individual trust is more relevant in individualist societies than it is in collectivist societies. Group membership is the main item for collectivist traders, individual relations are the main item for individualist traders. In individualist societies, customers cannot rely on social sanctioning systems, so they depend on their personal judgment and will be more careful to trust. Although suppliers in individualist societies do not like to be distrusted, they will more easily accept a trade partner tracing their trustworthiness than collectivist suppliers.

Maintenance of Beliefs about Partners. The acceptability of trade partners and the estimate of their trustworthiness are primarily based on group membership in collectivist societies. In addition, and for individualist societies in particular, the experience of previous deals counts, be it personal experience or the experience of others (reputation). For both individualists and collectivists, negotiations resulting in an agreement increase the partner's acceptability, and failing negotiations decrease it. The weight of reputation compared to personal experience is stronger in collectivist societies than it is in individualist societies.

The individualism dimension of culture does not influence the extent to which negotiation success influences the belief about a partner's trustworthiness. However, the negative effect of revealed deceit is stronger in collectivist societies than it is individualist societies. Whenever deceit by out-group suppliers is revealed, collectivists will be unforgiving toward the deceivers and the groups they belong to. The deceived and their relations will exclude the deceivers and their relations from business for some time.

For an individualist trader, partner's acceptability after revealed deceit will be determined by future interests, but of course the estimate of partner's trustworthiness is decreased.

Partner selection. The question "whom do I deal with?" is important for collectivist traders. They prefer to do business with in-group members, or will have to familiarize with out-group trade partners before doing business. Business is only possible if some personal relation exists. With respect to out-group relations the traders benefit from information exchange in the in-group. On the other hand they are accountable to their in-group for their out-group relations. Questionable relations weaken their position. Collectivist traders do not take the initiative to propose to others than in-group members and existing business relations. Upon a proposal made by a previously unknown counterparty, a collectivist trader will only respond if the proposal is framed in a socially acceptable way, for instance introduced through a common relation.

Individualist traders feel free to enter into negotiations on the basis of new proposals and take the initiative to propose to new partners. Taking initiatives and starting new business in one's own interest is respected in individualist societies, but on the other hand individualists will value personal trust relations, as these relations represent the social capital that they acquired by investments, and that is not given to them like in collectivist societies. When entering into negotiations with new partners, individualists do not like proposals that appeal to common group membership. An individualist trader proposing business to a collectivist trader may be surprised by the refusal of the other, not realizing that business is only possible after an introduction by a common relation, or some other way to get familiarized before explicitly considering business proposals.

4   Representation in Agents

Building on the analysis in section 3, the present section formalizes rules for culture dependent agent behavior in trade, with respect to the individualism dimension.

Simulation of the negotiation process follows the negotiation architecture of Jonker and Treur [14]. The architecture defines negotiation processes in terms of utility functions, and parameters of the negotiation process: negotiation speed, impatience factor, allowable gap between own bid and partner's bid, concession factor, configuration tolerance, and some parameters for financial aspects.

Impatience is modeled as the likelihood that an agent will break off negotiations if the utility of a partner's bid is below the critical cut-off value or if the partner makes not enough progress. The first two rules express that impatience is moderated by

common group membership and trust relations, relative to the extent that an agent is collectivist. All real valued parameters are normalized in the interval [0, 1]. Finally, the rules apply to sellers – for buyers replace benevolence with trustworthiness.

```
/* 1 have patience if in-group partners make unrealistic bids */
if cultural_script_contains(individualism_index(I: Real))
    and current_negotiation(C: Trader, X: Integer, L: Commodity_list)
    and current_round(X)
    and partner_model_contains_belief(C, group_distance, D: Real)
    and partner_model_contains_belief(C, benevolence, B: Real)
    and agent_trait_value(impatience, P: Real)
    and agent_trait_value(cut_off_value, M: Real)
    and others_bid_utility_in_round(U: Real, X)
    and U < M
    and random(0, 1, Z: Real)
    and P * (1 - (1-I)*max(1-D,B)) * 0.5 > Z
then stop_negotiation(C, X, L, gap);

/* 2 have patience if in-group partners make little concessions */
if cultural_script_contains(individualism_index(I: Real))
    and current_negotiation(C: Trader, X: Integer, L: Commodity_list)
    and current_round(X)
    and X > 3
    and partner_model_contains_belief(C: Trader, group_distance, D: Real)
    and partner_model_contains_belief(C: Trader, benevolence, B: Real)
    and agent_trait_value(impatience, P: Real)
    and agent_trait_value(minimal_progress, M: Real)
    and progress_in_bids(X-3, X, N: Real)
    and N < M
    and random(0, 1, Z: Real)
    and P * (1 - (1-I)*max(1-D,B)) * 0.5 > Z
then stop_negotiation(C, X, L, no_accommodation);
```

The minimum utility that an agent will accept depends on the concession factor. The following rule expresses that collectivists give less negotiation room to strangers.

```
/* 3 collectivist agents are indulgent only to in-group partners */
if cultural_script_contains(individualism_index(I: Real))
    and current_negotiation(C: Trader, X: Integer, L: Commodity_list)
    and partner_model_contains_belief(C, group_distance, D: Real)
    and partner_model_contains_belief(C, benevolence, B: Real)
    and agent_trait_value(concession_factor, F: Real)
then minimum_utility (1-F*(I + (1-I)*max(1-D,B)));
```

Deceit occurs in both collectivist and individualist societies, but for collectivistic agents, the threshold to deceive depends on group distance. The following rule only models the influence of group distance. In the eventual decision to deceive or not, other factors - such as personal relations - play a role as well, but we do not model these factors to depend on individualism versus collectivism.

```
/* 4 collectivist agents: opportunism increases with group distance */
if cultural_script_contains(individualism_index(I: Real))
    and current_negotiation(C: Trader, X: Integer, L: Commodity_list)
    and partner_model_contains_belief(C, group_distance, D: Real)
    and agent_trait_value(honesty, H: Real)
then deceit_treshold( H*(1-(1-I)*D) );
```

When a deal has been closed, the agents have to decide whether to trust the delivery or to put it to the test (*trace* it). In both types of societies, the decision is based on the personal trust relation between agents. Agents are less likely to trace as trust increases. However, in collectivist societies tracing in-group members is even less likely done. The decision is modeled as follows in the simulation agents.

```
/* 5 collectivist agents hesitate to trace in-group partners */
if deal_in_round(C: Trader, B: Bid, X: Integer)
    and current_round(X)
    and cultural_script_contains(individualism_index(I: Real))
    and partner_model_contains_belief(C, group_distance, D: Real)
    and partner_model_contains_belief(C: Trader, trustworthiness, T: Real)
    and random (0, 1, Z: Real)
    and (1-T)*(I+(1-I)*D) > Z
then to_be_traced(B: Bid);
```

The beliefs about partner's trustworthiness and benevolence are updated in the simulation, using the experience based trust update function

$$t_{C,x} = (1-\delta^+)t_{C,x-1} + \delta^+ e_{C,x}, \text{ if } e_{C,x} > t_{C,x-1},$$
$$t_{C,x} = (1-\delta^-)t_{C,x-1} + \delta^- e_{C,x}, \text{ if } e_{C,x} \le t_{C,x-1}. \tag{1}$$

$t_{C,x}$ represents the new value of an agent's trust in partner C, $t_{C,x-1}$ represents the value before the last experience, and $e_{C,x}$ represents the value of the last experience. δ^+ and δ^- are in the interval (0,1), and $\delta^+ = \varepsilon\delta^-$, with $0 < \varepsilon < 1$: a negative experience has more impact than a positive one. The value of the endowment coefficient ε is a personal trait. It will usually be closer to 1 in individualist societies than in collectivist societies, as individualists expect more opportunism and distrust.

```
/* 6 the endowment effect is stronger in collectivist societies */
if cultural_script_contains (individualism_index(I: Real))
    and agent_trait_value(base_endowment_coefficient, E: Real)
    and agent_trait_value(collectivist_endowment_coefficient, F: Real)
then agent_trait_value (endowment_coefficient, E*I + F*(1-I) );
```

After a negotiation the fairness belief is updated in a similar way as trust is. In case of a successful negotiation, the utility of the deal is taken as experience value. If the negotiation is broken off without a deal, the experience value equals 0.

Update information originates from own experience or shared information (reputation). The experience value equals 0 in case of revealed deceit, 1 otherwise. For shared information, which is especially important for collectivist agents, δ^+ and δ^- are multiplied by the maximum of the information source's believed trustworthiness and (1-individualism_index)(1-group_distance) of the source.

The following is an example of an update rule for partner beliefs.

```
/* 7 process shared information for positive experience */
if info_from_about(S: Trader, C: trader, R: Trait, V: Real)
    and cultural_script_contains(individualism_index(I: Real))
    and partner_model_contains_belief(S, group_distance, D: Real)
    and partner_model_contains_belief(S, trustworthiness, T: Real)
    and partner_model_contains_belief(C, R, Z: Real)
    and agent_trait_value(base_negative_update_factor, U: Real)
    and agent_trait_value(endowment_coefficient, E: Real)
```

```
    and V > Z
    and P = E * U * max(T,(1-I)*(1-D))
then modify_partner_belief_in_round_source(C, R, (1-P)*Z + P*V , X, S);
```

The following rule expresses the acceptability of another agent as partner for future deals. An agent tries and selects the most acceptable partner that is available for the next negotiation, i.e., not currently negotiating with another agent.

```
/* 8 collectivists: relations are important for partner selection */
if cultural_script_contains(individualism_index(I: Real))
    and partner_model_contains_belief(C: Trader, group_distance, D: Real)
    and partner_model_contains_belief(C: Trader, benevolence, B: Real)
    and partner_model_contains_belief(C: Trader, fairness, F: Real)
then acceptability (C, I*F + (1-I)*max(1-D,B) );
```

5   Simulation Examples

Table 2 presents results of multi-agent simulations of trade in populations of 8 suppliers and 8 customers. The agents apply the rules presented in section 4.

Simulations in populations with collectivist agents belonging to different groups typically show the distribution of run **1** in Table 2: in-group trade. Individualist agents rapidly develop networks of preferred relations, on which they trade very efficiently. In mixed settings like run **2**, the individualists develop the same pattern, but collectivist agents stick to their in-group trade. However, in run **3** where no in-group partners are available, the collectivist agents develop the individual relations pattern. Group *C* agents can find in-group partners in run **4** and show the collectivist pattern, while the other collectivist agents develop the individual relations pattern.

Table 2. Number of successful transactions in simulations with 8 suppliers and 8 customers

1. Customers Suppliers		collectivist gr *A* C1 C2 C3 C4				collectivist gr *B* C5 C6 C7 C8				2. Customers Suppliers		individualist C1 C2 C3 C4				collectivist gr *A* C5 C6 C7 C8			
collectivist	S1	9	7	5	3	0	0	0	0	individualist	S1	3	2	24	0	0	0	0	0
group *A*	S2	3	8	9	3	1	0	0	0		S2	1	0	0	12	0	1	0	1
	S3	5	6	5	4	0	0	0	0		S3	0	16	1	2	0	0	0	0
	S4	2	3	5	11	0	0	0	0		S4	14	2	0	7	0	0	0	0
collectivist	S5	0	0	0	0	4	5	5	4	collectivist	S5	0	0	0	0	5	6	6	6
group *B*	S6	0	0	0	0	6	6	5	5	group *A*	S6	0	0	0	0	8	3	5	6
	S7	0	0	0	0	8	4	6	6		S7	0	0	0	0	5	7	5	8
	S8	0	0	0	0	8	7	8	9		S8	0	1	0	0	8	7	5	4

3. Customers Suppliers		individualist C1 C2 C3 C4				collectivist gr *A* C5 C6 C7 C8				4. Customers Suppliers		collectivist gr *C* C1 C2 C3 C4				collectivist gr *B* C5 C6 C7 C8			
individualist	S1	1	25	1	0	0	0	0	0	collectivist	S1	6	7	7	5	0	0	0	0
	S2	9	1	0	5	1	0	3	6	group *C*	S2	9	3	4	8	0	0	0	0
	S3	0	0	2	0	0	0	9	4		S3	4	7	6	6	0	0	1	0
	S4	2	0	0	1	15	3	5	0		S4	4	5	5	6	0	0	0	0
collectivist	S5	1	0	0	0	0	20	0	0	collectivist	S5	0	0	0	0	17	0	1	1
group *B*	S6	0	1	1	17	0	0	4	0	group *A*	S6	0	0	0	0	1	0	1	16
	S7	5	0	4	0	1	0	1	9		S7	0	0	0	0	0	23	1	1
	S8	1	0	18	0	1	0	1	1		S8	0	0	1	2	1	15	1	2

6 Conclusion

The experiments correspond to the hypotheses in that trade goes smoothly when all traders are collectivistic, and have group relations, or when all agents are individualists. In mixed settings where buyers and sellers can be either collectivistic or individualistic, collectivist traders end up trading with in-group partners.

The work presented in this paper shows that the approach to vary cultural dependent behavior in trade processes in simulations, leads to behavior that corresponds to human behavior in trade simulation games [13]. Therefore, the paper shows that agent-based simulation contributes to the understanding of international trade processes.

Future work is (1) to develop models and study the effects of Hofstede's other dimensions of culture, using the same approach, (2) to integrate the models for the separate dimensions, and (3) to validate the models in human experiments.

Applications of this work are (1) as a tool for research in supply chains and institutional economics, (2) for education and training in business schools and multinational corporations, and (3) negotiation support systems.

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