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A Theoretical Approach To Trust Services In eBusiness

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Abstract

In this paper we discuss trust services in e-business. Although the importance of trust for business transactions is generally recognized, the actual mechanism of trust is not well understood. This hampers the development and use of effective trust services, aiming at supporting business transactions between partners all over the world. In this paper, we model the amount of uncertainty in a decision process as a function of information. Trust is unambiguously linked to the remaining uncertainty and information provisioning. Trust services are defined as services aimed at reducing uncertainty through providing relevant information. Finally, a categorisation of trust services based on different types of information and phases in a business transaction is presented.

1   Introduction

Intuitively, we all know what trust is: we trust that the bus driver is capable of driving a bus, we trust the bus company to hire capable people, we trust the bus driver to do his best. Without trust, the machinery of society and economy would quickly come to a halt. With trust one has a shortcut from otherwise extensive and expensive research on the background and possible behaviour of the bus driver. Therefore it is recognised that trust is an effective and efficient mechanism [Zucker, 1986].

In business, trust is equally important. We trust a retailer to supply food that complies with national laws, and we trust a business associate to keep his end of the bargain. The same holds for companies, as companies cannot function in isolation. To meet customer demand they depend on co-operation with suppliers and competitors [Prahalad & Hamel, 1990]. And, to do business adequately, they call on many types of services of external organisations. Driven by ICT-opportunities, the market situation has changed drastically over the last few years. Customers have become ever more demanding and product innovation rates are high [Wheelwright & Clark, 1992]. Globalisation of markets and the availability of new electronic media lead to more international competition and more dynamic business networks.

Ever since its emergence, an overwhelming amount of attention has been paid to electronic commerce in literature. Although electronic commerce activity is quite substantial, the possibilities of ICT technologies that support one-time relationships with unknown partners all over the world have not lived up to the expectations yet. Often this is contributed to a lack of trust when doing business on the Internet.

For this reason, trust has been given a lot of attention in business literature [Zucker, 1986; Williamson, 1993; Mayer, 1995; Nooteboom, 1996; Klein-Woolthuis, 1999; Ba, 2001]. In recent discussions on trust, much attention is given to security aspects. This is not surprising, because security relates directly to the important business questions above: how to *ensure* that communication is safe and uncorrupted, how to *ensure* that money does not get lost under way, how to *ensure* that authentication is valid?

In this paper we discuss trust and trust services in more detail. Although the common notion of trust is sufficient to appreciate the importance of trust in every day life, we argue that this is not sufficient to understand the workings of *trust services*. Starting point is the following observation: while every decision-maker is aware of trust and its function as a catalyst in business transactions, *he would rather* not *rely on trust for a business decision*.

We believe that understanding the mechanisms of trust services is a prerequisite to use trust services effectively in business transactions. The goal of this paper is to provide a conceptual framework that forms the basis for the successful development, deployment and use of trust services.

The paper is organised as follows. First we discuss the nature of trust in business decisions. Then we discuss a new definition of trust and trust services. This definition is then used to categorise trust services in business settings, and is illustrated with an example.

2   Trust

2.1   A Trust Discussion

In the undertaking of a business transaction uncertainty and vulnerability to the actions of others induce a certain risk: a financial risk, or a risk of loosing a good reputation. Clearly, this risk has to be assessed and decided upon. Economists in most cases emphasise a measurable and quantifiable decision process, which we denote by calculativeness. Sociologists and psychologists, on the other hand, also emphasise more 'soft' elements such as trust. The economist Williamson [1993] states that calculativeness is determinative throughout and that invoking trust in the rationalisation of business behaviour "merely muddies the clear waters of calculativeness". Other scientists argue that trust complements more rational approaches to business relationships [see Bradach, 1989; Zaheer, 1995; Nooteboom, 1996; Klein-Woolthuis, 1999].

In his paper, Williamson refutes numerous examples in literature of the influence of trust in transactions with the argument that, if considered more closely, pure calculativeness always lies underneath. He concludes that trust must be reserved for noncalculative personal relations only and for economical transactions calculativeness always reappears. Craswell [1993], in his comment on the paper of Williamson, adds some nuances: "Non-calculative norms of trustworthiness may make up part of the cultural environment, thereby altering the magnitude of the costs and benefits facing calculating actors. If so,

these non-calculative norms would indirectly affect even explicitly calculative behaviour".

Both Williamson and Craswell refer to a shipyard example [Coleman,1990], in which a Norwegian ship owner is seeking a loan to release his ship in Amsterdam. The shipyard is unwilling to release the ship without direct payment. The Norwegian ship owner contacts a London bank who is willing to issue the loan and arranges for an Amsterdam bank to deliver the money. Coleman explains this difference in the decision by considering an expectation function, which expresses the expected revenues for the loan supplier of the transaction taking into account possible gains and losses. Coleman reasons that apparently the expectation for the Amsterdam shipyard and Amsterdam bank must have been negative and positive for the London bank. According to Coleman, the driving force behind this difference is trust.

Williamson rejects this reasoning and argues that all parties were calculative, that no trust is implied and that the party that projected the largest expected net gain issued the loan. He argues that the London banker must have had other information on the behaviour of the Norwegian ship owner than the other parties thus explaining the larger expectation value. Williamson concludes that calculativeness is determinative throughout. Our interpretation is that Williamson wants to make the point that too often and too easily people flee to the concept of trust as an easy explanation for behaviour that could have also been explained if more effort was put into the reasoning. However, we think that there is still room for trust in a decision process. After our definition of trust we return to this discussion.

2.2   Defining Trust

Trust has been studied from sociological, psychological, philosophical, legal, economical and marketing perspectives, which resulted in a multitude of definitions, many of which are summarized in [Blomqvist, 1997].

Starting point for our definition is the observation by the sociologist Simmel [Granovetter, 1992, p. 39]: 'the person who knows completely need not trust; while the person who knows nothing, can on no rational grounds afford even confidence'. The first comment in case of perfect information is interesting since it does not directly agree with a common intuition about trust. Intuitively, one would think that trust is maximal in case everything is known.

In this paper we model the amount of uncertainty in a business decision as a function of information. The meaning of a business decision in our context is the decision whether or not to engage in a certain business transaction. For information, we define information as all 'imaginable' pieces of written, verbal, confirmed, etc. information that may influence the business decision, denoted by I. For simplicity of discussion, we assume that all information is equally relevant and independent. In practise only part of the information I is obtained. We denote the obtained information by I_{ob} and denote the remaining unknown information by I_{rem}.

Obviously we require a measure for the amount of uncertainty. To this purpose we take an information theoretical approach [Lubbe 1997, Shannon 1948]. The total amount of uncertainty surrounding a decision based on the stochastic variable I is denoted by H. Note, in specific decision problems a mathematical definition of H is possible, but the precise definition of H is irrelevant for the present discussion. Shannon's measure H satisfies the following property:

$$H(\,I\,) = H(I_{ob}) + H(\,I_{rem}\,|\,I_{ob}); \;\; H(I_{rem}\,|\,I_{ob}) <= \; H(\,I\,),$$

where H(I) represents the total amount of uncertainty. The inequality behind the semi-colon, which is true in general, says that the amount of uncertainty is smaller under the condition that certain information is known. By providing information the resolved uncertainty $H(I_{ob})$ increases, while the remaining uncertainty $H(I_{rem}\,|\,I_{ob})$ decreases, see Figure 1. In case all information is available, the remaining uncertainty equals zero. This agrees with the earlier observations by Simmel and Blomqvist [1997]. The linear dependence suggested in this figure is not generic, however, the monotonic decrease is generic, [Lubbe 1997].
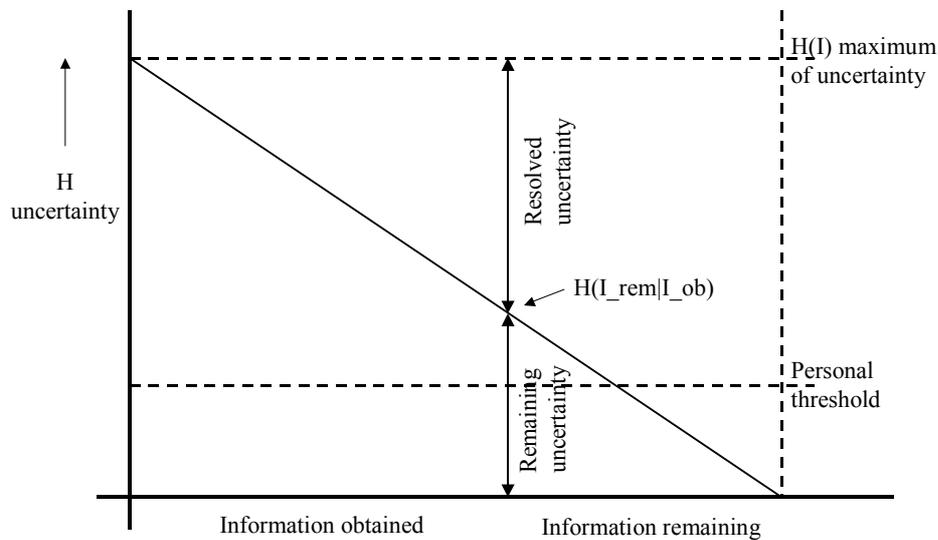
Figure 1: *Need For Trust And Information*

How does this relate to trust? Every businessperson has an individual uncertainty threshold (see Figure 1). If the remaining uncertainty is less than or equal to the threshold and the expected gain is still positive, the decision turns out positive. In case the uncertainty is higher than the threshold the decision turns out negative. Note that this threshold contains a lot of subjective elements, e.g., past experiences, opportunistic disposition, type of business engagement influence the individual threshold. Also, the personal threshold is not a static threshold and depends on time.

A decision does not mean that the remaining information has no value or does not contribute to a decrease of uncertainty. Practical restrictions such as e.g. costs and time limit the possibilities to acquire more information. In order to proceed with the transaction, the person involved in the decision *assumes that the remaining amount of unknown information is not likely to influence the outcome of the decision*, thereby cutting off the calculativeness and accepting the residue of uncertainty. We arrive at the following definition of trust:

Trust is the acceptation, by a business entity, of the unresolved uncertainty in a decision process.

Therefore, trust closes the decision process. As a result, trust enhances the willingness to participate in a business transaction and become vulnerable to the action of a partially unknown business entity based on the expectation that the unresolved uncertainty yields no grounds to discontinue with the transaction. This relates to the definition of trust by Mayer [1995].

Returning to the shipyard example in section 0, we can say that the London banker apparently has a positive economic expectation, and sufficient information on the Norwegian ship owner for the remaining uncertainty to be below his threshold value. The Amsterdam shipyard may also have a positive expectation on calculative grounds, but is unsure about the effect of remaining uncertainties on the economic expectation, resulting effectively in less attractive (worst case) economic expectation for the Amsterdam shipyard.

We agree with Williamson that the decision process is calculative and most certainly rational when applied to the resolved uncertainty part. However, in practise information is never complete, and trust is always required for the remaining uncertainty part. Since the effect of unresolved information on the expected gain in general is non-calculable, pure calculativeness is not feasible and trust, as defined in this paper, is an important element of day-to-day business.

In practice it is hard to determine how much uncertainty is resolved for a particular party through particular pieces of information, and also it not known what the personal threshold value is for a particular decision in the particular context. However, we can conclude that information *always* reduces uncertainty (the monotonic decrease of H), and thus always narrows the gap with the personal uncertainty threshold. This mechanism is sufficient basis for the discussion of trust services in the next section.

3   Trust Services

3.1   *Defining Trust Services*

In the previous part we have seen that information resolves uncertainty. Information need not only be the classical dossier-type information, but it may also be verbal information, information provided by certification institutions etc. A personal threshold determines whether or not to engage in a business transaction. To arrive at a positive decision, an information gap must be closed. This relates to the personal threshold discussed in the previous section. A certain amount of uncertainty has to be resolved to arrive at this personal threshold. In case to little information is acquired to arrive at this threshold, additional information has to be obtained to close this information gap. This is the basis for defining *trust services*. In the remainder of this paper we define trust services as follows:

Trust services are services aimed at reducing uncertainty through providing relevant information and thereby decreasing the required level of trust for making a business decision.

Every piece of information resolves a certain amount of uncertainty thus narrowing the distance from the actual state of uncertainty to the threshold value. Note that trust services may be invoked from a third party, but may also be part of the business strategy of one of the partners.

There is an interesting difference between the ideas presented in this paper and the concept of 'trust production' of e.g. Zucker [Zucker, 1986]. Zucker studies trust mechanisms to increase confidence for decision-makers in the positive outcome of a business transaction. In our case we have focused on uncertainty and information, and trust is required to overcome the remaining uncertainty. Due to a different view on trust we do not require trust to be 'produced'. Instead we require that providing relevant information *reduces* the need for trust.

3.2   A Categorisation Framework For Trust Services

Our definition of trust services makes it much easier to discuss the workings and relevance of practical trust services in e-business settings.

To develop and use trust services it is relevant to answer the question *what* types of information are relevant and *how* trust services can be applied. On the other hand it is important to know *when* the different trust services and corresponding information are useful.

For the first question we use the categorisation of trust mechanisms defined by Zucker [1986], namely: characteristic-based, process-based and institution-based trust. For the second question we relate trust services to the different phases of a business transaction.

Characteristic-based trust services are based on the characteristics of business entities: companies, persons or systems. Social and cultural similarities drive characteristic-based trust. In the B2B context, proclaiming technologies and *business practices* similar or familiar to those of other organisations can reduce uncertainty. Similarity between partners gives rise to less friction between partners due to the familiarity between each other's modes of thinking and working [Parkhe, 1998]. An example of uncertainty reduction through technology similarity is the phrase 'Intel inside'. *Factual information* on business partners and technology influences the perception of trustworthiness. For instance, the uncertainty regarding a business partner reduces if he uses reliable operating systems or because he is market leader in a particular business segment. In the online world trust services need to compensate for the lack of cues for non-verbal communication. *Facial displays* can be used to decrease uncertainty on the behaviour of business partners [Kasper-Fuehrer & Ashkanasy, 2001]. Also, the first impression of the user interface of a particular application influences one's perception of the trustworthiness of the technology. A badly designed website is not very convincing for the capabilities of the associated organisation.

Process-based trust services are based on past experience. Past experience may relate to one's own experience with the business partner or to the experience of third parties. In e-commerce, uncertainty about the business past of a company is especially important because of the lack of a shared history. In order to resolve uncertainty, *rating systems* could be applied [Ba, 2001]. E.g., on eBay's feedback forum consumers are encouraged to rate their satisfaction regarding business partners, while other consumers are encouraged to check their business partner's ratings before doing business. A rapid way to create a past experience with new customers is let potential buyers freely get acquainted with products and services.

Institution-based trust services are based on formal social structures such as laws, certifications and formalised codes of conduct. An example is a *seal mark*, which is awarded only to sites that adhere to established privacy principles, and agree to comply with ongoing oversight and consumer resolution procedures (TRUSTe). Another way reduce uncertainty is to draw up *contracts* between business partners, e.g. e-contracting as

discussed in [Tan, 2002]. By using contracts partners can enforce desired behaviour by the threat of going to court. A prerequisite for using contracts is the ability to supervise and judge the realisation of the contract by partners [Klein-Woolthuis, 1999]. Companies may also reduce the risks related to business partners by seeking *insurance*. By providing the 'money back guarantee' the uncertainty about the financial risk of a malfunctioning product is reduced. Virtual bookshops such as Bol.com often use this mechanism to decrease uncertainty for their customers.

Providing a *letter of credit* may also reduce uncertainty. A letter of credit is a document issued by a bank committing itself to honour drafts by the seller in accordance with specified terms and conditions. With this method of payment, the risk lies with the bank, not the buyer.

A second categorisation addresses the *when* of trust services, and relates trust services to the common decomposition of business transactions in three phases: the information, agreement and settlement phase [Schmid & Lindemann, 1998].

In the **information phase** business partners acquire a market overview by gathering information on business partners as well as the goods and services they provide. In this phase business partners may be uncertain about which partner and products to select. Trust services provide information about the characteristics of business partners and products. For instance, business partners consult a business information service to find out what the best-rated Internet providers are.

In the **agreement phase** business partners negotiate the conditions of business transactions. In this phase business partners may be uncertain about the conditions of doing business with a partner. Trust services may provide this information. For instance, business partners provide institutional based trust by means of a letter of credit or contracts that reduce the level of required trust [Bryant, 2002].

Finally, in the **settlement phase** the agreed-upon terms of the informal or formal contract are fulfilled. In this phase business partners may still be uncertain whether or not they will receive the ordered products. Trust services may be used to provide business partners with information about the status of their orderings. From the perspective of the vendor these trust services bind customers to the company.

Table 1 provides the two categorisations in one table with examples of trust services. The table is not meant to be complete; it is meant to stress that the different types of trust services may be used in different stages of business transactions for different purposes. Also, the examples in Table 1 show that technology has an important role. With the results of this paper this can be understood as follows. For trust services the main mechanism is uncertainty reduction through information transfer, and technology may provide the *means* to transfer this information in a reliable way. So technology services are not trust services, but clearly part of the overall quality and reliability of the trust service. See also [Lui, 2003].

Table 1: *Role Of Trust Services In Different Stages Of A Business Transaction*

	Information phase	Agreement phase	Settlement phase
Caracteristic based trust services	■ Business information services (Third Parties) providing factual information on partners (e.g. mission statement, # of employees, market share, product catalogue) ■ 'Feel and looks' services - Facial displays providing information on the social background of partners	■ Communication services providing verbal and non-verbal information on business partners - Tele- and video conferencing services	less relevant in this phase
Process-based trust services	■ Rating services providing information on the performance of products, services and companies ■ Business information services providing factual information of partners (track records, quality estimates, complaint history, creditworthiness) ■ Branding services providing information on the branding of companies by means of logo's and slogans etc. (e.g. Intel™ inside) ■ Trial services providing buyers the possibility to gain experience with products and services (e.g. free samples)	■ Business information services, providing factual information of partners (track records, quality estimates, complaint history, creditworthiness) ■ Services resolving uncertainty regarding communication: - Authentication - VPNs	■ Tracking and tracing services providing information on the status of the transaction - Delivery status (e.g. mail confirming shipment) - Payment status (e.g. mail confirming payment) ■ After sales services (e.g. filling in a form to be used in rating services)
Institution-based trust services	■ Warranty services providing guarantees on payment - Insurances (e.g. money back guarantee) ■ Seal mark services providing information on the codes of conduct (e.g. TRUSTe for privacy regulations)	■ Warranty services providing guarantees on payment - Letter of credits from banks - Insurances (e.g. money back guarantee) ■ Seal mark services providing information on the codes of conduct (e.g. TRUSTe for privacy regulations) ■ Contract services providing legal contracts (e.g. price, delivery conditions)	■ Warranty services providing guarantees on payment - Letter of credits from banks - Insurances (e.g. money back guarantee)

3.3   The Oyster Case: Finding A Transportation Provider

In order to demonstrate the role of trust and trust services in business transactions we demonstrate the different types of trust services with a fictive yet realistic e-commerce example. This example aims to demonstrate how a company can use the ideas of this paper and the above categorisation to capture the information needs in consecutive phases of a business process.

A seafood wholesaler named Oyster needs transportation for a shipment of shrimps to an seafood restaurant in Belgium. This restaurant is an important customer for Oyster, therefore it is of utmost importance that Oyster can quickly locate a reliable transport company, having trucks available to do the job. Oyster decides to consult a transportation portal, which offers an online search for transportation services. The online search for transportation reveals three candidates. In order to compare the services of these candidates, Oyster consults a rating site, which displays the past performance in terms of delivery speed, price, reliability and service of more than 500 transportation companies world-wide. A company named Transco has the best ratings in delivery speed, and price and service. Oyster visits the web site of Transco to find out more about the company. On the website photographs of Transco employees and a mission statement are displayed. The initial positive impression of Transco is reinforced by the looks and content of the website. Oyster contacts the sales manager of Transco to negotiate the conditions for doing business. After negotiating the conditions for transportation, Transco electronically confirms what they agreed upon. Transco asks if Oyster wants to pay electronically. Since the logo of Oyster's home bank is part of the list of payment methods, Oyster decides to pay for the transportation service through the payment service provided by its home bank. Right after payment Oyster receives a message that the truck is on its way to the address provided by Oyster, with the estimated time of arrival. The next day Oyster receives an e-mail asking if everything was conform expectation. Oyster is satisfied with the service it received from Transco.

In this example Oyster is confronted with different trust services in different phases of the business transaction.

In the information phase Oyster needs reliable information on transportation providers. To this end Oyster makes use of a rating service provided by a transportation portal. This trust service is based on process-based trust since the rating service provides information on the past behaviour of the transporters. Oyster is reassured that the company has a good reputation in terms of speed of delivery, price and service. Moreover, when Oyster visits the website of the transportation company it is confronted with photographs of employees and the mission statement of Transco. This trust service is based on characteristic-based trust. Oyster recognises itself in the employees displayed on the photographs and the mission statement.

In the agreement phase Oyster contacts the sales manager of Transco with the intention to negotiate the conditions for doing business. To take away any uncertainty about what has been agreed upon Transco confirms the agreed upon conditions electronically. This trust service is based on institution-based trust since it refers to a formalised code of conduct. Right before Oyster engages in the business transaction Transco asks for the preferred method of payment. The logo of Oyster's home bank displayed on the website reassures Oyster that it is safe to pay electronically. This trust service is also based on institution-based trust.

Finally, in the settlement phase, Oyster receives a message stating that transportation is under way to the address given by Oyster. Moreover, the next day Transco checks if everything was conform expectations. These trust services are based on process-based

trust. Oyster receives information and is asked for feedback on the performance of the provided service.

4   Conclusions

While the importance of trust for business transactions is generally recognised, the actual mechanism of trust is not well understood. This relates to the ambiguity of the word trust itself. If the meaning of trust is not clear, how can we expect to develop and use trust services that effectively support doing business with partners all over the world?

Therefore, in this paper we discuss trust and trust services in e-business. Trust services are often identified with technology-oriented services provided by trusted third parties such as e.g. Versign and Identrus. In our opinion, identifying trust services too strongly with these services doesn't do just to the meaning, purpose and potential of trust services.

From the perspective of companies the designated use of trust services is to enhance, facilitate and speed-up business transactions, since trust in a business partner is no goal by itself. Companies do not need trust production, but rather require a reduction of uncertainty. Trust is the assumption that the remaining uncertainty yields no new insights that will alter the decision process. Therefore, trust closes the decision process.

Based on this definition of trust, the main mechanism of trust services is to offer information. By offering specific information at the appropriate stage in a business transaction, trust services may effectively support the transaction. Categorisation of trust service helps to identify the appropriate services. Therefore, in this paper we categorised trust service along two important axes: which information need does the service satisfy, and in what stage of a business transaction is this information supportive.

We believe that understanding the mechanisms of trust services is a prerequisite to develop and use trust services effectively in business transactions. This is especially important in first time or short-lived business engagements that will occur more frequently in dynamic e-business networks. Merely appreciating the importance of trust is not enough. We hope that this discussion assists companies in successfully employing and deploying trust services, and that trust and security each attain their appropriate positions in business practice.

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