Trusted Business System Model
Using Context Sensitiveness

Chandrasekaran Subramaniam  Sankarbhathry Ponnusamy  Agilan Ravi, Hanumanth Praveen Ravindran
Department of Computer Science  Department of Technology Management  Department of Computer Science
Anna University, Chennai, NYU- Poly, New York  NYU- Poly, New York
India  USA  USA
chandrasekaran_s@msn.com  sankar@isis.poly.edu  aravi01, hravin01@students.poly.edu

Abstract—The objective of the paper is to propose a predictable context sensitive trust model for a business system. A business system can be imagined with four basic entities between which there is a mutual trust of different nature exists. A formal model, which encompasses the trust between the stack-holders is proposed where the context sensitive features of the multi variate trust issues are addressed. The impact of both the legal environment and the interoperability factors on various entities involved in the trust issues are focused in the work. The key dimensions of the trust i.e. integrity and loyalty are determined through acceptable uncertainties of various components in the proposed model the proposed context sensitive trust model for business systems. The model which represents the various trusts in a context sensitive business system is verified using a numerical simulation tool and the inferences are drawn with a scenario.

Keywords- Context Sensitive, Trust, Business System, Acceptable Uncertainty and Integrity

I. INTRODUCTION

The trust prevailing in the business system is not only depending on the concepts for product development and services including marketing and sales but also on the material suppliers and the working employees of the company. Basically trust is a positive expectation that an entity will not act opportunistically against the other entity. The trust being a belief, which is a more fragile relationship between any two or more entities and the violation of this belief, may destroy all the entities. In order to sustain the business activity the company must try to maintain good relationship in all business dimensions between various stakeholders. Assuming the initial trust between any two entities such as suppliers and the enterprise, the trust relationship starts increasing or decreasing depending upon the consistency and competence of the company in running the business. Meanwhile, if the company is not loyal or honest to the funding agencies even with considerable amounts of shares in the market, then the trust relationship deteriorates. Hence, a dependable system contributes toward raising and assuring trust in business relationships and services. It is clear that the trust encompasses larger issues than simply dependability of a computing or communication infrastructure which necessities a frame work for that business. In recent e-business, the term trust is usually used to characterize the more general reliance of business actors and consumers on other actors or systems within the Information Society [1]. In running a successful business the clear difference between a simple absence of trust, and positive mistrust has to be properly understood. The absence of trust basically implies that there are no previous interactions between the entities pertaining to that business environment however, the mistrust is supposedly a consequence of past actions. The mistrust is often a consequence of a complex set of beliefs, perceptions, associations and interpretations. Were as, trust is a multidimensional concept and defined as the perceived benevolence and integrity of a participating party in the transaction [2]. The most effective way to build trust in the workplace is to work together. There are no magic gimmicks or other simple solutions. Trust cannot be created by excessive wages, great company picnics or wonderful working conditions; it can only be generated through teamwork, honesty and fairness. Although trust and productivity are complex issues and represent only part of the total fabric of interpersonal relationships in small businesses, there are some attributes that have positive effect on trust in successful small businesses. In the earlier works, Zand defined trust as the conscious regulation of ones dependence on another that will vary with the task, the situation, and the person and emphasized the vulnerability aspect of trust [3]. The main issue in building business trust is lack of ethical guidelines in the business organizational framework. Generally money-making is an informed risk-taking, and when ethics are lifted out, it will not only affects the lives of thousands of employees but also ruin the financial conditions of the bank which funded the business. The company savings should be clean and green in the name of Socially Responsible Investing (SRI).

The paper is organized as follows; Section II Illustrates the trust issues in a business system with a help of a used case diagram and Section III describes the interdependency between different types of trust with in the organization and out side of it, leading to a generic trust including all the entities with information and legal supports systems. In section IV gives a different perception of trust as acceptable uncertainty and a formal equation for the actual uncertainty which may be considered as a trust index for the customers with a scenario. Section V brings out simulated results for the end to end trust based on the uncertainty values of the constituent elements.
involved in the business to reach an acceptable uncertainty level thus verifying the proposed trust model.

II. TRUSTED BUSINESS MODEL

The trust issues in any business system starts from behavior of the management to look after the employees welfare including their salaries and health care covering their retirement life. The employees first trust their organization in such a way that one is mutually exists for each other. The interpersonal communications develop a cordial relationship between the various categories of workers in the company. To establish the business in the correct path, the rights for the employees to openly comment on the management decision towards the product promotion and marketing techniques may be encouraged. The customers will trust the enterprise only when there is a systematic and regular monitoring of the fulfillment of their grievances towards complaints.

Each and every individuals in the company must know the real business targets and social responsibilities of their products in building a healthy and strong industry in the long run. The executives must politely listen to the grievances of the workers if any and attempt to rectify them as early as possible to build the trust from the workers on the business. The expert committee may recommend early and feasible solutions to some pitfalls of the decisions taken in urgent times. The financing agency and the sponsors may also come forward to detect the problems arising in various phases of the business.

The main objective of any company is to make money by selling products to the customers. Raw materials are supplied by the vendors, production of goods can be done utilizing raw materials. Also, employees are responsible for the production of the goods. Above all, to start a company, basic fund is necessary and this could be obtained from the bankers. Banks are the financial assets of any company. Trust between all these actors results in healthier function of the company. The legal environment is where a number of legal principles are framed for maintaining trusted relationship between individuals and the company. The various actors playing different roles in a trusted enterprise is shown as a use case diagram in Fig. 1.

Fig. 1. Use Case Model of a Trusted Business

There are many constraints in running a small business with in a complex legal environment. The interpersonal relationships starts from selection, recruitment, and promotion phases may affect the honesty and fairness within the administration. But business laws may enforce certain actions on the company which inturn diminish the trust value of the affected persons. Every personnel system must consider the statutes relating to these issues in order to establish mutual positive trust and minimize the mistrust. The trust results from the combination of personal experience and perceptions of honest, ethical business practices, the expert recommendations but finally the most important is the relationship the people have with the company or the brand. The basic features of such a context sensitive trust involved in a business system are proposed as COM 4 (Competitive, Compliance, Compliance and Comprehensive) model and discussed below:

A. Comparative

In order to establish trust on the produced items by the customers is possible only by comparing the similar items from the competitors and bring out the salient features of the other manufacturers of the same item. However, the business may be lost or the trustworthiness may be increased.

B. Competitive

The trust between the enterprise and the suppliers will be enhanced only through offering a competitive price for the materials and regular payments for them. Here the mutual trust between the parties and the dynamic trust concepts based on the business nature are to be exercised.

C. Compliance

The trust between the legal authorities and the employees can be developed only by accepting and fulfilling the compulsory requirement by the enterprise through legal procedures. The most contentious aspect of SarbanesOxley Act (SOX) is section 404, which requires management and the external auditor to report on the adequacy of the company’s internal control over financial reporting (ICFR). This is the most costly aspect of the legislation for companies to implement, as documenting and testing important financial manual and automated controls requires enormous effort.

D. Comprehensive

The trust between the funding agency and the employees should be very comprehensive i.e. the enterprise should not have minimum or maximum number of employees other then the requirement for the consistent manufacturing and delivery of goods.

The trust with above features should exist not only with in the organization but also with the external parties. The customers are not directly associated with the enterprise, so the level of certainty between the customer and the enterprise is low. Similarly the procured product is from a third party supplier and so the certainty between the procurement and the
enterprise is also low. The quality of the finished product is directly dependent on the quality of the procured materials, which is not from the same organization. Hence the level of certainty between the finished product and procurement is low, while the certainty between the finished product and packing is high. There exists a high degree of trust between the enterprise and workers, procurement and manufacturing, finished product and packing as they are part of the same organization and are directly related to one another as shown in Fig. 2. The solid lines represent the relationship of low level of uncertainty and the dotted lines denote the relationship of high level of uncertainty. The workers, manufacturing and packing units have direct trust on the legal environment and the information services as all fall under the same organization, which gives a direct trust on the product. So the trust between the customer and the final product can be determined as the sum of the product of the trust between the enterprise and the workers, procurement and manufacturer, and finished product and packing. The various business entities and their relationship as a binary variable is shown in Table I.

![Table I: Business Entity and Relationship](image)

Let the equation for the generic trust between end to end i.e. customer to finished goods be represented as in equation below:

\[
T_{cg} = (t_{ce}*t_{ew}) + (t_{cp}*t_{sm}) + (t_{cp}*t_{cs}) + (t_{cp}*t_{ci})
\]  

where, \(T_{cg}\) = the total trust of the customer on the purchased goods over a period of time,
\(t_{ce}\) = the trust of the customer on the enterprise based on the reputation,
\(t_{ew}\) = the trust of enterprise on the workers based on their competence and loyalty,
\(t_{cp}\) = the trust of enterprise on the third party packaging company based on its quality,
\(t_{sm}\) = the trust of suppliers on the manufacturers based on timely payment,
\(t_{cp}\) = the trust of the customer on the manufacturing processes based on industrial standards,
\(t_{cs}\) = the trust of the customer on the supplier based on the quality of raw materials,
\(t_{ci}\) = the trust of enterprise on legal auditing based on antitrust policy and
\(t_{ce}\) = the trust of the customer on the information systems based on privacy and security policies over the same period.

IV. TRUST AND ANTITRUST POLICY IN BUSINESS CONTEXT

Trust is basically considered to be a degree of acceptable uncertainty. Generally a trust can either be a absence of trust, distrust, mistrust and zero trust. Where mistrust is defined as lack of trust, zero trust is defined as null trust, absence trust is defined as loss of trust and trust is defined as positive belief. Total acceptable uncertainty in business system is the weighted sum of individual uncertainty of various processes in that business. For example processes like procurement, manufacturing, marketing, auditing and business meeting the industry standards as per the laws and regulations. In a business to employee context, the employees do not discuss or exchange information with actual or potential competitors regarding the individual company prices, price changes, price differentials, mark-ups, discounts, warranties, allowances, credit terms, costs, production levels, capacity, sales, etc. The company has to limit their sales to particular territories, customers or classes of customers. In the context of M-commerce the security policies should define how and which mobile devices can be use in a mobile business application. Enforcement of policies makes use of certificates, defined for users and devices, which determine delegable application tasks and trustworthiness of devices [4]. In a business to legal context, the International Professional Compliance Association (ICPA), the members shall not engage in any discussion or agreement concerning particular representatives, distributors, other customers, or suppliers involving decisions to deny, limit or terminate business relations between any ICPA member and such firms. Sell to or purchase from, or termination or modification of sales or purchase arrangements with representatives, distributors, or other third parties, or prices or terms of sale or resale by customers [6]. In a business to business context, the Sherman Act prohibits "contracts, combinations or conspiracies in restraint
of trade or commerce.” That is the contract, combination or conspiracy requirement has been found to exist where there is some form of agreement between two or more parties [5]. Such agreements may be explicit, e.g., taking the form of a contract or other oral or written communication, or implicit, e.g., implied by the conduct of the parties and construed to indicate an agreement was formed. In most cases, the prohibitions of the Sherman Act extend only to transactions that are found to be unreasonable restrictions on competition. Under the antitrust laws, “price fixing” includes much more than an agreement to set prices at a particular level, within a specific range, or in accordance with a particular formula. It potentially includes any agreement that tends to raise, fix, stabilize or otherwise affect price. Thus, even if the parties permit the price to vary somewhat under the agreement, the agreement is illegal if it has the effect of stabilizing the price among those participating in the conspiracy. Similarly, price fixing includes agreements to control other factors that directly or indirectly affect price, such as establishing production levels, setting uniform discounts, credit or warranty terms, or agreeing on matters relating to costs, especially when those costs account for a substantial percentage of the final price. For an enterprise to be successful there are major roles to be played by some key players like employee, vendors, bank financiers and customers. From Table II, it can be seen that there are various forms of trust which the enterprise keeps on the key players which changes the outcome of the entire business system. There are various forms of trust based on their values namely zero trust, absence of trust, mistrust, distrust and trust. When the trust in a relationship breaks, it is defined as zero trust. The absence of trust indicates that the entities are not dedicated to the jobs assigned to them while the mistrust is the act of believing that a particular party has a hidden agenda or ulterior motive. The distrust is a formal way of not trusting any one in a situation of grave risk or deep doubt. That is the distrust implies as trust but verify approach. If a detailed evaluation is done then it shows from the Table II that the enterprise keeps trust on the employees then a quality product can emerge . Likewise if the enterprise keeps trust on the other key players then the material flow normalizes across the enterprise, excess fund and profit for the enterprise. If the enterprise doesnt have trust on the key players then it results like high turnover, deficit, debt and loss. The results may also of different nature if the trust level varies from one value to another and the impact will be readily realized on each and every process of the business.

In a business system the uncertainties can be divided into two categories. They are the uncertainties due to inside factors within and the uncertainties due to outside factors of the organization. The uncertainties due to the inside factors of an organization can be represented in an equation as given below.

\[
U_{in}(Uncertainties\ due\ to\ inside\ factors) = K_{11}U_1 + K_{12}U_2 + \ldots
\]

where,

\(U_1 =\) Uncertainty in the procurement process of buying raw materials

\(U_2 =\) Marketing uncertainty due to lack of training

\(U_3 =\) Uncertainty due to Employees competitive knowledge in the manufacturing and management and similarly there may be \(n\) uncertainty factors outside the organization

All \(K\)s are Empirical constants depending upon the nature of the business, number of workers and the amount of average turnover of the business.

The uncertainties due to the outside factors of an organization can be represented in an equation as given below.

\[
U_{out}(Uncertainties\ due\ to\ outside\ factors) = K_{21}V_1 + K_{22}V_2 + \ldots + K_{2m}V_m
\]
where,
\( V_1 \) = Uncertainty in the legal standards and maintenance
\( V_2 \) = Uncertainty in the compliance standards towards safety and security
\( V_3 \) = Uncertainty in the information services focusing the e-marketing and e-advertising methods
and similarly there may be \( m \) uncertainty factors within the organization
All \( Ks \) are Empirical constants depending upon the nature of the business, number of workers and the amount of average turnover of the business.

From the above two equations it is possible to predict the total uncertainty which plays a major role in maintaining trust in the business system. The equation for the total uncertainty is given below.

\[
Total \, Uncertainty = \sum_{i=1}^{n} K_i V_i + \sum_{j=1}^{m} K_j V_j
\]

The total uncertainty is used to predict the acceptable uncertainty which the indicator of trust in the overall business system. The equation to calculate the actual uncertainty which is inversely proportional to the number of competitors for the same product during the given period of time is given below.

\[
Actual \, Uncertainty = \frac{Total \, Uncertainty}{N_c}
\]

where,
\( N_c \) = Number of Competitors
The acceptable uncertainty which is called the overall business trust should lie between the minimum and maximum values of the total uncertainty in the business system, due to various processes involving a number of internal and external entities.

V. Scenario

The scenario which emphasizes the impact of trust issues on the success of a business is explained below: A strategy followed by company X which is a small scale detergent industry against company Y which is the biggest player in detergent with 40% market shares. The company X’s low cost strategy helped them to competed against the company Y and acquired more market share in short span of time. The major advantage which made company X to be dominant over Y was due to the fact that they had more trust on their labors and suppliers. Even the marketing strategy of X was totally different, they were more direct and they also had the policy to return the money back if the customer was not satisfied with the product which started to create a trust between the enterprise and the customers. So these interlinks of trust helped the small enterprise X to overtake the large enterprise Y which eventually failed due to lack of trust with the customers even though the finance agencies trusted Y much. The other major advantage in X’s success was the use of raw materials which contains no hazardous chemicals. They also, relied on their own workers who worked as a team in packing the final products and delivering them. With out having any legal environment to govern the activities of company X, it gained 100% trust from the common public to its own competitors. The company X trusted their employes by looking after their grievances through simple and direct communication strategy. The behavior of the employes and the organization was such that they were ready to appreciate their competitors technology and experiences. As a cottage industry the company X’s marketing strategy was through door to door campaigning with out having any advanced e-advertising and e-business systems. Their logistic system was so simple with out expensive fleet of trucks for product deliveries and supplies. When an organization stops delivering on its promise on integrity, people lose trust and eventually business fails. So the trust and integrity translate to wealth through relationships. This scenario clearly illustrates that the relationship between a company and its customers starts through simple and single transaction. If the company provides something of value to its customer, which engenders trust and so the customer continues to return, the benefit of each single transaction is multiplied for the company in revenue and future growth.

In Fig. 3 the X axis represents individual uncertainties due to inside factors whereas the Y axis represents the total uncertainties due to same factors of the business system for various process constants \( K \). In Fig. 4 the X axis represents individual uncertainties due to inside factors for increased empirical constants which are factors covering the annual investment, number of employees and vacation packages and the Y axis represents the total uncertainties due to same factors. The individual factors are incremented by a very small quantity then the corresponding uncertainty values are shown in the Y axis as shown in Fig. 5 and Fig. 6.
VI. CONCLUSION

A context sensitive trust model for a business system is proposed and formally specified. The various factors within the business organization and outside the organization which are responsible for the trust issues are discussed. The interrelated trust flow of all the entities are considered to predict the trust of the customers on the finished product. The generic approach for the prediction of the consumer trust on the finished goods is given in terms of the individual trust on each entity. The scope of the work has assumed that there is no security violation and privacy overlooks within the business organization considering the trust relationship between man to machine and machine to systems in different context the trust factor varies due to micro level inter personal relationship between the employees and the macro levels inter organizational relationship between establishments like banks and legal authorities. The work may be further improvised by considering the distributed nature of the business and the trust policies of various intercontinental trust standards and their compliance policies in the case of software businesses.

REFERENCES

[5] Antitrust Division Manual Antitrust Division, Department of Justice Chapter II July 2009