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# Identifying Information Systems Security Requirements for Different Organizational Forms: A transactions cost approach

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## ABSTRACT

Organizations find it imperative to implement measures geared towards protecting the information assets. The research problem is to identify information systems security requirements for various organizational forms. Management theorists have argued that organizations represent stable patterns of transactions between individuals. In the realm of transaction cost economics, the flow of information between transacting parties represents an organizations information system. Therefore adequate security of the information resources of a firm helps in lowering the transaction costs thereby ensuring efficiency in firms' business operations. The argument of the research paper is that we need to move beyond technical measures and implement governance, as well as, normative measures of information systems security so as to transactions cost economize.

## Keywords

Information systems security, organizational forms, transactions cost approach.

## INTRODUCTION

Organizations have different architecture which varies in structure and scope. Various organizational forms exist currently and efficient organizational architecture can further emerge to meet the changing requirements. An increasing amount of organizations are dependent on information systems to conduct and support their daily operations. This has also contributed to a phenomenal presence of the sensitive information accessible through the information systems of different organizations. With a growing threat to the information systems, organizations are hard pressed to develop and implement measures that are geared towards securing the information assets deemed critical for their existential thrive. We need to know the IS security requirements that would enable protection of the information assets of an organization.

The research problem of this paper is to identify IS security requirements for various organizational forms. The theoretical lens through which we look at this problem is transactions cost economics (TCE). It allows us to view an organization as a network of transactions between individuals. The premise of transaction cost economics is that the transactions should be aligned with the governance structures in a transactions cost economizing manner. This dictates the relation between transactions costs and organizational forms. Each transaction is further governed by a contractual relationship. The transactions cost increase as we move from structured to an unstructured contract. As per TCE, the change of organizational form from market to bureaucratic organization is driven so as to economize on certain expensive transactions. The argument of this research paper is that as the nature of contractual relationship changes from structured to an unstructured contract and transactions cost increase, we need to move beyond technical measures and implement governance, as well as, normative measures of IS security. Adequate security of the information resources of a firm would help in lowering the transaction costs thereby ensuring efficiency in firms' business operations.

This paper is organized into five sections. Following a brief introduction, section two presents TCE. This section also discusses the suitability of transactions cost for studying IS security. Section three presents the conceptualization of IS security for various organizational forms. Section four provides a discussion on the lessons learned from transactions cost analysis of IS security for organizations. Finally, section five presents the conclusions.

## TRANSACTIONS COST ECONOMICS

In the seminal paper, Coase (1937) addressed the issue as to why the organizations exist. He argued that the operation of a market is associated with certain costs and by forming an organization the marketing costs are saved (1937:392). Ouchi

(1980:140) explains that under certain specifiable conditions, bureaucratic organizations are the most efficient means for an equitable mediation of transactions between parties. The argument forwarded by TCE is that transactions should be aligned with governance structures in a transaction-cost-economizing manner (Williamson, 1988: 73). In the long run, the structures with better transactions cost economizing properties will replace the ones with worse properties. In other words, transactions cost analysis involves examination of comparative costs of planning, adapting and monitoring task completion under alternative governance structures (Williamson, 1981).

An organization can be viewed as any stable pattern of transactions between individuals or aggregation of individuals (Ouchi, 1980:132). As per Williamson (1981:552), a transaction is said to occur when a good or service is transferred across a technologically separable interface. The author considers transactions cost to arise as a result of an economic exchange. Ouchi (1980:130) defines transactions cost as any activity which is engaged in to satisfy each party to an exchange that the value given and received is in accord with their expectations. It includes ex ante costs as drafting and negotiating contracts and ex post costs as monitoring and enforcing agreements (Rindfleisch and Heide, 1997:31).

Ouchi (1980) describes transactions cost problem as the one which requires various organizational forms to reduce either ambiguity of performance evaluation or goal incongruence in order to mediate transactions efficiently. The different forms of organizations exist because they are able to offer the lowest transactions cost under certain conditions. In accordance with transactions cost approach, Williamson (1981) attributes the existence of various types of organizations to the vast differences in transactions. Subsequently, efficiency is only achieved if the governance structures are determined as per the specific needs of each organization. As Coase (1937: 390) argues, the cost of discovering the relevant prices, negotiating and concluding a separate contract for each exchange transaction which takes place on a market are few of the costs of using the price mechanism. These costs must be taken into consideration.

TCE has been employed to study authority relations, integration problems, communication costs and corporate structure. Dow (1987) questioned the functionalist imputation of efficiency to observed governance structures in explaining the appearance of authority relations. Masten (1993) argues for a combined approach involving TCE insights regarding the selection of governance arrangements and strategy's orientation towards performance. In addressing integration problems, Anderson and Schmittlein (1984) argue for transactions-cost considerations as important determinants. Masten, Meehan and Snyder (1991) also investigated the role of internal organization costs in integration decisions. In studying communication costs, Casson and Wadeson (1998) focus on how communication is structured across the boundaries of the firm. Bolton and Dewatripont (1994) suggest that an efficient network must have a centralized design for communication costs economizing. Demsetz and Lehn (1985) explored the nature of the structure of corporate ownership. The authors argue that the structure varies in consistency with value maximization. Fama (1980) also investigated efficient forms of economic organization within the "set of contracts" perspective.

In IS research literature, TCE have been predominantly utilized to research IS outsourcing. Beath (1987), Klepper (1993) and, Lacity and Hirschheim (1993) used TCE as a theoretical framework to describe and explain the IS outsourcing phenomenon. Loh and Venkatraman (1992) used components of TCE as determinants of IS outsourcing. Aubert, Rivard and Party (1994) employed case study methodology to establish the relevance of using TCE to understand IS outsourcing. Cheon, Grover and Teng (1995) analyzed the use of TCE in reducing the costs in an outsourcing situation. Loeff (1997) developed a comprehensive model on the basis of TCE to assist in outsourcing decision making. Reekers and Smithson (1996) and, Bensaou and Venkatraman (1996) utilized TCE to study inter-organizational coordination and relationships. Clemons, Reddi and Row (1993) examined the impact of information systems on three components of transactions cost: coordination costs, operation risks, and opportunism risk.

### **Using TCE to study IS Security**

The aim of IS security, as per the traditional view, is to ensure confidentiality, integrity and availability of information systems in an organization. An information system involves handling information at the technical, formal and informal levels of an organization. As Dhillon (1995) argues, managing IS security to a large extent equates to maintaining integrity of these three systems. "IS security is viewed in terms of minimizing risks arising because of inconsistent and incoherent behavior with respect to the information handling activities of the organization" (Dhillon, 1995). This definition emphasizes the behavioral assumptions inherent to transactions cost approach. The inconsistent and incoherent behavior arise due to the underlying assumptions about human behavior: bounded rationality and opportunism. These behavioral problems would prevent transactions to occur or would lead to inefficient transactions which in turn would increase transactions cost. IS

security would decrease the problems associated with bounded rationality and opportunism. Minimizing risks associated with the behavioral assumptions would also lead to reduction in transactions costs. This discussion informs and allows the use of transactions cost approach to the study of IS security.

IS security provides a secure environment under which transactions can take place in a safe manner. It reduces misappropriated search and information costs by decreasing unauthenticated or corrupted information. IS security is an activity which is engaged in to satisfy each party to an exchange that the information given and received is in accord with their expectations. It assures confidence that the information available for processing has not been tampered with. As such, the cost of coordination is reduced by decreasing the cost of exchanging and processing information. In terms of operations risk, IS security ensures that the requisite information is available when required. The security of communication channels and processing capacity is ensured to allow monitoring the performance of various operation tasks. As such, IS security is able to address the problem of moral hazard and reduce information asymmetries. It also keeps in check the opportunism risk arising out of behavioral uncertainty even with increased information systems standardization and interconnection. IS security establishes a higher level of trust among transacting parties.

The argument of this research paper is that as the nature of contracts in an organizational architecture change and transactions cost increase, we need to move from technical to governance to normative measures of IS security. The argument is based on the understanding that we should interpret IS security in terms of contractual relationships. This would allow us to generate basic measures that would be applicable in varying degrees to different types of organizational architecture. The argument is elaborated and discussed in detail in next section.

## **ORGANIZATIONAL ARCHITECTURE AND IS SECURITY**

The aim of this research paper is to identify IS security requirements for various organizational architectures. The importance of IS security for the existential thrive of an organization is well established in research literature. Organizations cannot afford to ignore the IS security requirements in order to achieve the effectiveness of various business processes to attain the business objectives. Further, the complexities of business world have led to the evolution of complex organizational architecture from simple ones. There are myriad forms of organizations that have been created to negotiate through the uncertainties and complexities associated with the real world. The nature and scope of associated organizational architecture also varies to a large extent from one form to another. The development of IS security measures for all the existing organizational forms would require an effort of large magnitude. Even if we go through this exercise, there is a realistic possibility that another organizational form might evolve. How would we take these into account? In other words, our efforts would be incomplete as different organizational forms would keep on evolving.

One approach to overcome above mentioned problem would be to differentiate various organizational forms into few generic types and identify appropriate IS security requirements. This approach would allow us to overcome the problem of evolving forms as these could be clubbed together under common category. Ouchi (1980) categorizes markets, bureaucracies and clans as three distinct mechanisms of mediation or control that may be present in differing degrees in any real organization. That is, markets, bureaucracies and clans are the three generic organizational forms. This approach seems to be fine but the problem arises in terms of the nature of the forms and industry. In other words, the exchanges move from one domain into another as the form changes from market to clan. The organizational forms as a concept is too abstract to appropriately identify the IS security requirements. We need something more microscopic that would allow us to capture the intricacies of various transactions. We need to focus at micro-level to get a grasp around the nature of various transactions occurring in an organization. TCE insists that the process features of organization be examined in the context of specific contractual relationships (Williamson, 1981). As Williamson argues, any problem that arises or can be reformulated as a contracting problem can usefully be examined in transactions cost economizing terms. We would be able to interpret IS security requirements more thoroughly for contracts than generic organizational forms. Let us look at IS security as a contracting problem.

The primary aim of IS security is to secure an existing information system of an organization. An information system is made up of networks of information flows and files needed to create, set up, control and maintain the organizational network of exchanges and relevant contracts (Ciborra, 1987:62). Exchanges or transactions are governed by contracts which are binding to the parties involved in transaction. "Each exchange is governed by one of three types of contractual relations, all of which can be specified completely...because each party is bound only to deliver that which is specified, the contract must specify who must deliver what under every possible state of nature" (Ouchi, 1980:132). Contract defines the confines or limits according to which the transaction (or exchange) is to take place between two individuals or aggregate of individuals. As per

Coase, the contracts are only reduced not eliminated in the presence of a firm (1937:391). The aim of IS security controls would then be to ensure or reinforce the integrity of contracts to enable successful transactions. Transaction would be successful only if the parties involved abide by the overarching contract. Only then would IS security be able to reduce transactions cost and decrease the costs of coordination, facilitate performance monitoring and control opportunism risk. As such, we have reformulated IS security activity as a contracting problem.

The contract relations govern the transactional exchange that would take place between different parties. As such, it makes more sense to develop IS security requirements for each type of contractual relation. As these security measures would take into account the nature and scope of different types of contracts, we would be able to ensure that each transaction is taking place in a secure way. In this manner, we can generate IS security requirements that are general enough to be successfully implemented across different organizational architecture.

### Nature of contractual relations

Ouchi (1980:132) identified three types of contractual relations: spot contract, contingent claims contract, and sequential spot contracting. In spot contract, various contractual obligations are fulfilled at the very moment, that is, on the spot. The limitation of this type of contract is that it cannot deal with future transactions. Ciborra (1987:63) classifies this type of contract as a structured contract.

The second type of contract is the contingent claims contract. In this contract, all scenarios that can become possible in the future are drawn out and thought about. Then, obligations of each party to an exchange is fleshed out and specified against each possible scenario. The limitation of this contract is the inherent assumption that the future can be completely predicted and grasped. This leads to the problem of incomplete contract specification against uncertain future and behavioral weaknesses, like bounded rationality and opportunism, exhibited by individuals. Ciborra (1987:63) classifies this type of contract as a semi-structured contract which covers longer time period and is open in nature. This contract permits adaptation and modifications in later stages only if carried out at low costs.

Sequential spot contracting is the third type of contract as advocated by Ouchi (1980). The underlying assumption is that the future can be somehow dissected into short periods of time within which one can confidently predict the future outcomes. If the assumption holds, we can draw a sequence of contracts over short periods that have been reduced to behave like spot contracts. This type of contract overcomes the problems of uncertainty and bounded rationality. However, the problems arise when the suppliers gain specialized knowledge related to the goods exchanged and are able to bid effectively for contracts. This restrains other potential competitors from bidding and hence leads to a situation of small numbers bargaining. Ciborra (1987) acknowledges unstructured contracts as the third type of contracts. These are concerned with exchanges which cannot be specified or modeled in an explicit contract form.

### Identifying IS Security Requirements

For the purposes of this paper, we would adopt Ciborra's (1987) terminology on contractual relationships as it more closely reflects the domain of information systems. The IS security requirements would be interpreted against these three types of contracts: structured, semi-structured and unstructured contracts (Table 1).

Contract	IS Security control	IS Security Principles
Structured	Technical	Confidentiality, Integrity, Availability
Semi-structured	Governance	Responsibility, Integrity (membership), Integrity (data)
Unstructured	Normative	Trust, Ethicality

**Table 1. IS security controls for different types of contracts**

#### *Structured contract - technical measures*

In structured contracts, there are no uncertainties or ambiguities involved. The terms of contract for each party are clear and fulfilled on the spot. For this type of contract, the traditional principles of IS security - confidentiality, integrity and availability, would ensure that exchange takes place according to the expectations of the parties involved. Technical measures of IS security would be adequate to ensure successful execution of the transaction.

*Semi-structured contract - governance measures*

Semi-structured contracts are of longer duration and are open in nature. That is, certain aspects of the contract are not clearly specified to account for the uncertainties of the future. The contract does involve objective specifications to cover different possible future scenarios. Also, the terms of the contract has to be guarded against behavioral limitations of individuals. Towards this end, governance measures can be established in order to ensure successful execution of transaction. The governance measures would entail formal controls that would provide guidance in the form of rules to be followed in various situations. IS security principles of responsibility (of roles), integrity (as in membership) and integrity (of data) would guide the setting up of governance measures to ensure that the terms of semi-structured contracts are observed till transaction completion.

*Unstructured contract - normative measures*

Unstructured contracts govern the transactions that cannot be appropriately specified or formalized in explicit contract form. In order to guard against the threat of opportunism normative measures need to be established. These measures would be informal controls that need to be ingrained to encounter the ambiguities and non-specification of contract terms. Here, the terms of transaction are not explicitly written in the contract form and as such is exposed to hazards of opportunism. The delicate intricacies or complex nature of transaction involved might be a reason for the failure to adequately capture the contract terms. In such cases, IS security principles of trust and ethicality would primarily inform the normative measures to be established.

The transactions cost increase as we move from structured to semi-structured contracts. In order to address this increase, we would implement governance controls of IS security in an organization. As the transactions cost increase when we move from semi-structured to unstructured contracts, it would be prudent for an organization to adopt normative IS security controls. In short run, the transaction costs in an organization would increase as a result of introduction of various IS security controls. This is because the organizational members might not be comfortable conducting their work in the wake of newly implemented IS security controls. There would be a certain learning curve associated with adopting newly implemented controls as part of the daily work. In the long run, the transactions cost associated with the IS security controls would decrease.

The types of contracts discussed above would be present in all forms of organizations. However, depending upon the organization a specific type of contract would be prevalent as compared to others. That is, the three types of contracts would be present in varying degrees in different forms of organizations. Consequently, certain IS security controls would also be dominant in a specific organizational form (Table 2).

<b>Organizational form</b>	<b>Informational requirements (Ouchi, 1980)</b>	<b>IS Security emphasis</b>
Market	Price	Technical
Bureaucracy	Rules	Governance
Clan	Traditions	Normative

**Table 2. IS security controls for different organizational architecture**

In the market form, transactions are simple in nature and occur instantaneously. There are no uncertainties or ambiguities involved. It simulates real world where a buyer learns about the price of a good from seller and decides whether to buy it or not. If the buyer decides to buy the good, the good is exchanged in lieu for the currency equivalent to the asking price. The price is the only required information to make decisions (Ouchi, 1980). The structured contract is dominant in the market form. Hence, the emphasis of IS security would be on the technical controls. Implementation of these controls would ensure that the market form of organization has taken adequate measures to protect its information systems.

In bureaucracy, the employment relation comes into existence and the transactions become slightly complex. The authority relation becomes a requisite to efficiently perform the operations. The employment relation is an incomplete contract contingent upon the conditions of opportunism and submission to authority. Rules are the informational requirement for this organizational form. The semi-structured contracts are dominant in this form. Here, the emphasis of IS security would be to enact governance controls. Implementation of governance controls would allow tackling the uncertain future in a secure manner.

In clan, high level of ambiguity and uncertainty associated with transactions exists. Solidarity or goal congruity reign supreme in clans. Common values and beliefs dictate the dynamics of clan with traditions providing the requisite information. As such, the dominant type of contract is the unstructured contract. Normative controls need to be established so as to achieve the IS security objectives in clans.

The above discussion does not imply that only particular controls need to be implemented in an organization. It is important to address and establish technical, governance, as well as, normative controls in order to achieve the IS security objectives. However, in certain types of organizations we should pay special attention to a specific kind of control that would help secure the dominant type of contract. For instance, in bureaucratic organization all three types of IS security controls are necessary to meet the IS security objectives. That is, we need to establish technical, governance and normative IS security controls for a bureaucratic organization. However, the emphasis of IS security program should be towards establishment of governance controls. In other words, we should expend our maximum efforts and resources on governance controls. The argument of this research paper is that as the nature of contracts in an organizational architecture change and transactions cost increase, we need to move from technical to governance to normative measures of IS security.

## DISCUSSION

IS security controls should be implemented according to the nature of the contractual relationships. The transactions cost increases as the nature of contracts changes from structured to semi-structured to unstructured contracts. In order to economize on transactions cost, we need to move beyond implementing only technical controls and pay attention to governance, as well as, normative IS security controls. If we address IS security in terms of transactions or contracts, we are forced to think beyond technical measures and acknowledge governance and normative aspects of IS security as well.

The question arises as to what drives IS security. Is it the value attributed or transactions cost that drives IS security? Why should an organization implement different types of IS security controls? The value perspective, that is, the greater the importance of an information asset the greater the security controls that need to be implemented is problematic. The higher value or importance attributed to an information asset would push us to increase security controls around the information system. In turn, we would keep investing in technical security so as to make it stronger. This approach would not make us sensitive to recognize the softer, governance and normative, aspects of IS security. Let us approach the same issue from transactions cost point of view. We would implement IS security controls because we do not want to get into the hassle of restoring back our crashed systems or trying to find the same information (which was lost) again, for example. In these cases, we might have to involve certain agencies (internal or external) to help restore things to normalcy. These are indeed transactions costs. As such, we would implement IS security controls in order to reduce potential transactions cost.

Let us understand the argument using an illustration as a thought experiment. Let us consider a fictitious company, Feelgood Corp, which develops electronic components for defense industry. The design plans and programs required to develop the electronic components are very important to the organization. These provide Feelgood a competitive edge over its competitors. Now, why would Feelgood implement IS security controls? Let us consider that Feelgood would implement these controls because design plans and programs are valuable to it. So, Feelgood wants to protect the information assets. How do we protect it? In order to do so, we would implement technical security controls. We would ensure confidentiality, integrity and availability of the system on which design plans and programs are stored. Let us increase the stakes and say that the information assets are really critical to Feelgood. We need to protect these assets really well. In turn, we would implement more technical controls, maybe invest in cutting edge (state-of-the-art) initiatives in IS security. That is, approaching IS security from value perspective would lead us to recognize or address IS security as technical controls issue. We fail to see the importance of normative and governance aspects of IS security. These remain obscured from vision.

Now, let us take transactions cost approach. Feelgood wants to implement IS security controls because it does not want its information assets to be compromised. Why? Because it would be a hassle to either redo or restore them. Why? Because we might have to deal with different agencies and different employees (both governed by different controls) to work together and develop similar plans or programs. Alternatively, we may try to purchase them off-the-shelf and tinker it as per requirements, purchase them through a consulting or research house, or take assistance from a sister organization. However, all these efforts would involve varying degrees of transactions costs. The adoption of any one of these procurement means would result in tremendous increase in transactions cost. There would be more complexity, uncertainty, and confusion involved. Therefore, Feelgood Corp would implement IS security controls so to minimize potential transactions costs. What kind of IS security controls shall Feelgood implement? The answer to this question would depend upon the relationship or nature of contract between different agencies.

## Concerns

In information systems literature, it is well established that an organization can be defined as a series of information handling activities which can be undertaken at three levels – technical, formal and informal; and the system for handling information at these three levels is an organization's information system (Dhillon, 1995). In terms of transactions cost approach, research literature has viewed an information system as a mediating technology. This might be true about technical edifice. But, how can we justify formal and informal information systems as mediating technology. Further, information systems has been considered as means of reducing transactions costs (Ciborra, 1987). The use of 'means' in the statement is pretty broad, which is open to different interpretations. The problems with transactions cost theory has also been attributed to the presence of language ambiguities in the literature related to the use of its concepts. The above statement regarding transactions cost reduction is no exception. Yes, information systems is means of reducing transactions cost. But how shall we approach information systems in terms of transactions cost theory. The problem is whether we should consider information systems as a direct transactions cost or as part of governance mechanism. If we look at information systems as per the definition of transactions cost, it seems to be a transactions cost. On the other hand, information systems seem to be a form of governance mechanism too. It assists in transferring information efficiently. As Ciborra describes, information systems maintains organizational network of exchanges and relevant contracts. In this role, it is clear that it is in a position to reduce transactions cost. In a firm, transactions cost without information systems would be greater than transactions cost with information systems.

In this research paper, we consider IS security as a governing mechanism. This statement does not have any language ambiguity. It is clear about how we approach IS security in terms of transactions cost theory. This statement might not be agreeable to every researcher. However, it can be considered as an attempt to reduce language ambiguity. Dhillon (1995) argues that managing IS security equates to maintaining integrity of the three systems – technical, formal and informal. It is prudent to view IS security as a business enabler. This would entail certain costs. These governance costs are in actual the associated transactions cost (Malone, Yates & Benajmin, 1987). The transactions cost in a firm with an information system but without IS security would be greater than the transactions cost in a firm with appropriate IS security controls in place. As Coase (1937) argues, governance structures would reduce transactions cost not eliminate them.

## CONCLUSION

In this research paper, we have approached IS security as a governing mechanism that would economize on transactions cost by providing a secure environment to enable transactional exchange. Dhillon & Backhouse (2000) have raised concern against the practice of implementing technical IS security controls only. Transactions cost approach to IS security forces us to think beyond the technical measures. It guides us to consider the governance and normative measures in any equation devised to address IS security concerns in an organization. The paper argues that IS security requirements should be identified against the contractual relations governing various transactions between individuals. Future research would entail empirical testing of the theoretical implications outlined in this paper. The limitations of this research arise from the use of TCE as a frame of reference. We assert that transactions cost approach is useful as a theoretical basis to identify information system security measures for different organizational architecture.

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