ITG practices in telecommunication companies: A Complex Adaptive Systems Perspective

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Abstract

In recent years, the standardization of corporate governance practices has become increasingly important as a means for businesses to increase their control over their information assets. Many leading organizations have sought to improve their ITG structure in order to minimize the risks associated with IT management, putting in place clear and workable rules and responsibilities for agents and processes. Effective ITG practices help firms to make judicious, transparent and accountable IT decisions consistent with firms’ ethos of corporate governance. Despite an increasing awareness of the value of good ITG in practice, however, little academic research to date has been carried out on the subject. This paper offers a novel approach to analyzing and understanding ITG practices using a single case study. The study uses the metaphor of a complex adaptive system to examine the ITG mechanisms of a major telecommunication company in Korea. Through analyzing the key issues related to ITG complexity, we identify several governance principles important to the success of design implementation.

1. Introduction

In recent years, the standardization of corporate governance practices has become increasingly important as a means for businesses to increase their control over information assets. In the wake of major corporate and accounting scandals like those of WorldCom, Tyco International, Enron and Arthur Andersen, new regulation, such as the U.S. Sarbanes-Oxley Act (SOX), has emerged, advocating auditor independence and enhanced systems of corporate governance and financial disclosure (USA, 2002). Since most financial reporting relies on information systems (IS), there is a necessity for businesses to be able to manage and report data in a secure, reliable and accurate manner as a precondition of compliance with SOX. In this environment, many leading firms have sought to devise coordinated policies for the governance of their IT assets, placing IT in the context of an effective larger scheme of corporate governance (CG). IT compliance is often perceived as highly complex due to the evolutionary development of IT systems and the unwieldiness or co-evolution of IT management structures. In standardizing IT management structures, however, leading firms have been able to minimize risks associated with the control of information by clearly defining persons and processes’ IT roles and responsibilities. A recent ITG (ITGI) survey of 695 organizations in 22 countries reports that 87% of participants considered IT crucial to the delivery of business strategy, further perceiving that good ITG practices would improve firm accountability, transparency and the effectiveness of IT-related decisions (ITGI, 2006).

Despite businesses’ growing interest in ITG, however, there is a lack of understanding, in the literature at least,
of governance issues in this area. While a number of articles have been published the context of ITG as aligned with business strategy, the drivers of forms of structural evolution for business IT have yet to be explored theoretically from a socio-technical perspective. This paper, therefore, seeks a novel approach to analyzing and understanding ITG practices, looking at a single case study, in which the metaphor of a complex adaptive system (CAS) is used as a frame through which to examine the ITG practices of a major Korean telecommunication company. Through analyzing the key issues relating to ITG decision-making structures and governance mechanisms, we identify several governance principles crucial to firms implementing an ITG system fully compliant with reporting requirements.

The paper is structured as follows. The next section briefly presents a current literature review of ITG, complexity theory and complex adaptive systems literatures. Each domain is introduced descriptively. The third section describes our research methodology and the basis on which we propose an ITG framework in which to study a given case; this is characterized by five different ITG decision-making domains defined in the terms of CAS. Our conclusion considers how the proposed framework may be to some extent re-specified for the purpose of examining ITG practices from a socio-technical perspective, before proceeding to summarize a set of recommendations for the design of ITG principles.

2. Literature Review

2.1 ITG Research

After the large-scale accounting frauds of Enron and WorldCom, many companies have become more aware of the need to improve CG to clarify and effectively monitor the roles and responsibilities of shareholders, management, and employees (Brown 2005) in running businesses. According to the OECD Principles of CG (2004), the relationships between stakeholders, e.g. managers, the board of directors, and investors are critical in CG in strengthening firms' economic efficiency and in sustaining investors' confidence. The structuring of these relationships determines how a corporation sets its goals, pursues them and practically implements action plans in strategies' execution. Investors, meanwhile, will be predisposed towards firms seen to adhere to good CG principles. Further, the more internationalized the investment, the greater the importance for investors and others of CG principles. For Xavier Vives (2000), corporations are run by professional managers who in the absence of a direct link to investors must resolve classic economic problems of ‘adverse selection’ and ‘moral hazard’. Vives defines CG as a tool helping firms to overcome these problems. Shleifer and Vishny (1997) suggest that CG allows investors to assure themselves of a profit for the funds they invest, adding that CG schemes constitute the best forms of company structure, tending to maximize management performance, from investors' point of view.

In these terms, excellent CG leads to the efficient distribution of resources and capital, maximizing profits and operated under a set of governance principles. In situations where the management and ownership of companies are split, CG systems effectively give owners a claim in management decisions, thereby safeguarding shareholder rights. A related factor in securing efficient corporate management is the publicization, in good time, of all information influencing firms' management activity. Vishwanath et al. (1999) define information transparency as a flow of credible and well-timed economic, social and political information, while Bushman and Smith (2003) understand the same term as the widespread availability of relevant, reliable information on the periodic
performance, financial position, investment opportunities, governance, value, and risk of publicly traded firms. The publication of management data obliges a major actor in corporate performance i.e. management to take responsibility for the collective interests of a corporation and its shareholders (OECD, 2004).

Although the term ‘ITG’ (ITG) was initially used in the early 1990s by Loh and Venkatraman (1992), together with Henderson and Venkatraman (1993), to describe a series of mechanisms that helped best utilize a corporation’s IT capabilities, the term failed to gain much attention in academic research domains until Brown (1997) and Sambamurthy and Zmud (1999)'s formulation of ‘IS Governance Frameworks’ in the late 1990s. In recent years, ITG has been defined by academics and in different research institutions in various ways. ITG can refer to the organizational skills or capabilities developed in tandem by businesses and the IT sector in order to pursue synergies (Grembergen, 2003); it may also designate processes, including organizational, for the sharing and monitoring of IT decision-making powers (Weill and Ross, 2004). These processes further define the role of business leaders in contributing to overarching systems for delivering corporate strategy (ITGI, 2001). Common to all of these definitions is an understanding of ITG as a component of CG more broadly, involving the participation of board members, management, and IT managers in a firm's pursuit of its objectives. ITG also touches on activities such as creating value through strategic alignments between IT and business, improving transparency in IT investments, increasing productivity through IT services and applications, and designing mechanisms of risk control in the management of company data and investment.

These diverse definitions and multiple perspectives make the task of developing integrated ITG frameworks even more urgent for companies. In relation to decision-making and accountability, Weil (2004) divides the IT decision-making process into five separate categories: IT principles, IT architecture, IT infrastructure strategies, business application needs, and IT investment and prioritization. Weil assigns to each category six different governance archetypes: either of business monarchy, IT monarchy, feudal structure, federal structure, IT duopoly, or anarchy; this classification aims to understand which ITG archetypes best fit given corporate environments, and further which governance mechanisms, i.e. organizational structures, procedures and policies best organize these archetypes in firms' effective implementation of ITG. Simonsson and Johnson (2006) view ITG as related to IT decision-making processes deploying corporate assets such as hardware, software, business processes, human resources, and strategic goals. Their consolidated ITG framework is based on three dimensions: decision domains (e.g. types of decision-making related to goals, processes, persons and technology), decision scope (e.g. decision levels according to time-length and organization), and decision making processes (e.g. the relationship as framed and monitored between IT and the real world). The authors combine these dimensions to present an integrated framework offering rules or standards for preparing, selecting, and executing decisions relating to the tactical and strategic aspects of ITG. Webb (2006) defines ITG as a means of strategic alignment connecting IT with other business functions in order to maximize the business value of IT control systems; this is done through devising appropriate structures of IT development and maintenance, delegating responsibilities, managing performance and managing risk. According to this conception, strategic alignments, IT value transfers, performance management, risk management, internal regulations and responsibility delegation all count as components of ITG, which is related to CG as a sub-system for managing strategic information. Peterson (2004) develops an ITG framework concerned to run and supervise a more intelligently strategic IT decision-making process; this involves the delegation of responsibility and decision-making on IT-related issues to various interested stakeholders within a
corporation. Lee et al. (2006) develop a combined ITG framework based on a core set of ITG decision domains (Strategic Alignment, IT Resource Management, IT Investment Management, IT Performance Management, IT Risk Management), together with three main organizational IT activities (IT Planning, IT Development, IT Operations), to analyze governance mechanisms of two different companies in Korea. Their comparative case study suggests that better systems for coordination and control, conducing to greater transparency, efficiency and accountability, would be required to improve practices of corporate governance.

A number of scholars and practitioners have attempted to present diverse ITG frameworks seeking to fit definitions and models to a range of current environmental conditions. Most proposed frameworks, however, limit themselves to describing the relationship between a certain conception of ITG and some idea of CG; further, works tend to be offered in the absence of any empirical study that might validate their proposed frameworks. This lack of validation is disturbing as IT is an important component of company strategic activity, especially insofar as CG determines and regulates overall firm direction (Grembergen, 2005). It is important, then, not to envision IT resources as independent or separate assets, but rather as elements of corporate resources whose efficient deployment will maximize company return on investment (ROI). According to the ITGI (2001), and to Weill and Ross (2004), boards of directors must have a strong strategic vision for IT in general, specifying the financial benefits and corporate goals that may be attained through technology. Further, boards should establish an IT strategy committee, overseeing operations, control, value transfers and risk management. Many research approaches suggest that ITG should inherit and seek to put into practice the attributes of wider CG.

2.2 A Complex Adaptive System Theory

New technological developments and market demands have precipitated dramatic structural and operational transformations in business, entailing the reconfiguration of whole industries and processes. Contemporary value chain networks (VCNs) are no longer static but may be viewed as evolving or dynamically changing over time. Each VCN is comprised of a number of actors representing firms or different levels of organizational entity or function (e.g. marketing, manufacturing, sales, IT development teams) within companies (Lee, 2003). These actors interact with each other to create complex new orders. Research addressing these issues has recently begun to turn to methods developed for the study of emerging complexity across physical, biological and social science (Benbya and McKelvey, 2006). In these fields, complexity is typically understood as an emergent property of systems, as systems comprise a larger number of self-organizing actors interacting in dynamic and non-linear fashion. Complexity theory emphasizes the order and disorder of social systems existing on the edge of chaos but shaped by positive feedback (Dooley, 1997). Business and management literatures, then, borrow concepts and theoretical frames from harder sciences in proposing frameworks for the description and analysis of organizational dynamics in corporations and other human institutions.

The first step towards characterizing complexity of organizations, e.g. businesses in the terms of this field of research is to identify features corresponding to CAS properties, e.g. shifting patterns of interaction between network participants. Holland (1988, 1995), Markovsky (1998) and Benbya and McKelvey (2006) explain that such adaptations of organizational network exhibit many of the attributes of objects in complexity theory. These attributes may be organized under the categories of ‘Connectivity and Interdependence’, ‘Co-evolution’, ‘Far from equilibrium’, and ‘Self-organization’. In this section, we explain how these attributes may be brought to bear on real examples in case study analysis.
(1) Connectivity & Interdependence

In a complex network, each actor has its own forms of connection and interdependence with other actors; its actions may exert a significant impact on other actors and on its environment. Complex behaviors arise out of the interaction of different actor actions; connectivity also defines the level of inter-relatedness of each actor within a network comprising both human and systemic (i.e. IS) features or artifacts. A network's degree of interdependence, or fineness in inter-actor responsiveness, is often determined by its degree of inter-actor connectivity (Axelrod and Cohen, 1999). Intense interconnectivity creates multiple and intricate dependencies throughout a system. In supply chain management literature, the bullwhip effect phenomenon (Lee et al., 1997) is a classic example of how interdependence may create unforeseen consequences, as volatility is magnified as orders pass up an interconnected chain. Lower degrees of connectivity, by contrast, create damping effects, reducing responsiveness while minimizing network disruption.

This paper understands networks' level of connectivity and interdependence as one aspect of how complex behaviors arise and are managed decision processes in ITG domains. However, some actors within a decision domain will also be affected by other dimensional sources of behavioral change, such as social, cultural, technical, economic, political and global concerns (Axelrod and Cohen, 1999). These sources may be considered as external variables in any network and as themselves drivers of network change. We are concerned here to use the vocabulary of agents' inter-connection with others to describe the inter-relationships of persons and processes in the regulation of IT activities.

(2) Co-evolution

Another question posed by complexity theory is whether any actor network may plausibly be described as an ecosystem. Kauffman (1993) uses the terms of biological complexity theory to posit the process of co-evolution as an ongoing development in which every network actor is influenced by the actions of every other. A typical example of a co-evolution process, then, might be a merger between actors. The evolution of one network will conceivably be dependent on the activities of each actor within another network (Dooley, 1997). This paper examines co-evolutionary processes in the design of governance mechanisms in terms of the interaction of actors to create whole eco-systems. Kauffman (1993) uses a metaphor of hill-climbing to explain the fitness value and fitness landscape of network ecosystems. For this concept, every network environment may be thought of as more or less mountainous according to a qualitative measure. For instance, if two competing networks have co-evolved to solve a single problem, the distribution of fitness value will be less mountainous, meaning that the landscape as a whole may be subject to sudden deformation. This may have catastrophic effects on the company as a whole.

(3) Far from equilibrium

The assumption of traditional systems thinking was that systems were stable or in an equilibrium state. Complexity theorists suppose that networks are capable of realignment and change when they arrive at points designated as being ‘far from equilibrium’ or far from a stable state (Cramer, 1993; Mainzer, 1994). If, for instance, unforeseen events occur within a network, ripple effects e.g. in terms of quantity variabilities, output and flow will be precipitated; these may also lead to changes in network configuration. Chaos states generally resolve into stable states when the network finds new orders and a new network structure (Lichtenstein and McKelvey, 2004). When
systems are forced to deviate from stable states, actors are able to explore new opportunities, entering into a ‘space of possibilities’ or ‘edge of a chaos’ in which they may find pathways towards creating new patterns of network relationships.

This paper specifically explores actor and network behaviors arising from network deviations from an equilibrium state as a variety of actors cooperate in or converge upon the reorganization of ITG processes. The idea of a ‘far from equilibrium state’ can be applied to explain the evolution of patterns of relationships shaped by the emergence of new technologies or technological requirements. This model also allows us to identify new sources of space possibilities and alternative paths for actors towards network solutions.

(4) Self-organization

CAS has also typically deployed a concept of self-organization, understanding that term to describe an actor's robust or proactive reaction to stimuli in performing tasks on the basis of its knowledge and resources (Kauffman, 1993; Holland, 1995). Actors do not simply act in response to their environment, but also exhibit goal-oriented behavior in taking the initiative. Certain changes in actors’ internal and external environment may activate goals requiring actors’ immediate action.

While earlier research has focused on manufacturing complexity, other research works deploy CAS in the context of different IS fields. A number of contributions consider IS development (Benbya and Mckelvey, 2006), information as such (Moser and Law, 2006), large scale system change (Chae and Lanzara, 2006) and information processes (Kallinikos, 2006). Kovas and Uendo (2004) draw an analogy between the properties of CAS and information systems design for business. Mufatto and Faldani (2003) and Van Aardt (2004) likewise compare open source software to information systems development, where open source tools represent a bottom-up approach which can eventuate in a robust software design. Kim and Kaplan (2006) use CAS properties to model IS engagement between software systems and business organization. Janssen and Kuk (2006) deploy a CAS framework to understand how governments' creation of an Enterprise Architecture (EA), suggesting design principles improving alignment between IT and business units.

3. The Proposed Framework and Research Design

In order to understand an enterprise's management of its IT resources, this research selected a single case study (of a leading Korean telecommunication service provider) as an initial point of reference. Our analysis uses this case study's design to make explicit both its research model and unit of analysis, thereby clarifying the context and problem boundaries of a real-life phenomenon (Eisenhardt, 1989; Yin, 2002). Case study research can be positivist, interpretive, or critical, depending upon the underlying philosophical assumptions. Yin (2002) and Benbasat et al. (1987) advocate a positivist mode of research, while Walsham (1993) goes beyond data-collection to suggest interpretations of cases, in line with notions that case studies may test or disprove theories (Benbasat, 1987). The proposed case study framework adopts Weil and Ross (2004)’s research framework in segmenting ITG practices into five subfields: IT principles, IT infrastructure, IT architecture, Business Application Needs and IT investment and prioritization as shown in table 1. We then seek to describe each governance domain in terms of its CAS characteristics.
Table 1  ITG decision domains (Source: Weil and Ross, 2004)

<table>
<thead>
<tr>
<th>IT Decision Domains</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT Principle</td>
<td>High-level statements about how IT is used in the business</td>
</tr>
<tr>
<td>IT Architecture Decisions</td>
<td>Organizing logic for data applications, and infrastructure captured in a set of policies, relationships, and technical choices to achieve desired business and technical standardization and integration</td>
</tr>
<tr>
<td>IT Infrastructure Decisions</td>
<td>Centrally coordinated, shared IT services</td>
</tr>
<tr>
<td>Business Applications Needs</td>
<td>Specifying the business need for purchased or internally developed IT applications</td>
</tr>
<tr>
<td>IT Investment and Prioritization Decisions</td>
<td>Decisions about how much and where to invest in IT, including project approvals and justification techniques</td>
</tr>
</tbody>
</table>

The study selects as its unit of analysis the ITG practices of a major Korean telecommunications firm. Data collection was carried out through trustworthy institutions, and in-depth interviews held with the firm's CIO, IT team leaders, and other operational staff. The selected company was the third biggest by size in its market, and was seeking to improve its competitive position by increasing market share. The company has nine teams operating in the context of an independent IT department of some 40 to 60 members, including an IT planning team, an IT technology team and an IT risk management team. System development and maintenance was outsourced to one of the leading IT service companies in Korea. Our investigation corresponded to the firm's IT organization structure in conducting two semi-structured interviews, each lasting for about two-hours, over two sessions with each team. The interviews were carried out by five researchers. In addition, the company also provided the study with additional documentation concerning its ITG decision domains, including its Information Strategy Planning (ISP), EA framework, IT Service Management (ITSM) framework, IT Return On Investment (ROI) methodology and other supporting materials describing current ITG practices. The interviewees also validated a draft of the study's final report in separate two-hour sessions. In this way the study's procedure conformed with the recommended methodology in the literature based on Eisenhardt (1989) and Yin's norms (1984).

4. Case study analysis

4.1 IT Principles

One important aspect of firm-level IT is IT's role in supporting business units to execute company-wide objectives and strategies. Determining the role of technology in such strategies requires the analysis of business directions, including the determination of plans, goals and the articulation of IT in their delivery. IT-related activities and processes, and the interfaces and forms of relationship between IT and other business domains, may be defined at this stage. The presupposition of IT-decision domains may also be used as a cascading tool to define desirable behavior for both IT and business units. Clear IT principles, once determined, can lead to firms developing a single understanding of the effective management of IT resources according to a framework whereby information may be accessed at board level (Weil and Ross, 2004).
The company under review devised a corporate strategy with respect to IT in terms of certain mottoes defined as ‘the development of an IT infrastructure supporting strategic decision making’, ‘the enlargement of sales channel capacity’, ‘the development of a flexible information management structure suited to a next-generation data environment’, and ‘the integration of structures for customer information in order to create customer value’. These objectives drew on a mixture of approaches to ITG, as shown in figure 1, some of which were top-down and some bottom-up. Top-down approaches work as mediated tools cascading corporate strategy to IT units, while in bottom-up approaches the activities of units themselves suggest governance mechanisms to senior management. It was found in the company that IT workers and middle managers only engaged in a low level of interaction, with monthly meetings tending to be devoted to operational issues, despite the fact that IT was perceived as crucial to corporate strategy. The levels of business interdependence with IT units was low on account of the absence of ITG principles dealing with other so-called ‘C-levels’. Most principles either regulated the internal behavior of IT units or the reporting of IT management to board level; the effect of IT initiatives were not significant in this last regard. Further, the company determined many IT principles through committees supposing an ‘IT Monarchy’ type of organization, setting only limited operational indicators for IT as defined through Key Performance Indicators (KPI) or other measures. The definition of KPIs was largely left to the CIO and IT teams, who effected strategic alignment with other areas of the business according to their own judgment. In effect, CIO and IT team leaders set an annual target for IT activities updated according to the business unit’s strategic objectives. Such an operational procedure limited the scope of alignment between IT and other business-functional units, despite the existence of a common communication protocol for suggesting business improvements. The absence of managerial oversight meant that the level of connectivity within IT departments was cross-functional rather than hierarchical; moreover, no mechanisms existed for the framing of IT principles at board level.

Complexity theory can also analyze the forms of relationship and mutual influence between governance methods during the stage of principle articulation. Each committee for coordinating and controlling IT activities may be considered as an actor operating in the context of an evolving network. In the present case, the IT principle eco-system was diverse insofar as different committees discussed governance issues at different levels throughout the organization; the remit, focus and forms of connectivity of their deliberations varied widely, although the goal of all committees was purportedly to drive business improvement. For instance, ‘the IT Service Operations
Committee’ framed IT principles with their outsourcing partners in order to define Service Level Agreements (SLA), while an ‘IT Standardization Committee’ articulated IT principles concerned with the execution of IT strategy as reported up to board levels. However, the inter-relationships among committees were low, since principles were not determined either centrally or in some way integrally connected to all company activities. Committees tended to work in relatively isolated or autonomous ways on their own problem areas at sub- or inter-levels in equilibrium states. In CAS terms, this resulted in a less mountainous fitness landscape, distributing governance among a variety of plural eco-systems. As a consequence, the organization of IT activities within the firm stifled the potential emergence of new orders and patterns, on account of the limited possibility for articulating evolutionary IT principles. Actors’ degrees of robustness and proactiveness were likewise low, even though low-level governance committees exhibited goal-oriented behavior in seizing the initiative.

4.2 IT Infrastructure

Traditional IT infrastructures comprise technical (hardware, software and network) and human (IT managers and IT service providers) elements, which combine to provide informal processes for the execution of designated IT functions. In recent years, the idea of service has become a dominant paradigm in IT management, leading to the formulation of more explicit and formalized relationships and oversight processes in the IT domain. Most IT organizations have grown up in response to business’s increasing dependence on data, being shaped by the need to maximize business value through the capitalization of the knowledge and resources implicit in IT objects. Many businesses have re-engineered IT management processes better to serve this goal, often making use of an ITSM or ITIL (IT Infrastructure Library) reference model. The case company outsourced most system development and maintenance to an IT outsourcing partner, and also conducted surveys using a CSI (Customer Service Interview) to evaluate the strengths and weaknesses of its customer-facing IT provision. This sought to improve service levels to users using a Voice of Customers device (VOC) and a Focus Group Interview (FGI).

![Fig. 2 IT Infrastructure Governance Process](image)

More specifically, the case company committees were charged with governance issues relating to IT infrastructure: an ‘IT Service Operation Committee’ and an ‘IT Infrastructure Strategy Committee’ as shown in figure 2. The former’s degree of connectivity derived from its being managed according to a SLM (Service Level Management) concept, targeting a high quality of service through the dissemination of shared views among IT
outsourcing partners. An IT planning team mainly consisting of IT professionals, alongside the IT technology team, were responsible for IT resource planning. Committee plans were approved after review by an ‘IT Standardization Committee’, with decisions finalized by the CIO. Though the expected interdependence level of these structures is high, service levels’ KPIs (SLA KPIs) were not able to cascade to other IT activities, given the limited degree of facilitated articulation (delegation) in IT and ITG structure. The second IT infrastructure committee, however, concerned itself with specific incidents and problems in IT areas, sharing the burden of operational risks with other business units such as network infrastructure and data management teams. In these relationships, driving forces and fitness values (SLA/SLM) were clearly defined between IT units and its service partners, while governance channels between business units operated informally or in an unstructured way. The processes of problem resolution worked out informally because previous resource or investment decisions had focused on the organization of IT resources, having failed to ‘interest’ other business units in specific IT domains. Any evolutionary processes in the IT infrastructure domain, meanwhile, originated from the ‘IT Standardization Committee’. These initiatives grew out of a form of self-organization in relying on a system of informal feedback to manage IT resources; this was later formalized through the deployment of relevant methodology such as ITSM and SLA. These methodologies themselves may be considered driving forces in shaping the landscape of IT infrastructure governance rather than governance committees similar to IT principle decision areas. The re-engineering of IT management processes with reference to these norms saw the emergence of equilibrium states, and the drift of forms of relationship towards a stable state limiting the firm’s space of IT possibilities. The company’s eco-system for IT infrastructure has therefore become formalized, facilitating the more effective coordination and control of IT resources.

4.3 IT Architecture

Many leading corporations have sought to manage their IT infrastructure through positing an EA (Enterprise Architecture) or ITA (Information Technology Architecture) framework laying down IT norms or standards. The standard analogy for EA has been with city planning, with agreed guidelines and principles determining the development and maintenance of complex units something like city blocks. By providing a formalized blueprint for IT infrastructure and applications, IT architecture is fundamental to the management of IT complexity. Architecture seeks to translate principles into a clear vision of the normative operations of IT, grounded in a systematic way through the relationship of a firm’s EA to its strategic goals. In this way EA or ITA designs represent a core component of ITG practices, especially insofar as they regulate intra-company data flow and enable the tracking of business processes. In recent years, an increasing number of global companies have implemented formal processes supporting the management of IT resources; these deploy EA/ITA to improve the transparency, accountability and effectiveness of IT decisions.

In terms of IT architecture, our case company initially put in place three different layers of EA/ITA, relating to technical, application and data organization; each focused on the defining roles of designers and builders. The company used a TEAF (Treasury Enterprise Architecture Framework) or TOGAF (The Open Group Architectural Framework) methodology in developing information architecture. However, the primary objective in the architecture domain was to establish common protocols or principles connecting IT to other non-organizational units; at the same time, channels of interdependence between IT and non-IT units were not formed, on account of
the relatively autonomous or specific skills of IT unit designers.

**Fig. 3  IT Architecture Governance Process**

While, then, evolutionary processes of development in ITG and activity suppose a top-down process of senior management involvement, in an operational sense the driving force of IT development derived from units' local design. The company now faces the challenge of utilizing its EA framework to standardize its IT infrastructure; this task is complicated by the lack of channels linking management and business partners to those who set the underlying logic for IT design.

Although the framework creates new possibilities of space, potentially tipping the network away from an equilibrium point, the risk is that the only area of change will be the IT department. In the normal course of the firm's IT development, when a proposal for a new system development proposal is received, the IT architecture team evaluates its fit with current EA/ITA and frames an implementation plan for a standardization committee, before reserving the final decision for the firm's CIO as shown in figure 3. Here the company's EA framework works to optimize the IT fitness landscape, but the arrangement leaves little room for IT units' self-organization, meaning that all participants can find it difficult to follow processes' implementation. It will be necessary for the company to resolve these issues of cultural resistance, especially given its model of IT monarchy.

4.4 Business Application Needs

A critical activity within the development of information systems is the specification of system requirements as dictated by a structured system development methodology. IT organizations often have to balance two conflicting objectives in system development (Weil and Ross, 2004). The first entails developing an innovative system supporting business strategic objectives; this process requires some measure of creativity in understanding both the business and technical sides of the task. The second objective concerns the necessity of delivery a system on time to other business units. Viewed from this perspective, IT development constitutes an operational task, and as such must overcome organizational resistance to new systems and related business processes. Recent survey results suggest that more than 49% of IS projects fail due to a lack of discipline in project management and evaluation (Brookings Institute, 2001). These failures stemmed from inadequate conceptions of the target IT infrastructure, from a lack of rigor in proposing and executing systems and from the absence of a proper mechanism of oversight or governance.
In working through IT change, the case company receives requests, as noted, for modifications in operational areas where they interface with partners; the idea here is to reduce development costs and cut the time needed for inter-process and inter-firm interaction. In terms of the firm's Business Application Needs (BAN), it has a Customer Information responsible for customer-related solutions and a service request system; its all-purpose IT team deals with any other applications. ‘IT Standardization Committee’ takes charge of project evaluations for the development and introduction of applications as shown in figure 4. There is no separate organization for project management, although the company envisages introducing a system standardizing team activities. The decision making process in BAN is similar to that for IT Infrastructure in scope; the operation broadcasts its needs through a service request system to the IT department, which decides whether a project will be set up to serve these needs, as well as the terms (feedback channels etc.) according to which the project will be maintained. IT department proposals are then forwarded to the standardization committee for consideration and approval. The CIO again makes the final decision.

![Fig. 4 Business Requirement Needs Governance Process](image)

The connectivity level of the BAN domain is conceived systematically in order to manage any requirements to be delivered by IT teams. For instance, the ‘Customer Information Team’ manage a range of service subscribers (those who purchased the company's mobile phone), while a ‘Billing Team’ oversees subscribers' relationship to the company in terms of customer service, subscription types and payment. A Network Management team deals with other operational systems i.e. ERP, DW, CRM systems. All these teams are interdependent with business units through a single channel (i.e., CSR), with some IS specifically dedicated to supporting business units. The evolutionary process of this domain consists in an automation of business unit requirements, with emergent principles determining whether requirements lead to new System Developments (SD) or forms of system Maintenance (SM). However, we found the company lacked any integrated PMO (Project Management Office) to monitor progress or evaluate post-IT projects. In the absence of such an enabling tool, the fitness landscape of the BAN domain was deprived of a significant driving force, having effectively been monopolized by a converged ‘IT Standardization Committee’ led by the CIO. Self-organizationally, each team's role was clearly defined, with tasks well-divided where CSR imposed different requirements. ‘IT Standardization Committee’ acted as a
governance channel, with no possibility for the exploration of further spaces. This maintained an equilibrium state in governance at all times.

4.5 IT Investment and Prioritization

In investing in IT, businesses must decide how much to spend, what to spend it on and how to reconcile the interests of all the different constituencies with a stake in IT. The investment domain is typically treated in terms of a standardized process, which evaluates decisions through assessing their impact on the five ITG domains introduced earlier. Different patterns of spending will impact in different ways on various business operations, meaning that a formal methodology regulating investment decisions may prove valuable. The case company system envisions assessing spending with reference to its anticipated IT ROI, but its reliability in terms of performance indicators has so far been low. At present, preliminary inspection is partially carried out for the economic feasibility and validity of plans as shown in figure 5. Departments proposing projects are responsible for ROI evaluation, and an IT planning team within the central IT department is charged with oversight of a project and its maintenance after specific work has been completed. The IT planning team plays a leading role in liaising with ‘IT Standardization Committee’, as well as in defining IT performance indicators. Depending on budgetary limits, decisions on whether to go ahead i.e. governance decisions are made within the IT department or by a ‘Junior Committee(JC)’/’Executive Steering Committee.’

The connectivity and interdependence levels of investment decisions are relatively high: higher, that is, than in other ITG decision domains, since decisions are directly coordinated and controlled with business units. When the budget limit exceeds a certain amount, decisions pass to ‘JC’ or alternatively a managing ‘Executive Steering Committee.’ The annual budgeting process is also synchronized with the whole IT budget, with priorities being set by the CIO and It team leaders based on three factors (necessity in terms of system development, urgency and business value creation). Although dependency levels are high with other business units, we found no formalized methodology existed to evaluate IT investment decisions. Several reasons explain the absence of a significant driving force reshaping the IT investment decision domain landscape. These include the shortage of IT staff to evaluate proposals in business units and the lack of involvement on the part of senior management guiding investment. Self-organization tends to be passive, with IT staff rarely volunteering to collaborate on the definition of relevant KPIs. The perceived interest of evaluating IT investment effects appears less to business units, raising ‘IT productivity paradox’ problems. The company would benefit from instilling a far from equilibrium state, strengthening strategic alignment between units and ‘interesting’ other functional areas and cross-functional processes in investment activities.

5. Discussion

Our case study of a Korean company made use of a CAS perspective to characterize the strengths and weaknesses of the firm's ITG. The case study company has put in place effective relational governance mechanisms linking between IT and business units in such spheres as IT Infrastructure, BAN, and IT investment decisions. However, its governance mechanisms are primarily used as a co-ordination channel for the receipt of partner requests, rather than serving as a strategic alignment tool controlling IT activities integrally. Our analysis of each governance domain demonstrated it to be comprised of complex interactions between different stakeholders (agents with IT teams, CIO, managers of business units, board members), resulting in the creation of
different emerging orders and patterns governing the firm’s IT resources. We found that most operational IT decisions (IT Architecture and IT Infrastructure and Business Application Needs) were made by the ‘IT Standardization Committee’ coordinated by the CIO and IT units, while IT ROI and the framing of IT principles were partially determined with the involvement of other business units or at board level. Figure 6 shows how each ITG domain corresponded to a different organization types as proposed by Weil and Ross (2004). ‘Input’ here refers to the ownership of IT initiatives among stakeholders, and ‘Decision’ to finalized decisions.

As the company sought to deploy a systematic EA/ITA framework, it came to place greater emphasis on the establishment of formalized governance mechanisms mediating business and IT units and seeking to support the business units efficiently; in other words, ITG was progressively integrated into CG and strategic decision-making. The EA/ITA framework in effect operated as a driving force behind the convergence of all IT-related decisions, referring to a model of best practice. Previously, each governance domain had been shaped by its own fitness landscape, as determined by various relationships of interdependence between stakeholders.

Fig. 5 IT Investment (IT ROI) Governance Process

<table>
<thead>
<tr>
<th>Domain</th>
<th>IT Principle</th>
<th>IT Architecture</th>
<th>IT Infrastructure Strategies</th>
<th>Business Application Needs</th>
<th>IT Investment</th>
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</thead>
<tbody>
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<td>Input</td>
<td>Decision</td>
<td>Input</td>
<td>Decision</td>
<td>Input</td>
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<tr>
<td>Business Monarchy</td>
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<tr>
<td>IT Monarchy</td>
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<td>Feudal</td>
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<td>Federal</td>
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<td>IT Duopoly (No EM)</td>
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Fig. 6 ITG Framework (Source: Weli and Ross, 2004)
The case company's practice of engaging regular interactions between IT and operational managers and staff allowed it to arrive at agreed principles adopted by ‘IT Standardization Committee’, however, the company lacked sub-committees (e.g. ‘IT Service Operations Committee’) dealing with governance activities in each decision domain. In other words, while the company implicitly set a fitness value for emerging patterns in a far from equilibrium state, it denied itself the executive and business supports to deliver governance value (i.e. the self-organization capability to shape its fitness landscape). This situation also arose as a result of the low levels of connectivity between units in the context of an IT monarchy structure (except in the case of IT investment, where a JC or the executive committee make a final decision).

In the company, different levels of governance mechanisms have co-evolved according to the self-organization of different stakeholders. The company relies on different and differently defined fitness values or driving forces in its decision-making structure. All its governance mechanisms partially articulate IT principles together with sets of KPIs facilitating the strategic alignment of IT infrastructure with business objectives, and all of its corporate forms can be considered in this light: its SLA/SLM with ‘IT Infrastructure Strategic Committee’; its ‘IT Service Operations Committee’ and ‘IT Standardization Committee’; its IT architecture (EA/ITA framework acting through the IT Standardization Committee); and its IT investment and prioritization (running a ROI analysis through ‘IT Standardization Committee’, ‘JC’ and ‘Executive steering committee’); and its Business Application Needs (a CSR system). Our recommendation would be for the company to integrate its ITG mechanisms to a point where they clearly reflect accountability. Governance mechanisms should promote a firm-wide awareness of IT, creating a single integrated fitness value, despite the trend for IT units to have a limited organizational role and responsibility.

6. Conclusion

This paper made use of the methods of CAS analysis to present a broad picture of the ITG practices of a Korean telecommunication company. The research aims to contribute to the conceptualization of IT services as complex networks and to offer indications of possible causes of decision making failure in firms’ IT domain. It characterizes these as owing to deformations in ITG's fitness landscape, with different processes and stakeholders driving the co-evolution of dual sets of performance indicators and principles.

We described the case company's ITG structure in CAS terms as being comprised of a structure of highly interactive and interdependent stakeholders active in different IT-related decisions. Investigating five different ITG decision domains, and analyzing interactions between an ‘IT Standardization Committee’ and other levels of governance mechanism, we found that the current diversity of IT-related decision-making modes is not sufficient to align IT activities with company objectives, to maximize value-creation in IT units or to ensure corporate accountability. There is a need of a focal point on which to concentrate IT activities, thereby assuring the participation of senior management in delivering accountability, transparency and effectiveness. The case study also found most IT decisions to be centralized, with a lack of governance mechanisms associated with IT in other parts of organization. There is thus also a need for the company to design and implement more robust governance mechanisms in different IT decision making domains, for instance strategically aligning IT with risk management.
In methodological terms, this paper's finding is that CAS offers a useful lens through which to view and conceptualize the underlying dynamics of IT business processes and governance issues. Future discussion should focus on the design of integral organizational systems for IT, the design of coordination channels between IT and business units and the formulation of control mechanisms driving principles of transparency, accountability and effectiveness throughout the firm. In addition, further studies examining specific indicators and benchmarking the integration of ITG into CG would be desirable. It may also be plausible to develop a quantitative or modeling approach to analyzing ITG practices relying on CAS representation of company dynamics. A multi-agent system simulation model might suggest the changing or emergent behavior of single or aggregated stakeholder units over time. In this way, CAS models might propose or seek to evaluate different designs of ITG.
References


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