Law of requisite variety: a case of IT and business alignment

Jaroslav Kalina
Department of systems analysis,
Faculty of informatics and statistics,
University of Economics, Prague
xkaj34@vse.cz

Abstract: This paper provides an explanation of the increasing complexity of corporate IT management as a special case of application of the law of requisite variety. Frequently cited drawback of established frameworks of IT best practices like COBIT and ITIL is their complexity and related difficulty in their implementation. Through the perspective of the law of requisite variety, drawn from the field of cybernetics, we can take a more elaborated approach to this phenomenon. First, through mapping the domain of corporate IT management to the concepts from cybernetics, we ground this area in set of well defined terms. The aim of this paper is to promote the perspective, that problems with increasing complexity in IT management are directly traceable to the encompassing business environment.

Key words: IT Governance, Business process, Complexity, Alignment, Maturity Models, Cybernetics

1. Introduction

One of the frequently cited reasons for a low success rate of implementation of best practices frameworks for IT management is their innate complexity. According to survey conducted by IT Governance Institute [3], complexity of COBIT and ValIT frameworks is the main inhibitor in reaching higher maturity levels of implemented IT processes and internal controls.

The aim of this paper is to describe how this increasing complexity of IT management is rooted in corresponding complexity of the wider system of the business organisation and why any attempts to make IT management more transparent needs to begin with adequate action on the business level.

The structure of this paper is following:

- Firstly we delimit our perspective on the domain of IT management and IT Governance which is accompanied by the systems point of view and a referential model of IT management suitable for the following
- We consequently define what pressures this environment creates on IT processes and to what ends this lead.
- In the next section we map the concepts of IT management to the ones from cybernetics and explain how the Law of requisite variety manifests itself in the case of IT management
- In the last section we draw recommendation on how to approach this phenomena and propose a way of how to limit it's influence.

2. Layered perspective on corporate IT management

The perspective on the subject of IT and business relationship is analogous to the SPSPR model described in [12], although we encompass here the environment as another layer and a source of adaptive pressures organizations is exposed to. The layers depicted in Fig. 1 are:

- Environment Layer represents the market on which a given organization competes with it's adversaries for customers. This layer is the source of pressures (technological, legal, changes in customer preferences, etc.) to which the organisation needs to adapt in order to remain competitive.
- Business Layer consists of business unit/process (depending on the organisational model) which are responsible for direct delivery of products and services to their customers. This layer is also directly exposed to pressures arising from the environment and it's their responsibility to modify themselves in order to either alter characteristic of their output or just to conform to any other kind of requirement (legal, etc.). This process of continuous adaptation
is the source for new requests on the character, composition and quality of supporting IT services.

- IT Layer is not directly involved in the reaction on changes within the environment in which the organization exists. The pressures arising from the Environment Layer are transmitted, filtered and altered on the business layer and consequently presented to the IT Layer in the form of requests. For the IT Layer the environment in which it operates is the Business Layer.

**Conclusion 1 (C1):** The sole source of impetus to change processes and services on the IT Layer is the Business Layer itself.

### 3. Adaptability or Stability

According to the stated principles the aim of IT Governance approach is to ensure that information provided by exhibit characteristics displayed in Tab. 2.

<table>
<thead>
<tr>
<th>Requirements on IT output</th>
<th><strong>Effectiveness</strong> deals with information being relevant and pertinent to the business process as well as being delivered in a timely, correct, consistent and usable manner.</th>
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<tr>
<td></td>
<td><strong>Efficiency</strong> concerns the provision of information through the optimal (most productive and economical) use of resources.</td>
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<td></td>
<td><strong>Confidentiality</strong> concerns the protection of sensitive information from unauthorised disclosure.</td>
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<td></td>
<td><strong>Integrity</strong> relates to the accuracy and completeness of information as well as to its validity in accordance with business values and expectations.</td>
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<td></td>
<td><strong>Availability</strong> relates to information being available when required by the business process now and in the future. It also concerns the safeguarding of necessary resources and associated capabilities.</td>
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<td></td>
<td><strong>Compliance</strong> deals with complying with the laws, regulations and contractual arrangements to which the business process is subject, i.e., externally imposed business criteria as well as internal policies.</td>
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<td><strong>Reliability</strong> relates to the provision of appropriate information for management to operate the entity and exercise its fiduciary and governance responsibilities.</td>
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**Tab. 1: IT Governance requirements on IT output** [5]

In their study of population of enterprises in USA, Hannan and Freeman (shortened to H&F in the following text) have discovered a strong tendency of markets to favour organizations which were able to perform in a stable and predictable way in the long run: "In a world of uncertainty, potential members, investors, and clients may value reliability of performance more than efficiency." [9] The mechanism by which companies ensured that a stable performance and a consistency of output characteristics prevail was identified as building standardized routines for operations within the company. Tab. 2 shows the similarity of emphasised concepts between the study of H&F and IT Governance as postulated within the COBIT framework.
In both cases these characteristics provide a justification for the existence of the entity under review. In case of the study of H&F companies exhibiting these characteristics were more favoured by their business partners due to the predictability and justified expectation that the company would behave or deliver as specified in the contract. This ability proved to be favoured among potential customers, suppliers and investors, even though this is accompanied with a trade-off towards lower efficiency.

The perspective of IT Governance is directed towards justifying the existence of high corporate IT spending. In this case justification is in front of internal business users of IT services although the role of external business partners, potential investors or especially legal authorities remains to some extent as well.

Strategic Alignment and Performance Measurement are by their definition related to the concept of reliability of the corporate IT, e.g. ensuring the output remains focused on specified targets and it's variability is in the borders defined by metrics.

Resource Management and Value Delivery focus on internal justification of spending on corporate IT, providing arguments for accountable individuals and maintaining the trust in the operations of corporate IT.

The area of Risk Management is touching all three concepts postulated by H&F. It encompasses notion of that the performance remains reliable due to having back-up infrastructures (human and technical) and implemented countermeasures. The accountability is enchanted by definition of standardized procedures and back-up plans. Continuity is ensured by having documented standard routines, recovery plans and resources to make sure that organisation's structure and operations could be reproducible after defined types of incidents.

What both these approaches have in common could be summarized as reasonable efficiency with stressing the necessity of stability. Achieving and sustaining a high and continuous level of reliability requirements, according to H&F, development of a framework of standardized, well documented and enforced routines. From the IT Governance perspective this is exactly what COBIT framework provides, a set of domains and processes accompanied with detailed description of their desired characteristics.

Routinisation and standardisation of various processes leads however to high rate of organisation's inertia towards changes in it's environment. On documented cases H&F also show that statistically the highest company death rate occur when companies try to change these routines, since these periods of time are accompanied with decreased reliability of their operation, thus decreasing their justification in the eyes of relevant subject. In our previous paper (Kalina, 2010) we've described the mechanism by which increased standardization and modelling business processed imposed additional cost to business process change efforts, thus acting as additional inhibitor of changes.

The environment of corporate IT departments is the enterprise as whole.

**Conclusion 2 (C2):** Organizations favour their IT processes to be reliable, reasonably efficient and self-justifying. This environment pushes IT departments to high routinisation and standardisation of their routines. These pressures in the end leads to restraining the ability of quick adaptation of IT processes.
4. **Law of requisite variety**

In his book "An introduction to cybernetics" Ashby [1] postulates basic principles and perspectives of this scientific discipline which focuses in controls in systems. Law of Requisite Variety (LoRV) in short says the following: "External variety needs to be counteracted by internal variety of the controlling system". In more modern notion of this law we can substitute the term variety by the term complexity [2].

The principle of LoRV lies in the discovery, that in order to act properly, the system in control needs to incorporate routines to react on changes the controlled system is exposed to. With the increased variety/complexity in the environment of the controlled system, the area of potential events, the system needs to response to, is accordingly increased as well.

Fig. 2 depicts the subject of IT Governance versus IT Operation through the looking glass of classical control loop borrowed from cybernetics. The two most distinctive parts of Fig. 2 are:

- Corporate IT Layer as a system under control. This layer represents the operational IT processes that deliver IT services to respective business customer on daily basis.
- IT Governance Layer as a controller system responsible to evaluate outputs of the system under control and provide corrective feedback back to the controlled system to sustain output characteristics within defined borders.

![Fig. 2: IT Control Loop](image)

The environment in this depiction is represented by other business units within a single organization. From these units a continuous flow of requests on IT services is being produced and the responsibility of the operational layer is to process them.

In order to assure that the variety of output given by the operational processes is minimized, e.g. the variety of output remains in defined borders of what is considered appropriate, the controller has to correspondingly counteract the variety of input flowing into the operational level.

From this point of view there are two factors which are responsible for the increasing need to integrate new response patterns/processes into the controlling layer:

- Increase of the extent of exploitation of IT within the organisation.
- Increase of the intensity this exploitation is performed.

By extent we mean increasing of the number of areas and agendas supported by services produced by operational IT processes. By intensity we in general mean the sophistication of how is this support is being delivered, the importance of the role this support.

The accent of IT Governance is preeminent in sectors where the business is more dependent on utilization of information technology (financial businesses, TelCo, etc.). The term IT driven business is being used in these cases on common base. This as well goes in the line of LoRV, since the extent and intensity of IT utilization in these sectors is the highest the IT control and regulatory mechanisms (as represented by controls implemented under IT Governance layer) is highly evolved in these cases. This also means that increasing rate of changes in the environment in which organizations exist and their attempts to adapt to it are directly transformed into changing requirements on the composition and character of services the corporate IT has to provide. This transition of changes is amplified/reduced by the extent and intensity of IT utilization in given organization.
Conclusion 3 (C3): The increasing complexity of corporate IT Governance processes is caused by corresponding high level of complexity of the business environment in which operational IT processes has to operate.

5. Environmental pressures on the IT layer

The environment in which the organisation’s IT department consists of other business unit within the same organization and these units are the sole source of impetuses to change the processes and services which originate within the IT department.

On the other hand there is a fundamental requirement for these processes to produce services with long term consistent level reliability (and other characteristics as well). As stated before this is the aim of implementing IT Governance frameworks like COBIT, since creation of standardized routines for production and control of the given domain helps to keep the variance of the output in desired borders. However this also leads to the increased inertia towards changes within the IT. From the point of view of LoRV, complexity (dynamic and structural) of the business layer is translated into the need to increase the inner complexity of the controlling system of the IT layer.

The increased inertia arising from standardization and increased complexity taken from the business layer are factors which increase the time gap between the time a change request arrives and it’s solution. This may lead to miss-alignment between business and IT. However the origination of the inhibitors of change can be tracked back to the business layer.

Conclusion 4 (C4): IT processes are subject of antagonistic forces. According to C2, requirement imposed on them lead to their increased inertia. According C3, the same environment is pressuring them to react rapidly on remain aligned with changing business needs.

From the point of view of C4 IT Processes require a stable environment to develop proper level of routinisation and accompanied stability of output. Therefore according to LoRV a reduction in the complexity (especially the dynamic one) of the business layer the IT production (Corporate IT Layer) and controlling mechanism (IT Governance layer) could be less complex as well, e.g. more transparent, predictable and cost efficient.

Since the impetuses to change the IT processes and their controlling apparatus as well arise within the business layer, any approach to more efficient and transparent IT Governance has to begin on the business layer by ensuring that the business layer is ordered and predictable enough to give the IT layer space to develop routines and control processes to perform reliably.

6. The need for requisite maturity

In our approach we advocate the utilization of the maturity concept. Since COBIT framework is extensively using the concept of maturity models to give guidelines for implementation and also to help assess already existing process the extensive usage of maturity models on the business layer would lead to a more consistent and integrated approach to manage the mutual development of these two domains.

Fig. 3: Business and IT maturity relationship

The history of using maturity models to help assess and improve activities within organisation is tightly related to development of Capability and Maturity Model by SEI-CMU, focusing on depicting best practices in the domain of software development. Currently CMMI in a version 1.3 offers models for domains: Services, Acquisition and Development [6], [7] and [8].

In 2008 Object management group released their own maturity model (Business process maturity model - BPMM) aimed to be generally applicable on any business process. Tab. 3 shows the 5 levels of maturity defined by BPMM. According to BPMM [4] a process on a high level of maturity exhibits a following set of characteristics:

- Stable in the terms of structure, length, costs, output variety and goals

1 CMMI – Cappability and Maturity Model Integration
Above-average performance mature processes are bound to perform statistically better when compared with their less mature counterparts in terms of meeting given performance indicators. Mature processes also achieve this level of performance on a continuous basis.

Predictable development - due to defined review mechanism and causal analysis practice the direction in which the process is moving in terms of it's development exhibits consistency.

| Level 1: Initial — wherein business processes are performed in inconsistent sometimes ad
hoc ways with results that are difficult to predict. |
| Level 2: Managed — wherein management stabilizes the work within local work units to ensure that it can be performed in a repeatable way that satisfies the workgroup’s primary commitments. However, work units performing similar tasks may use different procedures. |
| Level 3: Standardized — wherein common, standard processes are synthesized from best practices identified in the work groups and tailoring guidelines are provided for supporting different business needs. Standard processes provide an economy of scale and a foundation for learning from common measures and experience. |
| Level 4: Predictable — wherein the capabilities enabled by standard processes are exploited and provided back into the work units. Process performance is managed statistically throughout the workflow to understand and control variation so that process outcomes can be predicted from intermediate states. |
| Level 5: Innovating — wherein both proactive and opportunistic improvement actions seek innovations that can close gaps between the organization’s current capability and the capability required to achieve its business objectives. |

Tab. 3: Maturity levels according to OMG² [4]

These characteristics, which processes on a high level of maturity tend to exhibit, make the functioning of IT processes easier in two ways.

AS-IS state is documented and relatively stable, therefore a clear notion of what IT services are required to effectively support the process can created. Also given the stable structure of the process advanced methods for allocating benefits and costs related to IT services (like Activity Based Costing) can be employed, thus allowing for a more responsible approach towards utilisation of IT services which one of the pillars of IT Governance.

TO-BE state is planned to a high extent by using a defined routine for evaluating causes of problem and designing solutions. Mature processes tend to be developed in a pro-active way, anticipating future needs. In this environment the modification of supporting IT services can benefit from a more orderly and consistent way the requirements on them being generated and often results into lower rate of contradicting requirements.

Conclusion 5 (C5): Business processes on high level of maturity exhibit lower rate of changes of their structure and orientation in longer periods of time.

Conclusion 6 (C6): By increasing the maturity of business processes and restraining the unreasonable overusing of IT within the company, a necessary condition³ for IT processes to develop a high level of reliability accompanied with higher level of business user satisfaction will be met (e.g. IT process maturity).

7. Summary and future work

In this paper we have described the mechanism responsible for problems with implementation and operation of operational and control process within organisation's IT.

The key thesis of this paper is that the source of increasingly high complexity of IT management and governance frameworks originates in the external environment of particular IT unit, e.g. the rest of given organization. The functions and content provided by the IS/ICT in fact reflects the entities and process taking place in a given organization. IS/ICT is therefore a model of the organization which it’s intended to support. In order to effectively support activities on the business level the IS/ICT has to reflect relevant changes implemented there in order to carry it’s purposes effectively. Therefore if the

² OMG – Object Management Group
³ Necessary, but alone it's not an automatic guarantee that the company will develop also highly mature IT processes.
maturity of the business units is low, resulting into ad hoc problem solving, missing guiding principles and low amount of formal procedures, the IS/ICT as a model of this environment is thus liable to exhibit these tendencies as well.

According to LoRV, in order for IT management and governance frameworks to success in their role of the controller of the IS/ICT, and keep the variety of the outcomes of the controlled system within desirable borders, their internal complexity has to increase accordingly. This implies that the source of difficulties (high complexity) with these frameworks lays not within the nature of IS/ICT in the first place but mostly in nature of given organizations used as a sample during the framework development. Further developing of these frameworks to address new emerging problems with IS/ICTs in organizations has therefore a nature of a symptomatic treatment which doesn’t address the nature of the problems.

As a solution to reduce the undesired tendency we propose a more integrated approach towards IT Governance and quality management. From our perspective in order to achieve high maturity on the IT layer a certain requisite maturity must exist on the level of business, else the environment would not be stable enough for IT management processes and controls to evolve into a mature state. The problem solving in both domains is interconnected and isolated approaches focusing only on IT domain are therefore inept to solve it in it’s wholeness. In order to stop the need of developing more and more complex IT frameworks the business layer has to adopt more disciplined and formal procedures to manage it’s own activities.

From a practical perspective we see a need of a simple yet accurate method to evaluate the readiness of organization to implement and successfully run it’s IT processes and controls in a meaningful way. Such a method would have to combine several concepts from already existing maturity models (those that affect the way requests on IT layer are being produced) with supplemental conditions not covered by process maturity models but vital to effective from the IT point of view.

The drawback of conclusions drawn in this paper is the absence of data from an empirical study to either confirm or disconfirm them. From the methodological perspective this theoretical construction has the potential to give a more integrated perspective on the implementation of IT Governance frameworks of best practices and improving the understanding of mutual dynamics of business and IT within organizations. The desired empirical evidence will be gathered in the wake of follow-up work on this methodological perspective.

8. References