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Managing divergences in IT infrastructure standardization

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ABSTRACT

Standardization of an infrastructure is seldom a straightforward process, local adaptations of the global standard are often necessary in order to make the standard viable. These adaptations can be seen as divergences from the standard and need to be managed in order to avoid disorder within the IT infrastructure. The existing literature does not go in to detail regarding divergences; it focuses mainly on the phenomenon of drift. The purpose of this thesis is therefore to increase the understanding of divergences and how they can be managed. Our research questions are; *"how can the divergences from a standard be described?"* and *"how can divergences from a standard be managed?"*. The findings of this thesis are of interest for both academia and practice in order to better understand divergences. Two opposing views of infrastructures and standardization are presented; one emphasizes the need for control and the other focuses on the phenomena of drift. By using both these views together with the results from interviews held with managers at Volvo Group we define the dimensions of divergences. We describe five dimensions that are necessary to understand; type, underlying causes, time of creation, context and effects. We also present a process model, containing four stages, for managing divergences in a structured way. The first stage concerns the detection of either existing or anticipated divergences. In the second stage the aim is to understand the divergence based on the five dimensions presented above. In the third stage a decision to permit, adapt or remove the divergence is made. The last stage focuses on communicating the decision made in the third stage across the organization.

Keywords: IT infrastructure, Information infrastructure, Standardization, Drift, Divergences, Divergence dimensions, Divergence management.

PREFACE

This thesis has been written during the spring term of 2008 as a part of our master program in IT management. It is the result of hard work and long hours, but in the end it has been worth every invested minute. Because we truly feel that our knowledge regarding both infrastructural aspects and Volvo Group has increased severalfold.

A number of persons have contributed to this thesis and made it what it is today. First and foremost we would like to thank our supervisor Ph.D Jonas Landgren, who has been very supportive before, during and after the writing of this thesis. From the start he has provided us with ideas and feedback that has been essential during our work.

We would also like to thank Åke Boije af Gennäs and Krister Eliasson at Volvo Group for helping us concretize the area for this study and giving us access to their organization. We furthermore want to give our thanks to our respondents from all over Volvo Group who took time out of their busy schedules to provide us with the answers we needed. In addition to this, a special thank goes to Jean-Peter Fendrich at Volvo Innovation who initially put us in contact with Åke and Krister.

Last, but certainly not least, we would also like to thank our respective families for their patience and support during this sometimes very demanding process. We owe you our gratitude.

Gothenburg, June 2008

Björn Ebbesson and Tomas Olsson

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1 INTRODUCTION

There is a common trend among larger corporations to standardize their IT environments, both hardware and software (Weill & Broadbent, 1998). This is not a new phenomenon but rather a natural part of managing the IT infrastructure within a modern organization, especially global ones. With diverse application portfolios across several sites in numerous countries it is seen as more and more important to assert some form of control over these applications. By standardizing it is not only possible to reduce the amount of applications or technologies that need to be managed, it is also possible to reduce the inconsistency between them. For instance, having very different applications doing the same thing can result in problems when sending files to others within the organization since not all file formats are compatible. Standardizing the application portfolio reduces many of these problems (Weill & Broadbent, 1998); however there may be drawbacks as well (Monteiro & Hepsø, 2001). The standard application may not meet all the requirements that the users within the organization have and their effectiveness may be reduced.

Another reason for standardizing IT environments, apart from control aspects, is cost reduction (Besen & Farrell, 1994). Reducing costs can be attributed to several different factors, although improved support is one of the most common ones. This decrease in support costs are often related to the fact that fewer applications and technical solutions are used within the corporation. By using fewer applications the support staff can become more specialized which can lead to faster and easier problem solving, hence lowering the costs for support.

A third reason for standardizing is often related to the maintenance and updates of applications and technology (Tassey, 2000). By having a standardized IT infrastructure it enables centralized updates of, for example, antivirus definitions and so on. In addition to this there is also the positive aspect of mobility. By having the same infrastructure on every site it is possible to bring a laptop computer from one country to another without the danger of not being able to use central applications. Many of these aspects might very well be related mainly to larger and more global corporations since they have more to gain by standardizing than smaller businesses.

Even if there are many positive effects to standardizing there are also negative aspects, or obstacles that need to be overcome. Unfortunately these obstacles are often overlooked and only the positive aspects of standardizing are put forward. A common belief is that when standardizing, everything within that standard should be identical. This is however seldom the case as local needs may result in adaptations that lie outside the standard (Ciborra et al, 2001). Lapses from a standard like this is commonly described as a phenomenon called drift, and will be explained in greater detail further down. If an organization is not aware of this, problems might occur. Such a problem could for instance mean that systems or applications that run on one configuration do not work on another.

Another aspect might be that employees find certain applications inferior to the ones that they are used to. Simple reasons like this can be the cause of unauthorized initiatives or local adaptations made across the organization, what we call divergences. A divergence is defined by Merriam-Webster (2008) as *'a deviation from a course or standard'* which is also the way we relate to it. A divergence in this thesis is seen as something that is does not comply, or is in line, with the agreed global standard. These divergences are also to be the focal point of this thesis. Even though the belief is that standards are to be identical they are mostly not, divergences are common an oftentimes necessary for a standard to be viable. However, these divergences need to be managed in a structured order and the divergence itself needs to be understood to do so.

Purpose and research questions

When standardizing an infrastructure drifting will occur (Ciborra et al, 2001). It is the nature of standardization that drifting happens during the process, which in turn results in divergences. The existing literature does not go in to detail regarding divergences; it focuses mainly on the phenomenon of drift. The purpose of this thesis is therefore to increase the understanding of divergences and how they can be managed. This will be done by answering the following research questions:

How can the divergences from a standard be described?

How can divergences from a standard be managed?

Limitations

The thesis will not focus on the process of standardization, but on the divergences that occur during it and how they can be managed. As a result no specific discussions or remarks regarding the process will be elaborated on. However excerpts and quotes may be presented that are related to the standardization process if they contribute to the overall understanding needed to answer the questions presented above.

We will also limit the research by focusing on a single organization, Volvo Group, to make certain that we get a deep understanding of the divergences that have occurred there. For the same reason we also focus on a single standardization project within this organization.

2 RELATED WORK

Standards and standardization has been extensively researched and different views have been presented over the years. The following chapter will present three different areas where research has been done and how these are related to this thesis. The areas are; standardizing technology, standardizing information systems and standardizing information infrastructures. We also explain where this thesis fits in, in relation to the studies presented below.

Standardizing technology

The standardization of technology has been common throughout the years, as have the articles related to the phenomena. The debate concerning the QWERTY standard layout for keyboards (David, 1985; Liebowitz & Margolis, 1990, 1995) was one of the first to address the issue of standards and their dynamics, such as lock-ins and path dependency. More recent articles have also regarded the effects of competing standards and how different organizations, as well as society, strive for a single universal standard in order to enhance global compatibility (Cusumano et al, 1992; Flaherty, 2004). In essence these studies focused on how standards gain grounds and grow larger.

A slightly different approach was taken in a study by Holmström and Stadler (2001) where they studied how a standard needs to be adapted to its surroundings in order to succeed. They looked at the Swedish cash card implementation to show what happens if a technology is not allowed to drift during its implementation. They claim that since the banks ignored the comments from the merchants meant to use the system, it was perceived as a system serving only the needs of the banks. Hence they mean that in order for a socio-technical system to stabilize it must drift from a single-purpose network, reflecting only the interest and agenda of its designers or originators, to a multi-purpose network that reflects the interests of all involved social actors.

Standardizing information systems

By standardizing information systems (IS) across a corporation the basic idea is to make sharing information easier. However, there is often also the hope that several legacy systems will be made obsolete and possible to remove, reducing the amount of systems that need maintenance and upgrades. During the last fifteen years it has not been uncommon for companies to try to replace several older systems in human resource, finance, planning and so on for an Enterprise Resource Planning (ERP) system containing modules for all of this and more. This has also, due to its commonness, been the focus for several academic studies. (eg Fenema and Baalen, 2005; Nandhakumar et al, 2003)

ERP systems are obviously not the only standardized systems, any system that is supposed to function similarly independently of location can be said to be standardized. This can be anything from surveyor support systems (Rolland & Monteiro, 2002) to support systems for research and development (Cordella & Simon, 2001). Something these studies have in common is the fact that seldom does the IS standardization, or its process, turn out as intended, there are several bumps on the road. As in many other cases, these bumps turn out to be divergences caused by drift.

The findings of Nandhakumar et al (2003) suggest that even though an organization has all the means for a successful IS standardization, such as resources, knowledge, skills, plans, blueprints and tools, this is not enough to guarantee the success of the project. External, as well as internal, factors beyond control affect the outcome of the project.

Cordella and Simon (2001) claim that there is often a difference between the intended ways of working and the actual, local, work procedures when a project is initiated. They state that infrastructure deployment has to be considered as the outcome of the interactions between global design and local adaptation. This means that it is seldom the case of a deliberate and straightforward implementation process; there are too many factors that can affect the outcome.

Rolland and Monteiro (2002) discuss the issue that commonly affects many standardization projects, the existing differences between an organizations sites and offices. They claim that there is a need to balance the local and global needs of the organization since what is reasonable for one site need not be that for another. However they also argue that in designing and implementing a shared infrastructure, local needs must always be weighted in relation to a well-functioning infrastructure that encompass different communities of practice, technologies, and diverging interests and needs. Monteiro and Hepsø (2001) also mention the need to balance local variation and adaptation to the uniformity of the standard. Another important aspect of this study is the use of gateways as a mean to connect old systems with new systems; in order for them to coexist. This approach made it very complex and difficult to remove the old systems.

All of the above studies focus primarily on the consequences and effects that the local adaptations, drifting, causes. In a recent study Fenema and Baalen (2005) the focus was instead on what actions a global organization took to handle the drifting when it occurred. Their study showed that firstly, the organization stopped the overall project to avoid unnecessary consumption of resources and continuation of the project without working solutions. Secondly, they stayed focused on the overarching goal, as well as addressed the sources of drifting. Finally, the project was resumed and lost time was made up for by applying the local knowledge, derived from step two, globally.

Standardizing information infrastructures

The standardization of corporate desktop environments is an area less studied. The standardization of an entire desktop environment would include basically anything from operating systems to word processors and internet browsers, in some cases even the hardware included in the desktop configuration (Hanseth & Braa, 1999; Butler & Weill, 1995).

Hanseth and Braa (1999) in their study described the development and implementation of a standardized corporate IT infrastructure. Moving from a multitude of solutions to a more common solution for the entire corporation was one of the most important tasks for the IT department. Initially the project aimed to encapsulate the entire organizations needs in one coherent standard. This, however, was not very successful according to the authors because of the ever-changing world. Despite heavy critique against the view on standardization the authors acknowledges the fact that standards do matter. Although infrastructures and standards get a local character they retain some of their universal aspects. They are, at the same time, local and universal. Standards do reduce disorder, but there will always be in disorder in terms of incompatibilities and redundancy. The diffusion and adaptation of infrastructures and their standards drive their own change. Fast and successful adaptation implies radical change. In this way, they claim, an infrastructure standard is becoming obsolete by its own success.

Most of these studies have the characteristics of describing the phenomena of drift and how it affects technologies, systems or infrastructures. However well they describe drift, we find them somewhat lacking when it comes to describing the divergences that are a result of the drift. In addition to this only one study that we found touched the subject of managing drift, but never elaborates more on how to handle the specific divergences. These two areas are according to us tightly connected and will therefore be addressed in this thesis. In order to describe a divergence and how to manage we find it necessary to start with a theoretical foundation, which we will present in the following chapter.

3 THEORY

In this chapter we will present the theories upon which we base our study. The chapter is structured around two different views of infrastructure management. We begin by presenting the different ways of defining and understanding an *infrastructure* in two parts; *Information technology infrastructure* and *Information infrastructure*. The first is largely based on the theories by Weill and Broadbent (1998) while the second is mainly constitutes theories from Ciborra et al (2001). These sources also play integral parts of the second section of this chapter, namely *standardization*. They are however complemented with other authors that share the same fundamental standpoints. The theories presented under the section of standardization are divided into *the control approach* and *the drift approach*.

3.1 Infrastructure

In this section we present two different ways of understanding infrastructures. First we introduce the traditional management view gathered under the concept of Information technology infrastructure. This is followed by the differentiating ideas presented under the concept of information infrastructures. This chapter also includes the critique, expressed by the represented authors, against the traditional management view.

Information technology infrastructure

There is more than one definition of the term information technology infrastructure, and the way IT infrastructure is viewed and managed differs as well (Peppard, 1999). Weill and Broadbent (1998) presents us with the various elements of IT infrastructure, presented in Figure 1. At the base of the framework are technology components such as computers, database software packages, operating systems and printers. These devices are commodities available in the marketplace. The second layer from the bottom is comprised by a set of shared IT services. The technology components are transformed into shared services by the human IT infrastructure, which consists of knowledge, skills, standards and experience. In other words, the human IT infrastructure binds the technology components to the services that forms an organization´s IT infrastructure. Outside the IT infrastructure lie the remaining parts of the IT portfolio, described as local application. According to the authors, an increasing number of companies have an additional layer of shared and standard infrastructure applications used by all business units. These often include organization wide applications that support shared services in functional and support areas. (Weill & Broadbent, 1998)

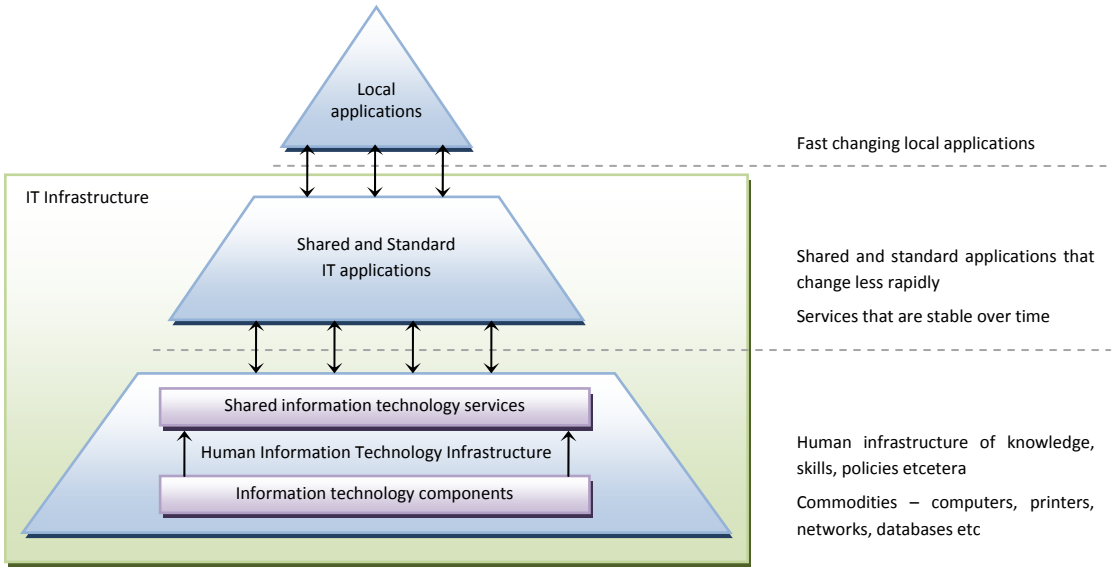

FIGURE 1 – THE ELEMENTS OF IT INFRASTRUCTURES (WEILL & BROADBENT, 1998)

The infrastructure services required by a company are according to Weill and Broadbent (1998) relatively stable over time. Normally similar services are required from year to year, with a few gradual improvements to take advantage of new technologies and efficiencies. The applications supporting the business process on the other hand, quickly changes requirements to better meet customer needs and respond to competitor activity. The IT for a business process uses the infrastructure services needed for the particular application. Already having the required infrastructure services in place will reduce the time and cost to build new applications since the infrastructural foundation does not have to be included in the development. Based on this idea the authors claim that the existing IT infrastructure should be seen as a competitive capability, and their studies show that companies with 'more infrastructure' have faster times to market and more sales from new products. (Weill & Broadbent, 1998)

According to Weill and Broadbent (1998), firms invest in a wide range of information technologies: local area networks, image processing systems, databases, security software and integrated application suites, to name a few. These investments have different management objectives, for instance cost reduction or providing information to senior management. Weill and Broadbent (1998) see all those investment decisions as contributions to a portfolio. The IT portfolio of an organization is its entire investments in IT, including all the human resources providing IT services. Managers make decisions about portfolio investments based on a cluster of factors, like capabilities required now and in the future, the role of technology in the industry, the level of investments, the clarity with which technology investments are viewed and the role and history of IT in the firm. The fundamental concepts to managing an IT portfolio are, according to the authors, those of business, not of technology: portfolios, business value, investment and alignment of resources with strategic goals. The objectives of IT investments are to successfully implement current strategies and to use IT to enable new strategies. The introduction of IT strategies often fails because of a "one size fits all" approach. Instead, the objective should be to tailor the IT portfolio to the firm´s unique strategic context (Weill & Broadbent, 1998). The concept of the IT environment as a portfolio is shared by Ward and Peppard (2002). They claim that in order to assess and prioritize IT actions one must examine the target portfolio by analyzing enhancement possibilities in the IT environment, including the organization, its competencies, and the technical infrastructure and supplier relationships.

To describe the nature of infrastructure capability from a business perspective, two concepts can be used: IT infrastructure services and the infrastructure *'Reach and Range'* (Weill & Broadbent, 1998). Services describe the business functions provided by the infrastructure, and Reach and Range describe the business dimensions. Weill and Broadbent (1998) consider the notion of services in an IT infrastructure as very useful for business managers trying to grapple what exactly they are getting for their investments in IT. These managers often encounter difficulties in valuing technology components and human IT. However they find it easier to value a service such as the provision of a fully maintained PC with all systems and Internet access. Services can be specified, measured and their cost controlled. Furthermore services can be priced and compared in the marketplace. In that sense, thinking of infrastructure as services places the business manager in charge, rather than the provider. Another advantage with the service notion is, according to the authors, that it gives the provider much more certainty as to its responsibilities and allows more precise planning. (Weill & Broadbent, 1998)

Each service in the IT infrastructure can be offered at different levels from selective trough extensive. A selective level of service means selectivity in at least one of the following three ways (Weill & Broadbent, 1998):

1. Only a basic level of the service is provided in terms of functionality.
2. The service is not available across all international locations.
3. The service is not mandatory across the firm.

An extensive level of service on the other hand indicates that the service has extensive functionality and is offered across all business units, or that its use is mandatory. The number of infrastructure services offered by a firm, together with the depth of these services, gives an indication of the degree of business functionality. (Weill & Broadbent, 1998)

To define an infrastructure's capability the notion of services needs to be complemented with the theory of infrastructural business scope (Weill & Broadbent, 1998). The concept of reach and range was first proposed by Keen (1991) and it describes what types of messages can be sent, and transactions processed between employees, suppliers and customers. Reach refers to the locations and people the infrastructure is able to connect. Reach can differ from a single business unit to the ultimate level of connecting everyone to everywhere. Range refers to functionality in terms of what business activities that can be carried out and shared automatically and seamlessly across each level of reach. In conclusion a wide reach and range means that the organization is able to simultaneously perform transactions on multiple applications, updating all databases across different business units in different countries Keen (1991).

According to Weill and Broadbent (1998) a good way to use the reach and range framework is to compare the current functionality with the one required to execute planned strategies. Often there is a gap between the actual Reach and Range and that desired by management to implement new initiatives. The gap can be identified through working communication between business and IT management. IT managers can assess the cost, time and difficulty of the required increase in reach and range, providing business managers with valuable information about the challenges they face implementing new strategies. (Weill & Broadbent, 1998)

The concept of an IT portfolio can, according to Weill and Broadbent (1998), be extended to multi business unit firms as well. Figure 2 below shows a multi business unit corporation with multiple IT portfolios: one centrally coordinated, and others within each business unit. The services required by the entire firm are provided by a public and firm wide infrastructure combined with business unit infrastructures more tailored to local needs. The latter should fit as "plug-ins" to the firm wide infrastructure. The authors provide us with an example: a large process manufacturing firm with eight business units provides some IT infrastructure services centrally. All business units are encouraged to use these but also to develop customized local infrastructures if needed. However, if a business unit breaks away, due to poor service and unique needs, it will be very time consuming and expensive should the business unit ever again need to be merged into the firm wide infrastructure. This, since the standards and systems in use are now different and not readily compatible. (Weill & Broadbent, 1998)

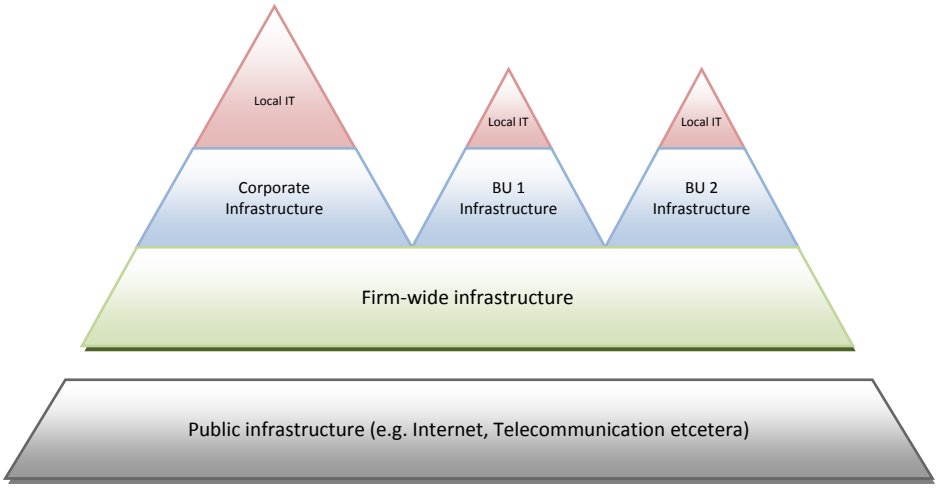

FIGURE 2 – IT INFRASTRUCTURE OF A MULTI-BUSINESS CORPORATION (WEILL & BROADBENT, 1998)

Shared infrastructure applications have traditionally accounted for quite a small part of the total IT portfolio but are rapidly increasing. Implementation of shared infrastructure applications requires conformity on, and standardization of business processes across the organization (Weill & Broadbent, 1998). The pyramidal representation provided by Weill and Broadbent (1998) is a typical way of modeling infrastructures in order to understand them and their parts. However there is a contrasting view that focuses on different aspects of infrastructures, presented in the next section.

Information Infrastructure

The traditional management view on IT infrastructure, advocated by Weill and Broadbent (1998), has been merged into most large organizations, and developed into the mainstream way of managing IT infrastructure. IT infrastructures have however, as the following chapter will submit, evolved into more complex environments trough the ongoing globalization. The notion of IT infrastructure has been found insufficient in the area of global infrastructures; hence the term Information Infrastructure has emerged. (Ciborra et al, 2001)

The concept of corporate infrastructure emerged in the 1980s in relation to the planning of large corporate information systems. The emphasis was on the standardization of systems and data across the organization in an attempt to reconcile the centralized IS department and resources, on one hand, and the distribution of systems and applications, on the other. More recent perspectives focus on the aspects of infrastructure that deal with communication, processes and services. Ciborra et al (2001)

As presented earlier Weill and Broadbent (1998) provide a pyramidal representation of infrastructures with four layers pointed out; IT components, human IT infrastructure, shared IT services, shared applications. This managerial definition echoes, according to Ciborra et al (2001), from the traditional definition of Management Information Systems. The pyramidal representation suggests that the layers of the infrastructure are clearly delineated, that it is possible to draw the boundaries between different layers. This is questioned by Ciborra et al (2001), and so are the ideas of infrastructure as an IT-portfolio. The possibility of pricing services and the notion that infrastructure can become the firm's capability if management can deploy it in a way that is unique and strategic for the firm is questioned.

Information infrastructure relates to ideas that differ from the traditional management view in terms of what an infrastructure actually is, but also in how it is implemented and managed. Corporate information infrastructures are, according to Ciborra et al (2001), puzzles, or even collages, and so are the design and

implementation processes that lead to their construction and operation. These are in turn imbedded in larger collages, forming a context of interdependence, intricacy and interweaving of people, systems and processes. In distinction to traditional management, where companies strive towards patching alignment between heterogeneous actors trough control and governance, the information infrastructure advocators call for a new paradigm, attuned with the new characteristics of modernity, not the industrial modernity, but the one caused by globalization. Ciborra et al (2001)

An alternate definition of infrastructure than the one provided by Weill and Broadbent (1998) is presented by Hanseth (2001), and focuses on the openness, multi layering and inertia of infrastructures. Hanseth (2001) uses a definition by Merriam-Webster's dictionary to identify the key characteristics of infrastructures; "*a sub-structure of underlying foundation, the basic installations and facilities on which the continuance and growth of a community, state, etcetera depend on roads, schools, power plants, transportation and communication systems, etcetera"* The author extracts a few aspects; infrastructures have a supporting or enabling function and infrastructures is shared by a large community. According to the author, the different elements of an infrastructure are integrated through standardized interfaces. Such standards are often considered important, because the alternative bilateral arrangements are too expensive. However, standards are not only economically important but also a necessary constituting element. An "infrastructure" built on the bases of bilateral arrangements only, is not a real infrastructure, just a collection of independent connections. Hanseth (2001)

Another aspect of infrastructures, pointed out by Hanseth (2001) is that they are open in the sense that there are no limits to the number of users, nodes, applications, networks etcetera using them. This implies that no borders can be drawn creating independent infrastructures in relation to each other. Also the unlimited number of users, developers, stakeholders, components and user areas creates varying relations over time, changing conditions and changing requirements, in short it leads to heterogeneity. Infrastructures are furthermore socio-technical networks where technology and human resources interact. In addition to this complex way of spelling out infrastructures, Hanseth (2001) mean that they are connected and interrelated ecologies of infrastructures. This means that one infrastructure is composed by ecologies of, sub, infrastructures layered, linked and integrated with each other. When a small, independent component is brought into an infrastructure, it becomes interdependent. Building an infrastructure takes time and as requirements changes it has to adapt. Since the whole infrastructure cannot be changed instantly the new has to be connected to the old, and the new must be designed to fit with the old. This is how the old, or the installed base, heavily influences how the new can be designed and that an infrastructure is never built from scratch, it always builds upon an existing infrastructure. Based on the concepts above, Hanseth (2001) concludes the aspects of infrastructure as: *an evolving, shared, open and heterogeneous installed base.*

Ciborra et al (2001) opposes the idea of infrastructural collages as something bad and dysfunctional that ought to be avoided, which is often the standpoint in traditional management literature (i.e. Weill and Broadbent, 1998). This mainstream way of managing infrastructures favors a more integrated and controlled approach that is supposed to streamline the infrastructure, fit it into the business strategy and extracting more value from it. The idea of management models and methods is thereby to move the infrastructure from a thrown-together institutional backbone to a value generating, integrated set of technologies, applications and processes. This is supposed to bring substantial gains in productivity along with an increased level of control over a resource that is complex, expensive, long-lasting and critical for running a business in the information society (Ciborra et al, 2001).

While Ciborra et al (2001) agrees that control is an overarching issue for business organizations, the authors believe that control is difficult to achieve. Nature, society and economy have always been unpredictable and uncontrollable. Deployment of more advanced instruments for governance only seems to create a world that resists control. This is where globalization comes in. The authors experience that governance in the age of globalization is more limited than ever. Global phenomena, for example global warming or global production processes, are created that can be controlled only in part. Information infrastructures are important instruments for controlling global phenomena but they share the same uncertainty. They are themselves difficult to control and can therefore limit managers' governance capabilities just as much as enhance them. Ciborra et al (2001)

The map in Figure 3 shows the vicious circle that leads businesses from the tight, top-down control of the information infrastructure to the actual drift of the infrastructure itself. The belief that "management *is* control" is a pre-requisite that forms the context of the circle.

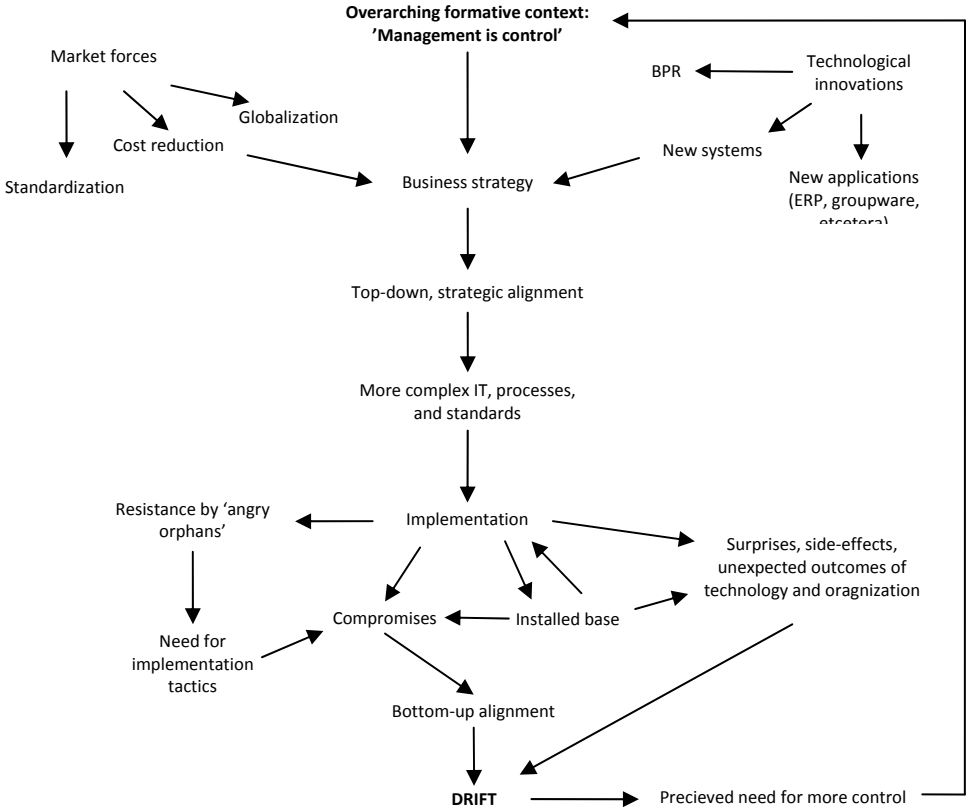

FIGURE 3 – THE DYNAMICS OF INFRASTRUCTURE (CIBORRA ET AL, 2001)

The instability of the environment and the business, implementation tactics, the power of the installed base, the difficulty of guessing user behavior and the sheer complexity of the new infrastructure are all factors that make for a different outcome, factors that cause drift (Ciborra et al, 2001). The phenomenon of drift is the fundamental basis for one of the two approaches to standardization presented in the next chapter. The other one is based on the striving for control and a positivistic view of standardization.

3.2 Standardization

In this section we present two different views of standards and standardization. Since these are closely connected to management philosophy, our references come from traditional management literature, but also from an alternate perspective that presents a contrasting view. We chose to call the two views *the control approach* and *the drift approach*.

The control approach

The control approach is closely connected to the views and ideas presented under the section information technology infrastructure. Weill and Broadbent (1998) represent many of the fundamental theories and mindsets typical for the control approach and they are the main source for this section of theory. Among other important authors in the area we acknowledge Peppard (1999) who is a firm advocator of increased control along with Earl (1996) who suggest different strategies for control over IT resources. The fundamental ideas of the control approach are those of control and standardization as means to manage greater infrastructural complexity.

Every layer in the pyramidal notion of the IT portfolio has according to Weill and Broadbent (1998) different objectives. At the base of the IT portfolio is the infrastructure capability. Infrastructure is delivered as reliable services, shared throughout the firm and coordinated centrally, usually by the information systems group. The infrastructure capability is depending on both technical and managerial expertise required to deliver reliable services. The services of the infrastructure are standardized and shared by multiple business areas and several applications. The authors see infrastructure standardization as a prerequisite for developing services and applications built upon it. Standardization is therefore listed as a management objective for the IT portfolio along with business integration, business flexibility and agility, reduced marginal costs of the business unit's IT and reduced cost over time. Weill and Broadbent (1998) have identified 25 infrastructure services in their work with companies and clustered them into 8 management groups. One of these groups is called Standards management and it includes two services central to management. First, senior management should recommend standards for at least one component in the IT-infrastructure, for example hardware, operating systems, data or communications. Second, they have to enforce the IT-infrastructure and the standards decided upon. This striving for control is shared by Earl (1996) and Pepper (1999). They aim to develop rules and mechanisms in order to maintain central control over decentralized parts of organizations. Their means to manage complexity can be summarized as a need for more control.

Burnes (2004) discusses the classical notion of the role of management giving three hierarchical levels often present in large organizations:

1. *Top management* – the policy making group responsible for the overall direction of the company
2. *Middle management* – responsible for the execution and interpretation of policies throughout the company and for operation of assigned divisions and apartments.
3. *First level or supervisory management* – responsible for the attainment of objectives by the units they control, through practices and procedures approved and issued by top or middle management.

This management view is based on control and hierarchical division, putting managers in command, representing them as systematic, reflective thinkers and planners (Burnes, 2004). The thousands of small IT investment decisions made every day in a large firm are very hard to manage and coordinate. Weill and Broadbent (1998) claim however, that if these decisions are not managed and coordinated, IT can become a barrier instead of an enabler. The authors aim to explain the importance of management using the following example; before implementing a firm wide standard, one large telecommunications company had 27 wide-are-

telecommunications networks across its different geographical locations, business units and functional groupings. Each network was fairly justified in business terms by local managers but hindered the firm wide business goal of cost control. Each network required different support staff who understood details in the network topography and standards. This resulted in a large overhead cost. At the same time the firm was rethinking its value proposition, which required a shift from account-based services to customer-centric services. The many complex networks made it extremely hard for different parts of the business to understand the firm's total relationship with each customer. A series of difficult organizational negotiations and technical considerations lead to a reduction in the number of networks down to two. Costs dropped and integration increased. The firm's strategy of customer-centric services was not achievable with the diverse infrastructure in place. Different systems could not be linked; customer data could not be easily shared and costs where to high. The new infrastructure based on agreed-upon standards across multiple businesses gave each of the businesses a clear picture of each customer's relationship with the firm while minimizing costs. (Weill & Broadbent, 1998)

The differentiating view represented in the next section shares and builds on the extreme difficulty of managing complex networks. However it does not share the ideas of more control and standardization as non problematic solutions to infrastructural complexity.

The drift approach

The drift approach is largely connected to the views and ideas presented under the section information infrastructure. Here Ciborra et al (2001) is the main source presenting many of the fundamental theories and mindsets typical for the drift approach. Another important author is Hanseth (2001) whose theories of Economics of standards make a substantial contribution to this section.

According to Hanseth (2001) the notion of IT infrastructure as an IT portfolio, introduced by Weill and Broadbent (1998), can be useful for understanding some aspects of IT infrastructures but this metaphor can also be very misleading. Where investment portfolios are flexible and easy to change and control infrastructures are different. The individual elements are very interdependent and their size and complexity make them extremely hard to control and manage. As mentioned before, Hanseth (2001) stated that infrastructure was an evolving, shared, open and heterogeneous installed base. This is the basis of an alternate view on the role and dynamics of standardization in global information infrastructures, that we call the drift approach.

Plans that are being diverted, surprises that arise constantly, opportunistic adjustments that must be carried out in heat of the moment are all common phenomena in infrastructure management (Ciborra et al, 2001). Planning may be undertaken but circumstances may force managers to improvise. This leads to a primordial situation of anonymous practices and events, in which every infrastructure will be found. Infrastructure implementation and management is disrupted by unexpected outcomes and side effects, which require frequent adaptations if not reinventions of the initial solution. This phenomenon is called *technology drifting.* (Ciborra et al, 2001)

Infrastructures are mainly designed through the standardization of interfaces and protocols, and through the diffusion of the various standardized components (Ciborra et al, 2001). The Internet, for instance, is designed as the individual users and Internet Service Providers install Internet software on their computers and link them to the existing network. Both the standardization and the infrastructure building are carried out by a large number of independent actors. Institutions hardly have any authority or power to enforce any kind of behavior on the individual actors. This is the opposite of models usually drawn of organizations. The

hierarchical structure is supposed to control and coordinate processes, giving managers the authority to make decisions and instruct his or her subordinates. But this is an ideal picture and not the reality according to Ciborra et al (2001)

A crucial aspect of infrastructure implementation is the design and diffusion of standards. As stated above, Weill and Broadbent (1998) say that to succeed in the establishment of IT infrastructures, a firm should enforce IT architecture and standards. Hanseth (2001) means that this is presented without explanation, justification or arguments and the he believes that the opposite is the case. This opposing view is grounded on concepts inside the *economics of standards* (Hanseth, 2001). These concepts are: increasing returns and positive feedback, network externalities, path dependency and installed base.

Increasing returns mean that, the more a particular product is produced, sold and used, the more valuable or profitable it becomes. Infrastructure standards are perfect examples of products having this characteristic. A communication standard's value is very much determined by the number of users that you can communicate with if you adopt the standard. This gives old technologies sustainability, like COBOL or FORTRAN which lives on far beyond the time when they had become technologically outdated. The basic mechanism is that a large installed base attracts complementary products which in turn make the standard more attractive and it also increases the credibility of the standard. Together these make the standard more attractive, which brings new adaptations, which further increases the size of the installed base, as illustrated in Figure 4. (Hanseth, 2001)

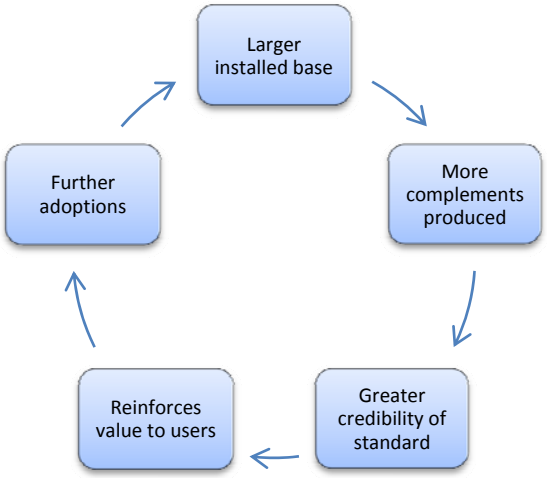

FIGURE 4 – STANDARDS REINFORCEMENT MECHANISM (GRINDLEY, 1995)

The phenomenon of increasing returns and positive feedback has been focused on over recent years in studies (Ciborra et al, 2001) of standards and the concept is contrasting to the basic assumptions of classic economics. According to Hanseth (2001) increasing returns and positive feedback stems from the fact that larger firms tend to have smaller unit costs, know as economics of scale. Large-scale productions machinery produces units at lower cost. Sometimes the cost developing new products are large while making copies of the product is cheap. This is particularly true in the sector of software and information, as the cost of making software products are close to zero while development can be very high. Further, there is a strong connection between increasing returns and learning process. Experience gained both from developing a product can make it easier to incorporate in other technologies and to produce the product even cheaper. Where learning takes place, beliefs can become self-reinforcing, which means that the product that is expected to become the standard will, in fact, become the standard. The success or failure is therefore driven as much by expectations and luck as by the value of the product (Hanseth, 2001).

The notion of networks effects means that the value of a network is determined by the number of users and nodes connected to it (Hanseth, 2001). This fundamental economic characteristic is true whether it is a real or virtual network and essentially this means that: other things being equal, it is better to be connected to a bigger network than a smaller one. Network externalities arise when one member of a network affects others without compensation being paid. These externalities can give rise to both positive and negative effects, for example positive feedback or pollution.

Network externalities and positive feedback lead to a number of more specific effects such as path dependency. This means that past events will have large impacts on future developments, and seemingly irrelevant events may turn out to have a tremendous effect. An example of this is a standard that builds up an installed base ahead of its competitors which makes it more attractive, making the choice of standards path dependent. A small advantage gained in the early stages highly influences the success of a standard. There are two forms of path dependency; early advantage in terms of numbers of users leads to victory and early design decisions of the technology will influence future design possibilities and decisions. The latter means that new products must be compatible with the existing installed base and that many technologies struggle with the backward compatibility problem. In the field of information infrastructures early design decisions have a considerable impact on new solutions both to improve existing services and to add new ones. For example the TCP/IP standard constrains how new Internet based communication solutions can be designed and added. (Hanseth, 2001)

Increasing return may create yet another effect called lock-in, which means that when a technology has been adopted, it will be very hard to develop competing technologies (Hanseth, 2001). In general, lock in occurs when large investments are made in multiple, complementary and durable assets specific to a certain technology. The author identifies a few different types of lock-in: contractual commitments, durable purchases, brand-specific training, information and databases, specialized suppliers, search costs and loyalty programs. The high switching costs along with the coordination problems that would occur when switching from one standard to another also cause lock-in. Switching cost and lock-in s are ubiquitous in information systems and managing these costs is very hard. These phenomena are not only created by hardware and software but by information itself. The database structures and semantics of information in individual data elements are linked together in large complex networks that create lock-in. For infrastructures and standards spanning across several organizations, lock-in problems become even more challenging. The problem of coordination means that standards with large number of users make it very hard to bring them together and have them agree on a new standard. (Hanseth, 2001)

There are, according to Hanseth (2001), two strategies to choose between in order to get out of a lock-in: an evolution strategy of backward compatibility or a revolution strategy of compelling performance. These strategies are based on the tension between innovation and network externalities: is it better to wipe the slate clean and come up with the best product, revolution, or to give up some performance to ensure compatibility and ease customer adaptation, evolution. The evolution strategy focuses on decreasing switching costs so that users can try new technologies and standards gradually. In order to offer this migration path the networks must be compatible with existing products and the key is in building a new network is to link it to the old one. The revolution strategy on the other hand is much more risky. It cannot work on small scale and requires powerful allies. It is also very hard to determine the success of the revolution at an early stage. Radical changes are often advocated but large networks and standards only change in times of chaos or crisis. (Hanseth, 2001)

Another important concept of the drift approach is the role of gateways (Hanseth, 2001). Gateways work as converters between different standards or systems allowing them to coexist even if they are incompatible with each other. This means that the choice of standard can be postponed and several different standards can live on. An advantage is that this gives the decision makers time to acquire more experience about the alternatives, avoiding a premature decision. Gateways support modularization of the information infrastructure which in turn is closely linked to heterogeneity. The decoupling efforts allow greater independence and autonomy which is why modularization is an acknowledged design virtue for information systems. However, since this development is likely to ten years than one the contents are bound to drift as a result of previously unrelated features and functions being brought together. (Hanseth, 2001)

We introduced two different views on infrastructure and standardization in this chapter. These views are summarized in Table 1 below. Both views are used to analyze our case later on in this study, but in order to create an understanding concerning the company studied in our case we start by presenting the research setting.

TABLE 1 – SUMMARY OF THE TWO DIFFERENT THEORETICAL VIEWS

	Weill and Broadbent (1998)	Ciborra et al (2001)
Infrastructure	• Possible to set the limits of • Relatively stable over time • A large infrastructure increases its capability	• Impossible to set the limits of • Constantly changing and heterogeneous • Large infrastructures involve complex problems
Standardization	• Positive towards standardization • Should be enforced • Necessary • Possible to control	• Problematizes standardization • Cannot be enforced • Necessary • Drift will always occur
Management	• Presents managerial advices • Control is central • Advocates models • Hierarchical	• Does not present managerial advices • Control is impossible to achieve • Questions the use of models
Central concepts	• Pyramidal representation • IT portfolio • Selective/extensive services • Reach and range • Infrastructural capability	• Drift • Increasing returns • Positive feedback • Network externalities • Path dependency • Installed base • Lock-in

4 RESEARCH SETTING

The following chapter introduces the settings in which the study was made. To explain the size of the corporation and how decision making works within it a brief overview of Volvo Group is given. The rest of the chapter lays out the background and history of the projects that have preceded the one that we have studied. This is done in order to clarify the process of refining the standard that is now used within the organization.

4.1 Volvo Group

The study was performed at Volvo Group with headquarters in Gothenburg and consists of nine different Business Areas (BA) and five Business Units (BU), as described in Figure 5. A BA is a company within Volvo Group that operates mainly on an external market. They are the ones responsible for marketing and supplying customers with, depending on the area, trucks, and buses and so on. A BU on the other hand is mainly an internal support function, delivering services needed in to run the respective BA:s. The Volvo Group is a multinational company that produces trucks, construction equipment, and buses, as well as engines for boats and diesel-powered generators, while also being active in the aerospace industry. Their operations are spread across 58 countries and they employ more than 100 000 people all over the world. This leads to an organization that is diverse in cultures as well as in languages and ethnicity. This in turn leads to a need for balancing, and taking into account, global as well as local demands.

Volvo IT

To manage, overview and execute their IT operations Volvo Group own and operate Volvo IT which is a global company. The services provided by Volvo IT are divided in Infrastructure Managed Services (operation of platforms and technical support, technical administration of systems), Application Managed Services (application maintenance and changes) and End-User Services (helpdesk, desktop, e-mail and messaging, telephony, training). Volvo IT is the preferred partner for Volvo Group, meaning that they are to be employed whenever they are capable of delivering the required solutions.

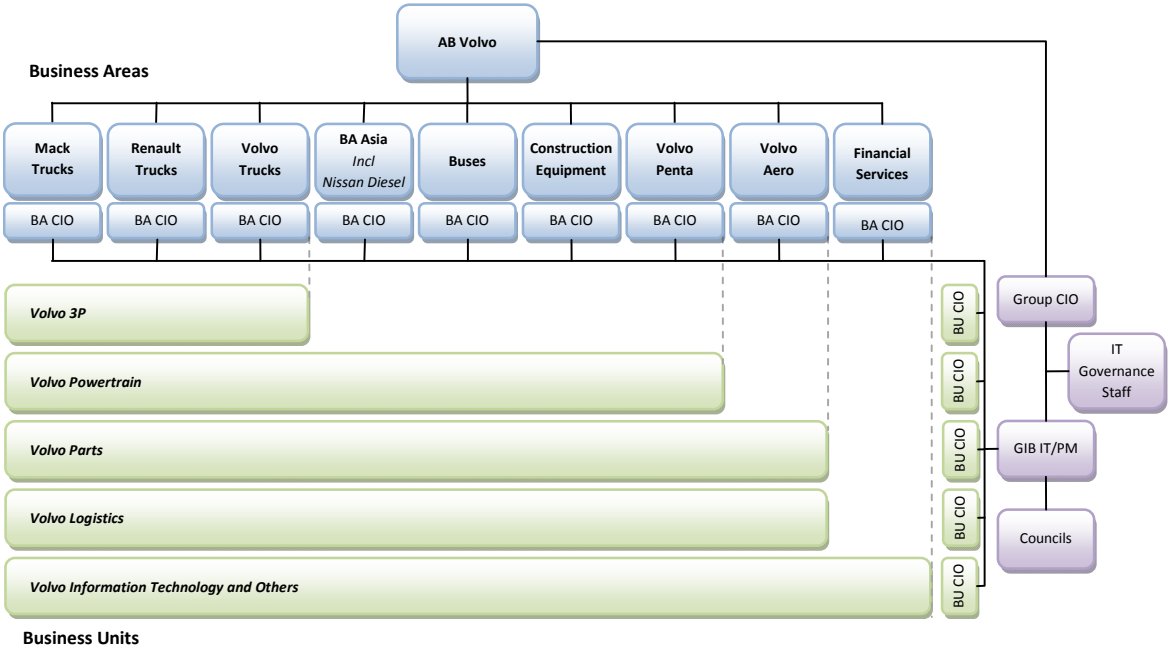

FIGURE 5 – ORGANIZATIONAL CHART FOR VOLVO IT AND THE GOVERNANCE STRUCTURE (VOLVO GROUP)

IT Governance

IT Governance at Volvo Group is proposed to align the organization´s IT strategy with the business strategy, ensuring that the company stay on track to achieve its strategies and goals. Important concepts in the area of IT Governance are strategic alignment, value delivery, resource management, risk management and performance measures. IT Governance consists of the Volvo Group CIO, IT Governance Staff, Group Issue Board IT & Process Management (GIB IT/PM) and several Councils. Councils are established for the development of applications and infrastructure areas within Volvo Group and the councils consist of members from the Volvo Group BA/BUs, appointed by the BA/BUs CIO's. One of those councils is called Infrastructure Council and this council approves what applications and standards will be used. This council, in turn, consists of another five councils where the Desktop Council is the one that handles issues concerning the desktop environments that will be discussed later in this report.

Respondents

Our interviews were held with several persons in different parts of Volvo Group. They are presented by their title and with a short description of their responsibilities.

Global Project Manager (GPM) - Is responsible for the implementation of the entire BITE2 project which among other things included the development, rollout and maintenance of Myplace. One of his tasks is to align IT with business needs at a global level.

Chairman of Desktop Council (CDC) - Is responsible for Desktop Council where decisions concerning the desktop environment, MyPlace, are made.

Rollout Project Manager (RPM) - Works in a group called Infrastructure and Operations, where he is involved in different projects. In the project of MyPlace he was in charge of the global rollout and implementation, which mean that he was in charge the local project leaders around the world.

Business project manager (BPM) - Is responsible for MyPlace at Volvo Trucks globally. He works in CIO office and assists in the rollout of MyPlace, not the technical aspects but in establishing the run-time organization. He also aids in gathering the requirements.

Customer service manager (CSM) - Is the counterpart of the business project manager, which means that the requirements go through him and on to Volvo IT who is supposed to deliver the services.

Service runtime manager (SRM) - Is in charge of a team consisting of 14 service runtime managers from around the world, responsible for the desktop services, where MyPlace is one. He deals with all the products included in MyPlace, such as networks, servers, applications and support.

4.2 The process of standardizing the desktop environment

Several attempts have been made to create a standardized desktop environment within Volvo Group over the years. It began with moving from, what they called, chaos to a more common desktop environment built around the IBM operating system OS/2. This was later to be replaced by a Novell NetWare operating system in the late 80's, early 90's. At the start of the new millennia the first BITE project (Business IT Environment) was initiated in 2000, to be built upon by the recently finished BITE2 project.

BITE and BITE2

The initial reason for commencing the BITE project was the need for a new mail client. The existing Notes mail client was becoming obsolete and needed replacing. It soon became clear that it was not possible to only consider the mail client, the entire desktop environment needed to be analyzed for potential upgrades. This resulted in the BITE project where all clients were to be migrated to a standardized Microsoft desktop environment.

The first BITE project was a downright failure and was terminated quite early. The reason for this was the problem of getting the business interested in the project. Even though Volvo IT had established several forums to gather the demands they were unsuccessful due to their affinity to discussing technological aspects of a common desktop environment. This caused the business representatives to lose interest in the project. Another reason was that the original idea was to have a single client where all the demands were integrated, which of course also meant than everyone had to pay for everything. This was seen as unfair by many and was also considerable factor for terminating the project early.

After rethinking the approach for standardizing the desktop environment BITE2 was initiated. The new project was to be built around four cornerstones that had been identified as essential for the success of the standardization. The desktop environment should be driven by business needs, made in a close partnership with the supplier, built around out-of-the-box applications and adaptable to varying needs in different parts of the corporation. The thoughts behind each cornerstone are described below.

The first cornerstone in the BITE2 concept is the fact that it should be *business driven*. For Volvo Group this means that the development of the standardized desktop environment is supposed to be delimited by business needs, not driven by technology for the sake of technological progress. It also means that the respective BA's are to take more responsibility over what technologies they use and have future needs for. This was, in turn, meant to result in the BA's only paying for the application they utilize and consequently, hopefully, reducing their cost related to their desktop environments.

The second cornerstone, *partnership*, is defined as the IT organizations understanding of business needs within Volvo Group, and is meant to make the IT supplier, Volvo IT, a competitive business partner. The reason for the partnership as a cornerstone in BITE, according to them, is to transform Volvo IT from a sheer supplier of IT solutions to a business partner that has detailed knowledge and expertise regarding the customer's needs and are more business oriented.

The *out-of-the-box* cornerstone indicates that by making use of solutions recommended by Microsoft the thought is to standardize the platform and the basic tools; such as printer handling, e-mail, distribution of applications and so on. Since Microsoft platforms are used all over the world it was found hard to justify the costs of developing a similar standard, and the problems that would arise when acquisitioning other businesses. The plethora of existing applications that run under a Microsoft platform was also hard to ignore.

The *segmentation* cornerstone, presented in Figure 6, means that there is an awareness of the need for local adaptations due to local business needs. The segmentation model was created in six layers; World, Volvo Group, BA/BU, Site, Role or department, User. Each layer is supposed to contain a description of that layers approved applications. For example, the Volvo Group layer contains what mail client, anti-virus application and so forth is to be used throughout the entire corporation. This layer is supposed to be kept as thin as possible, since these applications will be used on all 47 000 clients, thus increasing the cost when including more applications. This was another reason for creating the segmentation model, since it led to each BA/BU, site or department having to carry the cost of the applications they utilize by themselves.

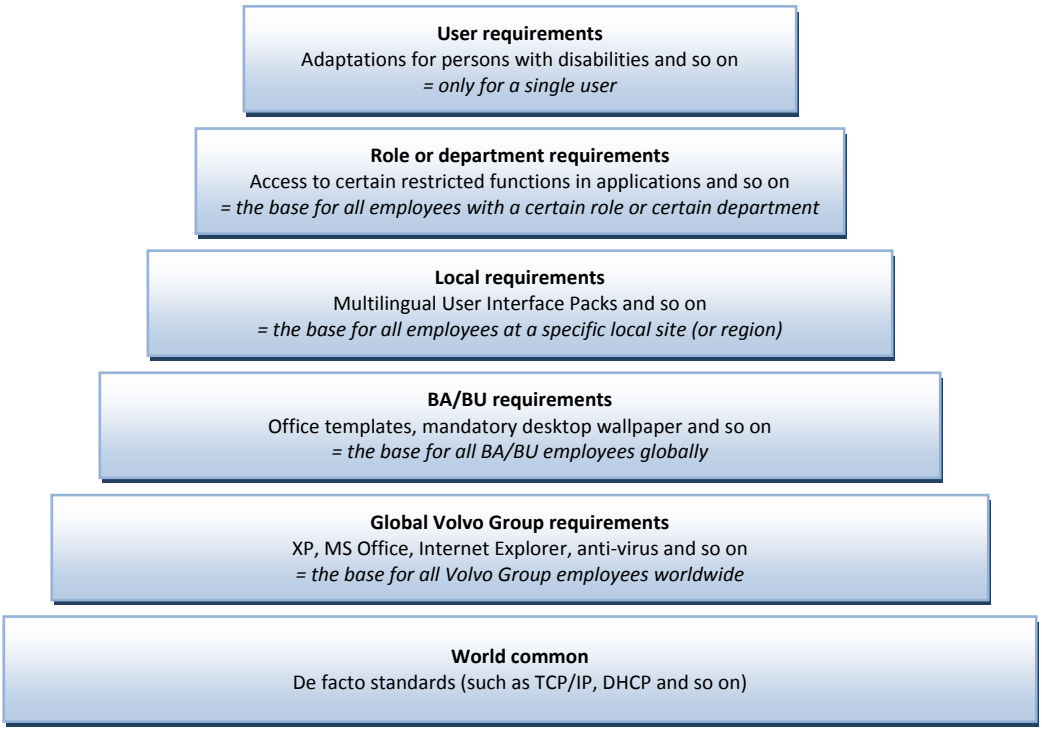

FIGURE 6 – VOLVO'S SEGMENTATION MODEL (VOLVO GROUP)

MyPlace

The technical definition of BITE2 came to be called MyPlace. This was the specification of what the desktop environment infrastructure should contain; its configuration, applications, technical solutions and so on. For a computer to be called MyPlace standardized, it must be locked, which means that no applications can be installed by the end user. Even though MyPlace originally was just the technical specifications it is today used synonymously with, and has almost replaced, the project name BITE2. MyPlace is the current version of the standard that is to be used for desktop environments within Volvo Group and is therefore the standard that we have been studying in our thesis.

5 METHODOLOGY

The following sections introduce the setting and methodological issues relevant to our study of divergence management. We discuss this in four parts: *literature review, empirical study, data collection and analysis*. First, however, we describe our methodological view and approach.

Our study is based on a *hermeneutic view* (Patel & Davidsson, 1994). This approach uses existing knowledge and theory in order to interpret and understand the empirics. In a way this means that it is an approach based on interpretation and subjectivity (Jacobsen, 2002), which to some extent is true in our study where we analyze gathered empirics using our own reflections as well as theories. We aimed to extend our knowledge based on our existing understanding for infrastructural issues.

We chose to practice an *abductive approach* (Wallén, 1996) for our study. Using this approach we combined empirical findings with theoretical conceptions. This allowed us to move between theory and empirics throughout the study and both aspects were considered equally important. The reason for the abductive approach was above all the fact that we had studied theories concerning infrastructures before which made it hard to perform a study without any presumptions. By gathering data and deepening our theoretical knowledge simultaneously we applied our findings in one area in the other continuously. Our need to engage our empirical analyses with our theories also confirms the abductive approach.

The gathering of empirical data was pursued using a *qualitative approach* (Jacobsen, 2002). The characteristics associated with the qualitative approach; openness, flexibility and proximity all matched up with the needs of our study. We needed to obtain a deep understanding and detailed insights regarding the specific case rather than studying several cases briefly, which is also why the qualitative approach was suitable. Another advantage with the qualitative approach is the possibility of modifying how the empirical gathering was conducted along the way, which is why this works well with the abductive approach.

Literature review

In this section we describe our literature review; we explain how it was conducted and then we discuss the credibility of the literature review. The literature review included both theories and related work.

We started our *literature review* (Backman, 1998) with a rather quick reading of the existing literature in the areas of IT-infrastructures and standardization. Our search for articles and books was carried out using the article databases supplied by the library at the University of Gothenburg, mainly SCOPUS, Science Direct, Emerald Insight but also other databases. Furthermore we performed searches using scholar.google.se as it allows searching through several databases simultaneously. The key words used in our search were initially information infrastructure, IT infrastructure, infrastructure, standardization, control, governance, management and combinations of these. This initial search gave us a substantial number of articles which we read synoptically in order to quickly remove those irrelevant. We focused on the articles that discussed different forms of infrastructural standardization in particular, since we had already decided to study a company standardizing their infrastructure. The main topic of the articles apart from this was IT, because we were focusing on IT infrastructural issues and not infrastructural issues in general.

We studied about 40 articles synoptically and then we read the ones relevant to our study in detail. This work combined with the fact that we had read about IT-infrastructures before, made it possible for us to divide the theoretical views into two different groupings. These groups of contrasting views became the theoretical backbone of our study. Also we chose a number of articles to constitute the section of related work. The articles that ended up there either aided our analysis or helped boxing in the problem area of the study. We

chose to categorize the chapter of related work into three areas: standardizing technology, standardizing information systems and standardizing information infrastructures. The idea of this categorization was give a quick résumé of the related work leading towards our area of research.

The literature we have used in our study is publicized in respected journals or presented on international proceedings, which means they have been reviewed by experts in the area. This in turn secures credibility of the articles. What affects the credibility is however the process of article sampling that we have performed. A larger number of studied articles could have given a more complete review of the subject area and also added more aspects.

Empirical study

In this section we describe how our empirical study was conducted. We present how an appropriate case and suitable respondents were selected.

The purpose of our empirical studies was to gather empirical data that could aid us in answering our research questions. In order to realize this we needed to conduct a study in an organization where major infrastructural standardization had taken place. We found this in Volvo Group who actually regarded the shortcomings of the standardization as an important issue on their agenda. Our contact person at Volvo Group is a member of the group called IT-governance which was important because through him we got the mandate to enter all the different companies and areas of Volvo Group.

Our contact person also helped us in selecting respondents in our interviews, which secured that we used the persons with the relevant insight and central knowledge. There was of course a risk in letting him decide on what persons to ask since the result might have ended up different had we chosen respondents our self. We could not however see any reason for him to lead us astray since it was in his own interest that we got the right information. Also, on one occasion one respondent informed us of another person that was relevant for us to talk to, which we of course did. Volvo Group was a relevant case for our study since their standardization project was on a global scale, which was in line with the theories we indented to use as theoretical lens.

The persons selected as respondents, all played central parts in the global process of standardizing the client infrastructure. Together they represented different areas of interest which gave us the different views and aspects that we needed. The different respondents were presented in greater detail in Research setting above.

Data collection

This section describes how the needed data was collected. We present how our interviews were prepared and executed and finishes by discussing the credibility of the data collection.

When gathering our empirical data, we chose to conduct semi-structured interviews (Bryman & Bell, 2003). Our thought was that the interview questions were supposed to be shaped and asked in such a way that allowed the respondent to describe the situations rather than just answering questions. This is why the semi-structured approach was feasible. The initial two interviews included fundamental subjects such as Volvo Group's organizational structure, decision making processes and MyPlace at a rather basic level. The following interviews were more specifically focused on the standardization and divergence handling concerning MyPlace.

Our interview guide also contained questions on a more philosophical level, to capture the more fundamental standpoints of the respondents. Even if the interviews got more and more complex as our understanding grew we stuck to our initial interview guide, modifying it only slightly over time. This interview guide was sent to the

respondents before the interviews in order for them to be able to prepare themselves. However they received a reduced version containing only the main topics. This was a precaution we took to maintain the openness in our interviews, not influencing the respondents to much. The main topic of our interviews was divergences from standard, which of course is closely linked to our research questions. We chose to cluster our questions into four areas; what were the divergences, what were the causes of the divergences, what were the effects of the divergences and how were the divergences managed.

All the interviews except one took place at the different Volvo Group sites were the respective respondent was situated, which was a choice by the respondents themselves. The other interview was conducted at the IT University. The respondents had reserved between 60 to 90 minutes to our disposal. Under none of the interviews did we feel that time was a limiting factor, instead the questions were answered within the timeframe. The interviews started with us presenting ourselves, our background, the purpose of the study and how they were going to be featured in our study. We welcomed the respondents to contact us if they wanted to read through or correct our interpretation of their statements, which none of them felt necessary. We also asked each respondent if we were allowed to record the interview, which was accepted by all. This was important in order to secure that we did not miss out on or forgot important aspects from the interviews.

We conducted our interviews using the interview guide and we asked further questions when the respondent did not answer our questions fully. Additional questions were also asked concerning subjects outside the interview guide, raised by the respondent. Four out of our six respondents used Power Point presentations to exemplify and explain different aspects, presentations that were given to us as reference afterwards.

Directly after each interview we discussed and wrote down our immediate impressions so that the respondent's body language and undertones were captured as well since the recorder cannot capture some aspects of communication. After that we transcribed the interviews from the recording. We chose to do a literal transcription so that we could use every statement later on in the upcoming analysis. This work laid the foundation to the presentation of our empirical findings and was of course an integral part of our analysis.

One aspect that favors the credibility of our study is the fact that we got six different persons views on the same issues. This allowed us to compare the answers of different respondents making the answers even more trustworthy. After each interview the recorder was turned off so that the respondent could speak freely in case he felt pressured by the recording of the conversation. Not that we could see any reason for them to lead us astray but a person might be subconsciously colored by his standpoints and appreciations. None of the persons interviewed where however plain users of MyPlace which might have given yet another point of view. All of the respondents used MyPlace at a daily basis which meant that they had some usage awareness as well. One aspect that might have affected credibility is the use of a recorder which in some cases might hinder a respondent from telling the whole truth. We do not however think that this was the case since the respondents seem to answer our questions in an open and calm way. On the other hand the recording of interviews allowed us to return to the respondents' answers over and over again.

We established a good relation towards our respondents and all of them offered to complement the interviews if needed. One occasion we felt the need to supplement one interview and an extra interview with that respondent was carried out. This gave us the possibility to contact the respondents until we were satisfied with the answers given to us. This gives the study credibility since we could secure that we got enough information.

Analysis

After the interviews had been conducted and we had written the chapter of theory it was time to analyze the results in order to see what common features they had and how they were related to our chosen theories. This process is described in this chapter. We also discuss the credibility of the analysis.

The respective interviews were transcribed and hesitating words like “eh” and “mm” and so on were removed and transformed to the form of quotations used in our report. After that, all quotes of irrelevance were removed, and the residual quotes were clustered. We chose to present our empirical findings using three of the clustered areas used for the interviews. In order to perform this clustering we printed out all interview quotes, cut them apart and divided them into different piles based on what they discussed. One additional area was discovered concerning the fundamental mindset of the respondents, forming a total of four areas: organizational mindset, divergences and their consequences, causes for divergences and managing divergences. The analysis is presented in a way where it refers to our empirical findings as well as our theory and related work. We use all of these areas of gathered knowledge to answer our research question, arguing for our conclusions and demonstrating those using examples.

A problem with all forms of transcribed text is that it may not always represent exactly what the respondent said from the beginning. In our case, we had to translate the transcriptions from Swedish to English which of course might have lead to minor modifications of what was said, since one cannot translate every word literally. We have tried to translate the quotations in such a way that the main argument is preserved. Our initial quote selection and clustering can be seen as an early analysis since we had to interpret and make decisions regarding what was relevant. We, however, see this phase as a categorization rather than an analysis and only the quotes of obvious irrelevance were removed at this point. We used our theoretical reading as support in order to identify the important areas of analysis. This can be seen as a problem since we actually did an analysis of the theories from the start which in turn could affect the formation of interview guides and categorization of relevant areas. We tried to avoid missing out on important statements by grouping all quotes that were left over and reviewed the relevance again.

This concludes the chapter of methodology where we introduced the setting and methodological issues relevant to our study of divergence dimensions and management. We described our methodology in four parts: the methodological approach, theoretical methodology, empirical methodology and analytical methodology. In the next chapter we present our empirical findings which consist of the interviews with the respondents from Volvo Group.

6 EMPIRICAL FINDINGS

This chapter presents our findings, based on the various interviews we held. The chapter is split into four parts, each reflecting an area that was identified before, during or after our interviews. These areas consist of organizational mindset, divergences and their consequences, causes for divergence and finally divergence management. The respondents will be labeled using the abbreviations presented in the Research setting; e.g. GPM, CDC and so on.

6.1 Organizational mindset

Organizational mindset addresses the different respondents' views on information infrastructures, standardization, divergences and drift. These views and beliefs are essential when it comes to how they relate to divergences since they affect their standpoint regarding them. This section is divided into two different areas, standardizing infrastructures and divergences and drift, each addressing a separate part of the respondents' mindset regarding the mentioned areas.

Standardizing the infrastructure

The initial mindset, concerning the establishment of the global infrastructure, was that each BA/BU of the Volvo Group was to develop an infrastructural environment optimized for their needs. The thought was that they would decide upon the content of their client, i.e. what applications to use, and it would then be Volvo IT's responsibility to deliver this to each of the BA/BU:s. Something that the RPM explained:

> *"The respective firm was to decide on the content of their client. Then it was up to us at Volvo IT to see to that these requirements where met for that firm on every location."*

This idea was however partly abandoned in favor of a more standardized solution that was to be adapted by basically everyone. The reason for this was that several of the different BA/BU:s did not know where to begin since their knowledge was limited in these areas. Therefore Volvo IT as a BU was the first to migrate and basically set the standard for the continuation of the project. This was due to the fact that many of the other BA/BU:s realized that their demands were not that different from the basic demands in Volvo IT. The goal was to create a standard that would be implemented on a global level, both geographically and organizationally. This would also be a way of saving money, since the infrastructure would be identical, or similar, across the entire corporation. The CDC mentioned:

> *"This was a way to minimize costs, if every firm was to build their own infrastructure there would not be any advantages of scale."*

With the new client infrastructure building on an old one, there was also an ongoing debate on how to handle the existing applications and solutions. Often this debate revolved around whether to keep it or replace it with the new standardized infrastructure. Many times the decisions were based on whether the cost for replacing it would be too big or not, the CDC described it by saying:

> *"It is a matter of cost, and of how much you want to reutilize what already exists."*

The basic idea of the standardized client infrastructure was according to Volvo Group a matter of control. In order to achieve control, a corporate wide standard policy was required, along with a consistent way of managing decisions regarding the standardization. One part of the control exerted was the fact that the standardized desktop environment was locked in the sense that the end users cannot make any changes by themselves. In order to make changes or install new applications administrator rights was required; therefore

all applications were distributed centrally by Volvo IT. However, not all BA/BU:s have been equally successful when it comes to implementing the standard. Some have been very strict not allowing any alterations, i.e disallowing users to change desktop wallpapers. Others were not as strict and had a more allowing attitude towards individual adaptations. The BPM addressed the differences saying:

> *"At Volvo Trucks we have been quite strict, saying that we are to adhere to the standard. […]The problem is that, at Volvo Group, and maybe in other firms as well, management is always not handled very well. If you claim that you want to head in one direction, you have to do so even if it comes with a certain cost."*

A part in gaining control over the desktop environment was to reduce the amount of applications and solutions that was used within the organization. However, some respondents mean that this has not yet been fully successful, and that there is a lot more to do in that area. The standardization process was a part in doing this as well increasing the awareness concerning which applications were used and which were not. One defining step in clarifying which applications to use was the creation of the segmentation model, Figure 6. This model, as described above, aimed to define the allowed applications on a level to level basis. This could be seen as a try to partly keep the idea of letting the different BA/BU:s define their own desktop environments. Another central reason for the segmentation was also to make certain that those who utilized the applications should be the ones paying for them, or as the GPM put it:

> *"[…] the thought behind the model is unbeatable; the whole point is that no one should drive costs for someone else."*

The general view within Volvo Group was that it was necessary to standardize as far, and as much, as possible. It was expressed by several respondents that a global and identical platform was necessary since this makes it possible to centralize management. This would, in turn, enable the option of managing and updating applications and solutions globally. The thought was basically that the entire client infrastructure should be identical across the organization globally. However, this approach also implies that local demands sometimes have to be overrun or ignored. The GPM expressed it by saying:

> *"Sometimes you have to make local adaptations in order to meet customer demands. These kinds of aspects must be removed in order for us to manage the technical platform globally as well."*

Based on this view standardization was largely seen as a positive, necessary and efficient way of managing infrastructures, even though it sometimes had negative consequences. The general idea was that standardization lead to increased control and easier management. An example of this was that information was easier to share globally since everyone uses the same applications. Another was that the control over used applications was easier to exert. The general view was well summed up by the SRM:

> *"Standardization for me is effectiveness and quality."*

There was however a few that saw drawbacks with standardization as well, realizing that there were consequences to it. Mostly this was related to cases where adaptations to local needs have had to be ignored or refused. The standard was considered to be for everyone, but it was not always advantageous for everyone to use it. Also, from a business perspective, it might not always be beneficial to standardize too far. The GPM expressed this business related view by saying:

> *"It can cost money if you standardize to a degree where you have make investments that exceed the benefits."*

All in all, the general view was still a positive one, even though there were negative aspects as well. The view was, as mentioned, that the standard should try to make certain that everything was identical. This, however, was easier said than done, and the views of our respondents on the subjects of divergences and drift will be elaborated on in the following subchapter.

Divergences and drift

As implied in the previous section the general view was that divergences and drift would not occur. As a result of this there was obviously no established way of relating to, or managing, divergences and drift. Also, since the idea was that no divergences would occur the managerial decisions had to be made as the divergences were discovered. Basically this led to view that divergences were not accepted and should be removed as soon as possible. The fact that there was not much regard taken to the possibilities of divergences and drift was expressed by the RPM:

> *"Those who wrote the document [concerning how to implement MyPlace] thought it would end up being 100 percent identical as it was just to read the document. We did not think there would be divergences that we would have to correct afterwards, there were no such thoughts."*

A more pragmatic view was, however adapted along the way by a few managers. Divergences could be accepted if they were needed, even if they were still considered negative. The result was that several divergences that had been agreed upon and documented were allowed to exist. If it was not, then there could be considerable problems related to it in the future. This was expressed by the BPM who said that:

> *"Divergences from what was agreed are never good if they have not been agreed on, so to speak."*

There was also a realization that the initial definition of the standard was not complete or might have to be expanded. The view, however, was to strive towards a single common standard that in the end would be global and without divergences. The hope was that drift will decrease as the standard grows and wins support. The following quote by the GPM suggested that the process of standardization and drift management was considered an ongoing project:

> *"Hopefully we will not get that many divergences once we have standardized."*

In essence the initial view was a rather naïve one, that lived under the presumption that it is possible to create a single standard defining the entire client infrastructure. Along the way, though, they realized that this was not the case and that divergences would occur, however decisive they tried to be when implementing the standard. The different divergences that were found and what they led to is described in greater detail in the following chapter.

6.2 Divergences and their consequences

Drifting occurred, despite a certain belief that it would not, which meant that several divergences were identified. These divergences were quite different but they could be categorized in two different areas; technical and procedural. These areas can, however, be divided into subcategories. A technical divergence can include divergences in what application was being used, as well as the technical specifications of a PC. A procedural divergence can be a difference in approval processes for acquiring new applications locally or different steering models as mentioned below. In addition, the divergences could be consciously or unconsciously created, they can exist in different levels in the segmentation model amongst other things. The distinction that is made below is based on how the divergences were perceived.

The GPM exemplified this by saying:

> *"There is everything from technical divergences to divergences in the different firms steering models and they can lead to each other."*

He also elaborates on where the divergences can occur; that is, on what level within the organization. The results of these divergences, especially the technical ones, were often experienced as a lack of mobility. Employees travelling between the different sites of the organization would not always be able to use their laptops at all sites. However, there were also other reasons for this, especially since the standard is not yet fully implemented in the entire organization.

Technical divergences

One of the larger technical divergences was the difference storage solutions. The divergence meant that customers arranged for a different storage solution than the standardized one, authorized as a part of MyPlace. The solution that was used in Gothenburg had been decided upon as the standard and the one that should be used globally. This solution allowed a central management and backup routine. If someone accidentally deleted an important document it could be restored basically immediately, also if a computer crashed it could be restored over night with the latest backup. Furthermore, if the entire server went down, it would have to be replaced with a new one, instead of just distributing the data from the central storage solution. However, some local sites had implemented their own storage solutions for various reasons. Many of these solutions were lacking in features, hence made it difficult to restore information to the same extent as mentioned above. Another reason more related to the standardization itself was that the central control was lost. The CSM mentioned this by saying:

> *"[…] we are supposed to deliver a global service that we can manage centrally. Local adjustments are not sanctioned."*

Another large divergence was the use of so called open clients. These were PC's where the end users had administrative rights and could install, alter or remove applications on their own. Sometimes this was because certain applications required PC to be unlocked to run, other times it was perceived as a need by both user and manager. The problem with this was that it would be impossible to control what applications were used and what security settings were set. It would also be hard to restore the client to a standardized, locked, client. The BPM explained why:

> *"Once you have reached that state, there is no turning back. You have to re-install the client."*

These were the largest and most commonly mentioned divergences; however there were several other minor technical ones. On a client this could be a different security setting resulting in the firewall allowing things that were not agreed upon. That in turn would lead to users being able to enable, for example file sharing, which could have larger consequences in the end and give different sites totally different functionality. There were also cases where applications that had been decided upon not to use were implemented anyway. An example of this was given by the BPM:

> *"We decided to remove WinZip, not because it was very expensive, it was just an unnecessary cost since the same functionality is included in Windows XP. However, when I came to the UK everyone ran WinZip, which goes to show that you don't always succeed."*

Even though this could be seen as a rather small divergence, and a fairly cheap application the total sum would be quite large if it had been run on all 47 000 clients.

Procedural divergences

One of the most common procedural divergences that were encountered was related to the support processes. Again, it was adaptations that meant that there was a different solution locally than what was agreed upon globally. The global agreement was that all support cases were to be handled by the global helpdesk. This function offered assistance 24 hours a day, seven days a week. Some sites, however, had local employees working as *'running support'*. Something that worked fine, until that person called in sick or left for another job. This resulted in difficulties comparing the different sites since there would sometimes be costs for a site not related to the standard, but in contradiction to the standard. Sometimes there would be billings for a product called *'Helpdesk'*, which was not a part of the standard, that helpdesk was called *'MyPlace Support'*. The BPM elaborated on the problem by saying:

> *"Helpdesk […] what kind of product is that? Normally it is called 'MyPlace Support' as a global service and that is what I look for when I want to compare costs."*

Another common divergence was related to how invoices were specified and handled. A good example of this was that the invoices looked very different. There were different price structures for the same service depending on where in the world one would look. There were also differences in how the services being paid for were presented; sometimes the same service would be presented in different ways based on the customer, even though it was the same service. The CDC gave more details by saying:

> *"We had services with the same content but different names and price, and we had different services with the same name. This made it impossible to compare […] even though it was a global service. "*

Technical and procedural divergences were the two central identified categories based on our interviews. These two different types of divergence have several things in common, and oftentimes that commonness was related to the reason for the divergences. This will be the focus of the following chapter.

6.3 Causes for divergences

Just as there are a multitude of different divergences, there are also several reasons for the existence of them. Several of these reasons share similarities in why they appeared, even though they appeared on different sites within the corporation. The three clear reasons we have found in our study can be categorized as divergences because of; local needs, legacy and human error. All of these will be described in greater detail below.

Local needs

One of the most common reasons for divergences that the respondents talked about was adaptations to local needs. These adaptations occurred in many places and were very different in how they looked. One of the more common parts where divergences occurred was storage solutions. Several respondents mentioned that the main reason for this type of divergence was that local managers found it better to buy a cheaper solution and use the exceeding money to develop the local organization in other parts. In many cases the solution was good and worked well, but it still was not accepted as they were supposed to be able to manage it centrally as a global service. The SRM spoke, not only about managers, but technicians as well:

> *"We have had creative technicians locally that have thought 'Ok, this is what they say [at Volvo IT], but we have a better way of doing it'. […] In certain cases their solutions are better than the central design, without a doubt, but it still isn't ok"*

Another of the major areas where divergences existed was when it came to support, helpdesks, as we mentioned in Procedural divergences. When MyPlace was to be implemented on a site in Italy the manager of

that site started to question the increased price that he would have to pay in order to use something that he saw as something forced upon him by Volvo Group globally. This caused his IT supplier, Volvo IT in Gent, to review what the MyPlace standard included and they realized that they could solve certain aspects cheaper by doing it themselves or suggesting that he arranged it locally on site, resulting in increased risks as stated in Procedural divergences. This was how the divergence in support solutions was created. It can be argued, though, that this was not solely based on economical factors, but political as well. The BPM, however, means that even though it was a technical divergence that was not the cause for its existence:

> *"This has nothing to do with technology. […] They choose to deliver a different service to lower the cost for the customer and to make more money themselves, money that otherwise would have gone to Gothenburg. […] That is politics, not technology."*

As the BPM explained it, it was not because the technologies were low-grade or the problem. The CSM explained that it was not that the solutions in MyPlace was inferior, rather it was the fact that strong local managers act on behalf of their local organization, was trying to minimize the costs for the local site. This did not always go hand in hand with the implementation of the standard. Although many respondents agreed with the need to avoid and correct divergences some also stated that divergences based on local demands were something that will occur, and was also something that partly could be accepted since they might exist for a good reason. Another reason for the need to meet local demands that was mentioned was that certain prerequisites were not fulfilled. Such as in the case mentioned above when a Latvian site could not buy their PCs from the preferred supplier, the BPM explained:

> *"When it comes to hardware, certain sites […] did not have a good relationship with the standard brand [PC] dealer at that site so they were using an alternative brand […]."*

Due to the poor relationship with the local dealer it was simply not possible for the Latvian site to buy their PC's from them. Thus, even external factors are reasons for making adaptations to meet the needs of a local site.

Legacy

Another major reason that was presented by the respondents was the already existing infrastructure, legacy, of both applications and hardware. Due to the fact that Volvo Group previously had, and still have, a multitude of applications and systems, certain connections between them are unknown or necessary to run the business. Consequently some of these applications cannot easily be removed or replaced. The GPM explained the consequences of legacy:

> *"When it comes to applications it is possible to find that systems are similar [hence should be possible to replace] but connected to other systems that makes it necessary to keep them"*

One reason mentioned by many respondents for technical divergences was that the different sites ha very diverse starting points. Even though basically everyone used Novell it was implemented in various dissimilar ways, it was only similar by name. This meant that the existing infrastructure to some extent set the boundaries for what would be possible to implement in matter of new infrastructures. Apart from taking into concern that legacy systems needed to be preserved, older investments in certain technologies needed to be taken into consideration as well. The GPM mentioned storage solutions as a good example of this.

> *"Storage solutions are expensive and in some way we try to standardize globally, but at the same time we have [existing] agreements where we might have a legacy [to take into consideration]."*

An example of this was the US sites, where large investments had been made in SAN[1] solutions. The standard solution for storage in MyPlace was built on a NAS[2] solution instead. Many of these areas are hard to identify, especially when it comes to applications and their various connections. Certain applications may be business critical but only through connections to other applications, therefore making it impossible to foresee the consequences of removing or replacing them. This and the fact that certain investments have been done recently, thus making it difficult to motivate a replacement financially, makes it difficult to totally adhere to the standard, the SRM described it:

> *"We know that these divergences exist; we just don't know the details. [...] part of it might be that a lot of investments have been done before MyPlace was introduced and [they] might not be willing to throw out that solution before it is written off. That might be a reason, but there is a lot of history that we don't have all the facts about."*

Many respondents agreed with this and also added that legacy was one of the main reasons for not being able to implement the standard the way it was intended. At the same time, they all recognize that it would be impossible to remove all divergences caused by legacy since that would be associated with great risk.

Human error

A third reason for the occurrence of divergences was the fact that people made mistakes. Technicians set up an environment incorrectly or a manager made a decision based on faulty data and so on. This was seen as one of the more unfortunate reasons for divergences since they could have been avoided easier than the other reasons mentioned in this chapter. This was something that could happen anytime during the implementation. The RPM mentioned the misinterpretations of the document describing the rollout process as one of the main reasons for divergences during the initial global rollout project. These types of errors are caused by misinterpretations are however being reduced over time as technicians are becoming more experienced, the SRM said:

> *"Errors in the implementation often originate from [...] inexperienced technicians that aren't used to implementing [MyPlace]. [...] Even though it is much less common now, it still happens from time to time."*

However, it was not the belief that divergences caused by human error would be possible to eliminate totally, even though technicians are getting more skilled, or as the RPM put it:

> *"We are not robots; it is just unfortunate that it happens."*

Something that sums up the general view shared by them both concerning mistakes made by those involved in setting up the environment.

6.4 Managing divergences

The divergence management in the rollout process and the following runtime state could be divided into two types, the proactive and the reactive. These types were identified in our empirical study. In addition to this there were also some attempts made at sharing the information gathered across the organization. This will be discussed under a separate section in order for the presentation of it to be clearer. This can however be seen as both proactive and reactive as it concerns sharing gathered information in order to avoid future mistakes.

[1] Storage Area Network
[2] Network Attached Storage

To a certain extent Volvo Group was aware of the need for local adaptations and therefore, among other things, created the segmentation model. Individual BA's have also proactively been trying to implement the standard in such a way that the outcome would be identical. This was not always successful and led to the necessity of reactively managing the divergences that had arisen.

Proactive management

One example of a more proactive way of managing the potential drift was in one BA where a review of every site was made before starting the roll out. This was to make sure that all agreements and processes were in place before beginning the implementation of the technical solution. This included both a business perspective and an IT perspective. This could be as diverse as examining whether the applications were packaged for the standard client, if policies for external equipments were written, if the approval process for new applications was in place and so on. Not until that was made certain did the rollout begin. If reasons for divergences were discovered they were supposed to be agreed upon so that they were documented, the BPM described it by saying:

> *"We have a global agreement with Volvo IT, then we have some local agreements, adaptations, that can exist but there should be a written agreement for that. For example in Poland we are implementing on a site in Warsaw, where there is cheap IT personnel. Then they can have the first line support and then we write an agreement for that."*

Another way of preventing or proactively managing divergences was similar to this. When rolling out the standard any potential divergences that were identified should be reported to the Desktop Council so that they could make a decision on what to make of it. As the SRM mentioned:

> *"[We] try to identify the divergences that exist so as not to remove anything that is business critical. It might actually be services that the entire organization can benefit from, and then we need to know that."*

This was, however, something that was not done from the beginning. It was rather something that they had found out along the way that would be necessary to avoid side effects of the standardization.

Reactive management

During the daily work several divergences were identified as shown above. These, of course, had to be addressed and handled in one way or another. Depending on the type of divergence and its overall effect within the organization a variety of ways was used to manage them. This ranged from the isolated and small ones to larger and more complex ones. The smaller and more easily defined ones where often handled as regular changes. An example of this would be the case where the firewall settings mentioned above needed to be changed.

Some divergences were more extensive and the reasons for them were not as obvious as in the example above. This has led to the necessity of doing a total analysis of the divergence. An example of this was when the set-up of a site differed totally in the technological aspects as the SRM described.

> *"Somehow the end user experience was the same [as in the standardized environment] but the underlying technology was totally different. Since it was not possible to immediately see how to correct it we performed a total analysis and examined setting by setting to produce an action plan – do this to correct the problem."*

In cases where the divergences were even wider and more difficult to define, projects were set up to make sure that the results were consistent. Many of these cases was the result of a BA or BU where the environment had

been handled locally to a large extent and Volvo IT only had been used as a consultant. It turned out that the man-hours needed would be many, so an entire project was necessary.

Sometimes divergences were impossible to avoid, as in the case presented above where certain sites had to use hardware suppliers that did not deliver computers adhering to the MyPlace standard. Due to bad relations with the preferred supplier the local site used computers of a different brand for a while. This was solved after a while, as the CSM explained:

> *"[…] one after another [they] replaced these models with the ones from the preferred supplier as soon as the differences with them were solved."*

This was explained by the GPM as necessary since the standard sometimes had to be implemented successfully. It was not always possible to do everything at once. In line with this he also mentioned that there were different ways of relating to the divergences regarding what to do with them. He gave two options that had been used by Volvo Group. The first was to eliminate the divergence, which basically meant to insist on the standard that had been agreed upon. This could be done either over time or immediately, one reason for waiting could be that the diverging technology was not yet written off, as mentioned above. The second way of handling a divergence would be to allow its existence. One reason for this might be an application that was so tightly connected to the overall infrastructure that it would be impossible to remove without causing trouble in other parts of the organization.

Sharing information

Based on the different divergences and the types of decisions made regarding how to handle them, there was also a need to share this information to others. To be able to use the experiences and information gathered within the organization attempts have been made to share information in a structured way among the project managers globally, the GPM named one way:

> *"We have a 'book' where you write how the project has been run. There is a checkpoint where you check what others have done before. It is being established but it can always be improved"*

However many respondent claimed that the ways of sharing information were not as many or as good as they could be and saw a lot of room for improvement. Attempts were made by trying to define support processes or checkpoints as mentioned above. However the BPM expressed that it was not working very well:

> *"That is something that [we] are really bad at. Drawing from previous experiences and bringing that into the next project instead of running into the same wall over and over. There is a lot of potential in that area I think."*

As both respondents said there was a lot of room for improvement in that area, something that other respondents agreed with. By improving the ways of sharing that information the hope was to become more proactive in their ways of managing, by spreading the information on how they acted reactively.

The four different areas presented in this chapter describe the views and actions of managers closely linked to the standardization process regarding their client infrastructure. In the following chapter we will expand on how these findings, together with the presented theories, can be used to understand how divergences work and how they can be managed.

7 ANALYSIS AND DISCUSSION

In this chapter we analyze and discuss the empirical findings based on the theories presented in our study in order to find the answers to our research questions. Our choice of combining ideas from both theoretical standpoints influences our claims regarding both the dimensions of divergences and how to manage divergences, arguing that a managerial middle course between the two different theories is needed. This chapter is divided into; *the dimensions of divergences*, *managing divergences* and *divergence process management.*

7.1 The dimensions of divergences

In this section we present the different dimensions of divergences we found based on our study, including empirical findings as well as theories and related research. Hanseth (2001) stated that infrastructure is an evolving, shared, open and heterogeneous installed base. Nature, society and economy have always been unpredictable as well as uncontrollable and infrastructure implementation and management is disrupted by unexpected outcomes and side effects which require frequent adaptations, if not reinventions, of the initial solution (Ciborra et al, 2001). Hanseth and Braa (1999) claim, that the diffusion and adaptation of infrastructural standards drive their own change. In this way, they claim, an infrastructure standard becomes obsolete by its own success. These theories consider drift as a natural part of infrastructure development. We share this view, and if we apply these aspects on infrastructural standardization we can see drifting from standard as inevitable. One result of drift in the process of infrastructural standardization is the actual divergences from standard. We claim that divergences therefore are not mere errors or mistakes causing a solution to differ from the standard, they are outcomes of the always present phenomenon of drift. Infrastructural divergences from standard can reveal themselves in different ways and have diverse causes. Depending on the character of the divergence the effects it has can vary. In the following chapter we will analyze and discuss the dimensions of infrastructural divergences. Based on our study, we have identified five dimensions forming the divergence; *the type*, *underlying causes*, *time of creation*, *context* and *effects* of the divergence in question.

Type

We claim that the type of infrastructural divergence is an important dimension of the divergence. Weill and Broadbent (1998) divide the elements of infrastructures into different layers or levels. As standards apply on different levels, we argue that divergences can occur on different levels as well. In other words there are different types of divergences from a standard. When a divergence is to be analyzed it is important to identify what level is primarily of concern. Weill and Broadbent's (1998) pyramidal representation can be used as one base for understanding different levels of an infrastructure but also different levels of divergence. However, Ciborra et al (2001) question the possibility of dividing infrastructures into layers, since it is difficult to define the borders between them. The divergences identified in our empirical findings could be categorized in two different types of divergences, namely, technical and procedural. There are also subtypes of a divergence that could be described using dimensions like local versus global, conscious versus unconscious etcetera. All of these aspects of this dimension are equally important to be aware of since they all affect the divergence.

Underlying causes

The second dimension of a divergence is the underlying causes of its existence. In order to understand why a divergence has occurred, we argue that the fundamental reasons and causes must be disambiguated. Weill and Broadbent (1998) give an example where a business unit breaks away from the standardized infrastructure due to poor service and unique needs. Understanding the reasons for the breakaway would be crucial in order to

satisfactorily comprehend the divergence. The respondents in our interviews pointed out the importance of understanding the underlying causes for divergences. The BPM, CSM and GPM all spoke about local needs, such as economical factors or systems legacy, as important aspects to consider when analyzing a divergence. Rolland and Monteiro (2002) emphasize the importance of recognizing local needs as a significant factor when implementing a shared infrastructure. This means that local interests and needs cause divergences. According to Hanseth (2001) an infrastructure is composed by ecologies of infrastructures layered, linked and integrated with each other. This can make it hard to find the original cause of a divergence. However, we believe that all information about the causes of divergence assists in understanding it, presenting a more comprised perspective on divergences. The underlying causes is an important dimension, since a divergence seldom appear spontaneously, mostly there are several reasons for them, whether good or bad.

Time of creation

We also claim that it is important to know when a divergence was created in order to fully understand it. Hanseth's (2001) theories concerning path dependencies for standardized infrastructures are applicable when analyzing a divergence as well. Depending on how long it has been since the divergence was created, the path dependency of the divergence can have varying influence on the overall structure. A practical example of this was when the GPM stated that some divergences, like large investments in a non standard server technology, created high switching costs in order to eliminate divergence. However, if a non standard solution is close to be written off, the divergence might be less path dependent. Hanseth's (2001) theories about increasing returns are also applicable in order to understand how the time of creation is an important dimension of divergences. In the authors example old technologies live on because of the number of users attached to them. We mean that this can also be true for a divergence. If the divergence has existed for a long time, it might have attracted a large number of adopters, adding to its sustainability. This is also closely linked to the context of a divergence. By knowing the time of creation for a divergence it is also easier to understand the reason for its existence. Something that might seem as a divergence at the moment might simply be a remainder of an earlier solution or infrastructure.

Context

Another important dimension of divergence is its context. The theories of the drift approach are based on the notion of infrastructures as complex collages, where the interdependencies and interweaving of people, systems and processes are central (Ciborra et al, 2001). These theories can be applied in order to understand an infrastructural divergence, based on the information about its relationships, interdependencies and connections to its surroundings. Hanseth (2001) describes how a standard gains ground by having more adopters and supporters, thus increasing its importance. We believe that the same could be true for a divergence, since the amount of users or systems, its context, relying on the divergence would affect its necessity. Hanseth (2001) also emphasizes the influence of the installed base. The GPM explained the consequences of legacy which meant that applications and systems had to be kept because of their connections to other systems. A perfect example of how the relations of a divergence are important aspects to recognize. In a similar way the BPM pointed out that relationships with external factors such as a vendor can be important to recognize in order to fully grasp a divergence. The importance of understanding the context of a divergence cannot be underestimated since this means that the divergence can affect much wider areas than those in which it is discovered.

Effects

The last identified divergence dynamic is the effects that come as a result of the divergence. These can sometimes be hard to identify and relate to. Weill and Broadbent (1998) say services can be easier to value than technology components. In the same way it might be helpful to analyze the effects of a divergence instead of the technical divergence itself, in order to understand it. Our respondents gave several examples of the negative aspects of divergences from standard. The CDC mentions incompatibility as an effect of divergence while the CSM focuses on the security problems that can arise from a divergence. These kinds of negative effects must be regarded as central aspects of the divergence in question. The BPM presented a case where support was agreed to be handled by the local site in Poland, where certain positive effects of the divergence, such as cost reduction, was anticipated. Information about the effects, positive and negative, is therefore important when analyzing the dimensions of the divergence. The GPM spoke of the need to weigh standardization against the sacrifices made to achieve it, in other words; the need to weigh the effects of the standardization against the effects of the divergence. It is not as simple as just saying that a divergence is positive or negative. A divergence is always both, however not necessarily in the same parts of the organization. Therefore it is even more important to consider both aspects, since something that seems as slightly negative on a global level, could be very positive on a local level. In the next section we propose how divergences should be managed.

7.2 Divergence management

Our theoretical study is built around two quite different views of infrastructure, see Table 1. These views have contrasting mindsets and approaches to managing infrastructures and they also differ in their stance towards standardization and drift. In this section we analyze and discuss the views, comparing them to the mindsets and approaches held by our respondents at Volvo Group. We also discuss how the different views can complement each other which lead to a recommendation for divergence management.

Although the theoretical views presented in our study have profound differences in their stance towards infrastructural standardization, they also have some contact points. The fundamental differences are strongly connected to the difference in focus of the theories. The classic management approach (i.e. Weill & Broadbent, 1998) focuses on simplifying reality by using models, such as the pyramidal representation, to enable management and thereby achieving control. We believe that this model can be useful as a start, when trying to understand infrastructures and their components but it does not however address the complexity of infrastructures. This is pointed out by the opposing view (i.e. Ciborra et al, 2001) which focuses on the problematization of infrastructures rather than proposing ways of managing them. We argue that the different focuses of the views make them complementary to each other rather than opposite stances regarding the same infrastructural issues. By using examples from our study at Volvo Group we aim to demonstrate the need for a classic management focus on control, but also the need for drift awareness and divergence management.

In our interviews with our respondents from Volvo Group we identified several different opinions, from person to person, regarding their views on standardization and divergences. The basic idea was that there should be no divergences, as pointed out by the RPM, SRM and GPM when saying that the solution should be the same globally. Volvo Group seems to have total standardization as an ambition, which is in line with the control approach, where Weill and Broadbent (1998) describe standardization as a managerial objective.

There were occasions where the respondents related differently to the idea of enforcing standards. In some situations divergences were seen as necessary, or depending on the factors of the specific situation. The BPM meant that divergences were negative only when they were not agreed upon. The SRM also saw the need for a balance between business needs and the extent of the standardization. The GPM concluded that it all depends on what the local adaptation is about. Cordella and Simon (2001) states similar conclusions when claiming that infrastructure deployment has to be considered as the outcome of the interactions between global design and local adaptation. The implementation process is seldom straightforward; there are too many factors that can affect the outcome.

These statements show the impossibility of total standardization; drift and divergences from the intended standard will always occur. This is the fundamental idea of the drift approach, but it is also acknowledged by Weill and Broadbent (1998), who slightly contradicts themselves in saying that all business units are encouraged to use the firm wide IT-infrastructure but also to develop customized local infrastructures if needed. In short, they want to enforce standards but allow some drift.

One of the reasons for Volvo Group's standardization was their need to simultaneously perform transactions and updates on multiple applications across different business units in different countries. The CSM gave examples of this when describing how they could update over night as long as the standardized solution was in place. This corresponds with the theories of reach and range (Keen, 1991), which gives an indication of the infrastructure's capability. The positive aspects of standardization were often emphasized by the respondents in Volvo Group while the negative were neglected or unheard of. Both Weill and Broadbent (1998) and Hanseth (2001) see standards as a natural part of an infrastructure, but the latter focuses on the negative aspects and dangers of standards. The aspects, encapsulated in the term economics of standards (Hanseth, 2001), can in some cases have negative effects. Weill and Broadbent (1998) also state that bad decisions regarding an IT-infrastructure can cause it to become a barrier instead of an enabler. Based on the different theoretical views and the situations found in Volvo Group, we argue that in order to manage drift, both the positive and negative aspects of each divergence must be taken into account in order to make a justified decision for it. This in turn means that the relevant information about the divergence must be made available; the dimensions of divergences must be understood, as argued above.

Volvo Group used their segmentation model, Figure 6, to proactively manage divergences. The model showed what mandatory standards that concerned each organizational level. This model is quite similar to the pyramidal representation, Figure 1, by Weill and Broadbent (1998); describing the IT infrastructure of a multi-business organization. It also adapts the idea of services, as being either extensive or selective. In the concept of segmentation the extensive services would be the World and Volvo Group layer. A selective service is not mandatory or available to the entire organization, which would mean that all other layers can be considered as selective services.

Based on our study we argue that a managerial middle course between the two different theoretical views is needed. We believe that depending on the situation and the various dimensions of the divergence, different managerial actions are justified in different cases. Sometimes standards need to be enforced and sometimes a divergence must be allowed. In order for a standardization to succeed, divergences must be managed in a structured way, which is why we propose a process for divergence management.

7.3 Divergence management process

To be successful when standardizing we mean that it is necessary to have an awareness about the phenomenon of drift and how to handle it. Drift, and therefore divergences, will always occur as stated by Ciborra et al (2001) and consequently they must be managed. Related work has covered the phenomena of drift but not the management of divergences per se. What we present in Figure 7 is the process that we propose as the way of handling divergences, both proactively and reactively.

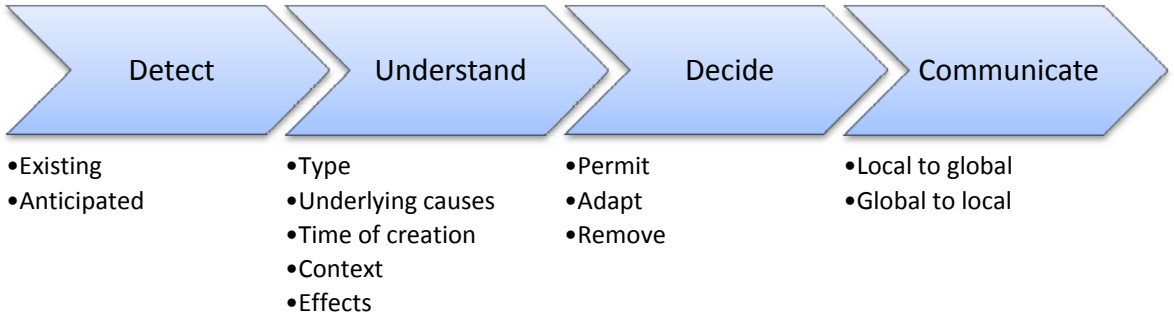

FIGURE 7 – THE DIVERGENCE MANAGEMENT PROCESS (OUR MODEL)

The process we propose consists of four stages; detect, understand, decide and share knowledge. All of these stages are important to manage divergence and neither can be skipped or hurried through. Each stage will be described in greater detail below. The detection of a divergence is what triggers the process and needs to result in an information gathering stage, this is what understanding the divergence means. By gathering information about the divergence, based on the five dimensions mentioned above, it is made certain that all the necessary information is gathered to make an informed decision. After deciding how to handle the divergence this information has to be shared within the organization to those in need of it.

Weill and Broadbent (1998) mean that shared infrastructural services should be coordinated centrally by an information systems group. In order to properly manage divergences we propose that there has to be *a central decision making person or unit*, which is in line with the suggestion of Weill and Broadbent (1998). This unit should be informed about every identified divergence and should make certain that correct and sufficient information is gathered regarding it. The initiative for the research needed to understand the divergence should be taken by the decision making unit. They s3hould also delegate the task of doing so to the relevant persons or units. When this unit has completed their investigation of the particular divergence the results are to be reported to the decision making unit. Based on the collected information it is then the decision of this unit how to handle the particular divergence. A general decision could be made regarding minor divergences; however more complex divergences would require new decisions every time. After making a decision it is also the responsibility of this unit to make certain that the information about the divergence and how to handle it is communicated to those that need to know.

Detect

The first stage in the process represents a situation where the divergence is detected. Up until this stage the divergence has existed without anyone noticing it. There is, however, also the possibility that it is an anticipated divergence that will occur in the future. There is no difference in the approach or execution of the rest of the process in regards to this; therefore we claim that all divergences, existing or anticipated, ought to be handled in the same way.

There is no easy way of structuring the detection of divergences since there can be many places or reasons for their occurrence, see our five dimensions. Mostly divergences were discovered by chance and examples were given by several of our respondents. The RPM mentioned it by saying that certain upgrades that were to install automatically across all sites did not work as intended. This is a good example of how a divergence is invisible to the organization until an event like this occurs. Another example was given by the BPM regarding the lacking relationship with the DELL dealer in Latvia. This was something that they recognized would cause a divergence further along in the standardization process. This shows that the identification of a divergence can be both reactive and proactive. Regardless of whether it is reactive or proactive the decision making unit should in this phase of the process be made aware of the fact that a divergence exists. When the divergence is detected it is then necessary to understand it in order to move forward.

Understand

When recently having detected a divergence it is reasonable to suppose that there is a lack of information about that divergence in particular. This results in the need of information gathering to increase the understanding of the divergence. By examining all the dimensions of a divergence proposed above it is made certain that all important aspects that affect the decision making is thoroughly investigated. One of the first things to gather information about is the type of divergence. By knowing the type it is easier to move forward and choosing the proper tools for examining it.

A good example of having all the necessary facts about a divergence is the case that the CSM and BPM put forward, concerning storage solutions. To begin with, they knew that it was a technological divergence since it was a totally different solution than the one included in MyPlace. Also, they knew that the underlying causes for the divergence was that certain sites found the diverging solution cheaper and saw that as an opportunity to save money here and use it elsewhere. In other sites, especially in the US, the divergence existed because of heavy investments in a different technology before the MyPlace design was introduced. This meant that they also knew when the divergence, in the US, occurred and that it was an investment that was not yet written off. Since it had existed for several years it had also connections to the surrounding infrastructure which made it challenging to remove. In addition to this they were also aware of several effects that the divergence would bring along, both positive and negative. For example positive effects would be lower costs by maintaining the current solution and no switching costs. Negative effects would, for example, be a more difficult update procedure and a technically inferior solution. By having gathered this information regarding all five dimensions there was a good foundation for making an informed decision regarding the future of the divergence.

Decide

When having all the information needed to make a decision it is important to take this new knowledge into consideration, and not routinely deciding to remove the divergence. In the study by Holmström and Stadler (2001) it is suggested that a solution must drift from its initial purpose to a multi-purpose network reflecting all interests and factors influencing the solution. Rolland and Monteiro (2002) also state that there is a need to balance the local and global needs of an organization, which contradicts the idea of enforcing standards, as suggested by Weill & Broadbent (1998). In addition, the GPM spoke about different ways of handling a divergence, saying that sometimes you simply cannot remove the divergence, sometimes you have to wait until it is motivated to change it and sometimes you have to phase out the diverging systems one at a time.

These decisions are to be made by the decision making unit after getting all the necessary information regarding the divergence in the previous step. The decision should be made based on the case at hand, deciding for each divergence one at a time. As mentioned above more complex divergences would require new decisions based on the dimensions of the particular divergence, while simpler ones could be handled as one. Based on our study we have adapted the suggestions above into three approaches to managing divergences; permit the divergence, adapt the divergence or remove the divergence.

The first option, when deciding upon how to manage a divergence from standard, is to *permit the divergence*. This means that the divergence is allowed to remain in its current form. In our interviews the BPM spoke of the possible decision to give up a standard on certain occasions. He meant however that this should be an aware decision, and divergences should not be allowed to remain unless documented and agreed upon. But there are also situations where the installed base and network externalities force a solution to live on (Hanseth, 2001). The examples of already existing non standard storage solutions, the NAS solution in the US, showed how the possibility of obtaining standard was decreased.

The second possible action is to let a divergence remain, but adapting it and its connections so that the divergence harmonizes with its surroundings. In the related work by Monteiro and Hepsø (2001), gateways are used to connect old systems with new systems, to avoid the removal of the old. In the same way a divergence can be adapted instead of removed. In the cases where large investments have just been made in a non standard solution, adaptation can buy time, delaying the standardization until it is justified. This is exemplified by the GPM when he mentioned the differing storage solutions used within Volvo Group.

The third, and from a standardization point of view proper, way of dealing with a divergence is to remove it. This is the action advocated by Weill and Broadbent (1998) who encourages the enforcement of standards. This approach means that a divergence is to be removed so that the solution is in accordance with the overall standard. The SRM gave examples of this way of working where minor differences where simply fixed in compliance with standard. The GPM, however, meant that a standard sometimes has to be implemented successively, that everything cannot always be changed at once. This would give this way of working a temporal aspect as well, basically whether to remove immediately or over time. Upon having reached a decision on how to manage the divergence it is then important to communicate this to those that need to know.

Communicate

The communication stage is not only essential in order to effectively inform all concerned parties about the decision, but also central in increasing the overall knowledge regarding divergences within the organization. Fenemas and Baalens (2005) study showed the importance of communicating information about drift, derived from local experiences, globally. Several of our respondents mention this as something important, although they, at the same time, claim that they are not very good at it. We propose that after having made a decision it has to be communicated to those that need to know within the organization. To a certain extent, making it the duty of the decision making unit to decide what action to take regarding the fate of a divergence simplifies this communication. The reason for this is that every decision is proposed to be made in the same place regarding all divergences. Therefore, if a divergence that has already been identified and decided upon in one part of the organization shows up in a different part, this will be noticed by the decision making unit. This will lead to fewer occasions where the organization, as the BPM exemplified it; keep running into the same wall over and over again.

In essence the process aims to structure the way decisions regarding divergences are made in organizations. By taking the five dimensions into careful consideration after having detected a divergence, an informed and reasonable decision should be possible to make. By centralizing the decision making regarding the divergences it will also be possible to facilitate the spreading of the knowledge regarding both the divergences and the proposed ways of managing them. In the following chapter we will explain how this relates to our purpose and answers our research questions.

8 CONCLUSIONS

Standardizing an IT infrastructure across a global corporation has proven to be a difficult task by our respondents as well as in our theoretical material and related work. Even though the intentions have been to avoid divergences these still occur. In order to fully be able to relate to these divergences we saw a lack of comprehension regarding their dimensions. Therefore, the purpose of this thesis was to increase the understanding regarding divergences that occur, as a result of drift, when standardizing IT infrastructures. In addition to this we also wanted to propose a way of managing these divergences, as this was seen as great challenge by the company studied in our thesis. This was done by answering the two questions:

How can the divergences from a standard be described?

How can divergences from a standard be managed?

In order to understand a divergence it is necessary to be aware of the dimensions that constitute it. The five dimensions that we claim are essential to comprehend a divergence are; type, underlying causes, time of creation, context and effects. By understanding these five dimensions it is possible to give a detailed description of the divergence. Something that we claim is crucial in order to be able to relate to the divergence and manage it.

To manage existing and future divergences it is not only important to be aware of the different dimensions, it is also important to handle them in a structured way. To do this we propose a structured process consisting of four steps; detect, understand, decide and communicate. Each step is described in detail and is important in order to make a sound decision and to communicate that decision within the corporation.

In essence, the process is applied and the dimensions are regarded to a certain extent within the studied corporation. However there is a lack of awareness regarding both. The dimensions are often overlooked or only briefly touched upon, and the process is only a mental one. This results in a somewhat unstructured way of handling divergences and their fate. The questions answered above are an attempt to clarify what divergences are and propose a structured way of handling them. Within this lies both practical and academic relevance. The contribution to practice can be seen as both the process for handling divergences; as well as the importance of the dimensions in order to make the right decision regarding a divergence, something that was seen as a great challenge by the organization in our study. The academic contribution lies mainly in the description of the dimensions of a divergence. This is an area that has been overlooked in previous research, which mostly focuses on the wider phenomenon of drift. In future studies where effects of drift are studied we believe that this thesis can contribute by defining and explaining the dimensions of these divergences.

A future study would be needed to verify that the process and its contents are relevant. This has not yet been done as it was not the focus of this thesis. However, as shown above, both the process and the dimensions are considered by our respondents unconsciously. This implies that the process and the dimensions are indeed relevant; however, this needs to be confirmed by letting managers facing these questions evaluate it. It would also be interesting to compare the process model with existing concepts for handling deviations in manufacturing industries, such as Six Sigma (Sörqvist, 2004). The concept of knowledge management could also be of interest in relation to the last stage of our process as a mean for more effectively communicating and managing the information regarding the divergences and decisions related to them.

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