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Challenging the Installed Base: Deploying a Large-scale IS in a Global Organization

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Abstract: **Economic theory and business strategists have pointed at the phenomenon of positive externalities and the related enabling and constraining aspects of an installed base. For instance, in the development of a standards strategy for technology products these externalities are of profound importance [11]. Likewise, deployment of large-scale IS creates interdependencies horizontally throughout the organization, and are constrained by a continuously evolving and socio-technical installed base of information, systems, artifacts, practices, and organizational structures. This paper draws from a case study of a global company and illuminates the role of an installed base in relation to the organizing visions in the deployment of a large-scale IS. The case illustrates that deployment of a large-scale IS in a global company is likely to be more similar to the development of infrastructures than traditional IS development and IT-strategy planning.**

1. INTRODUCTION

Deployment of information and communications technology has been given a role in global companies as a means for increased control and enhanced coordination [14]. Companies and organizations have been inspired to manage their use of information technology (IT) through the establishment of an IT-strategy, and alignment with the current business strategies. The deployment of strategic applications of IT is supposed to be "discovered" through rigorous planning and use of different models and techniques (e.g. critical success factors; the value chain ; the strategic thrusts). However, this implicitly implies that IT and information systems (IS) are highly malleable and enabling, and can possibly be deployed through planning and rational decision making by the management [18]. This rather "mechanistic" perspective to IT-strategy and IS deployment, has been criticized for undermining the role of organizational and social issues [18], as well as the role of improvisation and prototyping [7].

Similarly, the deployment of large-scale IS in global organizations does not follow a purely rational and waterfall-like process. As large-scale IS is likely to cut horizontally across practices, departments, and social groups in the focal organization, it becomes vital to mobilize the different social groups through negotiations and to form certain expectations of the future in order to reduce uncertainties. Following, Swanson and Ramiller [26], an organizing vision can be used to institutionalize the way an information system is interpreted, legitimated, and to mobilize different stakeholders in an organization.

However, an organizing vision is not unlimitedly enabling, it is in various ways constrained by a socio-technical installed base. An installed base can be defined as the interconnected practices and technologies that are institutionalized in the organization. Large-scale information infrastructures as the Internet have been recognized as hard to change due to the inertia of the installed base [21].

The purpose of this paper is twofold. Firstly, the aim is to illuminate how deployment of large-scale IS in organizations are constrained by the inertia of an installed base. This paper draws on evidence from a longitudinal case study of a global Maritime Classification Company (MCC), where a large-scale IS has been developed for supporting ship surveyors. It is illustrated how the installed base becomes an actor[1] during the deployment of a large-scale IS in MCC. In the case of MCC, the installed base of paper-based documents, information in a database and the related practices impose various constraints on the design, implementation, and use. The installed base that has been invisible during planning of the new system becomes increasingly visible as the system is embedded in the organizational context. Secondly, on the more general level, the purpose of the paper is to show that large-scale IS deployed in an organizational setting should be characterized as "infrastructures" rather than "tools", because their deployment is often constrained by an installed base. This view has been developed in a growing literature on information infrastructures [e.g. 12, 22, 25].

The conclusions drawn from the case study are that global organizations must recognize the infrastructural character of IS, and emphasize the socio-technical aspects of an installed base. The installed base should be recognized as a powerful actor, which becomes increasingly visible when the information systems are deployed in an organizational context. Consequently, the deployment of large-scale IS does not solely imply mobilization and alignment of different social groups, but also of the different aspects of the installed base. Thus, the process of designing and implementing large-scale IS in organizations are more likely to be similar to the development of the

[1] The view of technology as an actor is grounded in Actor-Network theory [6, 19, 20].

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Internet [1, 21], than traditional IS development and IT-strategy planning processes.

2. INFRASTRUCTURAL ASPECTS OF IS

2.1 On the notion of an installed base

The term installed base has been used in different settings to underline the inertia of a stabilized practice, product, structure, network or standard. In economic theory of networked systems and technologies the notion of an installed base appears [2]. Here it is suggested that all technological innovations, more or less, face the problem of compatibility with the existing installed base, such as stocks of capital goods, skills, and know-how [2]. Networked technologies provide positive externalities to an economic system through direct interdependencies between actors, so that, for instance, the larger the installed base of a certain telecommunication system in terms of users, skills, and technologies, the greater the advantage is for the involved actors. Grindley [11] draws from this insight in understanding the profound importance of the standards involved in technology products, and particularly in IT-based products. A standard that builds up a larger installed base with complementary products, becomes more attractive, and eventually reinforces itself (Fig. 1). For instance, JVC succeeded in the introduction of the VHS standard in competition with Sony's Betamax – not because of superior technology – but rather because JVC managed to build up a larger installed base [11].

A complementary product, in terms of pre-recorded tapes appeared first in VHS, which resulted in rapid decrease in sales of Betamax. In addition, JVS provided other vendors with the specifications of the standard, so other complementary products and more VCRs using the VHS standard were deployed. Similarly, in recent years, because of the installed base of Microsoft related software and PCs based on the Intel processor, it has become almost impossible to build up an installed base of new software products and standards. However, when new technologies arrive the current standards regime can be changed [11].

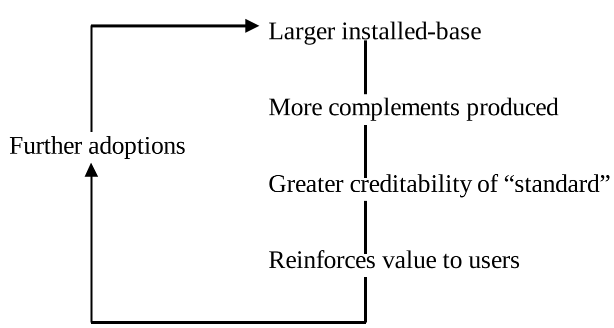

Fig. 1. Building the installed base [11: p. 27]

2.2 Installed base and information infrastructures

Having recognized the profound importance of the installed base in relation to technology product standards, installed base issues are also present in the design and implementation of large and complex IT-infrastructures [e.g. 12, 25]. Recently, the term information infrastructure has been used to describe large-scale networked structures that cut across work practices, departments, functions, and organizational borders. Examples of an information infrastructure span from tailor-made large-scale collaborative systems [25], large EDI networks [22], National Information Infrastructures [4], to the Internet [21]. Following Star & Ruhleder [25], an information infrastructure cannot be understood as pure technology, but that an information infrastructure is always embedded in a larger social structure. Moreover, Star & Ruhleder underlines that an infrastructure is something that develops in relation to practice, it is not to be conceived as a "thing" or a static technical structure, and the question becomes "When is an infrastructure?" – not "What is an infrastructure?" Consequently, "*an infrastructure occurs when the tension between local and global is resolved*" [25: p. 114].

Thus, this information infrastructure discussion focuses on some interesting aspects that increasingly are met when designing and deploying large-scale IS. Including a focus on the installed-base, which implies that a large-scale IS is never developed from scratch. There is always something there in form of social practices, artifacts, and very often a heterogeneous collection of different technologies.

Along these lines an information infrastructure becomes a socio-technical phenomenon. Information infrastructures are always more than communication protocols, routers, computers, operating systems, and applications. More specifically, Hanseth [12] sees an information infrastructure as an enabling, shared, open, socio-technical and heterogeneous installed-base. Furthermore, Hanseth [12] underlines the heterogeneity and describes information infrastructures as connected and interconnected components – or ecologies of infrastructures. Hence, one information infrastructure emerges through "sub-infrastructures" by:

- building one infrastructure as a layer on top of another;
- linking logical related networks;
- integrating independent components, making them interdependent.

For instance, the global Web infrastructure is an integrated and interdependent component of the Internet infrastructure. In this way, a large-scale IS could be understood as a component in a larger information infrastructure.

Bud-Frierman [5] states that the concept of an information infrastructure is a potentially useful unit of

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discourse, being both a historical and cultural entity in addition to being used to describe both micro- and macro-level structures. Thus, the term "information infrastructure" can be used conceptually, as opposed to viewing information systems as tools, which is so often done [16].

2.3 Installed base and large-scale IS

There is a large body of IS related literature that point at various socio-technical and political challenges concerning the deployment of IS in organizations. However, there has been little focus on the profoundly important socio-technical/political issues concerned with modifying, integrating, and replacing existing systems and technologies. Still, there are some exceptions.

Davenport [9] notes that large-scale IS such as enterprise systems, often becomes hard to modify due to its complexity and size. When first implemented, enterprise systems could become a constraint for organizational and strategic change. In this way an enterprise system can have a rather paradoxical impact on the organization – the system is deployed for changing the organization, but when first implemented it imposes every attempt for changing the organization.

Likewise, Hanseth and Braa [13] discuss implementation of an Enterprise Resource Planning (ERP) system at Norsk Hydro. As the ERP system becomes integrated and tailored in different local contexts, the ERP system changes from being a system to becoming an emergent heterogeneous infrastructure. Once integrated with the corporate IT infrastructure the system becomes everybody's enemy and resists all organizational change [13]. Thus, the ERP system becomes a powerful installed base and an actor in subsequent re-designs and modifications.

Newman [23] gives examples from cases where integrated database systems undermines the flexibility of various local business units in a large insurance company. In this way the integrated system represents centralized control and standardization of work routines, that do not fit with the existing autonomous business units.

In general, large-scale IS often imply a higher degree of integration of both technical and non-technical components. Deploying large-scale IS often means integration of different information, technologies, as well as the interconnected work processes and practices. Integration implies to some extent to develop standardized categories and meanings in order to provide a transparent infrastructure for users. This has been proven difficult [3]. Thus, development and re-design of large-scale IS will have much in common with the dilemmas concerning the International Classification of Diseases (ICD) [3]. The ICD is a list centrally administrated by the World Health Organization (WHO), and General Practitioners, hospitals, insurance companies, statisticians, governments and others, use it all over the world. The purpose from the WHOs point of view is to have a uniform way of categorizing causes of death in order to generate sophisticated statistics. However, in practice, it has proven to be nearly impossible to fully standardize the ICD due to local work-practice, cultural differences and diverging requirements and interests. These local contexts constitute the relevant heterogeneous installed base for the ICD.

On a more theoretical level, IS research has conceptualized how information systems and technologies are embedded within social and organizational arrangements [e.g. 15, 17, 27]. In conceptualizing IS as institutions, Kling and Iacono [17] describe how IS that are well-used and are based on stable social structures of support are more difficult to replace than those with less developed social structures and fewer participants. Thus, large-scale IS become increasingly difficult to change because of its institutional inflexibility [17]. In a case study of a medium sized manufacturing firm, Kling and Iacono found that the way in which the social and technological elements were organized and structured hindered the implementation of a new IS [17]. Here the complex mix of social and technical elements across units, space and time are conceptualized as the "social organization of computing". Accordingly, the concept of the "social organization of computing" will refer to the installed base as the term is used in this paper.

Large-scale IS can be institutionalized before the system is deployed in the focal organization. Institutional processes are engaged from the beginning and shape how a certain IS is interpreted and legitimized in the organization [26]. Following Swanson and Ramiller [26], an organizing vision is described as the dynamical processes of institutionalizing the way an IS is interpreted, legitimated, and how different interests are mobilized in an organization. When an organizing vision is established, this will influence how the IS is adopted and diffuses in the focal organization.

2.4 Transitions

The inertia of an installed base does not imply that large-scale IS are impossible to re-design or replace. Systems do change, but not always according to management's top-down planning and centralized control. For instance, Abbate [1] describes how different users and interest groups have constantly "re-invented" the Internet infrastructure by launching their own applications as electronic mail and web. Ciborra [8] uses the notion of "drifting" to describe how groupware technology tends to be adjusted in use within specific work practices. The term drifting emphasizes how a technology, as for instance groupware, gets a different role in a specific use context, than what was planned before implementation. Drifting is the sum of the emergent improvisations happening when a flexible technology is put into use [8]. Hence, this

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emphasizes that an installed base is changed through use in different contexts.

Orlikowski [24] draws from Giddens' structuration theory [10], and suggests that IT is always both enabling and constraining for any given organizational change. Consequently, the installed base for any given IS could be described as being socio-technical and always both enabling and constraining for a certain organizational change.

3. THE CASE: IS DEPLOYMENT IN MCC

3.1 Research site and method

In a longitudinal case study of a maritime classification company (MCC) the deployment of an in-house developed information system was studied. The large-scale IS, which in this paper is called the Horizontal IS, is a large-scale middleware-based system to be deployed globally in over 300 offices to support the work of surveyors in conducting surveys as part of MCCs distributed classification process. The case study was particularly focused on how the Horizontal IS was integrated within different local settings, and how it was constrained by an installed base.

Established in 1864, MCC has long traditions in operating world-wide as an independent foundation working with the objective of "safeguarding life, property and the environment". The MCC organization has 300 offices in 100 countries, and it has a total of 5500 employees. As most ships operate globally, it becomes a prerequisite for MCC to have local presence and be able to operate effectively through a global network of stations in order to meet the customers' needs. Most of MCCs activities are based in the larger offices in London, Piraeus, Houston, Singapore, Shanghai, Hong Kong and Dubai. Since Japan, Korea and China are the most important ship building nations, one fourth of the employees in MCC are located in Asia.

The method used in this research is the interpretative case study, based on an interpretative approach to information systems research [27]. Both in-depth and semi-structured interviews have been conducted of 21 respondents in two different offices. Of the 21 respondents, 4 of them were managers in the Horizontal IS project; 4 were senior developers in the Horizontal IS project; 7 were surveyors; 1 former surveyor; 1 super user; 2 IT support people, and 2 managers from other parts of the organization. In this case study people who were engaged with the development, implementation, and use of the Horizontal IS were selected to be interviewed. All respondents were familiar with both MCC as an organization and the Horizontal IS (however, not everyone were employees in MCC). The interviews were focused around some topics that were selected prior to the study. Issues discussed included, "What are the visions behind the Horizontal IS?", "How will the system change today's work processes?", "What are the main assumptions behind the design and the product model", and "Have there been any special problems and obstacles for implementing the system at different locations?".

In some cases the respondent was given a list of the topics that were to be discussed. In addition, informal talks and discussions have been conducted on the basis of the researchers written material as research plans, article abstracts, and theoretical perspectives.

Documents, including requirements specifications, design documents, workflow plans, project plans, presentations and various newsletters have also been studied.

3.2 The organizing vision: "one world – one MCC "

During the 1990s MCC was challenged through increased global competition and swift changes that effected their business environment. An important part of MCC's strategy to meet these challenges has been to deploy IT with the intention of 're-engineering' their way of working and become a "learning organization". This alignment of MCC's business strategy with the IT/IS-strategy, indicated a shift from a local and vertical IS and IT-infrastructure, towards a more global and horizontal IS and infrastructure. However, this alignment was made possible through negotiations and the alignment of the interests of the top management with those of the managers and system developers in MCC's software department. Instead of "fragmented" and "local" IT solutions based on different technologies and standards, the IT solutions should be standardized. Thereby it would be possible to distribute the classification process, and to increase the flexibility for the customers by allowing parts of the same survey job be done in for instance Hong Kong, and another part in London. Pursuing this strategy, in 1997 MCC invested approximately 52 million USD in common IT-infrastructure. The common IT-infrastructure was launched in 1997-98 under the mantra "One world – one MCC", and comprised a WAN that linked 300 offices, common NT servers, office applications, common e-mail system, and shared document databases.

As a part of this strategy, the software department had been developing a common IS for supporting the work of the surveyors as well as the information requirements of managers and customers. The key idea was to integrate all relevant information for classification of vessels in a common product model. A product model is a standardized detailed description of all parts of a ship and the relationships between those parts. This common product model was developed using the UML modeling language and additional CASE tools, and serves as the foundation for the Horizontal IS. The development of Horizontal IS became an opportunity for the software department to utilize new technologies and skills, and thus this made the Horizontal IS development project technology-driven. In short, Horizontal IS is a state-of-the-art client/server system built on Microsoft's COM architecture as middleware and a common SQL-based relational database as a server. MCC had for several years been cooperating with Microsoft and MCC's IT-strategy had been entirely based upon Microsoft's applications, development tools, and operating systems. Thus, it was easy for the software department to argue for utilizing Microsoft's state-of-the-art technologies in the development of the Horizontal IS.

The Horizontal IS was imagined as a powerful "catalyst" for standardizing work processes in MCC. MCC had systematically worked for streamlining and standardizing their work processes and several projects have been undertaken to define new work processes. A system with 'work process owners' who are responsible for a defined work process worldwide had been established.

MCC has a large installed base of paper-based information. Therefore, MCC sees it as their main challenge to go from being paper-based to have all information available on a digital format – and thus build up what they call a "digital nervous system" for the entire organization. Also users (e.g. surveyors, middle managers, secretaries) were enthusiastic about the vision of "access to knowledge" – because they needed better ways of accessing information on ships, ship owners, certificates, and previous surveys conducted on a particular ship. As most activities in MCC included some manipulation, use or production of paper-based documents for example reports, checklists, drawings, comments on drawings, status overviews, type approval certificates, renewal lists for certificates and approval letters this vision of a organization without paper was not hard to establish.

The Horizontal IS development project started in 1994 and the first version of the system was successfully implemented in the largest offices in early 1999. However, part of the vision concerning the replacement of the existing paper-based ways of working has not yet been accomplished.

3.3 Design: the installed base becomes visible

The surveyors have established a system of different paper-based checklists for supporting the different types of surveys conducted by a surveyor in MCC. There are a total of 74 different checklists to be used in different kinds of surveys and types of ships. The different checklists have been made of different people for different contexts and environments. Thus, there is no standard representation or common use of terminology, and these checklists have not been a part of the official documentation given to the customers. These checklists have been most helpful for inexperienced surveyors who use them down to every detail, and in this way they are learning what to focus on when conducting a survey. On the other hand, more experienced users usually do not use the checklists – or they only use it in a very limited way.

The plan was to import the paper-based checklists into a common database and use them in the Horizontal IS as a means for standardizing how and what information the surveyors should report. In order to be able to generate standardized survey reports the information had to be structured and standardized in terms of terminology. The data for the checklists were stored in a FoxPro database, where the data was simply structured in the most convenient way for just printing them out on paper. Thus, the paper-based checklists with related practices, and the FoxPro database represented a considerable installed base for the Horizontal IS, which was planned to include a standardized and digital version of the checklists.

However, this installed base was in the beginning treated as a resource rather than as a constraint for the development of the Horizontal IS. The Horizontal IS development team's initial idea was to import the FoxPro database with the checklist data into the new data structure in the database to be used with the Horizontal IS. In the common information model for the Horizontal IS the description of the checklist data was more generic. Thus, this made it impossible to import the data directly into the new database, without any programming to adjust the old checklist data. Some of the checklist data were of "bad quality", and since the various items in the checklists were not structured in a standardized way, the checklists had to be reorganized before migration could take place. However, this was not only a technical problem. Different parts of the organization had to agree upon a standard representation for the checklists. Some surveyors and groups outside the systems development group argued that the whole checklist system had to be revised before the Horizontal IS could be used at all. On the other hand, the systems development group offered slightly improved checklists to be used in a transition phase. From the system developers' point of view, due to the complexity in the Horizontal IS it was increasingly challenging to change the functionality in the applications and data representation in the information model. For instance, in the worst case a change in functionality could trigger: 1) changes in the overall COM based IT architecture, 2) changes in the information model and re-generation of server code, 3) changes in the SQL database schema and database scripts, 4) re-building (compiling and linking) of software components and distribution of these components, and 5) changes in the application code and user interfaces. This process is time-consuming, and requires careful planning and co-ordination among different developers and groups. In the case of the checklists the changes needed included everything except changes in the overall IT architecture.

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In late 1997 a group of people were put together to reorganize the existing checklists to satisfy the database structure and the surveyors terminology and way of working. This group worked for over a year with adjusting the checklists to the information model that was based on a product model philosophy. When the Horizontal IS was put into use in early 1999, the checklists included in the system were basically a digital version of the original paper-based checklists. The installed base of paper-based checklists, the FoxPro database, and related practices – together with a large and complex information model made a radical break from the old paper-based system impossible. Even though a system with digital versions of the checklists had to be developed seemingly from scratch – the installed base worked as a powerful actor.

3.4 Implementation and use: information-based lock-in

The vision was that Horizontal IS would enable knowledge sharing through transparent access to all relevant information on vessels, certificates, surveys etc., regardless of roles, departments, and positions in the organization. Consequently, this vision of IT was in stark contrast to the recent use of IT in MCC, which could be characterized as being local and vertical. Surveyors had been using PCs connected to different LANs mainly for word processing, e-mail, and for the use of different local databases. Thus, this can be characterized as local use of IT with a limited number of users involving local control of the computing resources. In addition, a specialized e-mail based application was used for retrieval of up-to-date information on a vessel's status and reporting of surveys. A large database running on a centralized Mainframe System had been used to store all information on vessels, surveys, certificates and ship owners. The information in this database represents an information-based lock-in, hence, it is nearly impossible to build up a "competing" database with similar information.

Implementing the Horizontal IS in the different offices could be characterized as a time consuming and complex learning process, rather than sequential steps for deploying new information technologies in the organization. Clearly, because of both technical and organizational reasons it was impossible to implement the system in all 300 offices simultaneously. Hence, for a period the old Mainframe System had to be used in parallel with the Horizontal IS. Offices using the old Mainframe System and those using the Horizontal IS were dependent upon having correct and updated information when planning and reporting surveys. Consequently, two problems had to be solved: 1) How should the Horizontal IS and the Mainframe System be updated? – and 2) When should the Horizontal IS take over as the only information system being used?

In order to update the common database used by Horizontal IS with data from the Mainframe System and vice versa, various scripts were made. In other words, the installed-base made it necessary to develop a gateway [12], because a discrete transition from the old system to the new system was impossible. Due to the complexity of the product model, the technically different databases used, as well as several adjustments in the design, it was difficult to ensure perfect updates between the Mainframe System and the Horizontal IS. Thus, the Mainframe System represented an important part of the installed base that had to be considered in the design and implementation processes.

However, the installed base issues were not considered until the new Horizontal IS was tested with what was considered as relevant data. The data in the Mainframe System that had at first been considered as an enabling resource to be included in the new Horizontal IS, became a constraint in the design and implementation. Furthermore, this had unintended side-effects in that it increased the surveyors' distrust towards the new Horizontal IS. In using with the Horizontal IS some of the surveyors experienced losing some of their information because of the imperfect gateway between the databases. The surveyors had to enter the information into the system several times, and hence, this made their office work more time consuming. This increased the distrust toward the Horizontal IS, and thereby created the need for working around the system.

Some of the surveyors stated that they were more careful not to enter too much data into the system at a time. At the same time one of the intentions with the Horizontal IS was to support more detailed, consistent, and a larger amount of information than before. In fact, the unintended side-effects of the Horizontal IS may lead to the opposite, namely that the surveyors report less information than before. Secondly, this distrust towards the new system made the surveyors to double check the information provided. For instance, they constantly used a large book containing information on all vessels classified by MCC and compared the information in this book with the information on the screen.

4. DISCUSSION AND CONCLUDING REMARKS

In analyzing the deployment of the Horizontal IS in MCC it is illuminating to examine how the installed base in different ways and phases of the deployment becomes an actor. The installed base seems to become increasingly *visible* as the system is embedded in an organizational context and during negotiations between different interest groups in the design phase. The *visibility of the installed base* denotes to what extent the installed base is enabling or constraining for the design and deployment processes aimed at accomplishing the visions established.

In the case, the installed base of paper-based documents (i.e. the checklists and the related practices) was not recognized as a constraint before certain parts of the design was tested. Even though the Horizontal IS represented a

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new technology and the design was focused on supporting "new" work processes, the installed base of paper documents involved a considerable constraint in the design. For instance, it limited the possibility of including a standardized version of the checklists in the Horizontal IS. This emphasizes the view that an installed base is socio-technical, and thus, the question is not only whether the new systems are technically compatible with the old systems.

The Horizontal IS was based on a large and complex information model (i.e. the product model), as the project goes on, this model in itself becomes institutionalized through use by the developers and through the organizing visions (i.e. "access to knowledge"). Thus, this model represents an installed base, which to some extent lead to an information-based lock-in that made it increasingly difficult change. Organizing visions – or the outcome of such visions can become a part of an installed base, and hence, become constraining for further development and implementation.

The installed base becomes a visible and powerful actor during the implementation of the system. The information on vessels, surveys, ship owners etc., in the Mainframe System was at first looked upon as enabling resources. However, it turned out to become a constraint because the migration of the data from the Mainframe System was time consuming and technically complex. Thus, the installed base becomes increasingly more visible as a design is embedded in an organizational context. The design is pragmatically adjusted and it drifts already before fully deployed in the focal organization.

Finally, the installed base becomes a constraint in the use of the new Horizontal IS because of the users' distrust towards the system when the imperfect gateway between the Horizontal IS and the Mainframe System. However, the users still believe in the organizing visions, and have various ways of compensating for this distrust.

In the case of MCC, organizing visions like "One world – one MCC" and "The digital nervous system" were established for mobilizing support for a large in-house project. These visions seem to have mobilized both top management and the users of the Horizontal IS. However, during design, implementation and use of the system, these organizing visions have to compete with an increasingly visible installed base. To some extent well formulated organizing visions can mobilize different stakeholders and influence their interpretations of new information systems and technologies. But, as pointed out by Orlikowski [24], IT has only a limited interpretative flexibility, which means, the ability for different social groups to form their own interpretations is limited. The reason for this, in the case of MCC, is that the installed base serves as a powerful actor, and when it comes to the surface it becomes more "visible" than the organizing visions. Aligning different social groups is not enough – a socio-technical installed base, in terms of practices, paper-based documents, and databases, must be aligned in a successful deployment of a large-scale IS. This suggests that the symmetry between human actors and non-human actors as in Actor-Network theory [e.g. 6, 19, 20], would be helpful in recognizing the constraining aspects of an installed base. Thus, an installed base serves as an actor, and whether it is defined as human practices or technological artifacts does not matter. As the installed base is changing through different phases of deployment – the installed base is more or less visible – and consists of different mixtures of technical and non-technical components. Constraints and challenges are always both technical and non-technical. The challenge is then to uncover how different designs and organizing visions intrinsically interconnect with the "invisible" installed base – and how to impose a smooth transition from the existing installed base to the "new" IS. The installed base is constraining and enabling for the ways the new IS is used. An IS that is not, to some extent, compatible or integrated with the existing installed base, will most likely neither be well integrated into the work processes and practices.

Future research should emphasize both human and non-human "stakeholders" involved in deployment of large-scale IS. Guidelines and frameworks should be provided for how to manage the cultivation of an installed base, and for developing transition strategies for how to evolve from a stage to another.

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