

Business Processes, Process Logic and Information Architecture

A Tentative Case Study

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Keywords: Process Logic, Information Architecture, Organisational Semiotics, Business Processes.

Abstract: Subject of this paper is modelling the process logic of the business processes of an enterprise, taking into account both the formal and the informal aspects of the organisation, but disregarding how the business processes have developed over time in operational practice. The aim is to arrive at a stable information architecture that has sufficient flexibility to absorb developments in the environment and in the enterprise itself in the presentation layer and business rules, without affecting the information architecture itself.

1 INTRODUCTION

Subject of this paper is the modelling of the process logic of the business processes of an enterprise (here named AYS), taking into account both the formal and the informal aspects of the organisation, but independent of how the business processes have developed over time in operational practice. The aim is to arrive at a stable information architecture that has sufficient flexibility to absorb developments in the environment and in the enterprise itself in the application software that will be built upon it. Parts of this approach have been described in earlier ICEIS and BMSD papers, in particular, papers presented at ICEIS 2010, BMSD 2011, and BMSD 2012. This paper will present the preliminary results of the application of this approach to a practical case.

After this introduction, the second part of the paper describes the problem and the backgrounds to the issue. After a short explanation about the theory of the firm and the role of semiotics in the case study the role of the analysis and modelling of business processes as foundation for the development of an enterprise information system is explored.

The third part describes the backgrounds of the enterprise where the study was carried out as well as the most significant characteristics of the enterprise itself. This is followed by a short description of how the study was carried out and in particular of the interaction between analyst and practitioners in such a project.

The last part of the paper is the evaluation of the results of the case study against several aspects.

Especially the process logic for the internal structure of the business processes and the concept of lean IT for the efficiency of the business processes are important here.

2 MANUSCRIPT PREPARATION

2.1 Problem

The problem in this case study is the design of a solid foundation for a newly to be developed information system for the enterprise concerned. The main aims for the enterprise are (1) to be able to replace the current software package in the short term without loss of essential functionality, (2) to expand the new system in the slightly longer term to provide the desired support for the enterprise's business processes and (3) to be capable of supporting possible strategic scenarios (of which it cannot be determined in advance if and when they will occur) at some later date.

At first, the problem demands an information architecture based on both the actual processes and on the new processes envisioned in the strategic scenarios. Meanwhile the architecture must allow the implementation of just a number of key functions at first to allow full decommissioning of the current system. An essential feature of the information architecture must be the maintainability of the business rules in a number of areas because the rules imposed by external stake holders are subject to sudden and rapid change. Complying with

these rules is required to operate in this line of business.

The main idea behind the case study is that the stability of the desired information architecture is determined by its autonomy from chance factors and passing circumstances. In other words, the main idea is that the essential and durable structure of the business processes should form the foundation of the information architecture. This introduces the question how this stability can best be found. This approach presumes that the characteristics of markets and products determine the essential structure of the business processes for an enterprise. To be active in a certain market, the enterprise has to follow a number of social conventions that are associated with the market and that place norms on the behaviour of the individual enterprise in the market. The same holds for the products of an enterprise, for both material and immaterial products. Of course, for material products a number of physical rules and constraints apply as well, such as food safety requirements in case of food products.

The idea is that hard statements can be made regarding the structure of the business processes and the associated information flows based on knowledge of the norms that apply for markets and products.

An additional motive to start the analysis of the structure of business processes with the markets and products is that this provides a better foundation for the collaboration between analyst and practitioners than the analysis of the current business processes of the enterprise. This will be explored further in a later paragraph.

2.2 Earlier Work

For the case study, we will rely on earlier theoretical work, as presented at ICEIS 2010 and also at two editions of BMSD, namely BMSD 2011 and BMSD 2012 (Suurmond, 2012; Suurmond 2013), and we will also rely on a long-term involvement with the Organisational Semiotics Community as well as on extensive experience in the design of information systems for the food processing industry. However, this case concerns an electro-technical reparation enterprise and thus presents an interesting case for the transfer of practical experience between two very different lines of business.

2.3 Theory

2.3.1 Theory of the Firm

An enterprise derives its existence from successfully

delivering products to its markets. The two basic requirements for sustainable business are market demand and efficiency of production. Every successful enterprise also has a form of 'uniqueness' that distinguishes it from its competitors and that cannot be copied (Kay, 1993). This unique and idiosyncratic character of an enterprise determines its place on the market and can be found in partly intangible factors such as company culture, history and market trust or reputation. These factors can indirectly be found in the company culture and directly in the way in which individual employees are dealing with individual cases in the business processes. The latter is subject to acculturation processes, with conscious and unconscious, designed and historically grown mechanisms by which individuals learn "how things are done here".

This approach to the enterprise indicates that how an enterprise operates and the operations within an enterprise always have to be evaluated in light of its position in the market. This does not mean that the contribution to the market position is the only norm; there are inescapable human and societal norms after all. It does highlight that it is essential for the continuity of the enterprise that the market is the ultimate standard against which it is evaluated. This holds for operational actions and it holds as well for the actions taken by its management and for its strategic choices. Therefore, in analysing business processes and in designing an enterprise information system to support those business processes the orientation on the markets and products of the enterprise should be the first criterion.

From the above considerations it follows that the metaphor of the enterprise as an organism is more appropriate than the rationalistic and mechanistic approach of the enterprise (De Geus, 1997). After all, an enterprise is a social phenomenon in which the actions are determined by social norms and by interpretation processes. This means that modelling business processes and information flows from a purely rationalistic-mechanistic view or weakening the strengths of an enterprise by reducing the number of possible solutions in the business processes have to be avoided in the development of an enterprise information system.

2.3.2 Semiotics

Social communication happens through sign systems and the interpretation of signs is partly determined by history (the way in which signs were interpreted in the past) and partly by context (and sometimes by the way in which they are uttered as well, a certain

inflexion of the voice for example).

Within business processes the efficiency requires that much of the information can be processed by systems. The sign systems created to this end are of a formal nature: the meaning of variables and of possibly of value ranges is recorded in the systems in advance.

Within an organisation all kinds of capacities in which information can appear can be distinguished. Part of the information can be found in computer based systems, part is 'between the ears' by training, knowledge and experience and part is exchanged through all manners of ad hoc communication. The nature of the sign system determines the possible interpretations of the information given. In part because of the degree of formalisation.

Although semiotics remains in the background in the case study, semiotic insights certainly play their part in the analysis and modelling. This is especially evident in the meaning of sign systems and of interpretation processes in both the analyses and in the business processes. It is also visible in the prominent role played by social norms, in particular in understanding business processes against the background of the normative function of the markets and products of the enterprise (Stamper, 2000; Liu, 2000).

2.3.3 Process Modelling and Information System Development

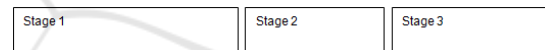
Modelling business processes with the associated information flows, and validating the resulting model, is a communal activity of two different kinds of actors, each with a completely different background. On the one hand there is the analyst with communicative, analytic and modelling competencies (accustomed to formalised sign systems), on the other there is the practitioner with a detailed knowledge of what happens in practice, of organisational structures and procedures and equipped with lots of tacit knowledge.

The difference in perception and background of the different actors cannot be bridged by the analyst transforming himself into a practitioner (or vice versa). As well as the time such a transformation would cost, it would mean a fundamental lack of recognition for the difference between the role of the analyst and the role of the practitioner. It might seem tempting to unite all of the required knowledge and experience in one person, but it would imply a major risk of consigning the process of modelling and analysis to the realm of tacit knowledge, with pernicious consequences for validation and

maintenance of the model. In effect it would be a one man show.

The model that is to be constructed of the business processes and the accompanying information flows should represent the essential structure, thus forming a stable basis for the information system that is to be developed. As a model it is an abstraction and not 'true' or 'false', but suitable to a greater or lesser degree for the purposes for which it was developed. A basic condition is stability: it should be possible to support all kinds of variations of the business processes by one single model. A second condition is the reduction of complexity: the model should enable insight into the complex reality of concrete business processes by omitting all kinds of details that are irrelevant to the structure and by naming the separate elements of the processes.

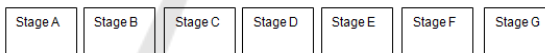
An abstract example of one aspect of modelling: say that a certain production process moves through three different steps and that these steps are modelled as they are observed in practice:



Later, the process is changed and the model with it:



However, if the process elements had been analysed further, the following model could have been the outcome:



In this last model with stages A through G both process variants could have been represented. Before the changes to the process stages A, B and C form the first sub-process, D and E the second and finally F and G the third sub-process. After the changes the sub-processes encompass different stages (A, B through F, G), but the basic model remains the same.

The major challenge is to distil those elements A through G from the concrete business processes with all of their details. It is not unusual to start from interviews with practitioners from different layers of the organisation combined with the analyst's own observations of the processes and information products. Often, documents regarding the organisation and those of the processes regarding quality control are important sources in arriving at an understanding of the processes. However, in practice this springs a number of problems. The first issue is the degree to which the formal documentation of the organisation and its processes

agrees with the organisational reality. Giving prominence to these documents implies taking a position regarding the value of these documents, either negatively ('worthless paper truths of the managers') or positively ('we are trying to act in this way, but it was not possible just now'). In both cases the formal documentation is the leading norm in taking stock of and evaluating the processes.

The second issue is the effectiveness and efficiency of the Interviews with practitioners. On the one hand the analyst can drown in details; on the other essential elements of the business processes might remain undiscussed. The analyst does not know they are there, while to the practitioner they are so obvious that it does not occur to him to mention them. The same holds for looking into the information products. How does the analyst find out what is not there, what is left out because it is supposed to be known or because the information is obtained by other means?

Another approach is working from the underlying norms of the enterprise. This begins with an orientation on the markets and products of the enterprise. After all, the enterprise exists because it creates products for customers and this is given shape in the business processes. The organisation (and quality control) has to structure and stabilise the business processes, but that should happen to serve the higher purpose: to effectively serve customers in an efficient manner. Needless to say, other essential norms apply that lie outside of the enterprise. Those are in part societal norms and in part norms from specific stakeholders such as regulations by the government (requirements for the financial accounts are a striking example).

The norms that are based on markets, products and external stakeholders are in general more stable and accessible than all the ins and outs of the business processes (especially when the analyst has to work his way through lots of details before isolating what is structural from what is irrelevant for his purpose). On top of this, possible developments in those norms are essential for the internal structure of an enterprise. Those can be developments as a consequence of strategic decisions by the enterprise or external developments that the enterprise has to follow if it wants to remain in the market. The model of the business processes should be capable of following those developments without major structural changes.

2.3.4 Ontology and Ideal Type

Through the process logic the essential and stable elements of business processes and information

flows should be mapped. This aim can also be distinguished in several ontological approaches. Essentially, the process logic is used to define a small and specific universe of discourse along with the associated operations. Using a classification of Poli the process logic could be placed under the term formalized ontology: "...to find the proper formal codification for the constructs descriptively acquired..." (Poli, 2010), with the essential difference however, that the intended constructs are not obtained by means of "collection of such prima facie information on types of items either in some specific domain of analysis or in general" (Poli, p2), but by a normative and critical analysis of the enterprise against its background of its products and markets.

The use by Dietz of the term ontology points in the same direction: "Our goal is to understand the essence of the construction and operation of complete systems, more specifically, of enterprises" (Dietz, 2006). In a very different time and against a very different background Max Weber was searching for a precise and consistent description of social patterns and their backgrounds in his main work *Economy and Society*: "In order to give a precise meaning to these terms, it is necessary for the sociologist to formulate pure ideal types of the corresponding forms of actions which in each case involve the highest possible degree of logical integration by virtue of their complete adequacy on the level of meaning" (Weber, 1968).

A marked difference between the ontology approach as used in ICT and the use of the concept of an ideal type of Weber is the way in which the resulting model is viewed. Is it a basic design to engineer the social world towards what it should be or is it an instrument to understand patterns of rule-based human action in a specific context? The thinking behind the former idea is formulated clearly by Dietz: "Contrary to many dissenting theories that have been advanced in the past century, organizations are artifacts. They are systems that are, and have to be, designed and engineered, like any other artifact" (Dietz, 2006). The latter is expressed by Weber in two ways, directly following the earlier quote: "...it is probably seldom if ever that a real phenomenon can be found that corresponds exactly to one of these ideally constructed pure types." (Weber, 1968) and "The more sharply and precisely the ideal type has been constructed, thus the more abstract and unrealistic in this sense it is, the better it is able to perform its functions in formulating terminology, classifications, and hypotheses" (Weber, 1968).

The approach of using the process logic as a means to arrive at an information architecture shares characteristics with both of the above approaches. The concept of process logic is based on a Weberian idealisation and it is based on an analysis of the underlying norms of human action. The information architecture that is based on process logic is an especially good example of organisational engineering: a formal and consistent model of the essence of the business processes in an organisation. However, since the organisation as a social phenomenon is anything but an engineered system, but rather an emergent system that is continuously changing itself, the information architecture is not a prescription to how the organisation ought to behave. It works in the reverse direction: when the organisation behaves and develops itself as described by Taylor and Van Every (Taylor, 2000) and when the actions of the organisations are at the same time determined by a number of inescapable rules, then it has to be possible to represent those matters within the capricious daily organisation reality that are essential to the business in the information architecture.

3 DESCRIPTION OF THE CASE

3.1 Introduction

AYS is a leading service and repair business for mainly audio-visual equipment of major brands operating nationwide. The enterprise carries out both on-site and carry-in repairs and has a network of six branches for the on-site and smaller carry-in repairs that service the different regions of the country. Larger carry-in repairs are performed centrally in Arnhem. The main contract partner is a leading brand (represented by its national importer), AYS is a certified partner and carries out all repairs in The Netherlands for audio-visual equipment of this brand. AYS is also active on a smaller scale in the repairs of other brands and of other kinds of electrical consumer products.

The key elements of AYS are:

- Both on-site repairs and carry-in repairs of audio-visual consumer products
- National coverage with six regional branches
- Strong affiliation with a strong brand
- About 100 employees

3.2 Structure of AYS

The legal structure and the structure of the business processes are rather different at first sight. AYS presents itself to the outside world as one homogeneous company with a specific service package. There is also a strong centralisation in terms of management and strategy; the head office defines the corporate identity and determines how the business is done. Legally there are a number of different entities (each a separate legal person) on three levels:

- Level 0: The holding
- Level 1: The main office and multiple entities that are not involved in the servicing and repairs and that will not be discussed here
- Level 2: The regional branches

The main office encompasses a number of central services, the main workshop with reception desk for carry in service and it provides the on-site service in its region. The regional branches provide the on-site service in their regions and they have a limited workshop facility with a limited reception desk service. The regional branches are either full subsidiary companies or fully owned by an independent entrepreneur.

3.3 Contracts, Agreements, Commitments

Curiously, there is only a very limited use of formal SLA's. The affiliation between the importer and AYS has much more the nature of a relational contract in which the details of the mutual obligations are not described as much as it is based on trust, established practice and, especially, on the binding effect of the settlement of financial claims of work carried out by AYS that are accepted or declined by the importer depending on the circumstances (circumstances that are not always known to AYS). Here, it is clear that this is not a symmetrical relationship; it is the importer who leads the way, who determines how matters must be handled both materially and financially. In practice, there are a multitude of agreements and expectations regarding the handling of repairs (turnaround times, success rates) and regarding the handling of the financial side. Current practice is mainly based on the knowledge and experience of a number of key figures in the AYS organization (which is both a weakness and a strength; a weakness because of the dependence on individuals, a strength because it is hard to reproduce and thus cannot easily be adopted

by others outside of AYS).

For other products groups and brands the same pattern holds and the size of the contract partner is there too defining for the (a)symmetry of the relationship between AYS and its contract partner.

3.4 Strategy

AYS has a growing strategy in two directions. The first direction is diversifying the brands. Because there is a strong current dependence on one brand, AYS is investigating the possibilities to apply the current competencies for audio-visual consumer products to different brands. Potential new activities are not foreseen to demand new processes. However, it is possible that agreements and interactions with new parties will take on new forms (but that also holds true with regard to the current clients).

The second direction is to use the competencies and the nationwide network for new activities, in particular services to professional users. Potential such activities are the servicing of permanent audio-visual installations, both for companies to whom that is the core process (informing and/or advertising to its customers) and for companies where it concerns more internal presentation capabilities. A different possibility is to provide the entire handling of defect equipment for larger retailers (logistics service partner). Another possibility is to provide installations of new audio-visual equipment to professional users. Currently, there are some small-scale activities in these directions and growth towards full scale services is a real possibility.

3.5 Stakeholders

In principle AYS is dealing with one, two or three external parties and with one or two internal parties for one repair job. The external parties are the end user (usually a consumer but it can be a company), the direct supplier (big chains of nationwide operating retailers), and the importer as representative of the brand. The client of AYS is one of these three parties and the details of the 'preceding parties often have to be registered as well (the consumer has two preceding parties and the importer has none). The contractor is one of the AYS branches which can subcontract the work in whole or in part to another branch of AYS.

Each stakeholder has its own way of providing and requesting (or demanding) information and of tracking the work and handling the financial side. Moreover, these patterns are subject to unpredictable change. The use of references by the stakeholders is

also erratic. Standards for dealing with warranty conditions and for the execution of work differ per stakeholder. Market and power relations determine who is in charge, and as a smaller party AYS usually has to comply with the demands and expectations of the (much) bigger clients. Here, logic and facts can sometimes be set aside. The flexibility with which AYS deals with these complex and rapidly changing practices is an essential factor for the internal costs and for successfully getting the remuneration for the performed work.

NB: The term 'customer' is difficult to apply in the case of AYS, because there are so many kinds. Because of this, the term will be avoided as much as possible.

4 SOME PRACTICAL ISSUES IN THIS CASE STUDY

4.1 Creating Common Background between Analyst and Practitioner

The analysis and modelling took place in a series of open conversations and presentations with discussions with two of the three executive managers / owners. As indicated the aim was to arrive at a stable information architecture for the enterprise. The stability of the architecture requires that it is based on the underlying lasting patterns of the business processes, as well as on an understanding of the markets and products, trends and strategic scenarios. At the same time practitioners will take a perspective based on their everyday work and will mainly be focused on their current operational obstructions. To them, the benchmark for the description and model of the business processes is their daily practice, as it should be. However, at the end of the process of analysis and modelling the analyst should have a sufficient grasp on the operational processes and the company culture, while the practitioners should have a sufficient grasp of the abstracted view of their processes. Without this resulting communal basis it will not be possible to discuss and evaluate the result of the modelling in a fruitful manner.

The background to all of this work is formed by the norms imposed by the external stakeholders, the norms imposed by the nature of the products and the norms that originate from the enterprise itself. It is up to the practitioners to indicate these norms and it is up to the analyst to formulate these norms in a precise manner and to continuously test these norms

against the background of the business environment. Here, it will often prove necessary to adjust the way in which the norms are formulated; either by adjusting the norm itself or by adjusting the circumstances under which the norm applies. One of the results of the analysis of the norms is that it becomes clear which norms are hard with hard conditions and context (and thus suitable for machine interpretation) and which norms are either 'soft' or significantly subject to circumstances (and which thus involve direct human interpretation and responsibility in applying the norm to a concrete case).

4.2 Rigid Principles Bring Practical Solutions

The purpose of this phase of analysis and modelling was not to solve current problems (other than the problem of replacing the current software package which could not be maintained), neither was it to evaluate and to take stock of the demands and wishes of AYS regarding the new information system. Because of this it was remarkable to see the following pattern emerge at a number of times (especially in the latter stages):

- Within the process logic a sharp distinction is drawn between two processes
- The practitioners react at first by projecting their view of current practice onto the model. This can result in an initial negative reaction: we do not recognise our processes!
- Next, a discussion emerges about the correctness of the formulated model against the background of the norms within the organisation (mainly in the area of responsibilities for the end result and for the costs) and those outside of the organisation (what do the external stakeholders demand)
- Sometimes the discussion results in adjustments to the norms and/or to the model (but not in most cases)
- Finally, the practitioners conclude that by working according to the formulated model a number of current practical problems will be solved, because those problems are the result of a muddying of the boundaries between two processes

An important example of this pattern is the introduction of the concept of transfers combined with the concept of a process step and the assignment of a service order to a single branch. One of the principal norms in the enterprise is that of

turnaround time. External stakeholders link the remuneration for a repair to the meeting of the agreed upon turnaround time. Thus, the monitoring of turnaround times is a crucial component to the internal monitoring of the service orders. Because of the current out-dated information system, but also because of how the work floor is organised, this monitoring is at present a cumbersome and vulnerable process. Building software that supports the current practice would likely be a major task, with lots of maintenance afterwards.

By making the current practice explicit by modelling a number of successive process steps (receipt – administrative screening – technical screening – actual repair – preparation for shipping – shipping) and by explicitly naming the transition between process steps as a transfer, it becomes a trivial job to evaluate both internal and external turnaround times per process step in the new information system. The explicit transfer between process steps also improves organisational clarity: who is responsible for the service order? If desired, it is also possible to split the transfer in two: making it available to the next process step and the acceptance by the next process step. This system also allows for easy monitoring in such a way that internally accumulated delays can be compensated for by adjusting the turnaround time for the next process step for the particular case.

An accompanying concept to this concept of transfers is that of "on-hold" situations. When a service order is waiting for activities outside of the control of the relevant process step, the order will be on-hold. Here, it is recorded why it is on-hold, by whose actions the on-hold situation will be lifted, when this is expected to be the case and if the on-hold situation causes the turnaround time to be suspended.

And while this model was completely new to the practitioners, it cannot be called an invention by the modeller either. It was just giving shape to and formalising something that was very close to the surface of the business processes, but which was not viewed as such up to now. Rigorous modelling of the process steps, transfers and on holds led to clearly definable administrations and responsibilities, and less complex business processes.

5 EVALUATION

5.1 Process Logic

In this paper the term process logic has been used to distinguish it from the idiosyncratic characteristics of the enterprise. Usage of this term was founded in a number of considerations. First, it deals with a schematic representation of the inevitable structures within a certain line of business, valid within a specific social environment. One might say that these are the structures a student should be taught, while he does not yet know which specific company will employ him. Second, norms for completeness and consistency hold for this schematic representation. On the level of abstraction chosen, it should be capable of representing every scenario that arises in practice (a tall order and a real challenge!) and there should be no inconsistencies or ambiguities. This demands definitions of the elementary terms and a precise formulation of the underlying norms.

In applying a concrete model of process logic it is essential to realise that it is an instrument to represent situations and processes (description, and an instrument for analysis) and that it not intended to be used to dictate how processes and situations ought to be (prescription). At its core, the process logic is a formalised sign system to (1) gain an understanding of the processes in the analysis, (2) precisely formulate terms and rules and (3) describe an information architecture that because of its character forms the basis for later system development. At the same time, process logic has to help the enterprise avoid inconsistencies (for example by preventing the use of key terms such as “service order” to mean various things) and leave the enterprise to choose how it sets up and executes its processes. An enterprise with five experienced employees will have to organise itself very differently from an enterprise with 5 offices, each with 20 employees and 10 flex workers!

In the case at hand the attempt to uncover the process logic has worked well, both to establish a common background between the analyst and the practitioner and to arrive at precise definitions, rules and demarcations.

Process logic is an important element for a common background, because it is a shared search for the underlying structures. For the analyst a general orientation on the specific markets and products of the enterprise with its peculiarities combined with a general background and common sense is sufficient to play his part in the discussions.

All kinds of details that are hard to understand for an outsider can be isolated in this stage and assigned to specific places in the structure, without first needing to be fully explored or understood. This approach also forces the practitioners to be explicit about what really matters.

The approach also clarified what actually happens in the current business processes, as the examples regarding the concepts of process steps and service order have shown above. This conceptualisation of current practice allows for a very precise and fitting way of modelling and monitoring the business processes and leads to a better understanding by the practitioners of their own processes.

5.2 Administrations, Identities and References

One of the pillars of process logic is the concept of an administration. The definition of an administration given by Starreveld is: The systematic collection, recording, processing and supplying of information for purposes of the managing and functioning of a household and for purposes of the accountability thereof". When we combine this definition with the idea that an administration concerns one specific domain, it seems obvious to directly name the required administrations when process logic is specified. Here, it is important to note that administrations concern product data and not master data.

The first criterion to arrive at an administration is a high degree of homogeneity and autonomy. It must be possible to view the data that are collected in one administration as a single coherent whole. Also, the direct interactions with and dependencies on other administrations have to be as few as possible. A second criterion is the responsibility for its management; each administration in an organisation should have a single person who carries the responsibility for the correctness, timeliness and completeness of the data in it. This responsibility should ideally be located close to the primary process, to ensure that those responsible are in touch with the reality represented in the administration.

In the case at hand this mainly means that each branch has its own administration and carries full responsibility for it. For example, there is no central registration of orders and stocks, but each branch maintains its own administration in these areas. Incidentally, in this concrete case it does not mean that they are free to choose their own systems. Everyone uses the same system, but within it every

branch has its own administration. Of course, in the presentation layer connections can be made across the different administrations to enable central monitoring of the processes. And the serial number administration in which the service history of individual devices is registered is an example of an administration that must necessarily be kept centrally because of the nature of the data and the interaction of these data with external systems.

For the development of the new information system the specified administrations are composed of two parts. First, there is a basic structure with entities with their internal and external identities. Of course, within the database a single entity has a single unique identity, but inside and outside of the organisation an entity might have many alternative identities. Think of the number of a service order for example: internal and external stakeholders can use all kinds of references for themselves and use their own reference to request or provide data. Another example of this mechanism is the serial number: at first viewing this is a unique number. In practice, this number is unique number within a specific brand, product group or model. Thus, a serial number does not uniquely specify a single device or part while it is required to do so. The enterprise also has a need at times to refer uniquely to a part that does not have a serial number, which can be met by assigning it a particular number generated for this purpose. When the part is gone, the number is as well. Based on these considerations, it is prudent to primarily assign unique numbers generated by the enterprise itself to parts and devices and to consider the serial number on a device or part as an alias to arrive at the generated number. This system is always applicable and avoids the complicated composite identification that results from accepting the serial number as identifier.

From the very beginning, the structure of the administrations has to be erected along with the associated references inside and outside of the enterprise. Further dressing up and setting up of the administration with data relevant to the contents, further status information, et cetera, can be done afterwards, in parallel to the development of the applications that use these data.

5.3 Lean IT

The lean approach places a number of demands on the set-up of an enterprise information system. Positively formulated, the information system must contribute to the effectiveness and efficiency of the business processes and use the most appropriate

means to do so. Negatively formulated, the system is not allowed to cause waste (e.g.: excess production of information), to place undesired limits upon the business processes and it may promote the autonomy of processes as long as this does not harm overall efficiency and effectiveness. Information from the system has to be reliable and relevant.

Put otherwise: employees have to keep being presented with information in the right way and feed back information themselves and they must have the freedom to make their own decisions within their domain. Two examples illustrate the application of these criteria: First, the registration of direct hours on service orders. From the management there was a strong desire to gain a detailed view of the usage of hours in the primary process. In computer systems nothing is simpler than granting this wish: registration per service order, per department, per activity of time used. In everyday reality however, such a system leads to unusable information. First, because there is a mismatch with the way in which the work is actually done. Second, because it results in an excess of registrations. Either the categories are too general and the registrations limited, or the categories are specific and the registrations time-consuming. In both cases the registrations will provide an unreliable view of reality. That is why we opted to start with registration per service order in just the repair department, where it is registered for each employee when he begins and ends with a service order and which activities he performed during this time (which does not provide the time per activity). In this way, insight is provided into the ratio of time spend on service orders to time spend on other activities. Insight is also provided into the cases in which a service order has been handled repeatedly, by whom and to perform which activities. These data provide the foreman with a measuring stick to monitor the performance of his crew and to pay additional attention to activities that seem to take up too much time.

A second example is insight in what tasks must be done and which tasks might be done. The turnaround time of service orders is one of the most important parameters for the performance of the enterprise with regard to the various stakeholders. When norms are created for the turnaround time as a whole and for the turnaround time of each individual process step, it is possible for the system to directly show which service orders have to be handled on a particular day in a particular team and which other work remains to be done with what time remaining according to the norms. This allows the team to make optimal use of its capacity by handling the

service orders that are the best fit at that moment for the current activities and available resources. Self-control instead of central control should result in a significant advance in efficiency here.

5.4 Protecting and Strengthening the Distinctiveness of the Company

The strength of the enterprise is two-fold: nationwide coverage and a strong bond to a strong brand with strong partners. The downside of this bond to market heavyweights is that they determine to a large extent what the service conditions will be, both regarding the fees and regarding the mutual information supply. In this sense we are dealing with strongly asymmetric relationships. On the other hand, AYS is able to relieve large market parties of work that those parties are much less well equipped to handle and to carry out this work to a high standard. In other words, the enterprise has a clear place in the market.

Current legacy information systems of AYS have been built or adapted based on concrete developments in and requests by the market partners. Because of the aging core system solutions have been added to applications that were not originally meant for such. The new system should improve the ability of the enterprise to react to market developments through improved insight into the actual course of the processes by sharply demarcating the various administrations. This improved information position should result in an improved bargaining position with both existing and new contract partners.

A second contribution to the strategic position of the enterprise is also based on pulling apart the core administrations. In this way the enterprise is enabled to develop activities other than just service orders for defective equipment. The potential of nationwide coverage with service vehicles can be utilised for other activities as well. The information architecture allows both developments to be introduced gradually to expand into new markets, without major, risky, investment.

Finally, the flexible legal and financial structure is a major advantage. The current diversity with both fully-owned branches and branches exploited by independent entrepreneurs allows for rapid change both in acquiring work and in subcontracting it. AYS can profile itself as a strong market party because it presents a unified face to the client (in corporate identity and in home visits) and orchestrates the orders, while the work may be carried out elsewhere. Separating the diversity of the

legal and financial structures from the unity of AYS as a business actor is an important requirement for the information architecture.

6 CONCLUSIONS

At the time of writing this paper the analysis was not fully completed yet. The manner in which the project went and the structures that have been identified as process logic are already sufficient to consider the project successful for the client AYS. Here, it is relevant to note that AYS commissioned an analysis of the business processes by a potential supplier and industry specialist about a year before this case study, thus supplying AYS with a comparison. This earlier analysis did not lead to new insights into their processes since it was fully based on inquiring after factual details of the business processes of AYS to prepare for the implementation of the package. Terms were mostly left undefined and the information gap between supplier and customer was never bridged.

In contrast, the approach in this case study encompassed a critical analysis of the business processes and resulted in many new insights for AYS into its own practice. Furthermore, the structure described is suitable to accommodate future developments.

Thus, the method of analysis of the process logic has withstood the test of practice. However, the form for the final product, the description of the process logic, has not yet been found. The description as a list of definitions, a specification of the administrations and a specification of references certainly forms a useful and testable foundation, but a more formalised form of core entities and their transitions would be desirable.

To conclude, to make the transition between daily actions by employees in the business processes on the one hand and the process logic and information architecture on the other, a number of layers will have to be distinguished in the enterprise information system:

- A core system with administrations and operations
- A number of rulebooks (sets of business rules that determine the behaviour of the operations)
- Application software
- Setup of the application software
- Agreements and procedures regarding information flows and use of the computer systems

- Actual information flows within and outside of the pre-determined paths for doing so (computer systems, forms, structured consultations) within the daily business processes

The core system as a stable basic structure and the more changeable rulebooks on top of it should be specified rigidly in an abstract and formalised manner. The actual information flows are a constituent part of the organisation as a socially emergent phenomenon and ultimately it is impossible to fully capture their dynamics and wealth of detail. The elements in between are a mixture of social conventions and logical modelling in practice. IT people and bureaucrats (in its Weberian meaning) prefer to work here with formal sign system, while the practitioners who need to deal with nuance and to weigh heterogeneous norms against one another in practice are much more inclined to non-formal sign systems such as free text, oral explanations and face-to-face discussions with colleagues.

A major recurring problem in the development of an enterprise information system is the balancing of model with reality, of System with Lifeworld (Habermas, 1986). Acknowledging the formal nature of the core system and the surrounding rulebooks and acknowledging the dynamics, the capriciousness and the intangibility of the daily organisational reality can help in developing applications in a more efficient way. On the one hand, these applications are supported out of necessity by the stringent core system, on the other they themselves have to support daily practice. The conscious decision to limit computer systems to those operations for which they truly add value to operational practice is an essential step. Too often requirements and wishes are drafted from the perspective of managers located too far from daily practice and too often slogans such as 'paperless office' or 'everything inside the system, no dependence on people' are adhered to. In the end, it is about the criteria of the Lean approach: add value, avoid waste and always use the appropriate means to the task (the latter is a translation to practice of the avoidance of waste).

This case study had a tentative character, trying out several ideas regarding both the theoretical background and regarding the application of the ideas in a real world project. As such, it succeeded; in a short time good results were obtained (especially in comparison to a previous analysis of the same company carried out by a potential software supplier).

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