THE JANUS FACE OF LEAN ENTERPRISE INFORMATION SYSTEMS

An Analysis of Signs, Systems and Practices

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Abstract: The term “Enterprise Information System” can be used in two ways: (1) to denote the comprehensive structure of information flows in an Enterprise, or (2) to denote the computer system supporting the business processes. In this paper I will argue that we always should take the first meaning as our starting point, and that in analysing the use of information and information flows we should recognise the different kinds of sign systems that are appropriate to different kinds of use of information in business processes. In system development we should carefully analyse the way a specific company is operating, and design a comprehensive information system according to the principles of Lean Thinking and according to the conversational maxims of Grice.

1 INTRODUCTION

The central question is: How to handle a project, as a sector specialist, with standard software for a customer with its own distinctive capabilities? The extremes between which the project moves represent on one side the Standard (Best Practices, Me Too, “everyone can work with our solution; so can you”) and on the other side a customer specific solution for a specific customer. On top of this it is common practice for the standard solution to be developed further partly as a result of customer projects. Unfortunately it is also common practice for the dividing line between standard and customer specific not to be drawn distinctively enough. In the case of new developments within the sector this is complicated further because the first, second and third customers turn out to have set the de facto standard implicitly.

In this paper I will argue that (1) information supply is distinct from information technology; (2) in the development of an information system a clear distinction must be made between the “bare” software, the configuration, and the conventions and working procedures regarding the use; (3) when all information requirements are indiscriminately committed to information technology, the result will be a malfunctioning and burdensome system; (4) the concept of Lean IT can be used as guidance to prevent these negative consequences.

This paper is written based on 25 years of experience at a supplier of industry specific standard solutions, paired with a theoretical background in business economics, organisational studies, and language philosophy.

In this paper I will use insights from the general science of sign use; semiotics. An important part of the problems we encounter in IT projects can be traced back to the properties of the different sign systems, and our inclination to disregard these properties in the analysis, development and implementation of systems.

This paper will first look into the use of the term “Enterprise Information System”. The theoretical groundwork will be done in the subsequent sections about semiotics, sign systems, business processes, the relations between system and reality, and the general requirements which an information system should satisfy. By analysing several cases it will be shown how these issues can affect practice. The paper will be concluded by suggesting a layered model for system development and by stating the conclusions.

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2 WHAT DO WE MEAN BY "ENTERPRISE INFORMATION SYSTEM"?

By definition a system is the total of a number of mutually connected parts. When we talk of an Enterprise Information System, about which total do we speak? Two views are important for the scope of this paper: (1) the operational computer system, including configuration and operational data, (2) the total of conventions and procedures regarding the information supply within a company. It should be clear which view takes precedence: the information system of the second view contains the information system of the first view. In other, and stronger, words: An information system of the first view which is not properly embedded in an information system of the second view, cannot fulfil its role and in many cases will work counterproductively: efforts will be inefficient and it will result in a distorted representation of reality.

The "real" Enterprise Information System is the structure of all information flows through an organisation. The structuring of these information flows should be founded on three pillars: (1) responsibilities per part of the organisation, (2) conventions regarding the meaning of data that are made available to other parts of the organisation, and (3) conventions regarding the correctness, timeliness, and completeness of the information made available. Of course computer systems nowadays play a decisive role in information supply within organisations, and increasingly in between organisations as well (Supply Chain, EDI). If, however, there is a lack of embedding in the real information system, this decisive role can also turn out negatively (expenses can be made unnecessarily, decisions might be made on a basis of false information, the company under performs regarding customers and other stakeholders).

Lacking a definition of the comprehensive Enterprise Information System, the computer system itself will often be considered as the Enterprise Information System in both meanings of the word. When an idealised view of the organisation and its processes is dominant, failure will be ensured. When the users and practice take centre stage, the "real" information system will at least implicitly be present. This results in problems being brought to light, but at the same time the comprehensive framework is lacking to usefully discuss them and, finally, to make well-founded decisions regarding them (a well-founded decision is better to maintain than a compromise that everyone can agree upon eventually, but which is clearly a result of negotiation instead of logic).

The concept of "Lean IT" could provide guidance here. Analogous to the concept of "Lean Production", the question of information should be analysed in terms of value added. The concept could be summarised as: Provide information where it adds value, do not waste resources in providing superfluous information, and provide information in the right way. The rest of the paper will focus in particular on the questions of "the right way", and analyse sign systems, business processes, and the frequent misfit between computer systems and business reality.

3 SEMIOTICS AND TYPES OF SIGN SYSTEMS

3.1 Sign Processing and Sign Systems

A comprehensive Enterprise Information System provides for the obtaining, processing, storing and supply of data for the execution of tasks within an organisation. In principle the employees of the organisation as information users are an integral part of the Enterprise Information System, because they continuously obtain, process, store and supply data, just like the computer systems do it in their own way. It is clear that such an information system consists of very heterogeneous types of use and types of users, and that information can be stored and used in very different ways.

It is therefore essential to consider the way in which all those different kinds of sign users and all those different kinds of sign systems cooperate with each other. It is also important to analyse how different types of sign systems function, and what happens when one kind of sign system is replaced by another kind. It goes without saying that an essential part in establishing an comprehensive Enterprise Information System is assigning fitting kinds of sign systems to the different parts of the system.

3.2 Transactions between Sign Systems

Another semiotic aspect of information systems is the analysis of the transitions between sign systems. What happens when someone codifies an observation to input it into the computer, what happens when someone interprets some output of a computer to make a decision? Some trivial examples are: the transition between writing systems (e.g. Cyrillic or Chinese script to Latin script, the example becomes less trivial when it concerns practical consequences like a no-fly list) or the transition between languages (the German term “Disposition” does not have a proper translation in either English or Dutch). A good example of the problem of identity in different sign systems is provided by de Saussure: “the 8:25 train from Geneva to Paris” (Saussure, 1966, p108). For the timetable the train is the same each day, for the train spotter or railway engineer it is not. Please note: these examples are still entirely unrelated to computers.

Within a language these transitions happen as well. Think of the jargon within a profession for example. A more subtle form, however, we find between the different departments of an organisation, think of communication between the commerce and production departments, but also between the hierarchical layers within an organisation.

3.3 Sign Systems and their Properties

A fundamental distinction can be made between sign processing within formal systems and sign processing by humans. The most important property of sign processing by a formal system is the closed nature of it: pre-encoded data is processed by pre-encoded software. Opposed to this there is the ability of humans to interpret data according to context. In other words: the perception of the environment plays an important part in human sign processing. The importance of this attribute is shown by an important means of protest for public officials: the punctuality protest. In this protest they act as a formal system would; they adhere strictly to the rules as rational actors and are not perceptible to reason.

3.4 Ruthrof

In his work “Pandora and Occam” Horst Ruthrof names three categories of a fundamental lack of clarity in our use of natural language, namely: (1) modal opacity, (2) propositional opacity, and (3) semiotic opacity (Ruthrof, 1992, p 4f).

Modal opacity concerns the intention of what we say; when a customer asks a supplier whether he can deliver 300 kg of steel tomorrow, it really is an order. Depending on the backgrounds and expectations, a delivery of 265 kg can be seen as fulfilling the request, or a delivery of 298 kg can be considered a deviation by the customer (see also Searle’s discussion of locution, illocution and perlocution in his theory of Speech Acts) (Searle, 1969).

Propositional opacity concerns the contents, or the references, of our communications; in the Frequently Asked Questions on his website Andrew Tanenbaum addresses the question of which countries he has visited. There he names the example of visiting the USSR, but never Russia. Now suppose he went to Moscow while in the USSR; he then would have visited the capital of Russia, without ever having been in Russia itself.

Semiotic opacity concerns the problem of the transition between sign systems, and is in part a result of the other two opacities; in the transition between sign systems part of the context, and with it part of the meaning, of the possibilities of interpretation is lost. See also the movie “Lost in Translation”.

3.5 Boisot, Van Heusden & Jorna

Max Boisot in his analysis of knowledge assets has developed an instrument for the assessment of the different aspects of knowledge and information; the concept of Information Space or I-Space. The respective axes of the I-Space represent the degree of codification, the degree of abstraction, and the degree of diffusion. “The process of codification creates perceptual and conceptual categories that facilitate the classification of phenomena” (Boisot, 1998, p42). Abstraction generalises and searches for underlying structures. Abstraction is often based on codification, but not necessarily. The abstract processes according to which a craftsman plies his trade are not usually codified, but they are certainly present. Or consider the pattern-industry in Software Engineering; the work of Gamma and his co-authors was able to gain popularity in such a small amount of time, because it appealed to already present abstractions of software engineers. Using their codification these were made accessible for a much more efficient transfer and further analysis. Thus we have arrived at the third axis: the spread of information, or diffusion. Both technical and social systems are required to make information available to others through time and space.

From the point of view of sign systems it is important to understand that the different technical and social systems each place their own demands on the way in which the information is encoded and abstracted. Also, in the production process the abstract and codified information of a product specification must eventually be converted into concrete individual products by machines and humans.

Van Heusden and Jorna have generalised the model of Information Space to a model for the Semiotic Space, with the following three axes: (1) level of detailing of sensory (perceptual) knowledge, (2) degree of codification, (3) degree of abstraction (Van Heusden, 2001).

3.6 Organisational Semiotics (Stamper/ Liu)

The Organisational Semiotics approach takes a similar interest of the role of semiotics in information systems engineering (Liu, 2000). The concept of affordances (Gibson, 1986) and the basic notions of human responsibility and norm-based actions could prove very useful for the development of lean information systems. However, it seems to me that this approach has difficulties in case of vague, evolving or conflicting norms, and that it has a rather "static" semantic stance. In analysis it tries first to establish the meaning of all terms concerned, and will then define the norms involved ("A Norm Analysis is normally carried out on the basis of the result of the Semantic Analysis", Liu, 2000, p102).

The pragmatic and the social components of this approach are in the current state not sufficient to deal with the problems that are discussed in this paper. Especially dealing with the questions related to the different kinds of information, or to conflicting norms in business practice is problematic using the available methods of organisational semiotics.

4 TYPES OF PROCESSES WITHIN A COMPANY

There are a number of frequently used classifications of processes within companies. Important is the distinction between primary processes, control processes, and supporting processes. The primary processes directly concern the creation of products for the markets, control processes concern the planning, direct control, coordination, and accountability of the primary processes, and the supporting processes facilitate the first two types of processes (and themselves).

For our purpose this classification is important, but another classification is even more important. Some processes have a clearly defined beginning and ending; once they are started they go through pre-defined stadia to reach their point of termination. Consider for example the handling of a customer order for standard products: from the order itself, via order pick, dispatch, delivery, billing, and payment. Other processes are iterative, production planning for example. It is iterative because the same activity is repeated on different points in time (for one particular production week a year in advance, three months in advance, one month in advance, the week preceding it). Another example is the one-off sale of capital goods through negotiations: this is very much an iterative process. There are also processes that are permanently active, like production monitoring; as long as the production is active, the monitoring will be active. Certain registration functions are of this nature as well; think of the weighing process in a slaughter line, or a porter or a receptionist.

Another criterion to classify processes by is the nature of the information that is being processed. In terms of Boisot / Van Heusden & Jorna: To what degree is the nature of the information sensory, codified or abstract?. One could also say: is the information hard or soft? In the two examples mentioned above the customer order for standard products is very much codified, while the one-off sale of capital has a strong sensory component (that is the nature of negotiations: a constant gauging of the limits of the opposing party). The discussion on SigInt (Signal Intelligence, the automatic monitoring of telecommunications by systems of intelligence services) and HumInt (Human Intelligence by agents in the field) is closely related to this classification (Keegan, 2003, p22ff).

A fourth criterion is the degree to which processes are determined. At first this criterion seems to be a derivative of the preceding criteria; terminating processes are determined to a greater extent than iterative processes, and processes based on hard information are determined more than processes based on soft information. However it essentially is a question of the responsibility for the execution of processes: the responsibility for a determined process can be located higher up in the organisation, and the one executing it is responsible for handling it in accordance with requirements. In the case of non-determined processes the responsibility is located more within the primary process: decisions in the case of unforeseen circumstances must be taken there. Particularly in production planning determination is often assumed, thus having the planner decide what should happen in the production (this image strongly appeals to hierarchical bosses). Consequence is that the production manager executes orders without having the power of decision-making (which after all lies with the planner). When practice turns out to be less deterministic, and creativity is demanded on the floor to deliver the products to the customers, such an organisation will not be able to function well.

5 RELATION BETWEEN SYSTEM AND REALITY

The relation between the computer system and reality can be diverse. In some cases it is very clear what the representations in the computer correspond to in reality. In other cases this seems only to be the case at first sight and on closer inspection it turns out that the representations are not bounded properly, that they overlap, that they are too rigid, et cetera.

The relation between the computer system and reality is not a problem when the computer system is seen as an integral part of it. Whether it is seen positively or negatively is of no consequence, because the system is embedded in some artefact or other and inseparable from it. A computer based control system of a technical installation for automated transport is an example of such a system, as is the automatisation within an everyday object like a car or a coffee maker.

The relation with reality is also not a problem when the processes are formalised to a large extent, as is the case with financial administration or trade. The representations in the computer have, over the last few decades, become normative, thus allowing for an increasingly paperless manner of working (electronic transactions and electronic commerce).

In most cases however the "real" processes take place outside of the computer, and the computer system operates based on a model of reality. In such cases it is also possible for the user to perceive a large discrepancy between "his" reality and what the computer makes of it.

An example of such a choice in modelling is the way in which railway companies model the departure tracks on a station; nowadays that largely happens through the departure track number, in the past it was common to do so through the platform number along with some additional coding (east / west for example). The second model better fits the traveller looking for the stairs to the correct platform while on his way to the train, but complicates matters on the platform itself. The first model can cause confusion in finding the right platform (in Koblenz track 104 is accessible from the same platform as tracks 2 and 3).

6 SIGN SYSTEMS, PROCESSES AND COMPUTER SYSTEMS

The above shows that the formal and closed sign system is a good fit for a technical system, or in cases where reality itself is "pre-formalised". The transition between sign systems is then smallest. With "open" systems, based on a human practice of everyday routines, this transition is much bigger. It is not unusual for this to lead to the conclusion that "the computer system does not fit", and also that a computer system cannot fit. In that case the challenge is to show that it can be done, and how it can be done, taking into account its possibilities and restrictions.

This challenge has a variety of possible responses; there is (of course) a category of system fundamentalists who hold that the system should be normative. The problem of transition is at first denied, and once it is recognised, the burden is on the practices to adjust themselves to the system (which, after all, has been thought through so well and so rationally). The computer fundamentalist is basically a subspecies of the system fundamentalist. At the start of the nineteenth century the German philosopher Hegel attempted to systematise history. Prompted with the question how he would react if the facts did not match his theory he is supposed to have retorted: "um so schlimmer für die Fakten" ("too bad for the facts").

A different response is the attempt to eliminate the differences between modelled and actual practices by an increasing amount of detail. The underlying idea is that whenever a difference is observed, that difference can be described and analysed, before modifying the system. Of course the system will then first be tested by means of a set of realistic use cases. In this way the system will always be lagging behind (there will always be new differences to be found), but for now that is of secondary importance. Of more importance is that the idea of the system containing a model of actual practices has been abandoned in this view. Consider the idea that a map models a landscape, but a map that contains all the details will necessarily coincide with the landscape itself. Why do we make a map?

In other words: the computer system contains a model of reality, it must support reality and must not rule reality from some supposed system rationality, the model cannot coincide with reality, and the model has its own sign system with its own possibilities and limitations.

The difference between reality and computer system is just as natural as the difference between the landscape and a map. In designing a computer system the designers have to be aware of the possibilities and limitations of the sign system of the computer, together with an awareness of the nature of both the use and the users (and their sign systems). When the user perceives the computer system as distorting "his" reality he can either accept it (the computer rules) or he looks for his own way of finding solutions, independent of the computer system. In the latter case the computer system will have to be satisfied to allow other processes to continue, which will run parallel with new processes in which the actual work happens. It is the power of human inventiveness that allows the discovery of ever new ways to adapt the primary business processes in response to external disturbances (like a computer system that does not function properly). But this also creates imaginary worlds because elsewhere in the organisation other employees will assume that the computer system realistically represents the primary processes, and will thus base their management decisions on it. Put another way, a good manager is aware of the double difference when looking at the numbers: (1) the difference between his view of reality and the model in the computer, and (2) the possible differences between the model and the real handling of primary processes.

7 LEAN IT (MAXIMS OF GRICE)

In 2003 a small booklet appeared, titled "IT doesn't matter, business processes do". This is, as the title indicates, a plea to consider the "business use of technology for competitive advantage" (Smith, 2003, p25). In other words: technology can be used as a tool to achieve a competitive advantage. Further down their plea the authors state that "the future of IT is about the management of the business processes that companies use to coordinate internal work across functional stovepipes and to collaborate, compute and transact with customers and trading partners with transparency and accountability" (Smith, 2003, p58).

The transparency and accountability can only be achieved if the IT systems are realised in such a way that people are, and that they remain, responsible. This in turn supposes the operation of the systems to be understandable, based on fitting structures.

For production and other business processes Lean Thinking offers a way to analyse processes for their added value, based on pull principles, the avoidance of waste of hours and material, and doing it right on the first attempt.

Based on the same concepts Lean Information Supply can be developed: assuming transparent processes, with clear boundaries and clearly assigned responsibilities it can be determined for the different tasks of the process based on what information the task can be executed, and what information products must be delivered to the next step in the primary process and to the monitoring processes (information can of course be interpreted in a broad sense here, not just the input and output of computer processes). Johannes Cottyn presented on this theme at the WBF of 2008, naming, among others, "providing data in the wrong format in the wrong time" and "incorrect data or too much checking for change" as examples of waste in information systems (Cottyn, 2008).

Fortuitously, the English ordinary language philosopher Paul Grice has formulated four conversational maxims which excellently state the general requirements for an arbitrary information system (Grice, 1989, p28):

- Maxim of Quality
    - Only say what you believe to be true
    - Only say what you have evidence for
- Maxim of Quantity
    - Make your contribution as informative as is required for the current purposes of the exchange
    - Do not make your contribution more informative than is required
- Maxim of Relation
    - Make your contribution relevant to the interaction.
    - Indicate any way that it is not
- Maxim of Manner
    - Avoid unnecessary prolixity
    - Avoid ambiguity
    - Be brief
    - Be orderly

In other words: information should be brief, correct, relevant, understandable and reliable. It is self-evident that the meeting of these requirements is a condition for avoiding waste in the use of information; for one thing because the user needs extra time to interpret and verify the information offered, for another because the user opts for incorrect actions because of incompetently supplied information. The pull principle also ensures that only information which is actually in demand will be produced (and in the required form), and that in the design of the information system the legitimacy of the demand can be verified in advance (does the user indeed require the information demanded in his tasks and responsibilities?).

Finally, the resulting comprehensive Enterprise Information System should recognise and support the distinctive capabilities of the company, as analysed by John Kay (Kay, 1993).

8 CASE 1: TRADING

A company is involved in the international trade of large quantities of raw materials for livestock feeds. One part of the activities is handling already closed deals, one part of the activities is the trading itself where buying and selling happen simultaneously, and a part of the activities consists of buying and selling independently of each other.

All activities are related to the handling of sales contracts, buying contracts, and services in the physical flow of products (transportation, customs, transshipment, and storage). In other words: all activities could be represented in the information system within the usual functionalities for buying, selling, et cetera. Moreover, because of legal and administrative aspects the usual contracts have to be represented. Buying, supply, control and acceptance (transfer of ownership), and so on, those aspects are all present.

At the same time it affects very different kinds of trade, which each have their own way of control and assessment. The common element is that all kinds of trade are tracked by means of calculation. This calculation is made known at the conclusion of a deal, and checked during the handling of it. When buying and selling are executed independently, the usual “one-sided” calculation for buying and selling will do. During the real trading however the trade itself is what it is about, where buying and selling are involved simultaneously. When deviating from the most simple form of trade (for every purchase there is exactly one sale), the trader will continuously keep an evaluation of the market in mind. He will buy long or sell short when he expects to be able to sell the quantity bought for the right price in an acceptable period of time or when he expects to be able to buy the sold amount for the right price.

How is the information system in such a company designed for the traders and their management, and how is the trade represented in the computer system? It is clear that the supplier contracts for the supply of goods and services and the customer contracts for their supply of goods and services must be represented according to the usual rules. The challenge is in representing the trade; it is impossible to represent the trade in the way it happens in the mind of the trader. But because of monitoring and accountability the right buys and sales must be connected with each other, including additional costs for services by third parties. The information system must also enable both the trader and the management to closely monitor and assess events, in order to be able to act quickly when necessary.

9 CASE 2: PRODUCTION CONTROL

A company produces a large range of salads in consumer packaging. The salads have a shelf life of a couple of weeks, the standard for the amount of time a finished product stays in storage is one week or shorter. Sales are relatively variable and for some of the products they are strongly dependent on the weather and on advertising activities by the retailers.

The steps in the process are (from the finished product backwards): filling/packaging/labelling; mixing of intermediate products; preparation of intermediate products; preparation of raw materials. The production lead time is several days. There are about 6 filling lines, 8 mixers, and there is a large number of specific activities on specific intermediate products and raw materials.

The control of the filling lines of the production itself is a different story. The recipes are sometimes dependent on the season and sometimes on the individual batch of raw materials. The variation of activities in a relatively small area is very large. The filling plans are adjusted several times a week because of unforeseen developments in the sales, and sometimes because of internal malfunctions.

How should the information system for the production of such a company be designed, such that the information system is still well operable for the users (maxims of Grice), while the costs for setting up and using the system are not exorbitantly high?

The modelling of all activities is much too complicated. Registration of production and stocks for each step in the process comes with too high a price. Yet the responsible production managers need to be supplied with the information needed to do their job properly, and changes in the filling plans have to be adequately dealt with. This can only be achieved by a good combination of a simple model of production and a well thought through information system on the production floor itself.

10 ANALYSIS OF CASES

In the earlier reflections three interrelated basic elements have been addressed: Enterprise Information System both in a broad and in a narrow sense, the nature of processes and sign systems, and Lean IT. Both cases present some interesting examples of the importance of these elements in practice. Both cases deal with a mixture of structured processing of encoded information (the handling of contracts in trading, finished product planning in production) paired with essential uncoded information within the primary processes.

In designing a comprehensive Enterprise Information System (in a broad sense) a number of key questions have to be answered, including the essential issue of bounding the role of the computer system in the whole. Subsequently it is the question how processes must be represented in the computer system.

In the first case it is clear that at least the handling of contracts will be part of the computer system. We have noted already that, with respect to the sign system, there is a large discrepancy between the actual trading process and how computer systems function. The question is what role the computer system must be assigned for supporting the trade itself. From the point of view of business processes there are three main areas besides the formal handling of contracts: (1) the monitoring of the physical flow of goods; (2) the monitoring of long and short positions; and (3) the monitoring of trade calculations. The artefacts used in modelling these areas (in conjunction with each other) will have to be carefully construed; they are not pre-determined in reality. The concepts of “trade”, “item”, and “batch” must be defined in such a way that they, while guaranteeing their recognisability for the traders, can support the clear and simple modelling of business processes in the computer system. And through these concepts the connection with the information system in a broad sense (such as by telephone, mail, Excel) must also be guaranteed.

In the second case other challenges are present. The classical approach would lead to a detailed production model, with labour intensive and not very reliable product registrations. In practice this will often lead to eroding the position of the production manager as well, because the planner seems to be controlling the production directly: each change has consequences for the plans (because of the high level of detail) and should thus be decided by the planner. And if the production manager keeps making his own decisions within his own world (forced to do so, the customers must get their products in time after all), that leads to the planning being a farce. The basic principle of the division of tasks between general and more detailed decisions has, back in 1965, been well described by Robert Anthony: “...the middle managers can in fact make better decisions under certain circumstances; to deny this possibility is implicitly to assume that top management is either clairvoyant, or omniscient, or both, which is not so” (Anthony, 1965). Unfortunately computer systems help sustain the illusion that the planner is “clairvoyant” and “omniscient”, which can be detrimental to the results of the company.

The information system (in a broad sense) must be based on: (1) clearly distinct responsibilities for planning and production management, and (2) a clear distinction between the sign systems of planning and production. This should lead to a solution in which the planning model is coupled “loosely” with production. The production manager has his own information system in his own area, in which the central computer system plays an essential, but limited, part. The central computer system is essential for the current filling plans and feedback from production about the use of raw materials and output of finished products. Within the production itself the central computer system has a minor role. The information system within the department matches the physical circumstances and the manner of working. Quantities are often indicative and not exact. Regarding traceability strict rules apply, which fit the nature of the process without involving too many registrations.

11 PHASES IN SYSTEM DEVELOPMENT

In designing an information system along the lines described above four main phases can be distinguished:

- Description of customer processes in "customer language"
- Analysis and definition of the underlying process logic
- Design of the information architecture
- Representation of the underlying process logic in the software
- Setting up the system in a broad sense
  - Making agreements with respect to the set-up and procedures detailed and particular
  - Making tasks and responsibilities of the employees in the information supply detailed and particular
  - Setting up the computer system with terminology, screens and workflows based on the represented process logic and the specific form of customer processes

In the first phase the processes of the customer are described in a way recognisable for the customer, in his own language. Here it is mainly about mapping the different sub processes with tasks and responsibilities and information flows, and the nature of the information flows.

In the second phase "customer independent" process logic is mapped. In each industry patterns can be distinguished, which are determined by the nature of the industry and by the markets and products of this specific company. Sales and logistics of daily fresh products have a number of process characteristics, which will necessarily be found in each company in this industry, and depending on the location and specific raw material and product markets a company can also have its own characteristics. The three central questions in this part are: (1) what should be controlled? (2) what must be known? and (3) what information can be made available? The first question deals with process control, the second with accountability for both internal and external stakeholders (e.g. taxation, product safety), and the third question deals with the non-trivial but often neglected question what information about business processes can be determined in a reliable and cost-effective way. In other words: what are the value-adding information processes?

In the third phase the information architecture is designed, in accordance with the existing process architecture and the formal organisation (sometimes the process architecture and the formal organisation will be taken as fixed, sometimes they might be adapted). For each process it is determined what information is required to fulfil the tasks in the process, what the information output of the process will be, and what kinds of information are involved. In this way the information flows between business processes are determined. Subsequently it can be determined what information tasks will be fulfilled in what way: what computer systems are used, what the required interactions between humans are, and what the human responsibilities are.

In the fourth phase it is determined how the process logic should be represented in the software. Here the possibilities of the software package are of course decisive to some extent. Because it is the underlying process logic that is being represented, this representation should be relatively stable.

In the last phase the information system in a broad sense is set up for operational use. Based on the underlying process architecture and on the representation of the process logic in the software the particular tasks within the information system are further specified and assigned to the responsible employees and the computer systems. Special attention should be paid to the information flows between the main components and assuring the correctness, timeliness and completeness of the information to be supplied (see also the remark above on the importance of the organisation). The computer systems involved are set up for the user; by means of terminology, setting up the screens, and workflows the software package is made specific for the customer.

In designing the information architecture and setting up the information system for operational use the guidelines of Lean IT and the maxims of Grice are followed throughout. The information supply is analysed from the need in the processes. If this need is unclear then that is analysed first. The fixing of data which is not made use of in a defined and legitimate way is not allowed. The information is brief and understandable for the user; his work will not unnecessarily be burdened by the use of systems and forms.

By separating the "process logic" in the second step and the business processes in the subsequent steps it should lead to multiple advantages. It helps the supplier to stabilise the branch-specific software solution by identifying the customer-specific features apart from the customer-independent process-logic. It helps the customer by providing a real Enterprise Information System where all factors are analysed in context, and where the computer system is considered a pragmatic tool and nothing more.

12 CONCLUSIONS

The question central to this paper is how the implementation of standard solutions in a company should be prepared to make successful operational use possible. The answer can be formulated in a short and simple way: by taking the user seriously (do not bother him unnecessarily, and supply him with what he needs to do his job), by taking the sign systems involved seriously (which information can be codified); and especially: by taking the transitions between sign systems seriously (in what way are processes modelled and what are the rules for the use of these models).

Bringing these answers in practice however, is considerably more difficult. The practices and sign systems within a company are often very hard to track down. Asking the users is of limited value. Formulating the process logic in the business processes results in better entry points, especially for a supplier of standard solutions in an industry; as an industry specialist it is well acquainted with the processes and developments within the industry, and through projection of the industry specific process logic it can track down the specific characteristics and peculiarities of the company involved.

The realisation that an information system concerns the whole of the structured information supply, including all organisational responsibilities and practical rules and conventions, should prevent the designing of a paper solution that cannot function in practice. For an important part it can be tested through Use Cases whether the solution thought up holds in practice, and where any additional conventions are needed to warrant the proper functioning. Guidance can be found in the concept of Lean IT. By analysing the value of information in the business processes, and by avoiding waste both as a consequence of overproduction of information and as a consequence of a lack of reliable information in the right form, in the right time and at the right place, our Enterprise Information Systems will be improved.

Finally: the issues discussed here are part of Information Science, a field that deserves its place alongside Computer Science.

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