THE ACCCOUNTING CONCEPT AS KEY CONCEPT FOR BUSINESS MODELLING

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Abstract: Many problems in IT systems can be traced back to two misconceptions: that all information comes from these systems and that the information from these systems represents reality “as is”. IT systems are often closed and inflexible. Modelling accounting subsystems, as closely as possible to operational practice, can prevent these problems. Current software architecture provide technical support for this approach. In modelling the formalisation and standardisation of the use of language is an important issue.

1 INTRODUCTION

The development, implementation and operational use of information systems within enterprises face certain persistent problems. These problems arise from misconceptions about the nature and role of information systems within an enterprise. I refer here firstly to the misconception that the role of the computer-based information systems is to cover all of the information supply within an enterprise. And I refer here secondly to the misconception that it is in the nature of an information system to represent reality "as is".

These misconceptions shape the analysis and the design of IT systems mostly as background assumptions, and are undiscussed. The nature and the role of information outside of the IT systems are often underexposed in IT projects, and such information is considered peripheral to these systems. Once an IT system is in use, the representations in the system are often considered as leading. E.g., a sales order is no longer seen as an agreement between a buyer and a seller; a sales order is defined by its representation in the system.

The result of these misconceptions is that IT systems often do not function properly in practice. Unforeseen limitations are imposed on business processes and on the commercial and logistic opportunities of the enterprise, as a consequence of the use of IT systems. Limitations that might cost money internally and that trade externally.

This can produce various reactions that aim to absorb these unforeseen negative consequences. First, the system can be expanded, to remove, to evade or to circumvent the limitations. Second, practice might create its own way of working and its own auxiliary systems for certain processes, alongside the IT systems that were meant to do this. Third, practice might learn to live with the limitations.

At the basis of any solution for the problems at issue must be the awareness that it is the task of computer-based information systems to facilitate business processes. These systems thus have an instrumental nature and a serving role. They cannot be the Archimedean point from which business processes are controlled. Neither should these systems determine how the business must be done.

To meet these demands IT systems should be open in three meanings of the word: (1) they have to be able to collaborate with other systems outside of their own functional areas, (2) they have to be able to collaborate with other systems within their own functional areas, when these systems have a lower-level execution task or a higher-level controlling task, and (3) they have to be able to deal with events within their functional area that (temporarily) circumvent the system.

If we want to achieve this openness, then I think it is useful, if not unavoidable, to exploit the concept of "accounting" as a core concept in the design of information systems. The accounting concept analyses the accounting processes separated from other processes, its operations are based on clearly

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defined services and it implies clearly demarcated organisational responsibilities. Although the concept originates in the financial domain, it is very well applicable outside of the financial field; indeed, the concept should hold for all information that is used communally in an organisation.

2 ORGANISATIONAL ASPECTS OF ACCOUNTING PROCESSES

2.1 Division of Labour, Coordination, Responsibility

Mintzberg defines the structure of an organisation as "the sum total of the ways in which divides its labour into distinct tasks and then achieves coordination among them" (Mintzberg, 1979). He distinguishes five different kinds of coordination mechanisms, namely: (1) mutual adjustment, (2) direct supervision, (3) standardisation of work, (4) standardisation of outputs, and (5) standardisation of skills. From an organisational point of view an accounting department can be considered both as a specialisation of labour and as a coordination mechanism.

Accounting departments are often specialised in the processing of either financial data, employee data or production data. The justification of such departments in an organisation is in the required competencies of the employees, as well as in the sensitivity of data. The departments have to meet a variety of requirements of a variety of stakeholders. They have to meet both the internal requirements of the operational and management processes, and they have to meet the requirements of external stakeholders. The head of the department is responsible for the quality of the information supplied.

Accounting processes might also perform coordinating roles in an organisation. When the meaning and use of accounting data are clearly defined, and when the accounting processes are specified as well, this will in effect be a coordination mechanism by standardisation of output and by standardisation of skills. The required skills are related to the ways and means of collecting and verifying the data in the operational processes, and (equally important) to the interpretation of the information supplied.

2.2 Organisational Meaning

Directing information flows through an accounting department or an accounting system also implies formalising the language used. The language used within an organisation is a mixture of everyday speech, jargon, and forms of more or less formalised language. Different departments can have different interpretations of the same concept. If an order is delivered to a customer in a truck with trailer, there is one shipment. If two trucks arrive together for the same delivery, does this involve one or two deliveries, and one or two shipments? If the customer demands that an order is delivered as a whole, then the answer is clear for the commercial department: in both cases one shipment is made. For the freight documents it is clear as well: in the first case one shipment is made with the accompanying freight documents and in the second case two shipments are made, each with their own documents. For the receiving DC of the customer it is also clear: in both cases two deliveries are made that must be docked and unloaded separately.

In practice people within an organisation use different kinds of sign systems simultaneously. The everyday use of language is fairly free and unconfined, even within the context of an organisation. For commercial and financial transactions the language used is more formalised and is ultimately grounded in written law and case law. The use of automated systems is another form of formalisation of sign use. Part of it is formatting (type and size of the fields), part of it is predefined categorisation (tick the correct box) and part of it is capturing some part of the organisational reality in IT artefacts.

To implement an accounting system implies the advance creation of conventions governing the terminology, relations and meaning. In this sense it is a formalisation of the use of language. It can also be considered as a coordination mechanism in the organisation: standardisation of meaning.

3 THE ACCOUNTING CONCEPT

3.1 Definitions

Starreveld arrives in his original work in the early 60s about information processes in organisations at this definition of accounting: "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" (Starreveld, 1963). The American Accounting Association defines accounting as follows: "the process of identifying,

measuring and communicating economic information to permit informed judgements and decisions by users of the information". The definition of the AICPA in 1961: "Accounting is the art of recording, classifying and summarizing in a significant manner and in terms of money, transactions and events which are, in part at least, of a financial character, and interpreting the result thereof" (Glautier et.al., 2001). The value of these definitions is that they sketch a clear and normative view of the role of accounting in the business processes.

From the FASB, part 2: "The purpose of this Statement is to examine the characteristics that make accounting information useful. …All financial reporting is concerned in varying degrees with decision making (though decision makers also use information obtained from other sources). …The usefulness of information must be evaluated in relation to the purposes to be served, and the objectives of financial reporting are focused on the use of accounting information in decision making ... Even objectives that are oriented more towards stewardship are concerned with decisions. Stewardship deals with the efficiency, effectiveness, and integrity of the steward. To say that stewardship reporting is an aspect of accounting's decision making role is simply to say that its purpose is to guide actions that may need to be taken in relation to the steward or in relation to the activity that is being monitored."

3.2 Analysis and Expansion of the Definitions

It is clear that the term accounting traditionally has a strong connection to the financial management and to internal and external financial reporting. At the same time it becomes clear from the definition of Starreveld that this financial aspect is not an essential element of the definitions given. The essential elements of the definitions are: (1) the systematic nature of the collecting, processing and making available of data, (2) the separation of the collecting, processing and making available of data on the one side and the interpretation of the data on the other side, (3) the usage for operational decisions, and (4) the usage for internal and external reporting, analysis and accountability.

Regarding the systematic nature I would like to draw attention to an element that is only found explicitly in the definition of the AICPA: classifying and summarising. Boisot has made an analysis of the nature of information and he defines three aspects of information (Boisot, 1998). One aspect concerns the extent to which the information has been codified, a second aspect concerns the degree of abstraction, and the third aspect concerns the degree of diffusion. In an accounting system information will have to be codified, the users request information at different levels of abstraction and an accounting system is a mechanism for diffusion both within and outside of the organisation.

4 OPENNESS OF INFORMATION SYSTEMS

4.1 Two Forms of Information Supply

A car navigation system is an example of an open system that gives its user the right information while leaving him the freedom to take his own decisions. Such a system continuously indicates the route to be followed, taking into account the actual position, possible routes and traffic intensity on the different routes.

This information system is open because it allows the driver to take his own decisions. He can divert form the route whenever he opts to do so. The navigation systems always works from the actual situation; what happened before and what motivates the choices of the driver are completely irrelevant.

To describe a route by step-by-step directions is quite a different story. See for example the directions given by the British AA for the trip from Corrie on Arran to Bridgend on Islay:

Direction	Miles
Start out on unnamed road	0.00
Turn left onto the A481	0.07
Turn right	8.78
Continue by vehicle ferry (Claonaig – Lochranza)	8.81
Turn right	13.47
Turn left onto the B8001	13.57
Turn right onto the A83 (signposted Glasgow)	18.63
Turn left (signposted Islay ferry)	19.00
Contirnue by vehicle ferry (Port Askaig – Kennacraig)	19.25
Turn left onto the A846	48.82
Arrive on the A846	56.66

Section time 6:16, Total time 6:16

Such a description loses a lot of its value when the driver is forced off the prescribed route. Apart

from that, these specific directions do not take into account that the driver should take either the ferry to Port Askaig (as described), or the ferry to Port Ellen (not described), depending on the time. And checking the miles travelled against the odometer of the car won't work either, because of the two ferries involved.

4.2 Two Forms of Information Supply

Starreveld writes in 1962 about information supply for making judgements ex ante (for decisions in the execution of processes) and ex post (for the accountability of processes) (Starreveld, 1963). He emphasises that on lower levels of the hierarchy there is mostly a need for all kinds of "grab"-information that is necessary to guarantee a correct and efficient execution of the tasks by good preparation.

Especially in production organisations there is a tendency to increasingly emphasise a cycle of planning and control where plans are made higher-up in the organisation and executed lower-down and where the results are reported back. This tendency is reflected in ERP systems with their modules for planning and control. The shop floor gets production orders to be executed, and can only report back in relation to those production orders. Registration of unplanned activities is difficult or even impossible, even if some problem on the shop floor made those unplanned activities necessary.

Compare this tendency with this quote from Robert Anthony: "Several authors state that the aim of control is to assure that the results of operations conform as closely as possible to plans. We emphasize that such a concept of control is basically inconsistent with the concept used in this study. To the extent that middle management can make decisions that are better than those implied in the plans, top management wishes it to do so. And the middle management 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)

Current ERP systems could be compared to the directions given by the AA. The individual steps are determined in detail in advance of the execution of a process and employees in the execution of the process get information pushed about the steps to be taken. This way of working is vulnerable in case of deviations, the responsibilities are higher-up and those that perform the tasks are regarded as being just cogs in the machine. The approach described by Starreveld and Anthony assumes a situation in which employees at every hierarchical level of the organisation have tasks and responsibilities and these are not frustrated by centralised and bureaucratic information systems. They can get the information they need whenever they ask for it, and they can make their own decisions within their domain. As a model this is more comparable to driver assisted by a navigation system.

5 SOFTWARE DEVELOPMENT

5.1 Software Engineering

Like organisations, software engineering has its methods for managing complexity. The multi-tier model, the client/server model and the service oriented architecture model are three examples of the principle of 'separation of concerns'. Earlier forms are the concept of structured programming, employing units (Pascal) or modules (Modulo) and later on object-oriented programming.

The mentioned mechanisms in software engineering are each directly concerned with the structure of the software as such. They do not or only tangentially concern themselves with how the software is used. In the last few decennia the discussion is increasingly about architecture. At first it was about the architecture of software, then about the architecture of information systems and finally about the architecture of the enterprise.

Within the software engineering as such Taylor states "By architecture we mean the set of principle design decisions made about a system; it is a characterization of the essence and essentials of the application" (Taylor et al., 2010). The architecture of this artefact consists of a number of more-or-less independent parts and the connections between them (static structure). Further there is a specific way in which the communication between the parts happens (dynamic structure). Both for the static and for the dynamic structure the architect makes use of a repertoire of standard patterns. This manner of working has first been charted by the architect Christopher Alexander and later on has spread widely within software engineering.

However, that similar mechanisms for managing complexity have been developed both in organisations and in software engineering does not mean that the mechanisms of both worlds should be considered equal. In the case of software we are dealing with a strictly formal and determined

system, whereas in the case of an organisation we are dealing with a social system.

5.2 RM-ODP (Reference Model for Open Distributed Processing)

The RM-ODP describes a model for the collaboration of interconnected autonomous, heterogeneous information processing systems. ”The objective of ODP standardization is the development of standards that allow the benefits of distributing information processing services to be realized in an environment of heterogeneous IT resources and multiple organizational domains. These standards address constraints on system specification and the provision of a system infrastructure that accommodate difficulties inherent in the design and programming of distributed systems.” (RM-ODP, 1998).

In the formulated aims of the RM-ODP it can be seen that accounting systems as described above fit beneath the heading "organisational" in such an IT structure. At the same time we must realise that a technical infrastructure cannot say anything about the organisational responsibilities and that the IT component often must be complemented with a human component for a complete information supply. It is ill conceivable that the financial department and the employee department would be fully automated and unmanned departments.

5.3 Software Architecture & Accounting Subsystems

The modern developments in software engineering, coupled with architectural ideas such as those expressed in RM-ODP are an solid basis for representing accounting subsystems in software. Such a separated accounting subsystem is accessed exclusively through well-defined interfaces, which are clear from a software perspective and the separate terms of which can be mapped clearly to definitions in the business processes. Such separated accounting subsystems can meet the demands of openness in structure and in management mentioned earlier. Ideally, the accounting system records just what actually is the case, regardless of any plans or intentions. When someone takes stock from the warehouse, this should be registered. The IT system should not forbid registration, because of some rule or constraint in the accounting system. It happened and it is relevant to the representation of the stock in the IT system, so it must be recorded in the accounting system.

In the same vein, employees and systems should be able to retrieve the information they need for their tasks (within the boundaries of authorisation) from the accounting subsystems involved and make their relevant facts available for the accounting subsystems. These processes should be based on a pull model for information retrieval and a push model for the information produced, all according to the organisational tasks and responsibilities.

6 KEY ISSUES IN THE DESIGN OF ACCOUNTING PROCESSES

6.1 Organisational Issues

Each accounting process has to be clearly grounded in the organisation. It should be clear who is responsible for the data. Accounting processes should be located as closely as possible to the operational processes involved, to ensure short communication lines. Those responsible for the accounting processes should have a clear understanding of both the operational processes and the accounting processes so that they are able to solve any problems occurring in the collecting, processing or interpreting of data. They should actively monitor the usage of the accounting processes, and indicate when they should be adjusted because of changing practices. This final point specifically concerns tracking change of meaning, either abrupt or slowly evolving. Consider for example the concept "customer" when an organisation first encounters the difference between the entity that places an order, the entity to which they should be delivered and the entity that pays for the delivered goods.

6.2 Modelling Issues

The domain of each accounting subsystem is clearly defined, together with the meaning of the main concepts. The rules for determining the identity of the individual accounting entities are explicit. The way in which both systems and human users refer to the separate accounting entities is defined and tested for practical applicability. Categories and range of values of the attributes of the entities are defined in advance.

The domain is determined by the question of what is it concerned with and of what is information requested. Essentially this is the same question as the one asked about objects in OO-thinking. An object is an identifiable unit with its own identity.

However, objects are no "ready-mades". They need to be carefully defined. See the problem above of what constitutes one shipment.

Another issue is how involved parties can identify the accounting entities. Systems use unique references, which must connect uniquely to physical or conventional reality. This can happen by physical identification such as barcodes or chips. It can also happen by conventional identification such as GTIN numbers for products or GLN numbers for addresses and locations, managed by the international GS1 organisation.

Human users have to know what they are dealing with as well. Either the references used are fit for both machine and human recognition, or different references are used for machines and for human users.

6.3 Technical Issues

The accounting processes can be supported by one or multiple IT subsystems with the responsibility for their proper working lying with those responsible for the accounting processes involved (and not with a central IT department somewhere far away in the organisation). Besides IT systems the accounting processes can be supported by locally developed solutions, in Excel for example, and by a systematic storage of forms, receipts, and lists. What medium is used to store data is less important, that the data are collected and made available according to the agreed procedures and in a correct, timely and complete manner is essential.

The interfaces of the IT subsystems supporting the accounting processes are explicit and complete. There is no tacit meaning and there are no hidden side effects. From the defined interfaces and from the defined technical implementation of the IT subsystem its behaviour can be fully explained. The technical interfaces of the subsystem can be directly mapped to the organisational aspects of the accounting processes. The subsystems can deal with the key characteristics as mentioned in RM-ODP 10746-1, paragraph 6.1: remoteness, concurrency, lack of global state, partial failures, asynchrony, heterogeneity, autonomy, evolution and mobility.

7 CONCLUSIONS

In the introduction two misconceptions were identified as a source of many problems in the use of IT systems, namely the idea that an information system would coincide with the IT systems used and that the information in IT systems would represent the reality "as is". The need open systems to facilitate business processes instead of systems designed from closed and encompassing models was discussed.

It was then analysed that the accounting concept as defined by Starreveld should provide a good basis for open systems. Well-designed accounting subsystems that provide their services to the organisation and to applications independently of one another should make the systems more manageable. A condition for this is that the independent accounting subsystems are well embedded into the organisation, as closely as possible to the operational processes. Modern software architectures like RM-ODP should provide a good technical basis for this.

The design of an accounting subsystem for a specified area starts with abstracting and modelling it. This should be accompanied by a thorough analysis of the process logic in the area, to arrive at an adequate and practical choice of the entities and references. This should also be accompanied by a certain formalisation and standardisation of the use of language.

When the people involved are familiar with the ins and outs of the chosen model they will be able to work well with the model in the interaction with the accounting subsystem while retaining the freedom of interpretation of data from the subsystem because they know what is not represented and because they are able to combine the data with data from other sources autonomously.

In conclusion: adequate accounting systems function semi real time, provide crucial services to the business processes, and are driven by employees that have a thorough practical knowledge of these processes.

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