Completeness and Levels of Business Models

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Completeness of business models is an essential characteristic of their quality. Consideration of requirements for completeness from a pragmatic viewpoint outlines a necessity to represent features of adaptive and learning organisations in the Business Models. Complexity of structure and processes in adaptive and learning organisations, in turn, requires multileveled architecture of the Business Model that comprises fractal levels, stratification and decomposition and reflects dependencies between different levels of representation.

1 Introduction

In Business Process Reengineering many different decisions are to be made concerning changes in the old system and particular features to be incorporated into the new one. One of the sources of information used for decision making is a Business Model of the organisation under the reengineering. As consistency of information is one of the most essential factors in decision making [1, 2], it is necessary to develop the reliable Business Model from which consistent information can be acquired. Investigations concerning consistency of information in requirements engineering [3] show that possibility to develop consistent Business Models depends on the completeness of information represented by the models.

Completeness of information in business modelling usually is viewed as a subjective factor. Therefore only relative completeness of models can be discussed [4].

The purpose of the paper is to discuss requirements for completeness of business models from the *pragmatic* viewpoint. Requirements from the pragmatic viewpoint are reviewed on the basis of comparative analysis of reported investigations regarding modelling of organisations in the areas of cognitive engineering, manufacturing and systems modelling methodologies [5, 6, 7, 8, 9]. Attention is focused on the modelling of adaptive and learning organisations.

Requirements for the Business Models that represent adaptive, learning organisations' behaviour in a turbulent environment are analysed and stated in the second section. Frameworks of representation, suitable for meeting those requirements, are represented in the third section. The attempt to satisfy requirements for completeness of the Business Model shows that the model must be represented as a complex multileveled system of submodels. Therefore multileveling of the Business Model is considered in the paper, too. In the fourth section a hypothetical multilevel architecture of the Business Model is proposed and evaluated from the pragmatic viewpoint. The fifth section consists of brief conclusions.

2 Model of an adaptive organisation in the turbulent environment

Business organisations today have to function in an environment characterized by faster changes and unpredictable influences [5]. Therefore success of the organisations in many cases depends on their capability to adapt to the environment and learn [6, 7, 8]. However, business models usually dealing with such aspects of organisation as *data*, *function, event, object, process* and *transaction* [10] do not add much to transparency of organisation's capability to adapt and learn. Consequently business models lacking such transparency cannot be considered as complete. The research work in cognitive engineering [6] and organisational learning [7] suggests some relevant aspects to be considered in business models to reflect organisation more completely.

2.1 Modelling the adaptive organisation

Research in Cognitive Engineering [6] has shown that analysis and design of modern, dynamic 'work systems' cannot be based on analysis and design of work systems in terms of stable task procedures. Instead, analysis of work systems must be in terms of the behavior shaping *goals* and *constraints*, that define the boundaries of space within which actors are free to improvise guided by their local subjective performance criteria. On the other hand in the Soft Systems Methodology [8] a 'human activity system' is represented as a holon (whole) that contains other smaller holons. To be able to adapt, the holon must have within it *activities and structure concerned with communication and control.*

It is quite obvious that (1) in an organisational context 'work system' dealt with in cognitive engineering can be considered as a 'human activity' system and (2) each holon can be described as an actor. For example, concerning university, actors are University, Institute, Department, etc. We can distinguish between *elementary actor* (a particular human being) and *composed actor* (two or more human beings organised to accomplish a particular goal or task). Each composed actor can be described as a reconfigurable organisation having its *space of activities* bordered by resources, goals and constraints [5]. There are three principles for reconfigurable organisations as realised by M. Hartmann [5]:

- *self organisation*: if actors are outside the space of activities they can correct their position by cooperating with other actors or splitting into several new actors with new spaces of activities
- *self optimisation*: actors can widen their space of activities by building up new resources (e.g., qualification of staff) or reaching new goals (e.g., better services)
- *self similarity*: all actors have a synergetic orientation given by a general goal system

Actually M. Hartmann and T. Forster's research in Change Management in Turbulent Environment has approved findings in Cognitive Engineering and Soft Systems Methodology concerning basic features of adaptive organisations. Similar results in different areas of investigation of organisations are a strong enough argument concerning relevance of incorporation of these features in the models of organisations. Therefore it can be stated that complete models of organisations have to deal with such concepts as *space of activities* defined, e.g., in terms of goals, constraints and resources, *holonic organisational structure* and *self control and reconfiguration* of organisations.

2.2 Modelling the learning organisation

In the world of business growing interest in knowledge and its processing has become evident [7, 11]. The business model in the learning organisation has two roles (1) it is a source of artificial knowledge [12] and (2) it must represent not only functional and administrative processes, but also, at least partly, knowledge processes (or learning) of the organisation. A notion 'knowledge' in business area is understood in many different ways [13]. The same applies to the notion 'organisational learning'. S. Wikstrom and R. Normann's research [7] is one of the few works that deals with knowledge processes in organisation, therefore the notion 'knowledge' in this paper is discussed in terms suggested by these authors. They consider the following types of knowledge:

- *information*: knowledge concerning some fact or circumstance
- *skill or know-how*: knowing what to do in a particular situation
- *explanation*: knowledge concerned with causal relationships and regularities
- *understanding*: recognition of principles and connections

A conceptual model of knowledge processing developed by As S. Wikstrom and R. Normann consists of three mutually related knowledge processes, namely: generative, productive and representative. Generative processes bring new information into the organisation from the environment. Productive ones incorporate it in products of the organisation, and representative processes present incorporated knowledge to the environment. The conceptual model shows that knowledge processes are related to the *value star* of the organisation (in which different kinds of knowledge meet and are synchronised [7]) and can influence value stars of other organisations. It is interesting that the notion *value* is present also in the frame of representation for analysis of organisation developed by J. Rasmussen at al. [6]. The frame has the following five levels of abstraction:

- purposes and constraints
- abstract functions and priority measures
- general functions
- physical processes and activities
- physical form and configuration

The notion *value* is located on the second level of abstraction *Abstract functions and priority measures* (figure 1) that represents concepts that are necessary for setting priorities and allocating resources to the various general functions and activities at the level below. "In order to grade the importance of allocating resources to different work functions, it is necessary to compare the influence of various functions on the higher level objectives by means of *value* measures that can be applied independently of their functional role" [6]. Attention is focused on the concept *value* here, because this concept usually is not incorporated in formalised business models.

According to figure 1, another pragmatic requirement is that the model of learning organisation has to represent circulation of different types of knowledge. Each type of knowledge requires representation of knowledge on a particular level or levels of abstraction (e.g. *know-how* can be described on the level *of Physical processes and activities*, *understanding* requires information from the levels *of Purposes and constraints* and *Abstract functions and priority measures*, etc.). Appropriate levels of abstraction for modelling learning organisation are a matter of further research, therefore abstraction levels proposed by J. Rasmussen et al. are simply adopted for the discussion in the remainder of the paper.

3 Appropriate modelling concepts for meeting pragmatic requirements

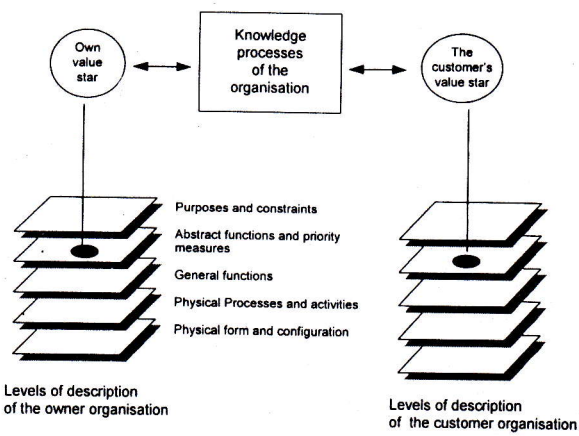

Fig. 1 Concept of value in knowledge processing and description of the organisation

The following pragmatic requirements for completeness of business models have been discussed in the previous section:

- representation of the space of activities
- holonic organisational structure
- representation of self control and reconfiguration of the organisation
- representation of different types and circulation of knowledge in organisation (including knowledge about values)

The requirements listed should not be considered as a full scope of requirements for completeness of business models. These requirements just focus attention on some pragmatic issues that usually are not considered in current business modelling frameworks.

Representation of holonic organisational structure can be based on the theory of fractal systems [11]. Fractals have a microstructure on many scales, they are splitted structures and the adequate measure for this is a fractal dimension. In many cases they show the property of self similarity. Thereby they represent a characteristic relationship between a part and whole. A simple example of fractal representation of university structure is presented in figure 2.

Fractal representation of an organisation permits to represent permanent

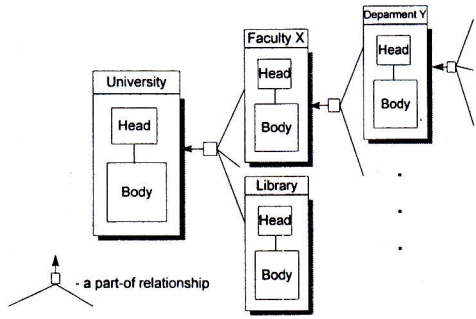

Fig. 2 A fractal representation of the university

organisational units as well as temporary ones. Thus representation of reconfiguration is supported, too.

Representation of space of activities and different types and circulation of knowledge partly can be based on the modelling concepts introduced by E.S.K. Yu [9].

In his methodology "Modelling Strategic Relationships for Process Reengineering" he introduces the following four types of dependencies (figure 3):

- *goal dependency*: the depender depends on the dependee because he has given him a particular task in terms of what is to be performed (without describing how it has to be accomplished)
- *task dependency*: "how" of the task is described, but not "why"
- *resource dependency*: the depender depends on dependee for the availability of an informational or physical entity
- *soft-goal dependency*: conditions to be attained are elaborated as the task is performed

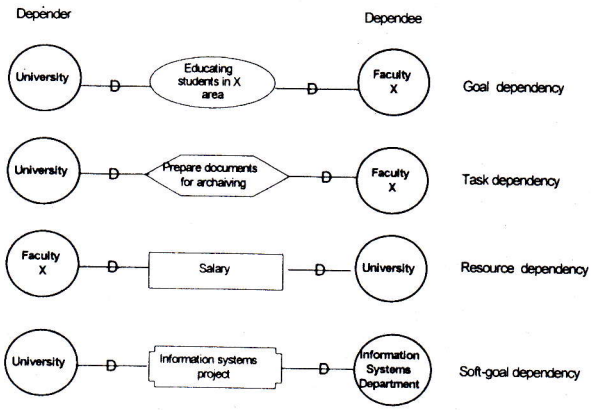

Fig. 3 Dependency types (university example).

Activity space can be defined by a combination of the goal and one or more other dependencies. In figure 3 *Faculty X* educates students in area X. The *University* does not specify exactly how it has to be done. However, particular constraints exist, e.g., money available from the university (physical resource), etc. Constraints can be expressed also as task dependencies if, e.g., some formal procedures of examination should be followed in all the university.

Different types of knowledge can be represented by different dependency types as well. *Information* can be represented by resource dependencies. *Skill or know-how* can be shown as task dependencies. *Explanation* requires a combination of several types

of dependencies. *Understanding* in particular situations can be represented as a soft goal dependency as it is in the case of *Explanation*.

Fractal representation of an organisation and strategic dependency links, actually, support all the completeness requirements stated in the previous section, except the requirement for representation of self-control. The frameworks for representation of the organisation's self-control are still under the investigation.

4 Multileveling of the business model (a hypothetical architecture of the model)

Business models are usually understood as rather complex systems of mutually related submodels [14]. Business modelling tools normally permit more detailed description of each element of the models, e.g., as in multilevel Data Flow Diagrams [15]. In other words, multileveled description of each element of a particular submodel is possible. Those levels are called *levels of detail* or *levels of decomposition* [6, 16]. Internal structure of the model on each level is different and does not depend on the higher level of detail or decomposition. In contrast, in fractal multileveling, proposed in the 3rd section, similar internal structures are represented on each fractal level (figure 3). Each fractal level that depicts a particular 'work system' [6], 'human activity system' [8] or 'actor' [9] can be described by multilevel representation where each level has its own modelling language (figure 4). According to J. Rasmussen et al. [6] these are levels of abstraction or strata [17]. Each stratum in a multistrata representation, actually, corresponds to a particular submodel of an organisation, e.g., the objectives model or the process model or like. It itself can be subdivided in several levels of detail or decomposition as described in the beginning of the section (not shown in figure 4).

Attachment of a multistrata representation to each fractal level opens the possibility to reflect in the Business Model information relevant to adaptation and learning of an organisation (figure 5). This information is reflected by strategic dependency relationships (described in section 3) between particular strata of particular actors. Such representation explicitly shows the character of relationships between actors belonging to the same or different fractal levels. Transparency of those relationships, in turn, aids rapid reconfiguration of organisational goals, values, functions, processes and resources, if it is necessary for managing in turbulent environment. Dependency links from different levels of abstraction can be used also for reflection of *outsourcing relationship* and so distinguish a particular type of outsourcing

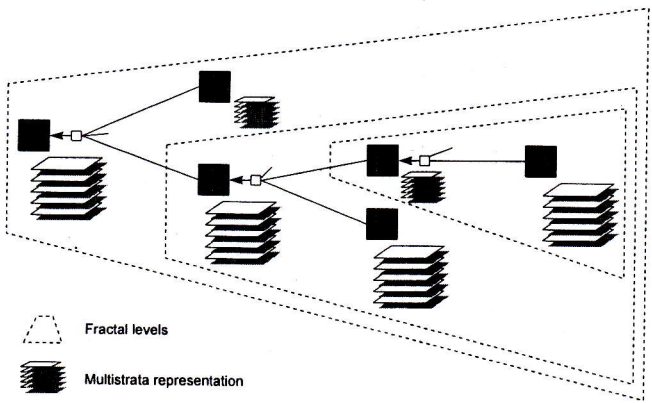

Fig. 4 A fractal representation of the system with multilevel description in each fractal level [18] from an ordinary external entity.

Existence of goal, soft goal, task and information resource dependencies implies that particular information or knowledge has to be transferred from depender to dependee or from dependee to depender. Receiver of the information is a particular human being; therefore transferring of information is a problem of knowledge distribution relevant in organisational learning and depends on the quality of the Business Model in use [19]. For example, in situation reflected in figure 6 faculty members should know that advanced courses are appreciated by the university. If temporal archiving in the university is planned and procedure for preparing documents

for archiving is worked out, faculty members are to be informed that they are expected to prepare particular documents. Employees M. Morgan and B. Mose, assigned to document preparation, must receive document preparation instructions.

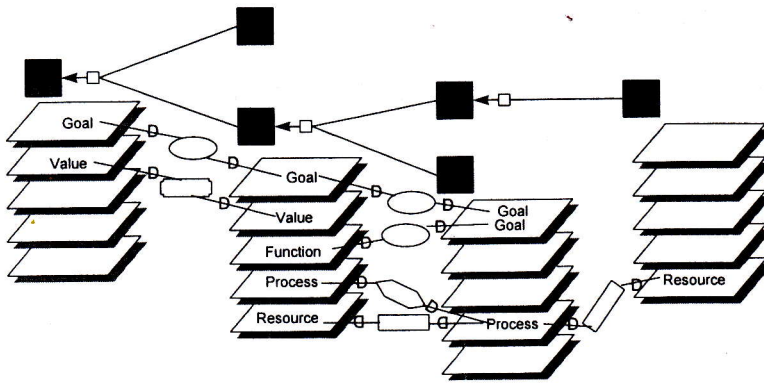

Fig. 5 Reflection of strategic dependencies in a fractal representation of the system

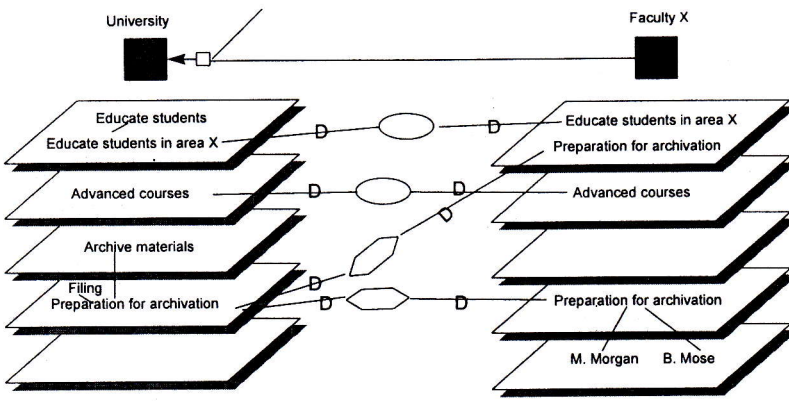

Fig. 6 Indirect transfer of information represented by dependency links

As dependency links indirectly reflect part of knowledge processes in organisation they can be used as a basis for modelling those knowledge processes.

It is evident that multilevel structure of the Business Model permits to represent regular as well as temporal situations in an organisation. It can represent processes that are based on rigid job instructions as well as on a definition of actor's space of activity. It can reflect impact of changes of one actor to the other parts of the organisation and therefore supports rapid reconfiguration of the organisation. However, model is discussed in this paper only from the pragmatic viewpoint. Several aspects of multileveling are still under the investigation as well as evaluation of the model concerning its theoretical completeness.

5 Conclusions

Pragmatic requirements for completeness of Business Model are discussed in the paper. The attention is focused on the requirements relevant in modelling adaptive and learning organisations. In this context such requirements as representation of space of activities, holonic organisational structure, representation of self control and reconfiguration of the organisation and representation of different types and circulation of knowledge in organisation are analysed and frameworks suitable for meeting those requirements are suggested. Multilevel architecture of business model that merges several representational frameworks is proposed. From pragmatic viewpoint the proposed architecture seems to be suitable for representation of adaptive and learning organisations. Theoretical aspects of the architecture in terms of information systems architecture completeness [20, 21] are under the investigation.

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