Application of ARIS business process management framework in NPD context

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ABSTRACT: New product development (NPD) is a complex dynamic process involving multiple interactions and co-operations. Efficient business process management (BPM) plays a pivotal role in successful NPD, and successful development is the outcome of effective processes. Therefore, streamlining the NPD process has become an important tool to gain and sustain competitive. The characteristics of NPD process is described and based on which the functions of BPM in NPD is summarized. ARIS (Architecture of Integrated Information Systems) business process framework is introduced to implement the descriptions of NPD process and process-related information. The rich diagram representations of ARIS modeling methods proved to be efficient in supporting process management in NPD context.

1 INTRODUCTION

With the switch of world market from the traditional relatively steady market to the dynamic changeable market, competitions among enterprises are evolved from local to global competition. The core of the global competition lies in satisfying market requirements and have knowledge innovation in new product competitions.

New product development (NPD) is a process of transforming customer requirements into product functional requirements which will be translated into physical products. It is a multidisciplinary activity requiring contributions from nearly all the functions of a firm; traditionally it has been viewed as an organizational activity, which was the result of various functional activities performed in stages from concept development to product delivery. In the late 1980s the concept of Concurrent Engineering (CE) was introduced as an organizational mechanism to resolve the communication barriers, and the essence of CE is not only the concurrency of the activities but also the cooperative effort from all the involved teams, which leads to improving profitability and competitiveness [1]. Typical characteristics of NPD process can be roughly summarized as follows:

- Multidisciplinary: NPD is a complex interdisciplinary engineering process, and the complexity do not simply arise from their engineering complexity, but also stem from the organizational sophistication necessary to manage the design process [1]. Therefore, successful NPD requires the participations of multiple designers and experts with complementary skills from different domain, such as mechanical, manufacturing, environment, etc.

- Cooperative: NPD process can be treated as an information processing activity, the importance of interfunctional or crossfunctional communication involved in the NPD process is obvious. In this sense, NPD is a cooperative process, it not only requires the cooperation of different departments within the enterprise, but also calls for the coordination, communication and control of multiple partner enterprises in the design of product and related processes.

- Iterative: A significant characteristic of complex new product development and design processes is the coupled, iterative nature of the activities. In a concurrent NPD process, in addition to meeting the functional requirements of the products, engineering designs need to simultaneously consider various
downstream activities throughout the entire product life cycle.

From the above descriptions, we can see that NPD is a information intensive and communication intensive process, which can be treated as a complex dynamic system including multiple concurrent collaborative processes, and the implementation of this cooperative process relies on the integration of various technologies including management, reengineering and information technologies. However, the main factor that influences the success of such a process is the efficient understanding and sharing of the information about the product and related process in the product development life cycle. Hence the management of information cross-organizational boundaries is of essential importance to enterprises in shortening product development cycle, which becomes one of the most basic and challenging problems in cross-organizational process management.

It was widely accepted that the ability to rapidly develop and market new product is one of the most crucial successful factors in competitive environment and successful new products are the outcome of efficient processes. In others words, streamlining NPD process has become an important tool to gain and sustain competitive advantage. As stated in the research findings of Haque [2], the main problem in new product development is the poor collaboration and communication cross functions boundaries. The reason leading to this is the missing or weak of a structured approach to process modeling and management.

Process modeling is a technology of organizing and documenting the system process, input, output and related data storage to implement the descriptions of logic flow of the information in the business process at different abstract levels. Process management makes efforts to optimally allocate resources, schedule activity occurrences, and solve possible conflicts. Its ultimate objective is to significantly improve business performance in terms of costs, lead-times, and product or service qualities, and it is growingly regarded as an indispensable step for companies to sharpen their market competitive edges. Efficient process management crucially depends on correctly understanding the nature of business concerned and efficiently processing a wide range of data. The Architecture of Information Systems (ARIS) can be used as a keystone for BPM [3, 4], it provides a well BPM framework and owns various rich modeling diagrams, which can be well used for the management of NPD process that consists of various cooperative activities.

The following sections are organized as follows: section 2 describes the functions of BPM in NPD, and sections 3 gives a brief review of ARIS business process framework. Section 4 discusses the application of ARIS in NPD context with illustrative examples from several aspects.

2 BUSINESS PROCESS MANAGEMENT IN NEW PRODUCT DEVELOPMENT PROCESS (NPD)

Due to the special nature of integrated product development processes, a method for process modeling has to be able to support and easily map the high interconnectivity between processes of different engineering disciplines over all hierarchies. Since the dominant elements in a model of NPD processes are the informational relations and flows, the goal of process modeling will mainly concentrate on the description and management of information. To sum up, modeling NPD processes should implement the following objectives:

- Communication: Providing support for the interactions between different persons in NPD process. It helps people to get an overview of the whole process and supports and understanding of complex product development process and their interactions and dependencies within the organization.
- Management: Providing process execution information to top managers for better process monitoring and control. With the implementation of transparency and early coordination the process model can serve as a sound basis for detailed planning and easier management of the actual development process.
- Decision Support: Providing decision-support information to decision maker. Process model can be used for what-if analysis and serve as the basis of improvement (e.g. reduce development life cycle). The achievement of this objective mainly relies on the simulation of the process model.
- Information System Development: Providing business process and workflow information to system designer. Development and deployment of supporting information systems in NPD, PDM for instance, demands for the sound descriptions of the actual business processes. Only if the process models well capture the characteristics of the process, the information system can well implement the desired objectives.

As described in the previous section ARIS business process model can well satisfy the modeling requirements in NPD context, and which will be illustrated in the following subsections.

3 ARIS BUSINESS PROCESS MANAGEMENT FRAMEWORK

The conceptual design of ARIS is based on an integration concept which is derived from a holistic
analysis of business processes. The first step in creating the architecture calls for the development of a model for business processes which contains all the basic features that describe the business processes. The result is a highly complex model that is divided into individual views in order to reduce its complexity, as shown in Fig.1.

In this sense, business process is a network of event-triggering activities, performed by enterprise actors that are equipped with various resources to reach certain enterprise goals [5].

In ARIS framework, components needed to describe a business process completely include processes, events, statuses, users, organizational units, and information technology resources. Considering all the effects on all the elements of the process for every event would severely complicate the model and lead to redundancies in the description, the general context is divided into individual views (namely data view, function view, organization view, output view) which can be handled (largely) independent from one another. Fig.1 distinguishes each of the views in different notations. However, breaking down the initial process into individual views reduces its complexity—albeit at the expense of the relationships between the process components of the views. For this reason, the control view is introduced as an additional view in which the relationships between the views are described. The interrelationship of these views can be well illustrated with an ARIS house (Fig.2). ARIS-House of business engineering (HOBEn) enhances the ARIS process architecture by addressing comprehensive BPM, not only from an organizational, but also from an IT perspective.

ARIS supporting toolset provides various modeling diagrams to represent different view information; some of the representation diagrams are shown in Table 1. Thereby, with the support of toolset, ARIS modeling method can well satisfy different management goals in the NPD context.

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<tr>
<th>Views</th>
<th>Descriptions</th>
<th>Representation Diagrams</th>
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<td>Transport input into output</td>
<td>Function tree</td>
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<td>Y diagram</td>
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<td>SAP App Diagram</td>
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<td>Objective diagram etc.</td>
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<td>Technical Resources etc.</td>
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<td>Data</td>
<td>Messages triggering functions or being triggered by functions</td>
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<td>Technical terms model</td>
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<td>(e) ERM etc.</td>
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<td>Process</td>
<td>Describing the relations among different views</td>
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<td>(e) EPC etc.</td>
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4 NPD PROCESS MANAGEMENT

From initial market analysis, running through design and manufacturing to final delivery service, NPD process can be divided into four stages as shown in Fig.3.

Product design is the core process of NPD, which is made up of conceptual design and detail design. Conceptual design relies on market research and analysis based on information from a variety of sources and synthesizes that information into a set of product requirements that conceptually describe the features and functions of the new product. In detail design state, it translate the conceptual structure into actual product designs captured in mechanical and electrical representations of the product, which can
take a variety of digital forms along which provide the precise descriptions necessary to actually build the product. Since product design stage is the embodiment of creativity, artistic and synthesize of product design in the NPD process and it takes up nearly 60 percent of the total development work, this paper mainly concentrates on product design to discuss the problem of BPM. The following subsections discuss the management of the different aspects in NPD context, aiming to implement the understanding and management of information related to the NPD processes and process related information.

In the objective diagrams, functions that lead to the targets and success factors that need to be considered in order to reach the target could be specified. That information is not shown in Fig.4 owing to limiting space.

![Fig.4 Objective diagram of NPD](image)

4.2 Integrated cooperative management

In a complex product design process, there are many designers responsible for the different parts of the product. Since the independently designed different parts may be at odds with each other, the co-operations among the designers should be well managed to ensure a consistent design process. The efficient management of the co-ordinations and the timely sharing of information will largely reduce reworks in succeeding stages.

Besides many managers have learned that new ways of managing internal NPD efforts could lead improvements, they also realized that cross-function integration should not just be limited to internal functions. Enterprises have recognized the importance of integrating external customers and suppliers, especially the integration of manufacturing functions in product design stage. Integrating manufacturing into design early has three main reasons [6]

- Encouraging manufacturing input early in the NPD process allows the development team to be cognizant of manufacturing’s current production capabilities, strengths, and potential weaknesses while they are at an early enough stage that they can still do something about it.
- Early manufacturing awareness of the product from its conception means that the product is more likely to resemble what the customer really wants.
Early manufacturing involvement can also generate ideas about potential product features that are feasible given the abilities of their existing facilities and technology.

Such similar integration information can be captured in extended Event-driven Process Chain (eEPC) diagrams. eEPC is a main process modeling method in ARIS toolset. EPC presents a process as a chain of functions and events which are linked by logical connectors. In the extended EPC, more rich components such as organization unit information, information type entity etc. can be added. Its powerful presentation ability makes eEPC efficient for such purpose.

From Fig.5 we can see that design department is the real executor of product design, while customers and manufacturing department are only contribute to the whole design process by providing crucial information; meanwhile, multiple experts are consulted to gain other product related information. The involvement of external function units in design stage can decreases iterations in the following development process, which leads to a smoother, less extensive and speedier development process.

By employing consistent terminology for a company and its departments, the acceptability of the specified information can be increased and the problems of conflicts resulting from inconsistent can be decreased.

In the method set of ARIS there is a technical term models which not only permit managing the different terms in the sense of synonym management, but also allow maintaining the relationships between the data models objects as well as the technical terms specified by the company (Fig.6).

5 CONCLUSIONS

In the previous section, some paraphrastic examples are given to discuss the application of ARIS BPM framework in NPD process. Something has to be pointed out here is that the examples given are just illustrative, the main point of this paper is on the modeling and management methods in NPD context, not on the detail design of the NPD process itself.

The above modeling technologies is only a few part of the ARIS model set. There are many other diagramming notations that can well meet the requirements of complex product process, such as interaction diagrams, function flows, etc. Besides that, with the support of toolset, ARIS can implement other management functions, such as process evaluation, simulation (such as ABC simulation), knowledge management, scheduling and capacity control, continuous process improvement and other functions [4].

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REFERENCES


