New Trends in Software Methodologies, Tools and Techniques
H. Fujita and V. Mařík (Eds.)
IOS Press, 2009

doi:10.3233/978-1-60750-049-0-389

Top Management Conducts an Enterprise System Development

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Abstract. This reports an in-house development of an enterprise system, directed by top management. The background is explained, and it starts from the corporate-wide business model. This top down approach is better fitted than usual bottom up approach. Various backgrounds supporting this are explained.

Keywords. Development, enterprise system, top-down development, intentional activity, investment

Introduction

The purpose of this paper is to introduce a theoretical basis of a new way of a system development, which is directed by top management. This discusses the early phase of such a development process in an enterprise system.

The most original form of an enterprise system is flows for the companies business (i.e. order → product items → ship-out). Taking these in mind, the corresponding "business process flow", or the "most abstracted data flow", or the "intention flow" may be written, which includes "the flow of information with processing". Namely, *it includes what and how they do for the corporate data processing or all processing of each work or each work process were recorded on flow diagrams. Only forefront people know these.*

In the initial form of an enterprise system, a part of the processing is performed by software, while human performs the rest. In the final ultimate form, all the processing is performed by software. An actual development is in between these two extremes. Based on aforementioned documents, following program team can easily construct the enterprise system. In order to eliminate some human work, software, which performs the same work as the human work, must be provided. This requires some cost, which is rationalized by the saving of the human works.

An important point is, *which human works are performed by software and how it is achieved. Usually top management decides these considering how much money may be invested.*

Let us explain some specialties in Japan. Many companies use own tailored systems, namely the percentage of package software is lower than other countries. Due to

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the increase of the development cost, however, leading companies in each field have absorbed smaller companies, which faced difficulties in own development. In the beginning of 2000, at almost every opening of such large-size unified systems of nationwide mega-banks, troubles happened. They were system downs; service stoppages, service restrictions and the delays, and they become critical social problems.

In order to improve such problems, Ministry of Economy, Trade and Industry (METI) developed two directions for their policy. The first one is CIO (Chief Information Officer), such as hearing from 100 CIO's successes, and the second is to develop "Software Engineering Center, (SEC)" in IPA (a NGO of METI).

NTT DATA CORPORATION, the largest system integrator in Japan, with eight major software vendors, made a joint study and summarized a desirable ways of development. In March 2008, the following works were handed over to SEC. Since then, SEC has investigated practices, and they will publish their intermediate reports in future.

These key points of what excellent CIO's did, what SEC people did and authors' proposal [1] share the same points. They will be discussed in the following.

1. Fundamental Laws

1.1. Human Intelligent Activities

A human lives by human intelligence, and which forms fundamental principles of human conducts. The most conspicuous among them are "human intentional activity". An example of "Hierarchy of Object [2][2]" is explained. The highest executive of a nation assigns the final objective "Occupy X island" to a supreme commander. The person commands "Approach Y miles to X island" to a navy commander, commands "Strike defenses" to an air force commander and commands "Land soldiers and bring the island under control" to an army commander respectively. When all these are achieved, the commander wins. Please note that it is human concept decomposition in a hierarchical manner from a parent to the children, using natural language, which is performed repetitively.

In Industrial Engineering (IE) [3], a work defined by the input and the output and process name is named "process", and it may be hierarchically decomposed repetitively until to an elementary operation of a human direct worker. Please note that it is again the same human repetitive concept decomposition. The entire shape may be expressed as a hierarchically expanding network model.

Software design is in between aforementioned two extremes as shown in Fig. 1 [4,5,6], which shows design records of a clock program. The top level is a function "Clock". In the next level, an elementary data flow of "Clock",

input –> function "Clock" –> output,

represents a concept of "Clock". It is assumed to be a parent concept, and is decomposed in the third level to a detailed children concept, consisting of cascaded three ele-

[2] "Hierarchy of object" is an empirical law [2] in Military science found by Carl von Clausewitz (1780–1831), a Prussian military thinker. It educates high level officer "how to plan a war", for lower level people, operational manuals underlying this law educate people "how one should conduct" in each situation.

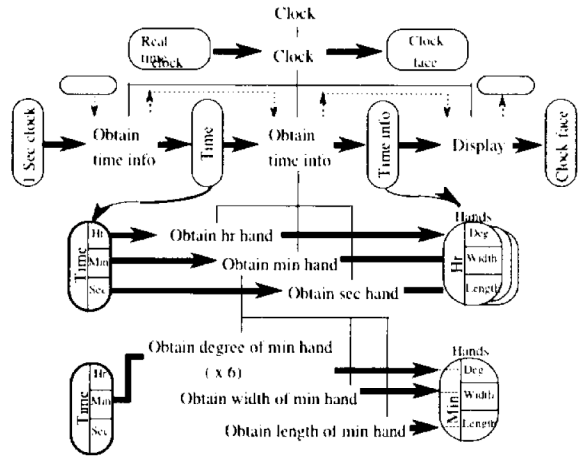

Figure 1. Design of clock.

mentary data flows in a serial manner. Similar decompositions are repeated, and at the last stage, a natural language expression is converted to computer language statements.

- *Design is a detailing process by repeating the hierarchical decomposition of a concept.*
- *Program is just a final stage implementation means.*

1.2. Principles of a Company Organization

Historically, in a military organization and in a religious organization, a hierarchical structure organization has been formed. From the end of the 19th Century and the early 20th Century, IE, which is engineering for production control in the wide meaning of the word, started. At that time there was a question about, which of a hierarchical organization and a non-hierarchical organization is better way of organizing for production. By comparing the actual field performances, a hierarchical organization was acknowledged as the better way. The hierarchical nature stems from the human knowledge structure, as shown by Fig. 1. A hierarchical system gives a better "global optimization". *Any organization should have be mutually orthogonal hierarchically manner. These are social-level rules.*

Figure 2 is a well-known V shaped network. A president of a company represents the company toward the world, and has the highest authority in it, and also takes the final responsibility. In Fig. 2, this person establishes the "corporate philosophy". Based on this, the person creates own "corporate management strategy", and then executes the strategy. Every year, the person plans a "corporate policy for this year" and orders people to follow it. By referring to Fig. 2, it is obvious that all the results reduce to the person. Therefore, it is the idealistic form that a president conducts an enterprise system development. In an investment of hardware equipment, it is usual that the person conducts the same.

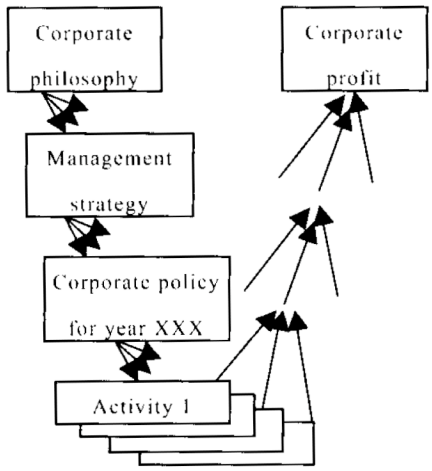

Figure 2. V shaped network.

Figure 3. Chain of processing.

2. Enterprise System

2.1. Foundations of a System Construction

Both direct works and indirect works require human work-hours corresponding to the demand of the respective works. If supports for each worker are provided, less work-hours are required, but this requires some investment. Direct work is conversion of an object, while indirect work is conversion of information. Input Process Output (IPO) Charts [7] may express the conversions.

Figure 3.a shows a series of business processing. In it, the flow consists of a series of elementary IPO's and Fig. 3.b shows a program, which works as specified by Fig. 3.a. Logically, both are equivalent. The degree of the automation may be optimized at will.

The top management of Taisei Corporation (one of the largest construction companies in Japan) felt it was dangerous that the cost of corporate systems was similar order to the corporate R&D budget, and ordered Mr. Satomi Kiuchi to cut these costs. He succeeded in the development of a new system in three years, and the cost was one third of the cost of developing the system using package software of ERP (Enterprise Resource Planning). For this outstanding achievement, Nikkei Business Strategy Magazine (NSB, a popular magazine among software managers in Japan) awarded him the "CIO of the year 2003" in March 2003. He outlined the project's success in improving the flow of the development in an interview [8]. The following are cited from his explanation:

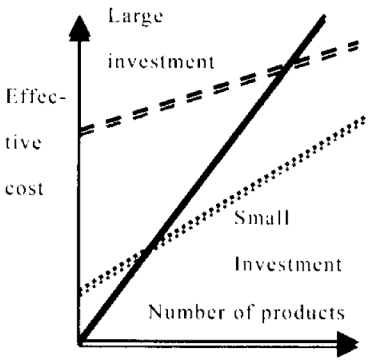

Figure 4. Cost characteristics.

(Using the HIT SYSTEM [9]) He encouraged people to integrate the business process with the business system structure to show what is the business that people are doing. ...*All processing of each work or each work process were recorded on flow diagrams*...Then each flow is examined to see if it is OK. ... Firstly, each work process is improved. ... More important is to discuss with people "How we should improve them things". ... Finally, *these diagrams become their business manual.*

They were not only used for evaluation of human works, but also the interface to following software implementation as well as evaluating.

He said that the key for his success is to "*Encourage people and Visualize each business process work flow prior to computer processing, then optimize each, and motivate people to promote higher morale*". Although this is difficult, but he achieved what he set out to do, and finally attained great success.

2.2. Investment for Saving Labor

Figure 4 shows the effect of investment. The abscissa shows the number of products, and the ordinate shows effective cost. A solid line, which corresponds to the case of all human works, starts from the origin, and goes right side upward. Dotted lines are for some automated cases. Each development cost is the intercept of dotted lines, and the gradient is smaller when the software is large or the cost is large.

From these, it is very important to invest at an optimum point. Responsible managers of design, production and quality assurance must review it and discuss and authorize with the president for the investment.

2.3. Preparing Proposals and the Approval

The proposal of an investment must includes following items for the commission:

- Objective from *the viewpoint of management* (i.e. saving of work-hours),
- *Effect of this investment of quantitative promise values* (i.e. 30% decrease),
- Date *when the promised effects are implemented,*
- Total investment, depreciation or amortization and collection.

As they are commitment with each other, the president must invest and people must achieve various effects (i.e. such as saving of 30%) before the dead line date.

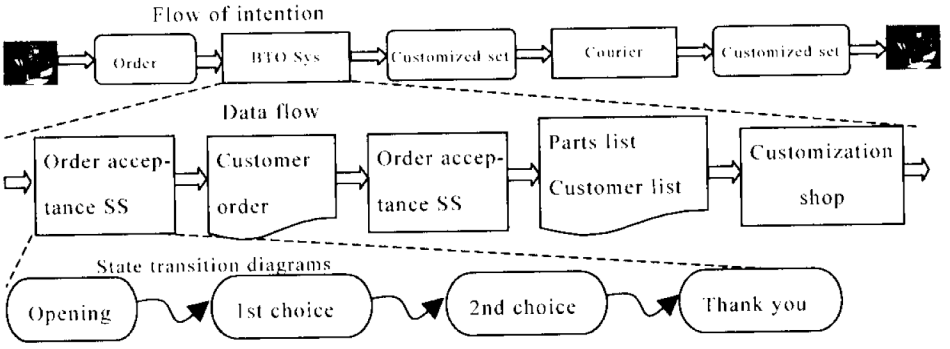

Figure 5. BTO system.

3. Systems Construction

Let suppose the corporate direction was thus settled to challenge BTO (Built-To-Order, taken by DELL CORPORATION). It accepts orders via Internet, the company makes the product as specified, and a courier sends the packaged product to the customer. As it eliminates both whole sales and reseller, margins may be decreased. As stock is only for parts and components, also the production cost may be decreased. In order to construct the enterprise system for the BTO, the work started. In order to enable to make all visible, the process is shown by hierarchical flows of various levels. They are "flow of intention", "process flow" and "data flow". Figure 5 shows the beginning of those for the BTO system. On the topmost level, a user shown on the left most side defines a specification of a PC, and the customized set is produced, and it is delivered via courier service to the user in the right most side. This flow may be called a flow diagram of intention.

The second level of Fig. 5 is a first level detailed flow, where the original process BTO is expanded to become three serial flows. The third level is a specification to an "Order acceptance sub-system" as expressed by a state transition diagram of 3 states. As each state shows each Input-Process-Output chart, they should be written under this level to define each function.

Thus repeating hierarchical decompositions of data flow, finally reach a level defined by Mr. Kiuchi as "all processing of each work or each work process are recorded on flow diagrams". Up to this, the design of processing in BTO was based on the knowledge of the present system. In this BTO case, processes performed hitherto by people in the past, are automatically processed in the following step. Thus checked "all processing of each work or each work process are recorded on flow diagrams" and are handed on to the next stage software people to code the system. Works after this are unnecessary to describe.

4. Concluding Remarks

Top management of a company must be capable of conducting investment both for software (i.e. an enterprise system for saving indirect works) and for hardware (i.e. automated production line for saving direct works) in an idealistic way, in order to suc-

ceed in each business. Financial rules and laws are ready for both cases. Excellent CIO's have been already succeeding in their ways. This paper has explained the way and the basis of an excellent systems development, directed by top management.

Acknowledgements

Authors thank to meetings with well-matured teams. One headed by Late Mr. D.A. Mnichowicz of GTE Laboratories for their quantitative attitude, and Mr. S. Nara and his team in Hitachi, Ltd. for their quality oriented approaches. Authors also thank to Mr. Daniel Horgan for his helps in English.

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