SUSTAINABLE BUSINESS PROCESS MANAGEMENT MODEL FOR CONSTRUCTION COMPANIES

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ABSTRACT: Construction companies require a management system to increase efficiency and profit due to the competitive and globalized business environment. Changing business environment also requires prompt and flexible responses such as establishing management strategies, increasing value of intangible assets, and measuring and collecting real-time data. Specific approaches are also called for to achieve realistic, organized and rational management amid constant and accelerating changes in the business environment of construction industry. Since the 1990s, construction companies have made various attempts to innovate their business structure both internally and externally by means of BPR, Six Sigma, PI and Workflow. Some improvements were made, but most of them were temporary and insufficient in providing the much-needed promptness for businesses to respond to the changes. In addition, various information technologies including ERP, MIS and PMIS to support the business process have been utilized, but they were estranged from the business process management and failed to meet the strategic goals of the companies as the technologies were function-oriented and focused on input/output processes and data flow. In the construction industry, only a handful of companies considered adoption of BPM and carried out basic theory-oriented researches. Accordingly, this research suggests a Sustainable Business Process Management (SBPM) model that improves and visualizes the process, executes and controls the systems and participants, and monitors and sustains business process improvement of the construction companies.

***Keywords**: BPM (Business Process Management), IT (Information Technology), PI (Process Innovation)*

1. INTRODUCTION

Since the 1990s, construction companies have made various attempts to innovate their business structure both internally and externally by means of BPR, Six Sigma, PI and Workflow. Some improvements were made, but most of them were temporary and insufficient in providing the much-needed promptness for businesses to respond to the changes. In addition, various information technologies including ERP, MIS and PMIS to support the business process have been utilized, but they were estranged from the business process management and failed to meet the strategic goals of the companies as the technologies were function-oriented and focused on input/output processes and data flow. In the construction industry, only a handful of companies considered adoption of BPM and carried out basic theory-oriented researches.

Elzinga (1995) emphasizes that BPM is a structural and analytical method for managing the complexity of variable business processes. Smith and Finga (2002) describe managing business processes and resolving the problem of the separation of business and IT. After this, the advent of the BPM from a technological viewpoint develops from workflow and EAI. Smith. H (2003) suggests a scenario of BPM applications centered on control function. Verner (2004) submits the advantage of process monitoring which economizes on cost, time and wages. These researches on BPM were conducted by other industries; construction-oriented research on the subject of BPM application is hard to find and only a few companies are considering the new system. Further researches on BPM for construction companies are in great need as companies lack systematic guidelines and methods to adopt BPM. This research is distinguished from the existing ones in that it focuses on aspects of implementing and controlling work-related personnel and systems in a consistent manner within the business process, improving and visualizing both internal

and external business processes, and carrying out a constant effort to monitor and improve business processes to adopt a business process management that can cater to management strategies of construction companies. Table 1 illustrates the result of a comparative analysis of the fields supported by SBPM for both previous studies and this research.

Table 1. Fields supported by SBPM

Current research	Strategy Connection	Process visualization	Business Support	Business Monitoring	Sustainable Improvement	Supporting the System
Process Management	◑	●	●	◑	◑	◑
Business Process Classification	◑	●	◑	◑	◑	X
IT system	◑	◑	◑	◑	◑	●
SBPM	●	●	●	●	●	●

Active support: ●, Semi-active support : ◑, No support : X

This research suggests a Sustainable Business Process Management (SBPM) model that improves and visualizes the process, executes and controls the systems and participants, and monitors and sustains business process improvement of the construction companies.

Table 2. Research Scope

Category	Description
Construction Industry	Construction-oriented architecture, and civil engineering companies and plants.
Participating Company	Considering that the adoption of SBPM is in its early stage, large-scale construction companies are selected for their effectiveness, accessibility, and advancement of information technology.
Classification of Business Process	The business process structure is based on a literature review and interviews with experts. Then, generalization is verified by interviews with experts from 11 companies to fine-tune different work features among the construction companies.
Task Executioner	Considering the five main components of construction companies' operational structure – strategy, organization, personnel, process, and information system, working-level staffs are from the departments of planning, financing, processing, human resources, information and other key departments.

2. Current Status of Business Process Management (BPM) in the Construction Industry

"B" Construction Company introduced Business Process Reengineering (BPR) in 1990 to improve corporate culture according to the company's 'management philosophy' and 'long-term management strategy' and to enhance business efficiency along with heightened competition in both domestic and foreign markets. To improve the work structure, 8 out of 19 major work processes were selected for BPR. Meanwhile, "H" Company implemented the first stage of PI in 2003; the company organized seven teams and identified nine tasks for innovation. Currently, the company is undergoing the second stage of PI and has plans to establish a BPM system based on the achievements of PI. "G" Company strives to improve its construction management and customer value through Six Sigma practice, and is also considering the adoption of BPM. Table 3 shows the current status of process management implementation by major construction companies according to the implemented methods.

Table 3. current status of business process management

Method	Company	Period	Team	Improved Effects
6 Sigma	D	2006	Development Business Team	Improved customer satisfaction.
	G	2006	Construction work team	Process standardization and cost reduction.
	D	2005	Construction work team	Easy to analyze rebar loss factor through real-time measurement.
	D	2006	Construction work team	Improved customer satisfaction.
	D	2006	Construction work team	Reduced concrete cracks.
	G	2003	Construction work team	Increased speed & accuracy of construction planning.
BPR	K	2002	Management Planning	Pursuit of business productivity
	H	2003 ~ 2006	Process Innovation Team	Established appropriate business process and system
PI	D	2003 ~ 2004	Management Planning	Achieved effective management capacity
	H	2005	Management Planning	Rapid decision making, reduced work load and work hours.
	H	2007	Process Innovation Team	Shortened payment time.
	A	2006	Management Innovation Team	Improved process and rapid decision making.
BPM	H	2005	Quality & safety team	Effiecient management of quality standard

Various process management models have been applied according to the changing demands and business environments. Under the rapidly changing circumstances, existing process management models need to advance and reflect new environments in the construction industry, emerging needs for business process management and particular demands from IT. Along with the advancement, construction companies need to adopt BPM for the following reasons.

Table 4. Rise of BPM Model for Process Management

Category	Description
Changing business environment in construction industry	· Evolution of process management model (diagnosis, design, system configuration, process implementation, process monitoring, continued improvement) · Changing environment outside the construction industry · Importance of work division and collaboration · Saving management cost and increasing efficiency · Securing flexibility, promptness, and transparency of work process
Increasing need for BPM	·Process can be unofficially defined, adopted and advanced · Work process is contained in various applications, organization structures and work styles · A construction company has hundreds of work processes. · Work process is dynamic, complicated and takes a long time to implement. · Highly dependent on the person in charge.
Demand for changes in IT	· Transition from unit-oriented application to integrated work management. · Shift of IT focus from technology to business process. · Transition of focus from function-oriented data to business process orientation.

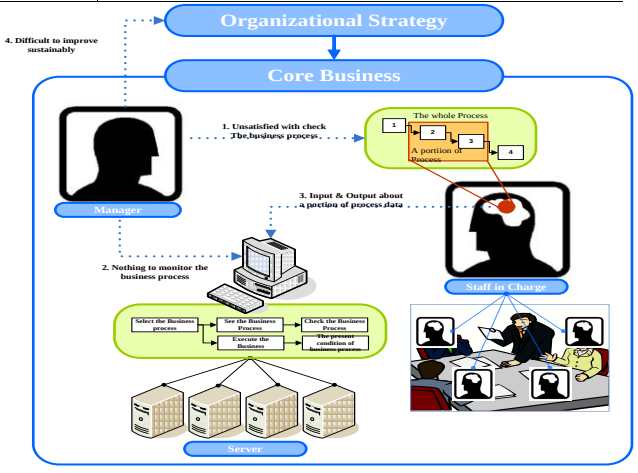

Fig. 1 Illustrates the aforementioned points

Currently, BPM models adopted by the construction companies for performance improvement turned out to be largely unrecognizable since they are contained in individual knowledge, work styles and applications. Also, the existing models are heavily dependant on people and organizational structure, and efforts to continuously improve business process are inefficient. Figure 1 illustrates the aforementioned points.

3. Definition of SBPM

Smith (2003) defined BPM, the third wave, as a well-organized and designed activity that manages and improves business processes to raise productivity, and a methodology or a system that supports these activities. Weskw (2004) agreed that BPM is a methodology used to design, execute and control operating processes related to human, organization, application, document and other information sources, and it supports business processes to utilize a system. As mentioned above, definitions of BPM in the existing researches are as follows:

Table 5. Definitions of BPM

Author	Definitions of BPM
D. Jack (1995)	A structural method which analyzes, improves, controls and manages processes for enhancing quality of product or service
Zairi, M (1997)	A structural method which analyzes, improves essential elements in the business activity such as production, marketing and communication
M. Weskw (2004)	BPM is a methodology to design, execute and control operating process related to personnel, organization, application, document and other information sources, or a thing that supports business processes by applying a system
Smith (2003)	A managing methodology or a software system supporting business procedure by designing, managing and improving to enhance business productivity

However, lack of selection and feedback on business processes in line with corporate core strategy, sequential application plans and sustainable management plans through BPM were pointed out as major problems.

Consequently, this paper defines SBPM model application of the construction industry as follows:

A system to improve and visualize the business process with in and out of the company by applying the business process which is related to the strategy of the construction company; to execute and control human resources and systems (related to work performance) suitable to the business process; to continuously monitor and improve the business process.

The model is expected to realize business efficiency through business process improvement and to eliminate

inefficient factors by maintaining the system. A conceptual diagram of the SBPM definition and the considerations are explained in Fig.2. Applying an SBPM model to business strategy of construction industry requires a sequential adoption. The reason for this is that feedbacks from trial and error can help reduce potential risks when it is applied to other tasks.

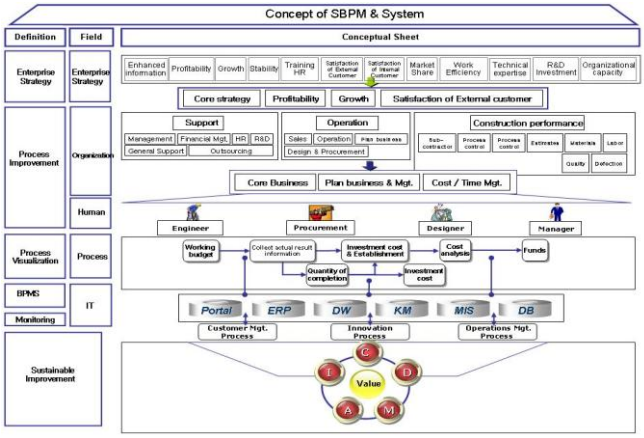

Fig.2 Definition of SBPM

4. Critical Factors to Successfully Adopt Sustainable Business Process Management (SBPM) Model

To apply an SBPM model, continuous business process improvement by eliminating unnecessary tasks and operation of information system that supports the business process are required. For sequential adoption of the SBPM model, key business strategies are needed to be established and priorities for applying SBPM to unit tasks in accordance with the key business strategies are needed to be identified. Then, the first-stage goal of improving the business process should be achieved in the order of: work analysis, analysis of relationship between work and application, problem identification and business process improvement. In order to achieve continued improvement of the business process with application of the SBPM model, work implementation, performance management and information management are required. Optimal work structure can be established by continuously extracting wasteful factors in the implementation process and improving them.

The SBPM model establishes an optimal business process environment by continuously identifying and eliminating valueless tasks in the stages of business process, work implementation, performance management, and information management. Figure 3 illustrates concept of the SBPM model that is based on key success factors with an effort to eliminate unnecessary factors in the business process and to improve unit tasks.

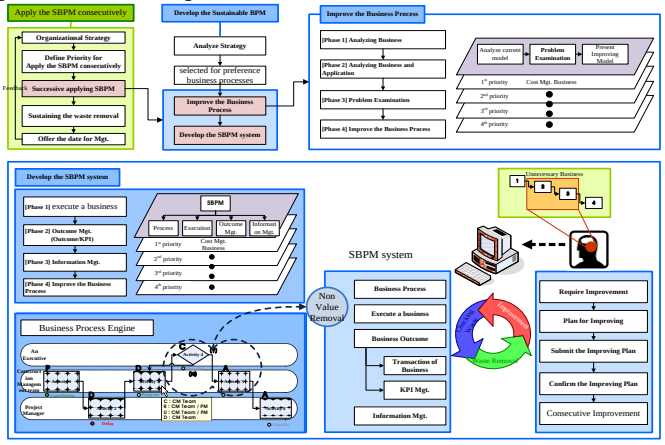

Fig.3 concept of the SBPM model

5. Architecture of the SBPM Model

Fig. 4 shows architecture of the SBPM model that primarily improves problems of unit business in construction firms and reflects the design principles of the model.

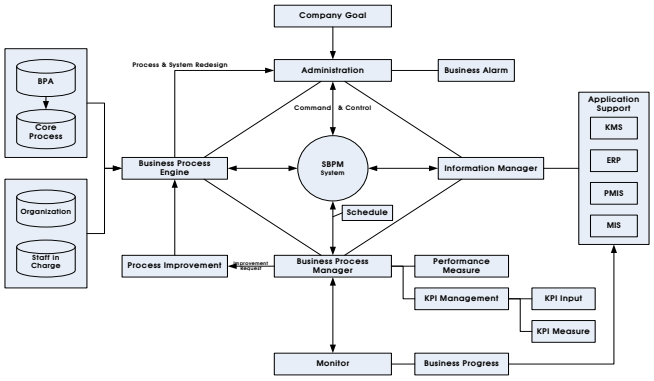

Fig. 4 Architecture of SBPM Model

The module of SBPM model is categorized into 7 large elements: ties with company strategy, manager, business process engine, information manager, business process manager, monitoring system and continuous improvement.

The module of ties with company strategy is to reflect the core strategy of construction firms and to plan future strategies. The business process engine is a process management module that supports business processes and enables one to search the processes undertaken by an officer in charge in accordance with the code of business process structure, and it also allows one to process tasks based on the process as it is interlinked with the

information manager module. The business process manager module is to measure results and manage KPI continuously, and it is also interlinked with the business monitoring module. The manager module is meant to continuously reflect improvements in relation with tasks, information support and business improvement, and to control business. This module has a role as an information provider for formulating future company strategy.

The SBPM model is focused on the process. The process is subdivided into levels of mega process, process chain, process and activity based on a value chain and linked to the data by the code of each process level. Each process is then delivered to each task operator based on job plan and its progress status is marked with start and completion date data.

The application already in use is processed in connection with the business process and an individual task list. Monitoring and performance management of each business is measured in connection with each process based on the KPI data.

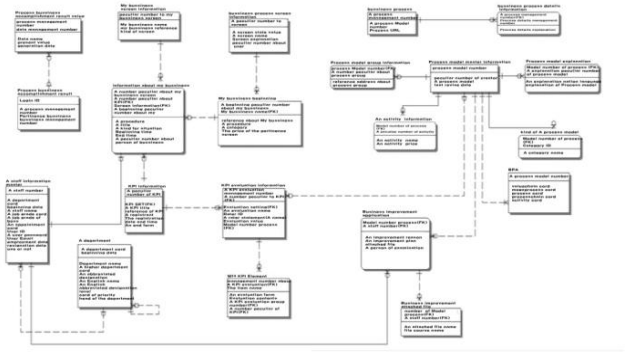

Fig. 5. ERD for adopting SBPM model

6. Business process monitoring

Business process monitoring is divided into two monitoring systems, one for task managers and one for task operators. The monitoring system for the task operator monitors the preceding operator, the follow-up operator and the status of an ongoing task. The monitoring system for the task manager provides integrated functions, such as monitoring processes across the enterprise and taking measures on processes that cause delays or problems. Task operators can check preceding status of their task process and follow-up operator of the task, and monitor the status and results of their own task. Moreover, current status of the processes such as completed, delayed, etc. are indicated on the visualized process and the operator can also check operating bodies of each task.

For senior managers, it provides integrated information of each process across the enterprise and status of the processes such as delayed, on-time, or finished early. The manager can check the processing status and operators of each task by clicking ‘Detailed Information’ icon. Fig. 6 shows this process.

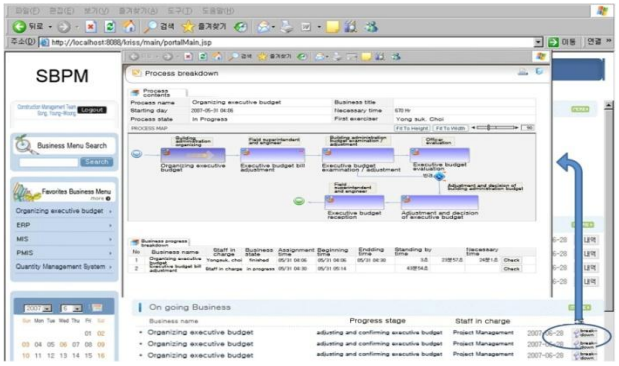

Fig. 6 Business process monitoring

7. Performance management of business process

KPI for continuous management of the SBPM model is managed from respective processes’ and organizations’ perspectives. Further, the KPI management shows performance status of the business process which construction companies can use as fundamental data for establishing future business strategy.

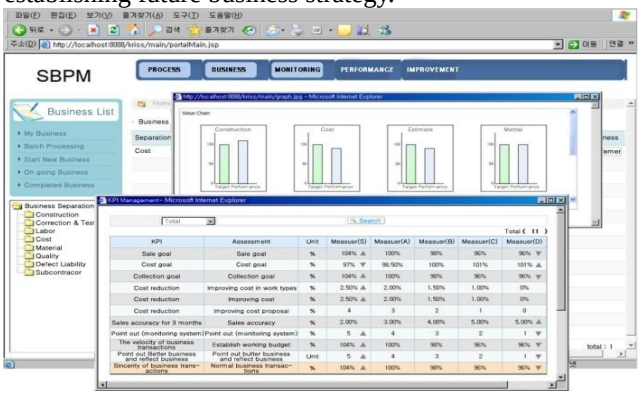

Fig. 7. Performance management of business process

The performance measurement of each process shows comprehensive performance of a process selected through Explorer and if you search for detailed information, it will show the performances in grades based on each KPI evaluation items and actual achievements on the goal. It also shows ups and downs of the current performance

compared to the past performances. Fig. 7 shows this process.

8. Expected Outcomes of the SBPM Model

Interviews and surveys of working-level staffs were conducted to prove how the SBPM model application can actually redress the problems of business process management. To examine the expected outcome of the SBPM model, working-level staffs with experience of more than 10 years were selected from sample companies and briefed thoroughly on the SBPM model. Table 6 outlines the survey conducted to analyze the expected outcome of SBPM.

Table 6. Outlines of the survey for expected outcome

Category	Description
Target	Working-level staff - with experience of more than 10 years – from 11 construction companies' Management, Human Resource Mgt., Process innovation, Financing and IT division in Korea.
Concept	Expected outcome of the SBPM model Qualitative effects and list of SBPM Improved function according to applied SBPM model
Analytical Method	*Select 5 among 12 items to rank as five points, four points, three points, two points and one point of the value-added scores*
Period	2007~2008
Return Rate	Number of total copies : 110 Replied copies : 83 Return Rate : 75%

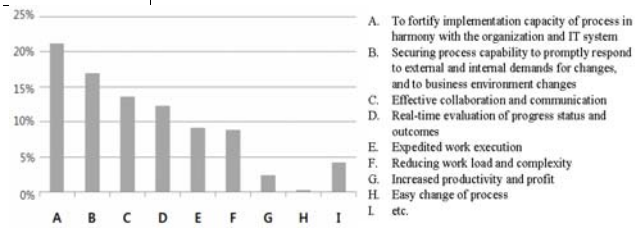

Fig.8 Expected Outcomes

The analysis of the effects of SBPM revealed that the most anticipated outcome (21%) is 'to reinforce implementation capacity of a process in harmony with the organization and IT system' as shown in Figure 6. This is followed by 'securing process capability to promptly respond to internal and external demands for changes and business environment changes (16%)', 'effective collaboration and communication (15%)', 'real-time evaluation of progress status and outcomes (13%)', 'expedited work execution (12%)', 'reduced work load and complexity (9%)', and 'increased productivity and profit (8%).

9. Conclusion

This research examined the critical need to adopt BPM to cope with changing paradigms in the construction industry and reasons for unsuccessful process management and application of BPM for construction companies, related problems, limitations of previous researches, and provided an SBPM model that enables continuous improvement for construction businesses. The model visualizes the business process and establishes human resources and systems related to the tasks in a process-oriented manner. This enables elimination of wasteful factors in the process of implementing, controlling, monitoring and evaluating performance of business processes, and eventually builds an optimal business process environment.

In consideration of the continuous improvement, SBPM model is consisted of seven modules including linking company strategies, administrators, business process engine, information management, business process management, system monitoring and continued improvement, and it suggests system architecture.

By pursuing improvement of business processes and information strategies simultaneously, the model ensures efficiency and promptness of the business process, materializes a fundamental business process management system and enables continued improvement of the business.

Acknowledgement

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