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Design Attributes and Performance Outcomes: A Framework for Comparing Business Processes

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Abstract

Though business processes have been a topic of constant attention to the organization in this decade, the term "Business Process" is understood and interpreted by people differently. This difference in understanding and interpretation is presenting difficulties for organizations to learn from business processes of other organizations or functions. Based on existing literature, this study attempts to identify and demonstrate the common design attributes and performance various business processes share. The common design attributes are identified as process context, process sub parts, process interaction and process management. The common performance measures are classified into higher level measures as process efficiency, process effectiveness and process flexibility. These attributes and outcomes can be used to compare various business processes and thus enable learning from one business process to another.

Keywords: Process Measurement, Process Design, Compare Business Processes

Introduction

For generations, various theories have emerged to manage organizations. During seventies and eighties, most organizations are organized on functional departments. The goal of organizational management was to improve the performance of individual functional departments. There is a fundamental shift in the philosophy of organizations in the nineties. Learned from their Japanese competitors, more and more companies are thinking the organization in terms of a set of value chains, or cross functional processes extending many departments. Correspondingly, the goal is to improve the performance of these cross functional processes as against the improving the performance of individual departments. (Hermon, 2003; Porter, 1985). This trend was further reinforced by the publication of research works on business process reengineering, business process redesign and business process modeling.

However, the term business process remains being interpreted differently by different people to mean a broad set of things. Davenport and Short (Davenport and Short, 1990) define process in three dimensions:

- Entities: Processes take place between organizational entities. They could be Interorganizational (e.g. EDI), Interfunctional or Interpersonal (e.g. CSCW).

- Objects: Processes result in manipulation of objects. These objects could be Physical or Informational.

- Activities: Processes could involve two types of activities: Managerial (e.g., develop a budget) and Operational (e.g., fill a customer order).

Harrington defines business process as any activity or group of activities that takes an input adds a value to it and provides an output to the external or internal customer (Harrington, 1991). In his research note on process, Van de Ven (1992) mentions three broad ways people talk about processes.

i) Process as a causal explanation, in which researchers have not explicitly examined the activities, events or associations within the process, but have instead used process oriented arguments to build hypothesized relationship between predictors and outcomes of the process.

ii) Process as a category of concepts, in which researchers have focused their attention inside the process, but their approach has been to identify specific concept or variables that represent the actions of individuals or organizations and how these actions and their interrelationships explains outcomes and

iii) Process as a sequence of events in which the focus is explicitly on the sequence of events within the process.

These diverse interpretations of process greatly hinder the ability of researchers to build on each other's work and make it difficult, if not impossible, for organizations to learn from other's processes and compare performance. To address this problem, we set the goal of this paper to find the minimal cover set of design attributes business processes share and to classify the performance measures at a higher level so that they are suitable to compare processes.

The paper is organized as follows: typologies are discussed in the next section to understand the various ways researchers have thought of processes. After discussing the definitions and typologies, the common concepts that processes share and agree upon are discussed. Based on the common characteristics shared, some of the design attributes that exist in all the processes are discussed. After the discussion of design attributes, the common performance metrics of processes are classified into higher level measures.

Typologies of Processes

Researchers have proposed various typologies to classify processes and explain their differences.

Garvin (1998) classifies processes as work processes, behavioral processes and change processes. Work processes focus on accomplishing tasks through linked chains of activities cutting across functional groups. Behavioral processes are the sequence of steps used for accomplishing the cognitive and interpersonal aspects of work. Change processes capture the dynamic view which focuses the sequence of events over time.

Davenport and Short (1990) classified the processes on three dimensions, based on entities as inter organizational, inter functional and interpersonal; based on objects as physical and informational; based on activities as operational and managerial. The processes are categorized based on the types of objects they manipulate. In physical object processes, real, tangible things are either created or manipulated; manufacturing is a typical example of physical object process. Informational object processes create or manipulate information. Processes for making a decision, preparing a marketing plan are examples. Based the dimension of activity the operational processes involve the day to day business purpose and managerial processes help to control, plan or provide resources for operational purposes.

Mooney et al. (1996) classify processes as operational and management processes similar to Davenport's classification. Operational processes are those that embody the execution of tasks comprising the activities of an organization's value chain, in effect operational processes constitute the doing of business. Management processes on the other hand are those activities associated with the administration, allocation and control of resources within organizations. Processes such as marketing and intelligence processes, design and development processes, procurement and logistics processes, production processes and product/service delivery processes comprise operational processes. Information handling processes, coordination processes, control processes, communication processes and knowledge processes as management processes.

Despite the diversity, when we systematically compare processes, commonalities and patterns emerge (Crowston, 1997). Thus accepting the diverse understanding and interpretations of processes, there are still some common concepts shared by the various definitions (Crowston, 1997; Davenport and Beers, 1995; Davenport and Short, 1990; Garvin, 1998; Mooney, et al., 1996). They are:

- Processes are composed of selected sub parts (called sub processes, activities, tasks)

- Processes have some inputs and outputs

- Processes are designed to achieve an objective.
- Processes have desired performance outcomes

Process Design

Argyris and Schon (1978) coined the term double loop learning to distinguish between two different but related types of learning. Davenport and Beers (1995) use the same concept and they consider the two loops as relevance loop and performance loop. The importance of the design attributes is established by the relevance loop. The relevance loop captures all the information such as the real purpose of the process, how the process supports the strategy. This relevance loop plays an important role in the performance loop.

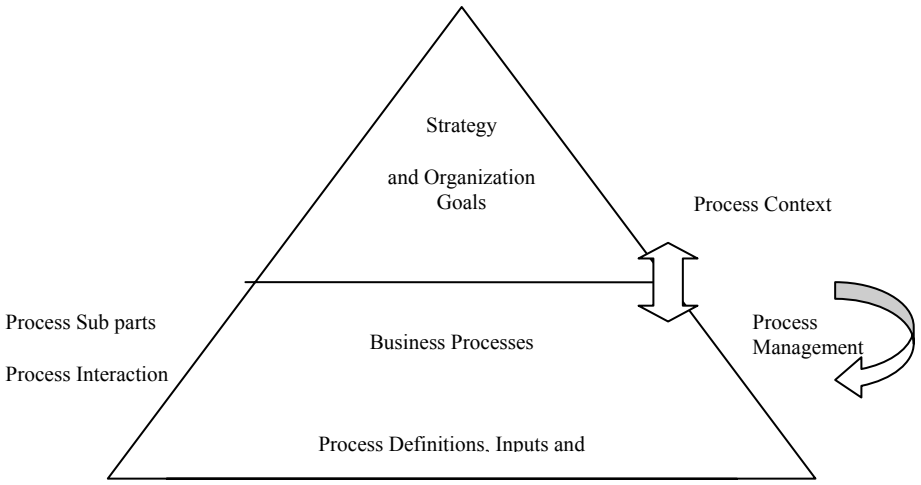

Figure 1 : Process Design Attributes

There are four major attributes in process design: process context, process sub-part, process interaction, and process management. These attributes have to be present in some form or the other in process design. Apart from these there can be a lot of design elements that can be present in the process, which are characteristic to each process.

Each of the four process design attributes are explained briefly in the following.

Process Context

Processes are said to be designed to achieve an objective. These objectives are generally part of a larger goal. A typical process can be represented as an input-process-output model (Harrington, 1991). The outside environment has an influence on the design and operation of the process. The larger the scope of the process, more elements and more complex interactions between the elements should be expected in the design phase. The process design should also be aligned with the business strategy of the organization. The importance of alignment is often highlighted in the literature (Davenport and Short, 1990; Hermon, 2003; Mooney, et al., 1996). Though processes have different objectives, their designs are totally not independent. So each process should be designed in the context of the whole organization.

Process Sub parts

The processes can be decomposed into what we called sub parts. It can be seen from the literature that the researchers have named these decomposed process by various names (Malone, et al., 1999). According to the design and objective of the process, the decomposition is based on different criteria, such as time, size, specialty and others.

The element symmetry and the number of sub processes are proven to impact the performance of a process. (Seidmann and Sundararajan, 1997) The symmetries, asymmetries and imbalance in the size of the tasks also impact the process performance. To provide an example of process decomposition, consider a process of selling products to customers. We can

decompose the process to identify potential customers, obtain order, deliver product and receive payment. It is obvious that the same process can be decomposed into different sub parts depending on the design strategy employed (Malone, et al., 1999). But different designs could lead to different outcomes.

Process Interaction

When we think of processes to be composed of elements like sub processes, it is obvious that they have to in turn interact to produce the outcome. The interaction represents an important part of design as the best effort in terms of processes decomposition could easily be ruined by poor process interaction pattern. The interaction among the processes could be hierarchical, network or sequential. Various sub processes could be executed parallel with appropriate concurrency control mechanisms. Depending upon the objectives of the processes and the resources involved, multiple processes can be managed through coordination, and the coordination mechanisms chosen to manage dependencies among tasks and resources involved in the process will decide the design and in turn performance of the process (Crowston, 1997).

According to coordination theory, elements can be compressed into two groups, tasks (includes goals and activities) and resources used or created by tasks and three kinds of dependencies can be defined task-task, task-resource and resource-resource (Crowston, 1997). To manage the dependency various mechanisms can be used. The task-task dependency can be managed by merging tasks if they are overlapping, pick one task at a time when the tasks are conflicting. The the task-resource dependency can be managed by identifying necessary and available resources and then assign a resource. The resource- resource dependency can be managed by identifying the dependency and managing the dependency.

Process Management

Process design is not a one-time activity. It is inevitable that it will be refined and adjusted during the execution based on feedback from process performance and changes of environmental factors. Examples of process management include to make proper modification of the process when there is a change in the form of materials input into a manufacturing process, or there is some problem in the operation of the other processes that interact with the process under consideration.

Process management is impotant for process to run effectively for a longer time(Davenport and Beers, 1995; Garvin, 1998). The process reliability depends on the the effectively managing the process.

These four design attributes are summarized in the following table (Table 1).

Table 1: Process Design Attributes

Name	Definition	Scope
Process Context	Process context constitutes the position of the process in the organization and in relation to other processes in organization.	External
ProcessSubparts	Process sub parts represent the decomposition of the process into smaller segments based on some criteria.	Internal
Process Interaction	The pattern of interaction of sub parts of the process.	Internal
Process Management*	Process Management consists of managing the resources and also the decisions that need to be made based on feedback and other environmental factors.	External And Internal

Process Performance Outcomes

Once the relevance loop is established through design and management, performance loop is needed to measure output. However, the metrics are generally designed to suit the requirements for a specific process. There is a need to take these metrics to a higher level so that they can be compared across processes.

Adam and Swamidass (1989) synthesize all the manufacturing literature and find that the outcomes most studied are quality, cost, flexibility, and delivery. Davenport and Short (1990) refer to the desired perforamnce outcomes of business processes as reduced cost, reduced time, improved quality, improved work life quality and enhanced learning and empowerment. Garvin

(1987) identifies eight dimensions of performance features as reliability, conformance, durability, serviceability, aesthetics and perceived quality. The service quality domain identified five attributes of quality service as reliability, responsiveness, assurance, empathy and tangibles (Zeithaml, et al., 1990).

Performance measure should include how well process is working, how is the process making a difference to the outside environment and how it can handle changes. Therefore, the performance measures can be grouped into process efficiency, process effectiveness and process flexibility. Table 2 lists some of the previous metrics used to measure the performance and their relationships to these three meta-measures.

Table2: Performance Metrics

	(Davenport and Short, 1990)	**(Garvin, 1998)**	**(Zeithaml, et al., 1990)**	**(Sambamurthy and Kirsch, 2000)**	**(Roth, et al., 1989; Skinner, 1985)**
Process Efficiency	Cost reduction Time reduction	Cut costs Reduce cycle times	Tangibles		Cost Time
Process Effectiveness	Quality of work life Learning and empowerment	Serviceability Improve quality	Reliability Assurance	User Satisfaction Meeting functional specification	Dependability Quality
Process Flexibility		Durability	Responsiveness	Timeliness	Flexibility

Process Flexibility

De Groote defines process flexibility as the ability to adapt easily to the new change with minimum costs (deGroote, 1994). A flexible process assumes different states quickly with minimum cost and maximum ease (Upton, 1995).

The flexibility of process can thus be presented in three dimensions of time, cost and ease.

Time –process should adapt to change in quick time

Cost – process should adapt to change with less cost

Ease – process should adapt to change with maximum ease.

A lot of processes in the past has been focusing on the responsiveness of the process. This is increasingly becoming in the competitive environment which is more geared towards value creation.

Process Efficiency

A process is considered to be efficient if the ratio of resources utilized by the process to the available resources is high. A process is more efficient than the other if it takes less time to transform inputs to outputs. A process is known to be highly efficient in the cost dimension if the cost incurred to convert inputs into outputs is minimal. Thus process efficiency yield tangible benefits such as low overhead, low costs and fast production. The common metrics used in the past to measure efficiency are productivity which compares the output of a process with respect to input.

In the manufacturing processes the typical efficiency measures are lead time, throughput rate, operation time which includes setup time and runtime. The efficiency of the process is increased typically by performing the activities and sub processes in parallel. Changing the sequence of activities also may result in an increase in the efficiency of the process. An efficiency gain is also achieved by reducing the number of interruptions to the process.

Process Effectiveness

Unlike the process efficiency measures which are explained in the relation to process itself, the effectiveness is decided by the customer of the process (Davenport and Short, 1990). Customer satisfactions, reliability, learning empowerment are some of the examples of process effectiveness.

The customer satisfaction has to be explained as how the process is bringing out a change to the customer, a factor external to the process. The reliability of a process is an indication of accuracy of the process. It is also a measure of trustworthiness of a process. The reliability of process is put to test when the process is subjected to adverse conditions.

The following table (Table 3) summarizes our discussion.

Table 3: Process Performance Outcomes

Name	Definition	Dimensions
Process Flexibility	The ability of the process to adapt to the change	Time Cost Ease
Process Efficiency	The performance measures associated with the process with measures related to the process itself	Time Cost Utilization
Process Effectiveness	The performance measures associated with the process with respect to the change induced to the environment.	Satisfaction Reliability

Discussion and Conclusions

Though processes are discussed and defined differently, they share some essential attributes. Identifying these similarities will be useful way to compare various processes and to borrow some features to apply to other process.

The design of a process impacts the performance measures of the process. Thus by studying the design of the process we can understand why processes behave differently and why the desired outcomes of the process are not always obtained.

The processes can be compared based on the design attributes provided. The design attributes common to processes are process context, process sub parts, process interaction and process management. The performance outcomes measures are classified as process flexibility, process efficiency and process effectiveness.

Processes can be compared using this framework. Based on our common performance measurements, if one process is considered to be less flexible or effective than the other, we can then trace back to their corresponding design attributes to see what causes this difference and learn from the other process design. In this way, this framework will facilitate the communication between processes and help with the dissipation of best practice in process design.

References

1. Adam, E.E., and Swamidass, P.M. "Assessing Operations Management from a Strategic Perspective," Journal of Management (15:2), 1989,

2. Argyris, and Schon Organizational Learning: A Theory of Action Research, Addison-Wesley, Reading,MA, 1978.

3. Crowston, K. "A coordination theory approach to organizational process design," Organization Science (8:2), 1997, pp. 157-175.

4. Davenport, and Beers "Managing Information About Processes," Journal of Management Information Systems), 1995,

5. Davenport, and Short "The New Industrial Engineering : Information Technology and Business Process Re-design," Sloan Management Review), 1990,

6. deGroote "The Flexibility of Production Processes : A General Framework," Management Science (40:7), 1994,

7. Feitzinger, E.L., Hau L "Mass customization at Hewlett-Packard: The power of postponement," Harvard Business Review (75:1), 1997, pp. 116-121.

8. Fisher, M.L. "What is the right supply chain for your product?," Harvard Business Review (75:2), 1997, pp. 105-116.

9. Garvin "The Processes of Organizations and Management," Sloan Management Review), 1998,

10. Garvin, D.A. Managing Quality, Free Press, New York, 1987.

11. Harrington Business Process Improvement, McGraw Hill, New york, 1991.

12. Hermon, P. "Business Process Architecture and Process Centric company," Business Process Trends, (1:3), 2003,

13. Lee, H.L., Padmanabhan, V., and Whang, S. "The bullwhip effect in supply chains," Sloan Management Review (38:3), 1997, pp. 93-102.

14. Malone, T.W., Crowston, K., Lee, J., Pentland, B., and et al. "Tools for inventing organizations: Toward a handbook or organizational processes," Management Science (45:3), 1999, pp. 425-443.

15. Mooney, J.G., Gurbaxani, V., and Kraemer, K.L. "A process oriented framework for assessing the business value of information technology (Reprinted from Proceedings of the sixteenth annual International Conference on Information Systems, pg 17-27, 1995)," Data Base For Advances in Information Systems (27:2), 1996, pp. 68-81.

16. Narasimhan, R., and Jayaram, J. "Causal Linkages in Supply Chain Management:An Exploratory Study of North American Manufacturing Firms," Decision Sciences, (29:3), Summer 1998, pp. 579-605.

17. Porter, M. Competitive Advantage, Free Press, New York, 1985.

18. Roth, A., De Meyer, A., and Amano, A. International Manufacturing Strategies: A Comparitive Analysis, Elsevier Science Publishers, North-Holland, 1989.

19. Sambamurthy, and Kirsch "An Integrative Framework of the Information Systems Development Process," Decision Sciences), 2000,

20. Seidmann, A., and Sundararajan, A. "The effects of task and information asymmetry on business process redesign," International Journal of Production Economics (50:2-3), 1997, pp. 117-128.

21. Skinner, W. Manufacturing: The Formidable Competitive Weapon, John Wiley and Sons, New York, 1985.

22. Swaminathan, J.M. "Enabling customization using standardized operations," California Management Review (43:3), 2001, pp. 125-135.

23. Upton, D. "Flexibility as Process Mobility: The Management of Plant Capacities for Quick Response Manufacturing," Journal of Operations Management), 1995,

24. Van de Ven, A.H. "Suggestions for Studying Strategy Process: A Research Note," Strategic Management Journal (13:Special Issue), 1992, pp. 169 23 pages.

25. Zeithaml, Parasuraman, and Berry Delivering Service Quality, Free Press, New York, 1990.