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A Metaphor for the Interface between OM and IS

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Abstract

Organizations are systems that carry out requisite processes to convert inputs to certain outputs, with the intention of adding value. For this to happen, operations management, information and decision processes need to be fused together synergistically. We highlight this with the following metaphor: though notes are played by different performers in an orchestra to produce music, the music is really experienced in the perception of the whole composition and this is made possible by the information of the notes already played, the expectation of the notes that might follow and the deviations around these kept within bounds that embellish the experience. In a similar manner, organizational performance is music, and notes or information alone do not make the music; operations and information flows fuse together, to produce the synergy in a seamless manner. In this paper we illustrate this metaphor with case examples.

Introduction

"Behind every great orchestra is a team of administrators who work together with the music director in creating a vision for the future," said renowned conductor Leonard Slatkin, who became the Music Director of Detroit Symphony Orchestra commencing with the 2008-09 season. So the knowledge and expertise from management is required in leading and managing orchestras and not surprisingly, workshops and seminars on essentials of orchestra management cover fields like artistic administration, operations, marketing, public relations, development, governance, education, community engagement, finances, planning, managing, and problem solving. On the other hand using orchestra as a metaphor for corporate management is not new. In tune with this, First National Community Bancorp, Inc., presents its 2007 annual report entitled *Finely Tuned*, giving elaborate description of an orchestra, comparing the string section to the senior management, and even alluding to 'the sweet sound of success' to refer to their achievements. In that document, of course, there are several other metaphors like 'music to your ears', 'fine-tuning the instruments', and 'hitting the high note' among others.

In this paper we use the music metaphor to bring out its new entailments which provide us the motivation to discuss the third order cybernetics that is at work. Before that we briefly discuss the history and evolution of operations management and information systems.

In the beginning

Since the dawn of the industrial revolution, organizations engaged in mass production and distribution of goods and services have been evolving and redefining the major functional

areas namely finance, marketing and operations. For a very long time operations were lower in the hierarchy among these functions. Even after the introduction of management as an academic discipline, the management of these functional areas remained isolated and problems in one area were addressed and solutions sought without the perspective of how it affects the other areas. The 'silo' metaphor was appropriate in such organizations. While industrial engineering was emerging as a new applied technology that used mathematics, statistics and psychology to solve problems relating to productivity and quality, it was slow to realize the need for an interconnected view, in bringing improvement in productivity and quality. Cybernetics was then an emerging field which influenced engineers, mathematicians, statisticians and philosophers. Norbert Wiener defines cybernetics as the study of control and communication in the animal and the machine. Introduction of management concepts in organizations starting with Taylor's scientific management theory can be considered as "first order cybernetics", as control of the operations was now possible from the performance feedback. The next level of feedback became apparent when the question about how well we were managing the operations became necessary to explain organizational success or failure. This could be considered as "second-order cybernetics", its emphasis is on how managers construct models of the systems with which they interact.

Quality of Management of Operations and Importance of feedback

A full-fledged grasp of the systemic nature of organizational operations and their management was put forth only when quality management was understood as a strategically important driver of organizational performance; this also elevated the status of operations management as an enabler of the financial and marketing goals of an organization. One of the key contributions came from the quality guru W.E. Deming, through his "System of Profound Knowledge". Deming's emphasis on the "System of Profound Knowledge" brought a

paradigm shift in the way organizations were managing their finance, marketing and operations, including innovative operations.

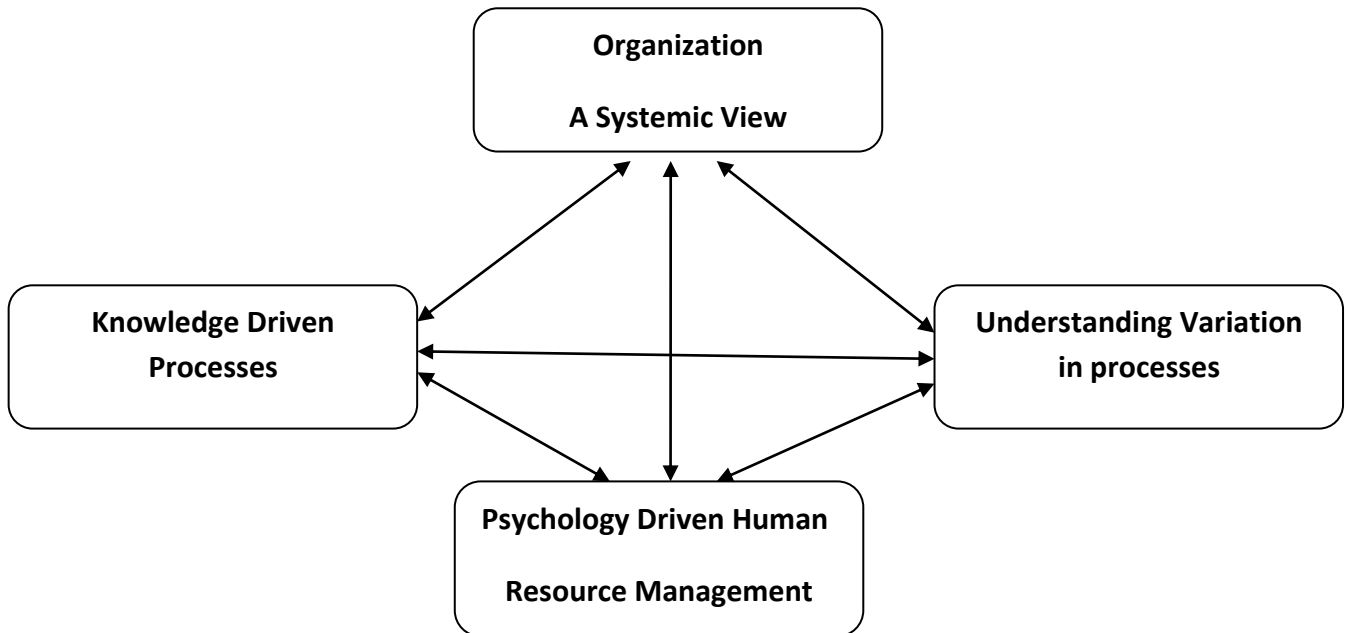


Figure 1: Interdependent components of Deming's System of Profound Knowledge

Deming's "System of Profound Knowledge" has four inter-related components, namely, a systemic view, understanding of variation, theory driven processes and psychology driven human resource management (Figure 1). These four components support the organization through their interactions. For instance, Knowledge driven processes includes, the knowledge that the processes are part of a system, the knowledge of the variation in the processes and how to manage variation, and the psychological issues surrounding process performance and coordinating interconnected processes. One of the salient features in all these interactions is feedback. For instance, improvement in process performance is achieved through feedback obtained on the process control, which may lead to the decision to manage the process *as is* or to strive for a break through to attain requisite changes in the process. Thus we can say managing quality of management of operations requires the feedback on how well we manage our operations, leading to the view of "second order cybernetics" in organizations.

Business Processes and their Interconnectedness

Though industrial engineering had established methods for obtaining performance standards or targets to be aimed at in processes it had to wait till the advent of statistical process control developed by Walter Shewhart to manage the process with feedback and control. But still the theme was improving individual processes. However this process orientation did not take long to identify the interconnectedness of processes and how processes cut across functional boundaries. With the introduction of automation and information technology it became evident how this interconnectedness could be visualized and used for better organizational communication and outcomes. These processes in turn would be overseen by planning, organizing and control mechanisms. While the flow of products and services occurs in the forward direction there is an equally important flow of information backward that enables feedback and control (Portougal and Sundaram, 2005). But for these mechanisms and flows to function effectively business, information and decision processes need to be interwoven together synergistically. We club all these processes together under the umbrella term 'business processes'. Sharp & McDermott (2001) define a business process as: "A collection of interrelated work tasks, initiated in response to an event that achieves a specific result for the customer of the process." Business processes are by nature inter-functional, that is, they span multiple business functions. Functions are usually specific to departments which concentrate/specialize certain skills and/or knowledge. Common examples of such functions are Manufacturing, Marketing, Sales, Human Resources, and Finance. Even the simplest of processes involves the application of specialist skills found in different departments/functions. The business process enables us to understand the dynamism involved in the delivery of value by an organization.

Over five decades operations management has evolved from its humble beginnings in Taylor’s scientific management to today’s supply chain management, clearly recognizing the need for connectivity, collaboration, and willingness for cooperation within and outside organizational boundaries (Davis and Heineke, 2005; Rainbird, 2004; Raturi and Evans, 2005; Finch, 2006). Simultaneously information systems have also evolved not only to provide function specific information but also to provide models for integrated information backbones and service oriented architectures for future business management systems. Interestingly, Anupindi et al. (2006) have titled their book on operations management as “Managing Business Process Flows: Principles of Operations Management”, bringing out the fact that first and foremost OM is concerned with managing business process flows. Similarly SAP’s Simon Dale (2007) while discussing ‘Holistic BPM: From Theory to Reality’ indicates that the third wave will be business process management (Figure 2).

1st Wave: Taylorism	2nd Wave: Business Process Reengineering	3rd Wave: Business Process Management (BPM)
<ul style="list-style-type: none"> ▪ Frederick Taylor’s “Scientific Management” theory ▪ Division of labour ▪ Managerial control of the workplace ▪ Cost accounting based on systematic time-and-motion study 	<ul style="list-style-type: none"> ▪ Processes manually re-engineered (typically a one time event) ▪ Processes implemented via ERP software ▪ Business & process logic hard-coded ▪ Led to EAI (application to application focused) 	<ul style="list-style-type: none"> ▪ Facilitating the ability to change ▪ Extract business processes from the applications which run them <p style="text-align: right; font-size: small;">Source: David Knight</p>

Figure 2: Three Waves of Business Management (Source: Dale, 2007)

Information systems intended for achieving organizational success

One of the key strategies of organizations in the 21st century has been the ‘sense and respond’ strategy. Sensing the changes in the environment, both internal and external, and responding at strategic, tactical, operational, and technological levels that will enable an organization to

adapt and survive. Some of the key elements that will enable the success of this strategy are: adaptability, flexibility, versatility, ability to handle complexity, digitization, moving from Uni-channel to Multi-channel, automation, reach, and range (Portougal and Sundaram, 2006). While adaptability, flexibility, and versatility might seem to be very similar concepts, there are subtle differences. Adaptability is the ability of an organization to change, depending on positive or negative feedback, either in a gradual fashion or in punctuated equilibria (Desai, 2005). In contrast we look on flexibility as a quality that of an organization, that allows it to dynamically and flexibly reorganize its strategies, people, processes and systems. Versatility is a measure by which we can judge the ability of an organization to move away from the beaten path. Can an organization that was selling books now sell music, can an organization that was brick and mortar now adapt to a clicks and mortar environment?

The world in which organizations operate is very complex and to survive in this complex web of interdependencies an organization needs to be adaptable, flexible, and versatile. Kalakota and Robinson (2003) identify three dimensions on which processes could be transformed so as to enable an organization to adaptable, flexible, and versatile (Figure 3). The first dimension addresses the degree to which the process can be digitized. At one extreme you have 0% automation i.e. it is completely manual; at the other extreme you have 100% automated and there is no manual input as such. And you have a huge continuum in between with various degrees of manual and automation. An ideal to which you want to move is a process where everything is automated. The second dimension that Kalakota and Robinson identify is the scope of process integration. How well are the processes that go on within an organization integrated together? Do the processes talk to each other seamlessly? At one extreme you have processes that are implemented in isolation, each supported by their own systems and personnel and at the other extreme you have processes that go on in multiple

organizations (your suppliers, your own organization, your customers) and these processes are integrated and operate in a seamless fashion so that people are not aware of when they are working within their organization and when they have moved out of their organization, the points of movement are unnoticeable to the participant of the process or the user of the process. In between these two extremes we have situations where all the processes within a department are well integrated. And in an even better situation all the processes within a particular business unit or a particular organization is well integrated. The third dimension refers to the type of process interactions that goes on. Are these processes only single channel (brick and mortar) or are they multi channel (Web site, brick and mortar, and call centre)? And here again it depends on the industry. But one of things we want to aim towards is a situation where we have multi channel process interactions.

Digitization	Integration	Interactions
Manual	Department	Single Channel
Semi-automated	Unit	
Completely automated	Multi-Enterprise	Multiple Channel

Figure 3: Process Improvement Dimensions (Adapted from Kalakota and Robinson, 2003)

Two mechanisms to judge an organization's ability to sense, respond, and interact through the value chain are reach and range (BroadBent, Weill & St.Clair, 1998). Reach enables an organization to evaluate how easily it can reach its stakeholders, customers, and suppliers, anywhere and at anytime. And complementarily we can ask the question how automatic and seamless is the range of avenues by which we interact with our stakeholders anywhere and

anytime. Supporting these key elements necessitates a process oriented approach. The business process factory and ARIS house of business process excellence (Scheer and Kirchmer, 2004) are attempts at coming up with a process that enables organizations to sense to changes and respond using best business practices.

The conductor's baton and the organization playing to cues from the leadership are well orchestrated metaphors, but much more goes on behind the screen that ensures the perfect performance, though an observer can only see the moving baton and hear the music. In a way seamlessly integrated operations management and information systems enable organizations to exhibit just such an effortless but excellent performance.

Shift from Decision making paradigm to Coordinated Performance

Thus the complexity of the 21st century organizations and their operations within and between organizations has called for a shift from the old decision making paradigm of operations research / management science to the new paradigm of coordinated performance of complex adaptive collectives. Once again this is reflected in the literature relating to both supply chain management and business process management. Hayes (2008) notes that the problems of coordinating the complex collaborations among networked organizations are becoming increasingly important in today's economy. Dale (2007) emphasizes this seamless collaboration between business process experts across the enterprise and beyond (Figure 4).

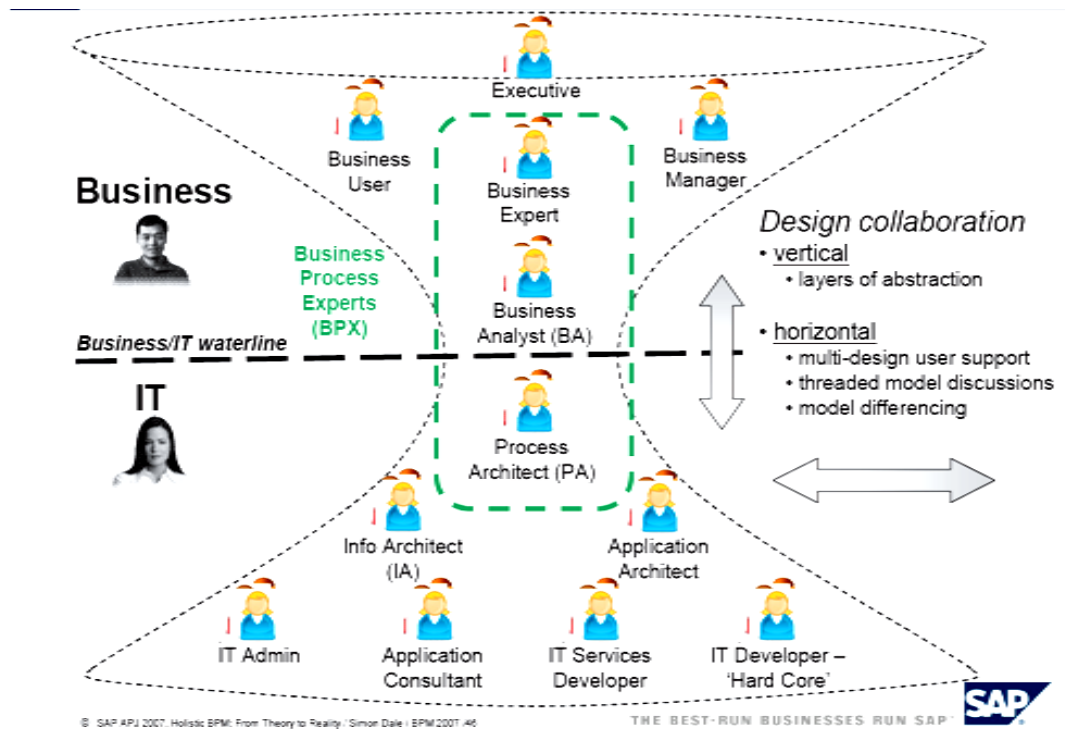


Figure 4: Collaboration is the Key (Source: Dale, 2007)

An important requirement in the design of business processes is flexibility. Research on process flexibility, however, has traditionally been focused on the intrinsic capability of a process to adapt to a new environment. Rosemann et. al. (2008) extend the research by studying the extrinsic drivers for process flexibility. They study the root causes that actually drive the demand for flexible business processes. The drivers for flexibility are found in the context of a process and include among others time, location, weather, and legislation or performance requirements. They suggest consideration of these contextual factors in the design of business processes, thereby making the processes more adaptive. In a way this is similar to the view that living systems cannot be studied separated from their environment. They also explain how context can be conceptualized, classified and integrated with existing approaches to business process modeling. It is at this juncture the discussion about the interface between operations management and information systems becomes relevant.

Metaphors, Interface and Importance of Communication

A metaphor is an imaginative way of describing something by referring to something else that has the qualities that you are trying to express (Collins, 1987). On the contrary, Lakoff and Johnson (1980) authors of the celebrated work, “Metaphors We Live By”, assert that ‘metaphor is pervasive in everyday life, not just in language but in thought and action. Our ordinary conceptual system, in terms of which we both think and act, is fundamentally metaphorical in nature’.

As noticed by Krippendorff (1993) all metaphors (1) carry explanatory structures from a familiar domain of experiences into another domain in need of understanding or restructuring, (2) require seeing some structural similarities between these two domains and (3) have entailments (Lakoff and Johnson, 1980) for the target domain they thereby organize far beyond any initial structural similarity. Sports teams, symphony orchestras, ritual dances, jazz bands among others are the metaphors used to compare organizations with, but each could be proved wrong by certain entailments that we may wish not to apply to the organization as brought out by Holmstrom (2007).

Commonly used information systems acquire metaphoric names like spreadsheet, notepad, bulletin board, desktop, paint brush, clipboard and so on. Not to mention the space metaphor or virtual world. Based on the human computer interaction, metaphors like dialogue and navigator are used. Metaphors like architecture are used to describe the design of the information system. On the other hand depending on how an information system behaves

metaphors like clock, reporter, agents or actors are used (Kendall and Kendall, 1993). While discussing virtual organizations, Gazendam (2002) considers three information system metaphors and the associated entailments. The mill, the cell, and the mind, are the metaphors. An information system as a mill is characterized by the efficient processing of large chunks of data to produce a product or output we call information. The cell metaphor is appropriate for an information system that interacts with its environment and preserves its integrity. The mind is obviously for an information system that shows the semblance of an intelligent being embodying that mind. Such an information system has capabilities like knowledge use, autonomy and learning.

Similarly brick and mortar metaphor is commonly used to refer to operations in real organizations dealing with physical products. For instance, when some students of OM were asked the question, “How would you explain a supply chain to someone who’s never heard that term?” the students have come out with interesting metaphors like, a big city, a human body, and a bunch of grapes among others (Supply Chain Metaphors, 2008).

In this paper we approach the interface between operations management and information systems with a metaphor. Interface is the overlap where two theories or phenomena affect each other or have links with each other or share boundaries between them. Interface or boundary between different fields necessitates coordination, communication, interchange, structural adjustments and above all coexistence. Among them communication becomes the crucial facilitating factor. Thus we are turning our attention to a metaphor we use to describe our communication.

Krippendorff (1993) while introducing the discussion on communication gives examples of how we express a failure in communication, like, 'Communication broke down'; 'The message got lost in the process'; 'It didn't compute'; 'She was screaming against a brick wall'; and 'There was no chemistry'. These examples have metaphoric reference to different things or fields. Major metaphors of communication listed and analyzed by him are the container, the conduit, the control, the war, the transmission, and the dance-ritual. Finally Krippendorff proposes the constructivist view of communication, "I took metaphors as windows into how their users create their understanding of communication. In trying now to understand their variety in use, I am in fact moving from an individual understanding of communication through metaphor to an understanding of this understanding of communication."

Further Krippendorff observes that individuals are cognitively autonomous, in the sense, 'their understanding of themselves, of the environment they occupy, of the language they speak, and of their communicative involvement with others always are their own.' Human communication can be invented, articulated, and altered by those realizing their cognitive autonomy. Language and especially metaphors are important in generating such realities. The conclusion Krippendorff makes is worth noting, "Let me then propose that communication becomes a social phenomenon precisely when its participants recognize or construct in their understanding of communication the understanding of communication of those they communicate with, when their communication theory recursively embeds the communication theories of Others, and when the participating communicators are thereby enabled to see themselves through the eyes of Others."

The Music Metaphor

As noted by Christos Hatzis (1998), “The image of the successful corporation as a finely tuned orchestra is by now a cliché, but it still adorns sponsorship pages of concert programs and other printed publicity. Conversely, the more a symphony orchestra resembles a corporation in its structure and operation, the more attractive it becomes to potential sponsors from the business community.” ‘With more than 1,800 symphony, chamber, collegiate, and youth orchestras across the country, America is brimming with extraordinary musicians, live concerts, and orchestras as unique as the communities they serve.’ ‘More than half a million individuals are involved with orchestras as conductors, staff members, board members, musicians and volunteers.’ ‘Being part of an orchestra encourages children to develop their talents and to experience teamwork, self-discipline, and individual expression.’ (League of American Orchestras, June 2008.) It is natural management concepts like Hoshin, employee participation and leadership training that are used to manage orchestras. (Toeplitz, 1998; Schmitz, 1996)

So what is new that we can learn from this music metaphor? It is “third order cybernetics”. While basic quality systems, work instructions and production schedules ensure the score is written down clearly and distributed so as to make individual process owners responsible for playing their part flawlessly, the communication and coordination is still the responsibility of middle management. While six sigma initiatives as a management paradigm identified and fine-tuned key processes, it still did not produce ‘the music’, though it achieved a necessary condition, of ‘fine-tuning the instruments’. Like notes are played by different performers in an orchestra to produce music, the music is really experienced in the perception of the whole composition and this is made possible by the information of the notes already played, the

expectation of the notes that might follow and the deviations around these kept within bounds that embellish the experience. In a similar manner, organizational performance is music, and notes or information alone do not make the music; operations and information flows fuse together, to produce the synergy in a seamless manner. This brings the responsibility for coordination, communication, and responding to changes to the process owners in their environment.

It is appropriate now to recall the social communication Krippendorff refers to between cognitively autonomous human beings, “when the participating communicators are thereby enabled to see themselves through the eyes of others.” In this sense the participants in an orchestra whether they are conductors, leaders, managers, or musicians or volunteers they are constantly involved in this kind of social communication and the result is what an audience admires as a flawless, excellence in execution. Interface or boundary between different fields necessitates this sort of communication. Unfortunately IS with its roots in computing and information theory, and OM with its roots in management control and mass production, both use metaphors replete with brick, mortar, machines, containers, conduits, control and last but not least clicks. Still OM experts and IS specialists by their choice of communication metaphors, could create worlds that are worlds apart.

The music metaphor is therefore about the emergence of a kind of social communication in organizations as an entailment. In an orchestra there are clear boundaries between its instrumental ensemble, with string, brass, woodwind, and percussion section. Apart from these, boundaries exist between the conductor, the board of directors and managers. When the social communication emerges during a performance we don't see the boundaries as a

coordinated co-existence of oneness is exhibited. One of Deming's 14 points is “Break down barriers between departments”, this does not mean removing the identities of these departments or their individual existence, but to exhibit such an organizational oneness.

Conclusion

In this paper we have discussed the evolution of operations management and information systems from their early days in management control of mass production to the present-day collaborative supply chain networks and business process management. Metaphors create the world we live in. So their importance in communication and our understanding of understanding are used to reinvent an old metaphor of music to bring out new entailments. Krippendorff's (2003) constructivist interpretation of social communication is used to bring out the “third order cybernetics”, which exhibits organizational oneness through the social communication that emerges at the interface between IS and OM.

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