BY *WILLIAM B. ROUSE* AND *MARIETTA L. BABA*

ENTERPRISE TRANSFORMATION

Fundamental enterprise changes begin by looking at the challenges from technical, behavioral, and social perspectives.

A variety of forces are driving change in the world. Globalization has become incessant, with outsourcing and offshoring on the agendas of most large enterprises. The service economy is becoming increasingly dominant in developed economies, with knowledge assets playing a greater role relative to physical and financial assets. Security has become a primary objective crossing virtually every sector of the economy and society.

At the same time, according to Thomas Friedman [37], the world has become flatter. Information and communications technologies have enabled developing economies to quickly progress on the path toward equity with developed economies. For example, China and India graduate one million engineers per year while the U.S. graduates 65,000. Compounding such disparities over years and decades will undoubtedly undermine the competitive advantages of developed countries—unless we change the nature of the game.

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However, changing the nature of the game will require fundamental transformations of many enterprises in industry, government, and academia. Business process improvement, or even business process reengineering, will not be sufficient. It is not just a matter of getting better at what we do—everyone is doing this. It is an issue of doing new things in new ways. This will require fundamental change. Unfortunately, we will not necessarily succeed with such changes. Indeed, most historical attempts at fundamental change have failed [84, 85].

This article summarizes an emerging theory of enterprise transformation—stated in terms of value deficiencies, work processes, decision making, and social networks. We then consider transformation from a technical perspective—the technical problem to be solved—and then contrast the technical perspective with the socio-technical point of view that emphasizes the contextual, behavioral, and social aspects of fundamental change. Finally, we consider the implications of this contrast.

Theory of Transformation

Enterprise transformation is driven by experienced and/or anticipated value deficiencies that result in significantly redesigned and/or new work processes as determined by management's decision-making abilities, limitations, and inclinations, all in the context of the social networks of management in particular and the enterprise in general [86, 87].

More specifically, enterprise transformation is driven by perceived value deficiencies relative to needs and/or expectations due to: experienced or expected downside losses of value; experienced or expected failures to meet projected or promised upside gains of value; desires to achieve new levels of value, for example, via exploitation of market and/or technological opportunities. In all these cases, there are often beliefs that change will enable remediation of such value deficiencies. Change can range from business process improvement to more fundamental enterprise transformation.

In general, there are three broad ways to approach value deficiencies, all of which involve consideration of the work of the enterprise. One can improve how work is currently performed, perform current work differently, and/or perform different work. The first choice is basically business process improvement. This choice is not likely to be transformative. The second choice often involves operational changes that can be transformative depending on the scope of changes. The third choice is most likely to result in transforming the enterprise. This depends, however, on how resources are redeployed. Liquidation, in itself, is not necessarily transformative.

We can characterize the work of the enterprise in terms of a hierarchy of purpose, objectives, functions, tasks, and activities. Transformation of work can be pursued at all levels of this hierarchy. Changing the tasks and activities of the enterprise, by themselves, relates to business process improvement. In contrast, changing the purpose, objectives, and/or functions of the enterprise is more likely to be transformational. Such changes may, of course, cause tasks and activities to then change. Thus, change at any level in the hierarchy is likely to cause changes at lower levels.

It seems reasonable to hypothesize that the higher the level of transformation, the more difficult, costly, time consuming, and risky the changes will be. For instance, changing the purpose of the enterprise is likely to encounter considerable difficulties, particularly if the extent of the change is substantial. In many cases, such change has only succeeded when almost all of the employees were replaced [84].

Attention and resources are also central to the theory of enterprise transformation. This includes both external variables related to customers, competitors, demand, interest rates, and so on, as well as internal variables such as resources and their allocation among work processes. Transformation involves allocating attention and resources so as to anticipate and adapt to changes of external variables, and cultivate and allocate resources so as to yield future enterprise states with high projected value with acceptable uncertainties and risks. Thus, the ability of an enterprise to redeploy its human, financial, and physical resources is central to the nature and possibility of transformation.

Value deficiencies and work processes define the technical problem of enterprise transformation. To fully understand transformation, however, we need to understand both the problem and the problem solvers. Mintzberg's classic paper [55] serves to shatter the myth of the manager as a coolly analytical strategist, completely focused on optimizing shareholder value using leading-edge methods and tools. Simon [97, 98] articulates the concept of "satisficing," whereby managers find solutions that are "good enough" rather than optimal. Another important factor is the organizational environment can be rife with delusions that undermine strategic thinking [85]. Managers' roles as leaders, rather than problem solvers and decision makers, are also central to transformation [40, 48].

Beyond the individual skills and abilities of managers and management teams, the "social networks" both internal and external to the enterprise can have enormous impacts [21, 41]. An important distinction is between weakly and strongly connected networks. It has been found that weakly connected networks are better sources of new information and novel ideas. The resulting big-picture perspective may better inform the nature of transformations pursued. In contrast, strongly connected networks are better at implementing change, at least once sense has been made of the anticipated changes and new meaning has been attached to these changes.

PERSPECTIVES

Here, we elaborate on two perspectives on transformation: the technical problem to be solved and the behavioral and social context and mechanisms of transformation.

Technical perspectives. An enterprise may experience or anticipate value deficiencies for a variety of reasons. It may be that competitors are now providing similar products and services for lower prices, or higher quality products and services for the same prices. It may be that technology and market trends portend this situation, although it has not yet emerged. Perhaps the enterprise hopes to take advantage of these trends before other enterprises can act.

The possibility of value deficiencies begs the question of the nature of value. It might involve standard functionality or services with higher quality and/or lower costs. Or, it might involve new functionality or services that others cannot provide at reasonable prices. In either case, it involves existing or potential customers who perceive value and see a particular enterprise's offerings as deficient, adequate, or superior.

How an enterprise creates value is central to this discussion. This includes the ways in which one creates new functionality, enhances its quality, and decreases its costs. This may include contributions from marketing, engineering, manufacturing, and so on. There are also likely to be important enablers such as finance, human resources, product support, and so on.

There are often activities that do not create and/or enhance value. Some of these activities may be required for regulatory reasons. Others may reflect housekeeping needs. Frequently, however, there are activities for which there is no justification other than they have long been performed and seem to be needed. Such activities are strong candidates for elimination, enabling the reallocation of resources to value-added activities.

Value is created by work that is accomplished via work processes. Value deficiencies can be remediated by redesigned or new work processes. Work processes can be represented from several perspectives. Engineering tends to see work in terms of the flow of physical items that are machined, assembled, and so on. Computing sees work as the flow of information to support the activities associated with work. Architecture views work in terms of the flow of people through built environments.

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Of course, all of these views are valid and useful. The key question is how these views come together in processes that create or enhance value. We also need to understand how these processes can be improved and supported to remediate experienced or anticipated value deficiencies. For example, it has been found that decision-making processes can be substantially improved by making them evidence based or data driven, thereby enhancing the quality and timeliness of resource allocation decisions, for example.

Technologies can be both drivers and enablers of enterprise transformation. More specially, many people see IT as both the driving force behind change and as the enabler of change. Examples include knowledge management, collaboration technology, and, increasingly, identity management.

The technical issues concern not how to make these technologies work, but how they are likely to change the ways enterprises accomplish work. The need to work across time zones and cultures, share information and knowledge, and assure both security and privacy are central issues in both how we create and enhance value, and how our work processes support value streams.

Social and behavioral perspectives—The socio-

technical systems concept. All approaches to closing the gap between potential value and projected value require consideration of the work of the enterprise, and transformation of the enterprise depends upon work process change in one form or another. While strategic and operational choices by management are key in determining how work process change will be approached, there is another dimension of such change that is vital to consider—the nature of human work groups and their interaction with work processes; that is, how people are organized to accomplish work, how they interact with one another and with technology, and how they conceptualize work and understand the meaning of their actions.

The basic idea of a socio-technical system expresses the notion that work organizations are not solely technical or rational systems designed to accomplish managerial goals, but they also embed natural or social systems whose characteristics extend beyond the rational and thus connect them with all other human social groups, for example, complex goals and informal social structures. Only through the mutual interdependency of its technical and social dimensions is an organization capable of co-producing value for stakeholders. An implication is that work process change must consider both technical and social dimensions together, and make specific provisions for "jointly optimizing" changes in these dimensions, such as, finding the best overall solution that considers their interactions simultaneously. Otherwise, design solutions for work process change are likely to be sub-optimal.

Historical background. The socio-technical systems concept as a framework for work process change arose from research conducted in the Yorkshire coalfields by the London-based Tavistock Institute after World War II [106, 107]. At that time, it was assumed that the technical and social aspects of work organizations were independent phenomena that "obeyed different laws" (that is, the physical and human sciences, respectively). Once situated in a work context, however, these phenomena were believed to become correlative and interdependent, in that each required the other in order to transform organizational inputs into outputs. The independence of technical and social dimensions meant that the requirements of these two elements could not be met fully and simultaneously in the same context (a "coupling of dissimilars," according to Trist [107]).

Therefore, "joint optimization" was considered the only effective solution, which meant that alternative designs that provided different configurations of technical and social elements should be considered, and the one that produced the best result overall should be selected. Within the framework of this theory, Fred Emery developed many of the key aspects of socio-technical systems methodology, including the first generalized model for separately identifying technical and social elements [30].

One of the Tavistock Institute's most significant contributions to work process change was its discovery of the semiautonomous work group as a fundamental building block for organizations situated in turbulent environments. The socio-technical theory of the efficacy of this type of group is based on the cybernetic concept of self-regulation. In a traditional technocratic bureaucracy, the parts (jobs) are designed to be as simple and easy to replace as possible (that is, parts are redundant), but this type of design requires an elaborate control mechanism and it is not flexible or adaptive in a rapidly changing environment. An alternative design, based on redundancy of functions, provides each group member with a multi-skilled role and endows the group with a wide repertoire of activities that enable adaptive responses to change [79]. Since the group is self-managing, fewer supervisors are required.

Toward a reframing of classical socio-technical systems theory. During the 1970s and 1980s, empirical research in the social constructivist tradition demonstrated that technological and social systems co-evolve in a complex, dynamic process in which all that is

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technical is socially constructed and all that is social is technically constructed [13]. Characteristics observed in any given technical factor may result from influences derived from a social factor, which in turn may have been influenced by earlier forms of a technical factor, for example, see Bijker's [13] analysis of the development of bicycles, bakelite, and fluorescent lighting and Nobel's [63] discussion of the development of numerical control machines.

A fundamental premise of socio-technical systems theory is that technical and social systems in a work organization are independent of one another and obey different scientific laws. But mutually causal technical and social elements invalidate classical socio-technical systems methodology, which is predicated upon identifying these as separate factors and then mapping their interactions. If the factors are mutually causal, as argued by social constructivists [13], it is not possible to separate the technical and social elements. Consequently, socio-technical systems methodology (and practice) unravels. An implication is that the socio-technical systems approach requires rethinking within the context of current social theory.

Rather than attempting to identify discrete technical and social elements of a socio-technical system, Bijker [13] suggests we conceptualize a "socio-technical ensemble," which is more than a combination of technical and social factors, but a thing-in-itself, sui generics. To cope with the complexity of such ensembles, Bijker encourages us to think in terms of technological frames that distinguish foreground and background factors specific to each case.[1] Technological frames are heterogeneous assemblies of elements that shape the interactions of all relevant factors and actors and, in so doing, influence the trajectory of technological and social outcomes. Depending upon the case, salient elements may include goals, problem-solving strategies, requirements to be met by problem solutions, theories current at the time, tacit knowledge, testing procedures, design methods and criteria, users' practices, exemplary artifacts, and other elements. (No two frames will be exactly alike; thus methods must permit relevant factors to emerge from the context.

Empirical research has shown that people (users) continue to modify the meanings, properties, and applications of technology even after it has been developed, and especially when it crosses organizational and cultural boundaries [74]. Thus, the configuration of a technological frame within one cultural context might be altered quite dramatically in a different context, or the meanings of elements in the frame might be unstable across boundaries [8]. This observation has increasing relevance for technology that is reconfigurable, and for enterprise transformations that are global in scope.

The meanings inscribed in technologies by designers, users, and other social groups draw their salience from a particular cultural context. When this context changes, the meanings may morph in unexpected ways, and the seeming closure (consensus about the meanings and practices surrounding an artifact or system) comes undone. This is what elevates risk in global technology transfer [17]. An implication for enterprise transformation is that methodologies for work process change may require modification when implemented in different cultural contexts.

Dynamic modeling methodology for socio-technical systems. A dynamic modeling and simulation approach to socio-technical systems analysis and redesign addresses several of the challenges posed by social constructivist theory, and is applicable across a wide range of goods and services settings. One relevant approach is that of Oliva and Sterman [70], who have adapted Senge's [93] organizational learning and adaptation theory to model the "interactions of physical and institutional structures with boundedly rational decision-making."

Their formal modeling approach meets the theoretical requirement of producing a heterogeneous framework representing the interaction of a diverse array of technical, economic, social, and psychological factors that flow from the situation, rather than assuming a priori categories of technical and social phenomena. Their dynamic model of customer service erosion in financial institutions captures physical flows, institutional structures (for example, managerial goals), employee behaviors, and cognitive factors (for example, perceptions). The method is empirically grounded, and can be tested with ethnographic, historical, and/or real-time data. One of the great advantages of this method is its ability to represent joint optimization through rigorous formal modeling and simulation, permitting consideration of various design alternatives and their consequences. Simulation delivers a policy roadmap for achieving enterprise goals, targeting those areas where key changes are needed.

Agent-based modeling (ABM) represents a complementary approach that may facilitate work process change in complex adaptive systems where organizational behavior is emergent (for example, as in cases of organizational learning). Insights may be gained

[1] It must be noted that Bijker [13] is concerned with the development of new technology, while socio-technical systems theory focuses on technology-in-use. These differences in foci may explain in part their contrasting conceptions of technology. However, in historical perspective, technology is not frozen after development, but continues to evolve over time as a result of contextual influences [74]. Thus, the two perspectives should complement one another.

through ABM where interactions among autonomous agents (human and/or non-human) generate patterns that cannot be reduced to the properties of the agents themselves (that is, emergent behavior). ABM can generate useful policy guidance for enterprise transformation in service contexts by engaging professional employees in the design and refinement of such models, and in the creation of recommendations for control, mitigation, and testing of risks or other key factors modeled by the tool [14].

Conclusion

Research in enterprise transformation must yield both understanding of fundamental change and the methods and tools that can make change possible. We firmly believe this will come from taking multiple perspectives on the problems of change—what drives it, what enables it, and what factors facilitate and hinder its success. This article has presented two broad and complementary views of fundamental change, one drawn from a technical analysis of the problem and the other based on a socio-technical perspective. These views, and many hybrids in between, will provide a foundation for success.

The contrast of these views raises important issues concerning what to measure, how to collect data, and what tools are needed to model and manipulate these findings. These issues present considerable challenges, both from a practical perspective and in terms of negotiating the cultural silos of academic disciplines. Nevertheless, we feel that addressing and moving beyond these challenges are central to understanding and enabling fundamental change and providing a strong basis for competing and succeeding in our inevitably flattening world. C

A complete bibliography of the literature used in the course of preparing the articles for this special section on services science is available on page 33.

William B. Rouse (bill.rouse@ti.gatech.edu) is a professor in the College of Computing and the H. Milton Steward School of Industrial and Systems Engineering, Georgia Institute of Technology, Atlanta. He also serves as executive director of Tennenbaum Institute for Enterprise Transformation.

Marietta L. Baba (mbaba@msu.edu) is dean of the College of Social Science and a professor of anthropology at Michigan State University, East Lansing, MI.

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