Human Resource Practices and Evolving Technology in a Production Environment

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Abstract

A key challenge in today's dynamic business environments is the rise of new technology driven paradigms in production environments. Many studies have focused on the best ways to successfully implement new technologies in a production environment. However, the high failure rate of these implementations suggests that deployment problems rest more with the misalignment of people and technical systems. The purpose of this paper is to examine the role of human resources (HR) practices in an evolving technology driven production environment. This paper, first, examines the role of HR in a production environment characterized by the rapid introduction of technologies. Then, a theory-driven approach to leverage HR practices and successfully introduce new technologies is discussed. Lastly, the applicability of this theory-driven approach to the successful implementation of a Just-in-Time (JIT) system is investigated.

HR Practices and Technological Change in Production Firms

In this section, the broad impact of technological changes on job design and HR practices in a production environment are discussed. Manufacturing has traditionally been considered to be a reactive function that reacted to customer demand. In the early 1900s, the classical management school, applying scientific principles to management focused on the efficiency of tasks undertaken by the workers. The industrial engineering/psychology school, with time and motion studies, reduced human workers to nameless roles in the quest for organizational efficiency. The rise of the human relation school a couple of decades later accorded a prominent role to the role played by workers in the operation process. This focus provided a thrust to research that emphasized the role of employee attitudes on performance and performance on employee behaviors (Judge et al., 2002). The 1950s witnessed the rise in the importance of the concept of quality as workers were given a prominent role in ensuring product quality by giving them greater accountability and responsibility for the maintenance of quality (Feigenbaum, 1956). Thompson (1967) through his interdependencies and technology links illustrated that different technologies and interdependencies give rise to different types of organizational forms and roles and hence job designs and desired skill sets.

Till the early 1970s, with a stable business environment and the continued use of mass production techniques, firms were content to follow specialization in job designs, and command and rule management of their workforce. However, increasing foreign competition in the 1970s and the introduction of new techniques like JIT put great emphasis on worker skills and

capabilities, and the safety of workers (Sugimoria et al., 1977). Total Quality Management (TQM), with its focus on continuous improvement processes, relied to a large extent on human elements for its successful implementation (Black and Porter, 1996). In the 1980s, the rise in the use of information systems such as manufacturing resources planning (MRP II) and computer integrated manufacturing (CIM) witnessed a change in the traditional skill requirements of workers change as job designs changed to accommodate the introduction of these new systems. In tune with the socio-technical nature of these implementations, Kelley (1990) suggests that job design changes arise out of institutional and organizational forces such as economic forces and labor management relationships that follow the introduction of new technological innovations.

The role of the manufacturing function around this time shifted from a reactive to a more proactive role. Wheelwright and Hayes (1985) outline four stages that firms go through on their way to achieving competitive advantage. In the first stage, 'internally neutral', the negative effects of manufacturing are neutralized. Competitive parity is established in the 'externally neutral' second stage. In the third stage, 'internally supportive', the requirements of internal functions are taken care of through integration. Lastly, in the 'externally supportive' stage, manufacturing is honed as a competitive weapon. Their study suggests that firms typically languish in stages 1 and 2 and only a crisis atmosphere drives them to stage 3. Firms tend to move along sequentially and generally they find it difficult to skip any stage. Firms that are in the first three stages are characterized by a hierarchal way of functioning and use the traditional command and rule method for managing their work force. However, firms that have evolved to stage 4 need to abandon their traditional HR approaches as these types of firms tend to work through teams.

In the past decade, the rise in the adoption of systems such as Enterprise Resource Planning (ERP) and E-commerce systems have resulted in dramatic changes in job designs and human resource practices. The increasing sophistication of these technologies has forced firms to adopt a social system view of their organizations to leverage their employee skill-sets from information gathering and knowledge dissemination (Gharajedaghi and Ackoff, 1984). In tune with this social system approach, Huber and Brown (1991) tie six HR practices to nine socio-technical principles to argue that HR practices in conjunction with socio-technical principles can provide the social change necessary for the introduction of new technologies. Researchers such as Barley (1986) consider technology as a social process and not as a physical entity that needs to be managed in parallel with the implementation of technological systems. Snell and Dean (1991) support the above view by indicating that the implementation of integrated manufacturing systems requires changes in human practices and that these human practices are nothing but exercises to build the human capital of the firm. The increasing use of the Internet and the incorporation of the e-commerce technologies into business models, the availability of cheap telecommunication facilities, and the heavy usage of outsourcing to cut down on backroom operations has brought fresh challenges to designing jobs, upgrading the skills of workers, and the proactive management of human resources.

Theory-Driven Approach to Align HR Practices and Technological Implementations

In this section, the use of a theory-driven approach to using HR practices to manage technological changes are discussed. To examine the role of HR practices in the context of

introduction of new technologies in a firm, key HR practices can be tied to a theoretical framework that would help facilitate the implementation of new technologies. Huber and Brown (1991) suggest the use of a socio-technical framework on which human resources practices can build on to achieve social change. A synthesis of literature suggests that key human resources practices involved in the implementation of new technologies are human resources planning, employee relations, job analysis and design (Huber and Brown, 1991; Kelley, 1990), learning, training and development (Stratman and Roth, 2003), selective staffing, development of performance appraisal, equitable rewards (external and internal) (Snell and Dean, 1991). These key human practices can be matched against the socio-technical framework as socio-technical principles encompass a wide array of criteria that can be used to analyze the necessary changes in HR practices essential for the implementation success of new technologies.

The socio-technical principle of information flow assumes that information should be available at the source or the origin. This would have the effect of giving instantaneous feedback to employees and may place undue stress on the employee. The socio-technical principle of multi-function could result in enlargement of job scope and hence change in selective staffing, job analysis and design, performance appraisal, training and development, and learning activities. The socio-technical principle of compatibility examines the long-term fit of implemented systems. This would require firms incorporating this into their HR planning activities through training and development so that employees are aware of wider organizational picture. The socio-technical criterion of minimal critical specification advocates that goals should be set and employees be given the freedom to work. This provides greater autonomy and freedom to employees to carry out their tasks and necessitates appropriate changes in job analysis and design and reward systems. The firm's top management should also ensure that employees realize this autonomy is bound specifically to the task. The quality of values socio-technical principle looks at the improvement in the quality of work life. This may not necessarily translate into job satisfaction for the employees. The socio-technical principle of social congruence emphasizes teamwork. This may threaten existing, hierarchical social relationships. Hence, employees need to be trained to work as part of teams, suitable performance appraisal and reward systems have to be designed (team versus individual).

Application of the Theory-Driven Approach to a JIT Implementation

In this section, the HR practices-socio-technical framework is discussed with respect to the implementation of JIT systems. Gherajedaghi and Ackoff (1984) suggest that firms be viewed as social system models that promote understanding (building on information and knowledge) and advocates continued employee learning as the key to developing understanding. Huber and Brown (1991) argue for using HR practices to leverage socio-technical principles and bringing about social change before or in parallel with the introduction of new technologies so as to ensure successful adoption of these systems. In the implementation of JIT systems, Germain and Droge (1998) suggest that JIT knowledge (JIT task scope) leads to JIT Process (JIT work integration) and Organizational Design (Specialization, Decentralization, formal performance control). JIT knowledge refers to the amount and variety of knowledge that is possessed, JIT work integration refers to the integration of functional processes. Their findings suggest that JIT knowledge forms the base which drives JIT work integration and organizational design. So firms

implementing JIT systems should make sure that they leverage their existing or acquired knowledge about JIT and then make changes to workflow integration and organization design.

The socio-technical compatibility principle may have an impact at the strategic level in terms of the fit of the JIT systems with the long-term business/technology policy of the firm. This necessitates that management ensures that all the hierarchy levels buy into the holistic big picture fit of JIT with their long-term mission. Traditionally information flow has been concentrated at the top of the organizational hierarchy. However, with the Jidoka principle under JIT, employees are given the freedom to stop defective products/lines the moment that it is brought to their notice (Sugimoria, 1977). The socio-technical information flow principle has the effect of pushing information down to the lower hierarchy levels. The socio-technical principle of multi-function corresponds to the key JIT practice of multi-function employees (White and Ruch, 1993) and results in the enlargement of the scope of the job. This brings issues of skills upgrading, learning to the fore to handle the additional new skill sets that accompany this increase in job scope. The socio-technical principle of minimal critical specification gives freedom and autonomy to employees. In a traditional production environment efficiency considerations usually dictate that workers specialize in repetitive, mundane tasks. Under JIT, however, emphasis is focused on worker's capabilities (Sugimoria, 1977) which can be developed and enhanced through training and development. The socio-technical principle of social congruence emphasizes teamwork. In traditional production settings, tasks are individualized and specialized taking efficiency considerations into account. JIT and its associated Kanban system emphasizes teamwork. Every process is dependent on other processes so the whole system has to work in a synchronized manner to achieve defect free and waste free performance. The above socio-technical principles considered along with their associated human resource practices and job designs activities that would ensure the build-up, maintenance, and enhancement, of JIT knowledge capital which could be then leveraged upon to drive JIT workflow integration and organizational design.

Conclusion

The findings from this study suggest that firms should not treat human and technical systems as separate entities. Firms should consider making changes to their social systems to parallel the technical changes brought about by the introduction of new technologies. Firms that are able to achieve an integrated human-technology fit through leveraging of their HR practices will obtain superior performance. The human-technology fit approach to successful system implementations needs to be empirically tested to ensure the validity of the study's findings.

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