

# Digitizing work – Organizational Work-Integrated Learning through Technology Mediated Courses in Manufacturing Industry

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**Keywords:** workplace learning, work-integrated learning, technology mediated courses, manufacturing industry

## Abstract

The manufacturing industry is continuously facing global competition and customer demands which impose the need to knowledge development to manage changes and long-term business goals. Continuous and lifelong learning is often seen as processes that support competence development and learning integrated within work. In this paper we focus on processes of learning within the manufacturing industry and how learning initiatives as technology mediated courses (TMC) can support learning from the workplace learning needs. Is learning initiatives integrated in work considered as means for strategic business goals? Can TMC be an important learning tool for support of knowledge creation?

The study is performed through interviews with production managers and human resource managers with eight manufacturing industries in the western part of Sweden. Through the study we try to understand what knowledge the industry needs to evolve and achieve effective production. We also study the readiness for technology mediated learning.

Early results show that the industries have interest in learning initiatives such as TMC and are willing to co-produce knowledge together with universities. We present a matrix model that interlinks business goals and the industries current use of technology mediated learning tools. However, the experience of using tools such as web conference systems and learning management systems for learning initiatives is diversified.

## Introduction

Today the technological development in the manufacturing industry is very fast, causing that educated engineers within the manufacturing industry must struggle to keep up with the progress of knowledge. Lean organizations means that the engineering graduate has a relatively unique role within the company and must seek peer support and knowledge outside the own organization. To meet the challenges that the industry deals with as efficacy, concurrency and high technology demands, learning initiatives integrated in the workplace is supposed to create new knowledge (Baert and Govaerts, 2012; Henriksen and Rolstaås, 2009). Ellström (2001) as well as Döös (1997) highlight the need for more studies that focus on insight of learning conditions of technological systems within automated production.

We present performance management as a possible paradigm that can shed light on conditions for learning within organizations (McKenzie, 2001). To be able to perform in everyday work and deal with advanced problem solving in the context of the manufacturing industry, learning and competence development initiatives is supposed to create new knowledge. Identifying knowledge in relation to performance of the production plant is often considered as task for educated engineers and managers. Performances also tend to prepossess how knowledge processes and learning initiatives can be identified and it may affect how actions for learning are treated and how to deal with learning initiatives. The social culture in the workplace as well as the pressure of the surrounding world also influences conditions for learning as well as what to be learnt and how.

However, learning can take place on different organizational levels but is foremost an individual process (Illeris, 2003). Boundaries between individual learning and organizational learning can also be discussed from different disciplinary backgrounds which give diverse answers to local learning processes (Engeström and Kerosuo, 2007). In this paper we discuss learning integrated in work, i.e. work-integrated learning. According to Edwards & Wajcman (2005) there are inherent tensions in organizations between learning, processes of defining business goals and how they are to be pursued. Our interest is therefore to understand critical aspects and relations between individual learning and organizational learning. Before we initiate and implement technology mediated courses (TMC) we need to consider the knowledge demand among the manufacturing companies as well as their readiness for learning. Is learning initiatives integrated in work considered as means for strategic business goals? Can TMC be an important learning tool for support of knowledge creation?

## **Methodology and case description**

The project Expert competence for Industrial Informatics and Production technology, EIIP is managed by University West in Trollhättan in collaboration with Skövde University, located in the western part of Sweden. The overall aim is to study the manufacturing industries demand of knowledge on master levels within the field of production technology. The industries involved are a mix of middle sized and large manufacturers of vehicles, engines and doors.

In this paper we use research data from eight vocally recorded two hours in-depth interviews sessions. We have used a semi-structured interview guide grouped in five categories; Employee background, Areas and levels of competence among employees', Currently used digital forms for internal education, Knowledge and education as tools for effectiveness and innovation, and Cooperation with academy. During the interviews with the production manager and human resource manager we discuss knowledge and learning for engineers and also strategies for work-integrated learning initiatives. The aim during these sessions is to understand how the managers circle and grasp the core of knowledge that engineers will need now and in the future. Also relations between individual learning and organizational learning are discussed. The findings from the interviews are analyzed through theories of performance management and organizational learning. Within the project we will design and offer technology mediated courses (TMC) in flexible forms that will be integrated within the workplace. Knowledge in the courses can be co-produced among the collaboration partners, i.e. participating universities, companies and research institutes.

## **Theoretical framework**

We are part of the new economy in a network society in the information age. Through social, technological, economic and cultural transformation, work and social life is dramatically changing and there is an ongoing process that continuously shapes our workplaces (Castells, 2010). The manufacturing industry is facing pressures from the global market, for example to adjust the production system to consumer demands and producing high qualitative products. As a consequence it seems as if employees and organizations need to adapt to changes that imply short term flexibility instead of long term perspectives, access to expert knowledge and high performance qualities. Changes within the working life enforce fragmentation of routines, which means that work is no longer organized by routines (Sennet, 1998) rather on flexibility. "To be flexible is to be adaptable to changing circumstances and yet not broken by them" (Sennet, 1998, p. 49). The tension between routines and flexibility affects individuals

as well as the whole organization. Routines may support long term goals and bring stability to work but do not emphasize quick actions to market demands. Flexibility on the other hand stresses short term actions and reactions to immediate consumer needs, but may affect long term business goals in the wrong direction. It is a challenge for workplaces to organize work and working conditions so managers and individual employees can be flexible and handle unpredictable situations quickly as market shifts and at the same time balance long term goals. In this view contemporary organization as manufacturing industries may benefit from development of knowledge and learning initiatives that aim to support continuous learning processes integrated in workplaces.

### **Effective work**

There are difficulties to achieve business goals in an effective way and at the same time handle change and learning, because it is partly contextual, as are the demands placed on individuals. As outlined above, Sennet (among others, see e.g. Giddens, 1999) describes the transformation of work on an overall and abstract level and identify current conditions of the world of work in contrast with past situations. Edwards & Wajcman (2005) on the other hand, present a different approach with connections and contradictions with a more local focus on every day work practice, individual conceptions of work and individual knowledge and learning. They draw connections between defining the structure of work and how individuals make sense of them as fundamental for work. Further, they argue that work should be based on social relationship where employees actively can shape their own practices and cultures within material contours. Though, workplaces evolve into a central location for realization of employee's personal identity and culture, which Du Gay (1996) also brings up. Identity is something contingent, meaning it is never fulfilled because it relies for its existence upon something outside of itself. He gives examples of contrasts (or shifting fashions) where the worker's subjective experience of work is of central importance, for example to make work more meaningful for those performing it, while simultaneously increasing profitability.

Edwards and Wajcman (2005) also stresses the contradiction between employers need to exercise control over employees while at the same time securing their cooperation in the performance of their work. In the employees' perspective, it is not all about making profit, but also to develop identity and means of self-actualization through work. The essence of capitalism is to run market driven businesses that are profitable and effective, which Du Gay also bring forth (1996:55) by quoting Miller and Rose (1990:19) as follows: "...the government of economic life in the twentieth century has entailed a range of attempts to shape

and regulate the relations that individuals have with society's productive apparatus. From 'scientific management' through 'human relations' up to and including the contemporary programs of 'excellence', the activities of individuals as employees have become 'an object of knowledge and the target of expertise, and a complex web of relays has been formed through which the economic endeavors of politicians and businessmen have been translated into the personal capacities and aspirations of subjects.'

Du Gay describes this as if employees' identities have been made up by exploring the contemporary management discourse of 'excellence' and its relationship to the political rationality of 'enterprise'. It is a tension between these two parts, the employees' side, the human subjective and the enterprise with external facts, which Du Gay means is linked together into an operating network.

### **Performance management**

To understand what performances means for learning and how performances can be managed (and if it can?) we discuss these concepts. Performance and individual development cover many areas and discourses. Performances can be about human performance but it can also deal with measurements of productivity to indicate the degree of performance. To better understand and describe performances and learning in business organizations, performance management can be used as an overall theoretical approach McKenzie (2001).

McKenzie (2001:56) describes Performance Management as "a gathering of diverse conceptual models, discourses, and practices. Its passage to paradigm occurs through models, schools as human relations, systems theory, information processing and decision making, organizational development, and more recently, the peak performance cult composed of theorists and practitioners of excellence, high performance, and maximum performance."

According to Edwards & Wajcman (1996) performance management can be used to assess how employees' obligations are established and how they experience the workplace. People are active agents creating systems and institutions; meaning that people have choices, and through interaction and communication they react and counteract to formally stated rules.

Thrift (2005) defines reflexive business knowledge as performative. It is based on specific training skills of interaction and presentation and is a social activity. Edwards & Wajcman (2005) then describes performance management as a kind of a tool or method for objectives to be reached, meaning that they are specific, measurable, achievable, realistic and time-bound. Those are more like a formalized standard for how to follow up work. In conclusion,

performance management is a way of managing inherent ambiguities and deal with a larger process rather than practice control.

In the space between individual work and organizational efforts performance management can be used to extend beyond individual employees' situation (McKenzie, 2001). The shift in focus has gone from an emphasis on individual's performance contributing to the organization, into how the organization can contribute to individual's performances, empowering them and support creative participatory interactions. It has according to McKenzie, been a larger movement of generalization, a generative process that has gathered a range of practices and discourses under the term "performance", including an overall organizational performance. Furthermore, McKenzie, suggest several different models as underlying. In all of these models, the perspective is on performance management as a generalized model and composed of both social and technological performances where high performance organizations are decentralized, flexible, dynamic, open and naturalistic systems.

The most important one for this study is perhaps Organizational Development, OD, where humanizing and cultural aspects on performance and management of performances are focused. OD seeks to create high performance organizations through education and development, (McKenzie, 2001:77), and is therefore often called organizational learning. "OD seeks to create high performance by continuously stimulating learning at all organizational levels. Not only can individuals learn so too can organizations."

This emphasize that learning is facilitated in various ways like evaluation of performance behavior, that organizations can be creative and self-transformative dealing with a variety of models and methods and support collaboration among employees'. Performance Management is focused on efficiency challenges, but can also be built on values like diversity and creativity and not only on control and measurements.

### **Organizational learning**

If we argue that performances could be understood with the lens of Mackenzie's paradigmatic argumentation of performance management, continuous learning and organizational learning is often used as a tool or a task to be employable. Employability is not only about those who are unemployed, but also a responsibility for business organizations to maintain and develop high qualified knowledge among engineers. In that sense, the individuals and the organizations share a common interest (Garsten & Jacobsen, 2011). Another concept that emphasizes learning in and between individuals and organizations is the concept organizational learning presented by Argyris & Schön (1996) among others. Organizational

learning also popular in the management discourse (Edwards & Wajcman, 2005) can be interpreted and understood from different perspectives as management, learning and information technology perspectives.

From a management perspective, organizational learning can be defined as “a set of differentiated skills, complementary assets, and routines that provide the basis for a firm’s capacity in a particular business” (Teece, Pisano & Shuen, 1990). From a learning perspective, organizational learning is traditionally considered to be on an individual or on an organizational level. On the organizational learning level, the individuals need and identity could be put aside, and the organizational perspective is the one that counts in a normative and practice-oriented way, where patterns of behavior are described into formalized objects along with specifications and instructions (Argyris & Schön, 1996). Within this view learning is treated as an impersonal agent. On the other hand, if we take the individual learning perspective, we know that it is people who have knowledge, can draw lessons from experience and reflect upon them as a base for new knowledge creation (Edwards & Wajcman, 2005). Knowing and learning is cohesive and practitioners’ knowledge is found within themselves and only tangible when performing every day’s work activities.

Information technology can be integrated within organizations as a communication tool to support learning. This can enhance the organizational learning through fast information and knowledge sharing on all organizational level. Simple work-related problems can be solved or discussed through use of IT as a learning tool and organizations with high learning capabilities can increase their capacity to learn from experimenting with IT (Robey, et al., 2000).

There are consequences of using IT for organizational learning and digitizing work for individuals and businesses. As discussed before, there is a forcing power for employees’ to update their competences, personal skills as “right” attitudes, flexibilities, and ability to lifelong learning. A business organization should in that sense be open and part of a network society with flexible production and flexible specialization enabling knowledge to the company’s employee’s on an everyday basis, timeless and reachable (Castells, 2010). Knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information (Davenport and Prusak, 1998:5). This knowledge is often embedded in documents or repositories as well as in organizational routines, processes and norms. Knowledge that is important to individuals to learn and understand and make use of in the

production. Information technology facilitates the process by sharing knowledge between users, machines, locally, regionally and globally. Creating the workplace to a learning organization counteract inequality of (technical) skills between people and nations (Castells, 2010).

### **Technology mediated courses as support for work-integrated learning**

Interactive social media technology is supposed to enhance learning and collaboration among practitioners. When we use new technology for learning and collaboration it also changes the behavior of us humans as social individuals, and is as a consequence influencing our workplaces and working conditions. The question is however if we really are more effective now or if we tend to use technology for other time consuming social fellowships (Taras et. al., 2004)? In the intersection of new technology and employment new contradictions but also potential movements towards technological innovations are raised. Communication online strain individuals to different and new behaviors and they must reconsider their own self-awareness of how to collaborate with colleges or as Mark Poster (quoted by Taras et. al., 2004, p. 5) claim: "..., the contested terrain of the worksite, with its power relations and interpersonal rivalries, has moved into the world of information technologies", a discouraging outline which many employees' experience as a struggle at work. The movement, process and potential of information technology is on the other hand, more interesting to study.

If we look upon learning as an agent for dealing with change and technology diffusion, both employees' and business organizations can jointly co-produce knowledge to deal with future instability and challenges. Working and learning is in that sense intertwined and integrated as capacities for future development, where IT is an open tool, emphasizing collaboration and networking and gives opportunities for development of support to create new businesses in the digital age. Work-integrated learning through support of information technology can in this sense be understood as an opportunity that emphasizes learning for both individuals and organizations.

### **Results and discussion**

The aim of this research study has been to highlight the readiness for participating manufacturing and also to discuss their ability to foresee their upcoming learning needs. Questions that initially was raised was if learning initiatives integrated in work was considered as means for strategic business goals, and also if TMC can be an important learning tool for support of knowledge creation. The focus has also been on how to support

learning processes so that the manufacturing industry can achieve knowledge through co-production of knowledge with universities and other partners as research institutes.

The field of knowledge is production technology, product development processes, virtual production, engineering methodology, and information technology to reach a higher degree of integration, automation and systems development. Through analyzing the company's future skills and needs, we aim to indirectly support them with internal growth, development and perhaps innovation. Giving the results of their need will be develop course modules, TMC, with varying degrees of depth where participating companies can choose level and scope. Courses can be chosen in modules, full courses or as entire master programs and are supposed to be integrated within everyday work practices and be adjusted to individual conditions. The courses will be given in different forms; on campus, on site at the company and through technology mediated forms to achieve flexible learning.

Through analysis of the interviews we tried to find out how the readiness for taking part in learning initiatives that are integrated within work. As a consequence we analyzed particularly two questions, i.e. the categories "*Currently used digital forms for internal education*" and "*Knowledge and education as tools for effectiveness and innovation*" to find out if there is a relationship between the incentives to change work places to learning organisations by participation within technology mediated course initiatives. Our study shows that the experience among the companies current use of on-line learning tools like web conference systems and learning management systems for competence development of employees' is diversified. We also argue for that the maturity of supporting learning processes within the workplace is related to business goals and use of TMC, which may affect them to be a learning organization. The eight participating companies are classified in a matrix model that interlinks business goals and use of IT-mediated learning tools, see figure 1. The x-axis represents the companies' level of use IT-mediated learning tools and the y-axis represents whether the companies on a business strategic level use knowledge and education as tools to achieve effectiveness and innovation.

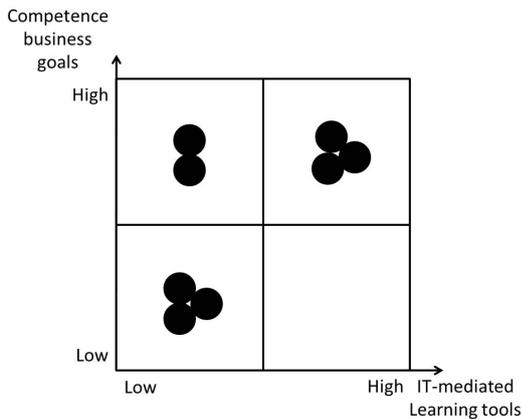


Figure 1: Matrix model interlinking business goals and use of IT-mediated learning tools.

Each company is represented by a dot in the matrix in figure 1. Note that the scale of the two axes of the graph ranges from low to high, but do not include an exact and detailed graded scale, but rather show a representation of which segment each company fit into. The result indicate that three of the companies interviewed demonstrate both a low level of use IT-mediated learning tools and a low level of linkage between business goals and competence development. Two companies have a combination of a low level use of IT-mediated learning tools and a high level of linkage between business goals and competence development. The three remaining companies show a high level on both axes. Note that none of the eight companies participating in this study show a *high* level of use of IT-mediated learning tools coupled with a *low* level of linkage between business goals and competence development. This could indicate that it may be more difficult to solely use TMC-learning without a high level of business strategy that considers knowledge and education as tools for effectiveness and innovation. Perhaps is it so that organizations that reach both a high level of IT-mediated learning tools and a high level of linkage between business goals and competence development are more able to achieve organizational learning and is therefore continuously improving efficiency and performance? This study does not show that, but we aim to analyze this further.

In figure 1, the companies are evenly spread out over three of the segments and it can be noted that there is no strong indication as to what type of company that is placed in which segment. For example, considering company size (number of employees') or type of manufacturing, conclusions cannot be made as to why some companies are more likely to reach both a high level of IT-mediated learning tools and a high level of linkage between business strategy and competence development. Since we cannot relate the results to

categorisation of companies there has to be culture or individual aspects that influence how well they can use TMC in relations to their business goals. Thus, the relationship between company culture and organisational learning also must be further analysed.

## **Conclusions**

Castells (2010) means that information technology is a humanization process which we in this paper have brought in through the initiative of TMC. We see information technology as profound instruments for creating new skills and job opportunities in favor of employees'.

Innumerable new products and services are based on IT and also force new businesses to develop. By use of IT we learn about job opportunities and get faster information regardless space and room (Baase, 2013). If the manufacturing industry will be a learning organization, technology mediated learning courses offer a way of supporting this work.

In conclusion, we think that workplaces can benefit from joining projects initiatives as EIIP to support development of the workplace into a learning organization. This calls for business plans that involve learning and knowledge creation as strategic means on long terms. The manufacturing companies view on work and learning as intertwined capacities for future development is important, where use of Technology Mediated Courses can emphasize collaboration and creation of new businesses in the digital age.

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