Knowledge Strategies for Organization 4.0 – A Workforce Centric Approach

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Abstract. This paper aims at presenting an overview of how the manufacturing industry formulates business transformation and knowledge strategies, to find gaps in Industry 4.0 concepts' impacts on the workforce. The results indicate that the industry is still focusing on the digital transformation era that was adopted at the end of the 20th century, and how to adopt computing technologies to work more efficiently in existing business processes. The approach of this article is to adopt a methodology of three areas; (a) Human resource processes, (b) Industry 4.0 pillars and (c) Process knowledge, where links between these three generate opportunities to address for further research.

Keywords: Industry 4.0 · Automation technologies · Collaborative robots · Business transformation · Human resource management · Knowledge strategies · Skills requirements · Employee education

1 Introduction

Industry 4.0 has started to make an impact in the industry and many manufacturing companies need to start a business transformation to adopt new technologies with more complex IT infrastructures [1]. Technology advancement requires new management strategies to close the gap between technology and skills, to avoid a drop-in performance and competitiveness. Personalized training, collaboration and knowledge transfer will be needed for operators and managers to handle and adapt to the enabling technologies within industry 4.0. With the technology shift, in all areas especially the growth of cumulative self-improvement AI, algorithms for big data with pattern recognition and advanced robots [2], humans need to develop new strategies to interact with robots. The accelerating technological unemployment raises a question if new jobs will be generated or will the technology increasingly be making skilled workers obsolete. Knowledge management strategies should be aligned with the 4.0 implementation in industrial enterprises and been taken in several phases [3].

The core of Lean is about three essential areas [4]: Learning, Leadership and Long-term perspective. This requires a special form of leadership. Lean innovation is very much built on a scientific method of learning, it is all about quickly train the workforce

in the new and better standards. Taking from a view of retraining we can assume that employees will be difficult in the first two steps which Human Resource need to consider in the knowledge strategies. The situation has called for more effective methods of retraining in companies. Academic institutions will be needed to create opportunities for lifelong learning with massive open online learning that is personalized to stay relevant [5] in the new industry ecosystem. The paradigm of teaching factory [6] has therefore entered to keep up with the rapid advances in education-related technologies, tools, and techniques. The concept comprises the relevant educational approach for the facilitation of interaction between industry and academia [7]. Research, Education, and Innovation are the pillars in the triangle of the teaching factory, which has been the new way of industrial learning [8]. This paper aims at answering the question; *How does the manufacturing industry formulate business transformation and knowledge strategies connected to workforce transition within industry 4.0?.*

2   Methodology

Three industrial studies have been performed in order to get a first indication on how manufacturing industry formulate a strategy for Human Resources and management. The study examined the overall training instead of specific groups of employees. In order to do these two different methods were used (1) direct observations in production and (2) semi-structured interviews with HR managers and training directors at the companies. Interviewees represented the major stakeholders responsible for the overall training strategies for each group. More specific questions were asked to as require ensuring that the data from each case would allow a cross-case comparison [9].

2.1   Within-Case and Cross-Case Analysis

Case 1. The company has been working with Industry 4.0 several years in a program called "Digital Transformation". The program aims to prepare managers for the future in terms of new technologies and digital maturity. Furthermore, the program has a cross-functional knowledge sharing platform with the purpose to stay on top in the digital transformation process. At the company, leadership is seen as an important skill in digital transformation. A leadership is defined by a person who is influencing others and does not necessarily have a formal responsibility as a manager or group leader.

The "*Learning Organization*" is a toolkit that is integrated into the training strategy where the focus has been to adopt knowledge sharing. The company pinpoints three main areas for knowledge; (i) Vertical integration experience (ii) Cross-company experience and (iii) Behavioral pattern management. The main strategic focus of Human Resource is a business transformation from a people perspective, with focus on how to capitalize on knowledge in areas as; (a) Business, (a) Knowledge and (c) Technology, and how to adopt technologies to work more efficient in process management.

"The most demanding part of this transformation is to change the view of what people can achieve in technology adoption. It is important that managers rethink the way to creating results. Managers need to get dressed in new capabilities. Even if the organization is hierarchical the decisions need to be decentralized to build a network culture where knowledge is collected cross-functional, to build network clusters with a span from inside to outside the share experiences and share knowledge. The historical way of building teams based on experts is contra-productive. In the era of business transformation, it is more important to know what questions to raise instead of knowing the answers".

The company have implemented a new talent review process to be able to meet the business transformation, where new demands of skills are established where managers are facing needs of multi-skilled profiles with technology skills added to the core skills. The group started a training program within technology innovation where employees could apply for a project and dedicate one day per week to experiment.

Case 2. Industry 4.0 is not yet implemented, even if the company is a manufacturing company. The main perspective is digital transformation, with a focus on modifying existing business processes and customer experiences to meet the new business requirements. The organizational structure is a matrix that facilitates the horizontal flow of skills and information, mainly in the management of product development. The company has moved from a product-centric to a customer-centric approach, where the focus is on; (a) How do we think in processes, (b) how do we engage with customers. The overall purpose is using data to simplify processes to work faster and more efficient when data is instantly accessible. In the context of digitalization, the group has revisited all processes, from internal systems to customer interactions. The company pinpoints three main areas for knowledge; (i) horizontal integration along the value creation chain (ii) vertical integration from the field to control level and (iii) information transfer from planning to maintenance, to ensure consistent engineering.

"The main challenge in this new technology era is knowledge. Workforce transition is about switching skills from operators/mechanics skills to technical/electricity skills. Operators/Mechanics are in educational programs to manage the transformation. The knowledge strategy is organized in a Competence Development Center to match the vertical and horizontal perspectives. Different programs are established based on needs and opportunities addressed from organizations. The center is organized based on geographical areas to meet the local needs in each market. The center is primarily focusing on hard skills while the Groups University is focusing primarily on soft skills. The group has recently updated their reskilling approach where the learning is integrated into practice. The programs run online with an agile approach where employees can learn daily. The Universities plays an important role for the group when it comes to building a platform of roles with scientific methods, critical thinking and statistic models. Reward programs today are connected to employee's skill-building and community knowledge sharing".

There is a gap identified today when it comes to soft skills development, either in production or sales & aftermarket. On a yearly base, the company has established a skill mapping program that all HR executives. This to be able to set real-time training programs with the purpose to adopt the changing business models. The group has recently updated their reskilling approach where the learning is integrated into practice.

Case 3. Industry 4.0 is not yet implemented, but the digital transformation is making a huge impact, and has started in the product phase of R&D that is years ahead of the

production. In workforce transition the group focus on overall purpose and goals. The main strategy in training today is to focus on job training where the group have adopted the agile lifelong learning approach. The group has an academy that is responsible for all training and educates both in soft and hard skills. The company pinpoints two main areas for knowledge; (i) robots and physical automation (ii) Knowledge transfer from automation engineers to maintenance engineers.

> "Industry 4.0 is not a commonly used term internally within the group. Strategies are about speed and scope in digital transformation. The group need to shift complete focus when it comes to business transformation. The workforce transition is more of a strategic level now starting with the managers, and not the operators. The automation impact on operators is highly connected to labor costs depending on low- or high wage countries, where the breakeven for investments differs dramatically. Another important angle of automation is new versus old factories, where it is easier to automate a new greenfield factory project. In a new factory, it is easier and more cost-efficient to plan for automation. Hard skills are easier and have a clear vision and path for learning, while soft skills are much more difficult when it comes to will-ingness and motivation to adopt new insights. From an operational perspective in the factories, the group work with training academies, as leadership programs, hard skills training related to production and basic training routines. The training strategy is taking from two models; 5 whys root cause analysis and 5 S workplace organization method. The main challenges right now begin already in an earlier stage than the Universities, where younger people are not attracted to technology engineers. The group work close to senior high schools as well as building the groups own senior high schools to be able to meet future demands".

The company expects the employees to adopt an agile lifelong learning approach where they learn "on the go" by combining the theory into practice. Redundancy as a state occurs based on knowledge strategies. Continuous feedback loops are a critical part. The group has a cultural talent management program, where the real talents appear in different vertical processes. Workforce transitions are addressed from executives, where executive HR translating directions into future. The group has a task-oriented approach and collects knowledge from verticals toward an agile methodology. Universities is an important link to collect knowledge.

3   Discussion and Conclusion

The current exploratory study examined how three manufacturing companies reflect on how the transformation of the workplace with new technologies impacts the employment and if there is a gap between skills available and skills needed. Furthermore, the study explores how the industry formulates and implements training strategies for skills retraining and how they invest in training systems.

The results shown a slow adoption of Industry 4.0 and the term is not commonly used within the HR-departments. The focus when it comes to re-skilling within the companies are still focusing on the digital transformation era that was adopted in the 1990s, and how to adopt computing technologies to work more efficient in existing business processes. The analysis shows that a common focus within the companies and a step towards industry 4.0 is the integration of existing data where integration needs to be aligned horizontal along the value chain, vertically from the field of production control and from planning and maintenance. Based on the within-case analysis

assumption can be drawn that these companies still are in an early phase of business transformation. Related to a product lifecycle, the transformation has started at the beginning of the process in R&D and Product Design. However, the study has shown that the gap between skills available and skills needed is increasing. The focus is the soft-skills training program for leaders to prepare for the business transformation. Technical-, process- and network agility are important skills sets as well as emotional awareness. The focus is concentrated on overall purpose and goals within the organization, and how to transform this to an organizational structure based on knowledge. The talent management strategies are important workforce strategies, where the support of employees in retraining has decreased. The prioritized talent management programs strengthen this analysis. The redundancies of workforce will take place but are still in an early phase, because it is difficult to find the right skills sets. The case studies also show that the "learn as you go" trend has been adopted where theory and practice are implemented. Universities are an important link to close the early stage gap in Research and Product Design phases as well as in Engineering to be able to balance the higher theory with real-world practice. A higher level of advanced process knowledge is required to meet the increased demands.

In the future, further research should focus on the development of specific training systems, as well as on the integration of individual training methods to support the knowledge within the enabling technologies of industry 4.0. This will enhance the speed and agility of closing competence gaps in the manufacturing processes. Further research is needed within Education 4.0 and Organization 4.0. Managers and Human-resource departments need to build a literacy within digitalization ad automation in order to handle the needed re-skilling in future manufacturing.

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