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Insufficient knowledge in industrial digitalization – Promising perspective from female suppliers

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Abstract

Small- and medium sized enterprises (SMEs) don't know exactly what digitalization means and have difficulties in reaching the potential benefits. To stay competitive SMEs, need support in how to implement digitalization. A promising perspective and ideas on how to get started were captured in two courses given to female suppliers from the automotive industry. The female suppliers stated that it is relevant to start small, find enjoyment in digitalization, involve all co-workers, find a strategy for competence insurance, start learning programs and find business in digitalization.

Keywords: Digitalization, agile, Industry 4.0, innovation, supplier, automative.

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1. Introduction

The focus of this paper is to investigate how industrial digitalization can be implemented in a smart and successful way. The implementation of industrial digitalization is relevant due to that technological advances offers huge potentials for industry e.g. they are more capable and inexpensive [1]. However, although these technologies are available, they are not adapted to the manufacturing industry [2]. The implementation is especially problematic for SMEs due to that they don't know exactly what digitalization is and therefore don't know how to approach and start working with digitalization. A literature review showed that SMEs often are ill-equipped to manage digital transformation in their production planning and control functions [3]. Although some SMEs have implemented digital solutions, the implementations are limited to monitoring production processes instead of using them to plan the production or to control it. In Sweden there are educational programs such as Digiresan, Digilyftet and Indigo where companies can join a program and get help from researchers and coaches to start their digital transition. Another initiative is taking courses in digitalization or joining a network. However, many of these initiatives are still in the start phase and digitalization instead of remaining a buzzword.

One way to find innovative solutions is to find a new perspective and ideas is to use new groups to get new input. In this project, females working at suppliers to the automotive industry were invited to find smart and innovative solutions. As an example, the concept Volvo car developed by just women introduced many new ideas that was implemented in new car models. Looking at automotive suppliers for advice is relevant due to that they have high demands on quality, time to delivery and on sustainability.

Therefore, it is relevant to investigate if females in the supplier industry can offer a new perspective and ideas on digitalization.

1.1. Scope

The aim of this article is to present a new perspective on industrial digitalization. The perspective is given by female suppliers working in the automotive industry and the goal is to give valuable tips and insights on how to implement Industry 4.0 successfully.

The research performed was part of a project called Digitalization from a female perspective funded by The Swedish Agency for Economic and Regional Growth. The goal of the project was to find new ideas regarding digitalization and to spread found ideas.

2. Theoretical background

Industrial digitalization will dramatically change production as it is now and for operators working in that environment new perspectives are needed. Digitalization is the turning point in manufacturing as current limitations like centralized manufacturing and design constrains where keywords are the internet of things, big data where automation which gradually transforming the traditional working environment into something more adjustable and personalized [4]. The trend of digitalization and industry 4.0 will increase the complexity of the production system which in turn will increase the need for understanding the operator in such a system [5-7]. As an example assembly systems are complex partly due to a high product variety [8] and since operators are flexible and can manage fast and dynamic changes [7].

In the following section a maturity index of Industry 4.0 is presented in terms of SMEs. Further, how to achieve a successful digital transformation is described.

2.1. Maturity index and the Digitalization stair for SMEs

The Levels of development in Industry 4.0, was developed to identify maturity stages within the company to help companies navigate through the stages [9]. The index includes 6 steps: i) computerization, ii) connectivity, iii) visibility, iv) transparency, v) predictive capacity and vi) adaptability. The index is developed from a technology perspective and to simplify the maturity index, a digitalization stair see Fig 1 was developed at RISE IVF. The model was based on the maturity index steps however are simplified to fit SMEs digital transformation. The model has been

tested at companies to assess their current state and to present potential possibilities. The stair has also been used as a discussion tool and it was also part of the first course.

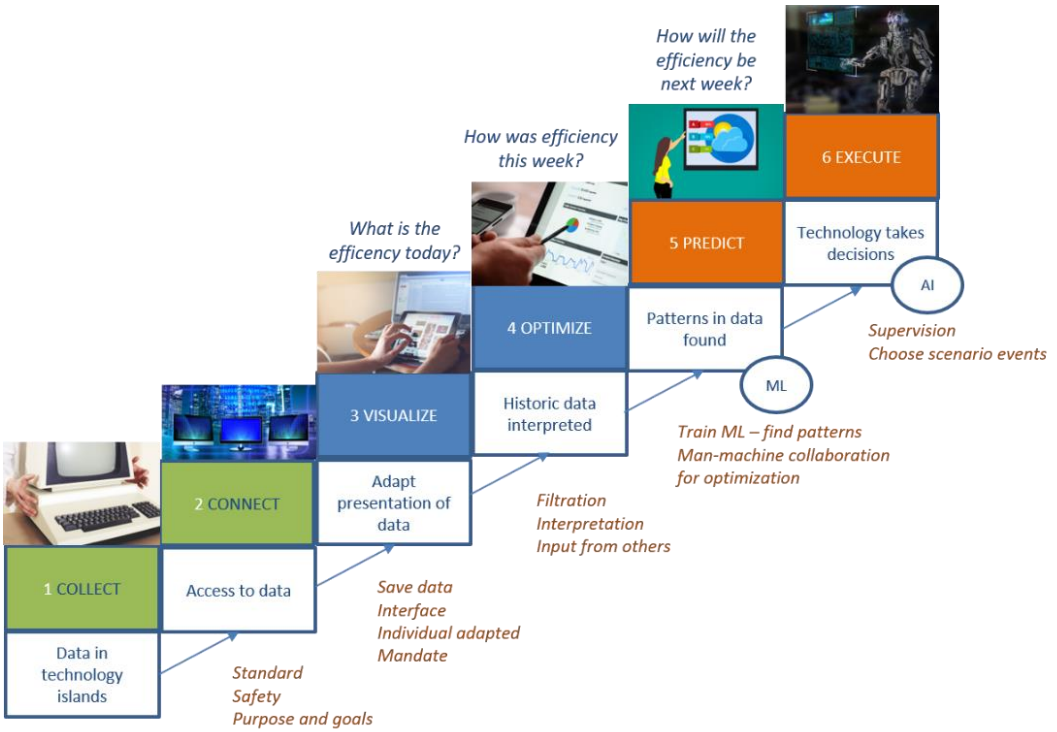

Fig. 1. The digitalization stair developed at RISE IVF, adopted from ACATECH's maturity index [9].

The model visualizes, similarly to the ACATECH's Industry 4.0 Maturity index [9], that the third step starts the Industry 4.0 transformation. The two steps before that are needed as a solid base as a preparation to reach the higher steps. The steps are: i) collect, ii) connect, iii) visualize, iv) optimize, v) predict and vi) execute. Going through the stair data is first connected in technology islands and then connected through Internet which gives employees access to the data, step two. In the third step data is presented in a better way so that each employee sees what they need (individualized). In the fourth step historical data is presented so that either the computer or humans can interpret and make estimations. Not until the fifth step is artificial intelligence (AI) included and it is here patterns in data is found and future states are predicted. In a production setting this could mean that stops are minimized due to that vibrations in the machines are found using the AI. The last step, step six, is when AI is used, and predictions serves as a base for technology changes to occur without human intervention.

As stated previously, SMEs often doesn't reach the benefits and full potential of digitalization. They stop at step 3 which is monitoring and visualizing their data. To advance in digitalization it is important that SMEs understand what the different steps characterizes and that they understand the challenges connected to each step.

2.2. Creating a successful digital transformation

Despite that digital transformation is grounded in the digital technology, organizations face challenges that is more than just of the technical nature [10]. Development in digital technology opens for brand new possibilities for industrial organizations [11]. Fitzgerald et al. describes that organizational aspects entails a major challenge for organizations that are aiming to transform themself to a digital organization [10].

To proceed with the organizational transformation and implementation of the vision for digitalization, the company must build up participation and engagement among stakeholders for the transformation [12]. Kotter argues that

employees often understand and are willing to help to fulfill the vison of but face obstacles on the way. In addition, Fitzgerald et al. provides insights that lack of familiarity for digital technology plays a significant role as a barrier for digital transformation in organizations [10].

The distinct goal or vision is a cornerstone in the process of organizational transformation [10,12]. A vision is therefore viewed as a cornerstone in the process of organizational transformation [10,12-13]. Further, Kotter stress that without a rational vision for the end station for the transformation, change effort could easily end up in wrong direction or nowhere at all [12]. Further, Kotter stressed that without a rational vision for the end station for the transformation, change effort could easily end up in wrong direction or nowhere at all. It is suggested that firms should take small steps in their efforts to make a digital transformation [10]. A pervading transformation takes time to implement, Kotter (1995) therefor argues for divide the vision into short term goals to undermine the risk for the transformation to lose momentum. To create a clear vision, Fitzgerald et al. argues that an organization digital transformation must come from the organization top management that is supported by the senior executives of the organization [10].

3. Method

Female suppliers from the network Woman in the supply industry (Kvinnan i Leverantörsindustrin) were invited to participate in two courses. The network is part of The Scandinavian Automotive Supplier Association (Fordonskomponentsgruppen), which is the trade association for Scandinavian suppliers to the automotive industry. The association has more than 350 member companies and offers meeting places for their members such as trips and courses. The female network has over 200 company members and was initiated in 2015.

The two courses were given by RISE IVF in collaboration with the Scandinavian Automotive Supplier Association and was funded by Produktion2030 a Strategic innovation programme for sustainable production in Sweden. The first course Digitalization from a female perspective was a two-day course and included a journey to Germany. The purpose was to gain insight into Industry 4.0 and to investigate the differences between Sweden and German companies. The second course Innovation and digitalization was a half day course that built on the results from the first course.

The captured perspective was combined as a summary of the discussions in the courses while the ideas were captured separately from both courses.

The sample, course structure and collection of data is described separately for the two courses in the following sections.

3.1. Course 1: Digitalization from a female perspective

In September of 2018 two course days and a Germany trip were offered to the female network. The course was arranged on the 4th and 27th of September and the Germany trip between the 11th and 13th of September. In total 19 women took the course and 16 of them joined the trip to Germany. In the sample five women were managers, four were CEO, co-partner or owner and two were project leaders. Their professions were connected to sales, quality, product development, energy and environment and human relations.

The course was designed to first educate participants in relevant aspects of digitalization and digitalization examples and then to capture participants ideas regarding how to implement digitalization in a smart way. On the first course day the following was included: digitalization introduction, mega trends, digitalization from a Swedish automotive perspective and risks and data safety. In addition, participants discussed the current state of their companies. On the second course day focus was put on Swedish networks, research initiatives and results from the trip.

The Germany trip included four companies and one research institute in the Stuttgart area. The following companies were visited (in this order): Daimler AG, Schnaithmann GmbH, Festo AG& Co. KG and Pilz. In addition, Frauhofer Institute for Manufacturing Engineering and Automation was visited. The company visits were arranged so that digitalization was in focus and most companies prepared a presentation of their work in the area as well as including female representatives. The trip was organized by the German-Swedish chamber (Deutsch-Swedische Handelskammer).

The trip also included a meeting with the network PANDA. The PANDA network mission is that 50% of leading positions should be held by women. The name Panda comes from that women in leading positions in Germany are like pandas in the world: rare.

The results were captured through four group discussions and an assignment. The four discussions regarded what digitalization is, current state of participants companies, how to digitalize in a smart way and insights from the Germany trip. All discussions were started as post-its sessions where participants first thought about the topic by themselves, wrote something on post-its and then three to five participants formed a group and discussed their answers. The aim of the group discussions was to form a consensus of the topic where half of the time groups summarized their own results and half the time the discussion leader summarized the results. In the end of the discussion, the discussion leader summarized the discussion on the white board so that everyone could verify them. One discussion was repeated i.e. what digitalization is (on the first day participants were asked what digitalization was and the same question was also asked on the last day). The assignment comprised of four questions:

1. Is Sweden before or after Germany in terms of Industry 4.0 and digitalization?
2. Are there differences between how Germany has digitalized their production – from a female perspective?
3. What new ideas do you have?
4. What things have a learned that I did not think about before this trip?

Fig. 2. Course participants at Schnaithmann GmbH.

The individual answers were summarized and discussed during the last course day.

In addition, a movie was recorded that captured five participants thoughts on the opportunities of digitalization[†]. The movie was showed as part of a release event connected to the second course.

3.2. Course 2: Innovation and digitalization

The course Innovation and digitalization included eleven participants and a group discussion was held to capture the perspectives and ideas on digitalization. The participants were from the female supplier network and researchers in the humans in production area. The group discussion was held similarly as in the first course i.e. started with post-its and then the discussion leader summarized bullet points on the white board.

The results from the first course was included in the course as a background and three lecturers were invited to talk about innovation and self-leadership, testbeds and collaboration with industry and gamification. The course ended with participation in the release event for the webpage edig.nu which is a knowledge platform for digitalization. As part of the release event the movie was showed and results from the first course was included in a fast course for digitalization which was tested by the participants that joined the release event.

[†] The movie can be found on https://www.edig.nu/artiklar/industri-4-0-en-resa-till-tyskland-med-fkgs-kvinnliga-natverk

4. Results and discussion

The aim of this paper was to present a perspective and new ideas on digitalization. The perspective investigated regards how digitalization can be implemented in a smart way and came from female suppliers to the automotive industry. The pillars of the new perspectives are: Innovative culture, small steps and, long-term strategy for competence and change. In addition, seven ideas were stated that can be used to start working with the pillars. In general, the pillars and ideas provide new knowledge in the area of digitalization. Previously when similar workshops have been made the discussion has not focused on humans to this extent. Instead, previous results point towards technology and concerns of IT implementation. However, workshops studying smart maintenance has built similar results i.e. that the organisation behind the technology is equally or even more important than the technology itself[‡]. The female suppliers in this study stressed collaboration, motivation and that all employees should be involved in the digital transitions. Further, an important aspect of this perspective is the business opportunities and that companies need their board members to take a course in digitalization so that they can steer the company better towards digitalization.

The pillars and ideas connected to them are presented in the following sections.

4.1. Innovative culture

Having an innovative culture is relevant due to that new technological tools requires new ways of thinking. The concept of Industry 4.0 and digitalization are not connected to a normal technical innovation. Fitzgerald et al state that one of the biggest reasons for why organizations fail to use technology is due to that they lack the urgency to change [12] and that they don't have enough funding [10]. In the second course it was stressed that positive feedback is an important part of innovation where the company should be forgiving and accept failure as part of their innovation. One important aspect of digitalization is therefore to involve all co-workers. Fitzgerald et al state that reasons for why digitalization transformations don't work is due to that roles and responsibilities are not clear and that there is a lack of vision [10]. This is also seen in change management were creating the vision, communication the vision, empowering others to act are important steps in transforming an organization [12-13]. In addition, participants stated that all digitalization transitions are different.

The culture should enable:

- Involvement of all employees
- Consensus on purpose / goals
- Humans as a key resource and technology as an enabler
- Understanding of the meaning and importance of individual participating in the transformation
- Trust and feelings
- Positive feedback - it is allowed to fail

Ideas on how to start working with this is to:

- Form a Structured change process both for goals, feedback and involvement of co-workers
- Offer Digital coaching via e.g. a leadership app
- Let employees be boss for a day

A business strategy needs to be developed and it is important to think about the company's future customers and their customers of the customer. Sometimes we think about digitizing our own operations / production first and then innovation for the customer. We can think of innovation in the business / production instead. When having the group discussions regarding how digitalization can be done in an innovative way the following questions were raised:

- Who are we? We should be customers, customers' customers and operators etc.
- What do we want?
- What do we not want to digitize?

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‡ The research project SMASH Smart Maintenance Assessment captured similar results after studying how companies should implement smart maintenance. www.research.chalmers.se/en/project/?id=7628

4.2. Small steps

To successfully start working with digitalization it is important to decrease the fear of not knowing what will happen when new technology and ways of working is implemented. As stated by Fitzgerald and Kotter it is important to take small steps [10,12]. Working with small steps means to:

- Start with small projects
- Show the profit in money
- Meet the employee where they are - low entry, which enables the use of technology to increase
- Educate everyone in digitalization

To lower the threshold for digitalization more knowledge is needed. Therefore, it was suggested by participants that everyone and especially managers should all take an introduction course in digitalization. In addition, to meet the employer where it is connected to gamification which states that if you introduce technology that is adapted to the operator the operator is more motivated to continue using the technology.

Some ideas on how to find enjoyment and lower the threshold are:

- Reduce fear by demonstrating digitization that already exists in the company
- Show examples of digital use by different employees

All companies are today digitalized in some way. Therefore, a small first step is to go out and look at what the company already has digitalized. This can be the order system or just how salary's work. In addition, employees can themselves give examples of how they use an Ipad in their work or how it was like when they started using a specific system compared to now.

4.3. Long-term strategy for competence and change

It is important to develop a long-term strategy for both competence and change. This pillar was probably inspired by Germanies strategy to have training programs. At the visited companies' participants asked about competence handling and if it was difficult to find them although they worked at a small company in the countryside. Thanks to the established training programs and connections to academia the small companies were not vulnerable to competence limits. Digitalization is forcing production processes to be more complex and therefore new types of education is needed [14]. Madsen et al. indicated in their empirical studies that vocational skills and educations will become more important [15].

Therefore, participants thought that it is important to develop long-term strategies for competence assurance but also for change management.

Ideas on how to start working with this is to:

- Combine knowledge from different generations: novices need to be connected to the company in new ways and the elderly must learn as digitization, they can learn much from each other.
- Change monotonous work into service professions.

4.4. Reflections

When visiting companies in Germany, participants reflected on if Sweden or Germany was closer to embracing the Industry 4.0 concept. Participants stated that they thought that Germany was closer in the sense that the companies seemed to understand the concept better. In addition, they thought that Sweden was more digitalized in general e.g. in the society and hence might be better equipped for digital transformations.

5. Conclusions

A new perspective was given by female suppliers in the automotive industry which is an industry that has high demands and therefore has good insights into the challenges with digitalization. To benefit from embracing digitalization many aspects of are needed. The perspective raised focused on humans, innovation and developing strategies. To develop strategies connected to new types of organizations and change management more efforts are needed in this area. Examples are seen in industry where companies have reached high levels of digitalization which

means that a lot of things that humans previously did are now being done by automation. This raised problems regarding how to work with that since operators could not grasp the changes that occurred. Problems are seen such as disturbances, middle managers not having accurate knowledge levels or tasks, mandate is not given to operators so that they can change processes although the flexibility is there from an automation perspective. Therefore, more research is needed before digitalization can be implemented in a successful way.

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