A Challenge for the Future: Efficient, Attractive and Sustainable Factories

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ABSTRACT

The concept of organizational development is of essential importance in order to maintain a sustainable industry; this can be seen in numerous articles and research projects presented in scientific magazines, books and conferences every year. In June 2008, the Future Factory project started at Luleå University of Technology, Sweden, inspired by participatory research, aiming at breaking existing patterns in organizational development by involving stakeholders that often are neglected or underrepresented, such as women and young people. The project as such is interdisciplinary; researchers with deep knowledge from different areas; industrial production, design, gender and ergonomics are all contributing with their specific expertise in order to achieve an understanding of the phenomena. This paper will present some of the result achieved so far. The aim is to develop principles that contribute to an attractive, effective and sustainable industry and also to identify or develop methods that support effective change processes within the industry. Early results points at the need of creating flexible organizations with the human factor in focus; offering the employees the possibility to plan their schedule, be part of an ongoing structured development process and stay connected to the inner and outer environment through different networks.

Keywords: future factory, macro ergonomic, life time trainee, participatory

INTRODUCTION

The purpose with this paper is to introduce the reader to the early result from the Future Factory project; a project with the aim to develop principles that support the idea of an effective, attractive and sustainable factory and to test and evaluate methods of an interactive research approach in organizational development. Identifying key factors, seen through a system perspective, will be of special interest for this paper, the result from our method evaluation is presented in another conference contribution. Organizational development is an often discussed field and in order to deepen the existing knowledge the project has taken a somewhat unusual approach, to invite and involve stakeholders that often are neglected or underrepresented in development processes in the industry, in Sweden this is often the case when it concerns women and young people. In the project, young people, labor union representatives, employers within manufacturing industry, shop floor workers and other industrial representatives are stakeholders in the project, but the main contribution comes from the work that has been performed in a design team, solely consisting of women from the industry. As we understand it, women are rather seldom given the opportunity to take an active part in the development process in the industry, this might depend on the fact that women are in a strong minority within the manufacturing industry in Sweden, only twenty percent are women, and by those are a further minority in a position where they can influence the result. At the same time, Swedish manufacturing industry are facing another dilemma, it is a low amount of women (and young people) that are positive to work within the industry or take part of a technical education. By gathering the opinions from these two groups we hope to identify key factors that, if introduced, can lead to a shift in this opinion. A result from this shift could be an increase of the industries attractiveness, lead to a wider recruitment base and thereby an increased possibility to employ high skilled workers at all levels, something that naturally would affect the industry in a positive direction.

THE FUTURE FACTORY PROJECT

In order to predict the future, the project begin from the past, drawing on the concept of ‘good work’; a field that originates from the socio-technical school (Thorsrud & Emery, 1969) and became popular in Sweden in the middle of the 1980´s when the Swedish Metal Workers Union (today IF Metall) adapted these thoughts (Abrahamsson & Johansson, 2009). The concept of ‘good work’ focus on the need of creating conditions for good work and a good work place in the industry and can be seen as a way of fulfilling goals of both efficient as well as attractive factories. The theoretical base in this project can also be found in the field of industrial work environment, gender, organization development, design and in

modern production technique; this implies that we are not focusing solely on the somewhat hard aspects in a production system; social and cultural aspects such as gender identity, profession identity and workplace culture (Abrahamsson & Johansson, 2006) is of most importance as well.

To reach a understanding of which key factors that are important in creating an attractive, effective and sustainable factory, and in order to find effective ways of working with organization change processes, a number of activities have been performed, which in total have included nearly 140 participants (including 7 researchers) described in brief in table 1 below.

Table 1 Activities within the Future Factory project

ACTIVITY	WHEN	WHAT	•
Comprehensive survey of manufacturing industry and literature review	2008	Study and analysis of research grants and contemporary industrial organizations	7
Workshop with Young people	2008	Study and analysis of young peoples values and preferences	23
Workshop with Trade Unions	2008	Values and preferences from a Trade Union perspective	12
Workshops, focus groups- and contextual interviews	2008 – 2010	Values and preferences from stake-holders: industrial employers (CEO'S), shop floor workers ,industrial employees, Swedish Work Environment Authority etc.	83
Design of a proposal for a Future Factory	2009-2010	Workshops with the design team of women technicians, system designer, CEO's, human resource manager, engineers, students, architects and researchers	14 +4.
Interactive approach test/ development of methods	2009-2010	Test/evaluate and develop to reach a 'Future Factory Approach'	(7)
Analysis	2010	Analysis of the material from all of the above performed activities	(7)
Prototyping	2010	Developing a prototype of a future factory, based on the material gathered during the project	(7 +15)
Research team	cont	Collaborative inquiries within research team; discuss, understand and share knowledge of performed activities/studies	(7)
		Total number of participants in project (including 7 researchers)	**139**

The material from the different activities is in the form of recorded interviews, recorded and photographed workshops, notes, mind maps etc and has later been used in the analyse work. The participants have all represented different organizations and industrial sectors; that imply that the key factors were discussed on a system level, not regarding a specific industry.

OUR APPROACH

It is our belief that it is necessary to encompass multiple perspectives when trying to analyze, change or design a new organization, a belief that is shared by many other researchers (e.g. Kleiner, 2006; Haro & Kleiner, 2008; Holden, Or, Alper, Rivera & Karsh, 2008). This insight, together with our earlier knowledge and experiences has guided us through our choices of underlying theories and methods.

SOFT SYSTEMS THINKING

We believe that in order to grasp a true understanding of a complex situation, is it necessary to analyze the situation by iterating between the whole and its parts, understanding relations in the studied system as well as the whole, this will lead to a holistic picture of the studied phenomena.

Soft Systems Thinking, SST, is an interpretative framework that was developed by Peter Checkland and his colleagues at Lancaster University in the 1970's. SST does not, as one might think, consider the world as organised in systems, it stress that in order to understand it better, we can organise it in system models. In order to reach a rich understanding is it necessary to take many aspects in consideration, such as relations and interactions between the different parts, functions, contexts, patterns etc. all with the underlying understanding that the whole is always more important than the parts (Checkland, 1981, 2000; Checkland & Holwell 1998). It's interpretative approach implies that humans perceive the world in different ways, and this has to be addressed in the research or design work as well; we start from an unstructured situation, add the different participant's perspectives and then compare the wanted situation with the existing situation in order to define the changes that need to be implemented (Checkland, 2006).

Successful organizational-level change requires a holistic systems approach, it is necessary to pay attention to all levels of the system, including macro level elements such as culture, management, and the environment, as well as to the interaction-rich system as a whole (Holden et al, 2008).

MACRO ERGONOMICS

One main concern in our project has been to discuss and learn from the experience and knowledge that the participants in the different activities has shared with us in order to reach a understanding of what preferences that is essential in creating a

efficient, attractive and sustainable industry. The participants in the project represent different organizations and have contributed with their own thoughts; these have been on several levels, from thoughts concerning design of their actual workplace to complex organizational design concerns. These various levels leads to the field of macro ergonomic, an approach based on the socio-technical system framework. In contrast to the more traditional ergonomic perspective, macro ergonomic is derived out of the need for a larger system perspective, all in order to raise the result of the performed activities (Kleiner, 2008). If traditional ergonomic often concerns micro work environment, how human and a workplace fit to each other, macro ergonomic deals with the overall physical work environment and how this is connected to the business objectives of an organization (O´Neill, 1998). Today it's necessary to understand the complexity of the studied system; the environment is turbulent, it exists in a challenging competitive market and there is a continually ongoing interaction within the organisation (Kleiner, 2006). In order to reach a successful large-scale change in industrial organizations is it necessary to pay attention to several important aspects. The traditional human-technology-organizational structure interface and, not to forget, the interactions that take place between different sub-systems within and outside of an organization needs to be addressed, together with an integrated micro- and macro ergonomic approach at all levels (Kleiner, 2004). Macro ergonomics stress the importance of the employees and other stakeholders participation as essential in order to reach a positive outcome, it is they that have the knowledge of *where* and *what* the problems are and with assistance of trained ergonomics they can correct this problems (Hendrick, 2003, 2008; Zink, 2006). Carayon (2006) also points at the need for researchers to address the end-users when designing a socio-technical system, otherwise we as researchers will fail in producing knowledge, concepts and methods that they can use and apply.

Finally, Zink (2006), stress that in order for macro ergonomic to reach its full power, is it necessary that it takes the step from being a specialist task to becoming a management topic. He continues, claiming that the difference between companies is mainly people, technology and organizational structures may be imitated, whereas the qualifications and motivation of a work force are difficult to imitate. Therefore, he continues, are human resources the most relevant enabler for the success of an organization.

METHODS

PARTICIPATORY APPROACH

It is our belief that involving stakeholders in a change process increases the possibility of reaching a result that will be sustainable and effective; the final solution is developed by the ones that are going to use it and is, if not accepted, at least understood by all involved. This belief has influenced us in taken a

participative approach in the project. The project as such has a directly forward striving approach; we are trying to look at what might be, instead of what is, thoughts that often characterize as a design perspective (Simon, 1969). Based on our understanding this implies involvement of stakeholders in the process, to explore their understandings and knowledge's. Design is a research field that has later gained a lot of interest in many other fields where attempts has been made to implement another, more solution oriented, way of thinking and problem solving (e.g. Edeholt, 2007). Therefore, our research project is characterized by an interactive research approach, inspired by the concept of design-thinking and the field of Participatory Design. Participatory design includes methods such as future workshops (Jungk & Müllert, 1987), personas (e.g. Cooper, 2000) and scenarios, described in detail elsewhere (Wikberg Nilsson, Fältholm & Abrahamsson, 2009).

RESULTS FROM THE PROJECT - SO FAR

We are now in the final state of gathering and analyzing the material from all of the performed activities in the project, in this paper we will try to address some of the results.

HUMAN RESOURCE

One thing that has been brought up to discussion in every activity that we have performed is the statement that the human resource must be recognized as the most important aspect in order to make efficient, attractive and sustainable future industries become a reality, whether it concerns individuals or a group of people, the human resource is, the most important factor to address.

LIFETIME TRAINEE

It is our understanding that we can see a shift in attitudes and values where the employees no longer strives at having a lifetime employment at the same company, instead many, especially young people, see their work and employer as a station along their development in life. For instance, under an interview we received information that there had been an unfamiliar situation in a company, former seen as the 'optimal and must secure' employer at the location, a received employment there could be kept until retirement. One employee refused to accept an employment-offer, instead she wanted to work as long as she 'felt for it' and then continue traveling around the world or taking another work – it would be less complicated and she didn't have to take the same responsibility for the performed work with a time limited employment.

At the same time, we have been receiving signals from our participants that many people are searching for another form of lifetime employment, this time with the content of a continuous individual development, a kind of a '*lifetime trainee'*.

To ensure that every individual contributes and develops within the organization, our participants have an idea of organizations that performs individual development – and carrier plans for everybody within that organization, no matter which level or workplace you begin at. The idea is that he/she works in various parts and processes in the organization during a certain period, this way, knowledge and experience can be shared within the organization and each employee gets an overview of the activities. These plans should include continuous training and education, whether it is shorter training in for an example welding or longer education in universities.

One important focus in this approach is to reach a higher level of rotation within the organization. According to our participants a problem today is that there are very few options open for changing work or positions within a company as people often stay at the same position for a long period of time. Adopting this somewhat different strategy could lead to an organization where people are changing workplaces in a more structured way, a way of marketing the industry as an attractive workplace for the employees. Another side-effect is the fact that the industries can keep employees with proper education and an excellent knowledge of the entire organization (that can contribute to an effective and sustainable industry). We understand this as a natural consequence of the development of the knowledge society; to either consider the workforce as disposables (following the same line is to move industries to developing countries), or, which our participants prefers, follow the knowledge societies development and develop industry in the same direction. The idea would also contribute to flexibility for the organizations, since all employees have an understanding of the processes.

FLEXIBILITY

As concluded above, the concept of lifetime trainee has many advantages for an organization; one is flexibility which we will highlight as a concept of its own. This concept has been brought up in a number of discussions, one concerning the employee's wishes of having the possibility to have individual schedules in contrast to the traditional inflexible shift forms that most of the industries apply today. In the flexible schedule, each group, consisting of people from the actual department, has the responsibility and possibility to plan and schedule their presence at work for a couple of weeks ahead, planned together according to what roles that has to be manned during each hour. This idea is already successfully used within Swedish Health Care but is in minor use within Swedish industry, even though both can be seen as a kind of process industry with an input, a transformation of material or services leading to a final output. According to our participants, flexible schedules could be a way of making it easier to balance the private life and the time spent at work. Depending of where you are in your life you have different possibilities to manage shift work; children needs day care and transport to school, making it difficult to start early in the morning or working late. When people are getting older it often implies that it's harder to alternate between the different shift-forms (night, day, afternoon) with problems of getting enough sleep as a result which can result in difficulties for the employee to perform, both at work and in the private life.

NETWORKING

Another key factor, this time seen from the employers point of view, is the possibility to have networks between e.g. local companies that jointly are responsible for certain types of competencies, such as e.g. welders, sheet-metal workers etc. The same thing when it comes to skills that, at least small, businesses find difficult to have in-house, such as specialist competences in ergonomics, organizational and industrial design etc. In Sweden, we see a lot of companies outsourcing the most monotonous and health concerning operations. Our participants see this as one way for organizations to buy out of ergonomically issues. If organizations plan and answer for those issues together, the solution might be better for all concerned. Furthermore, our participants also have an idea of another form of networking, considered to contribute to both an effective and attractive organization (not to mention an innovative organization). Each employee is part of one or several networks, both within and outside the organization. The networks could be about quality, safety, ergonomics or product or production knowledge. Having groups that are responsible for a specific area is not new within an organization, but to have participants in networks from other industries and from all levels of an organization is a somewhat newer idea. According to our participants, the idea of networks would make manufacturing industry a more attractive workplace and can, when fully implemented, contribute to an innovative and effective work force.

DISCUSSION

A large number of activities have been performed in this project. We have involved nearly 140 participants, people representing different industrial sectors, professions, hierarchical levels, genders and ages. We have tried to adopt a true multi perspective throughout the entire process, from the researchers and other stakeholders that are participating in the project, over chosen methods and theories and to our participative approach. From our perspective, this is an advantage as our focus is to achieve understanding of preferences and needs of attractive, effective and sustainable factories. This multi perspective approach has a price, it has been difficult to discuss this kind of questions looking at a special type of industry or organization, so the discussions and the result has been performed on a 'system-level'.

It is our belief that neither of the concepts efficient, attractive or sustainable is working in isolation from each other. An activity that influences a factory concerning its efficiency is most likely affecting its sustainability as well; the same thing with attractiveness, or turning it the other way around.

Finally, it is our hope that this glint into the Future Factory can inspire other researchers and practitioners to reflect upon their work in organization development and maybe see the benefits that an approach as the one we have used can contribute in reaching a richer understanding.

FUTURE WORKS

As for future research, we would like to take on the challenge of realizing our ideas in a real-life situation, as inside an organization that realize the need of new ideas and concepts to meet the future challenges as suggested in the initial future scenario.

As for now, our future works also include finalizing a model or a prototype which is intended to address all the aspects we have found as a proposal for a future factory.

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