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New Technology Introduction and Work Stress

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***Abstract*— The development of new technologies like robotics, artificial intelligence,and virtual reality has placed technology once again in the center of management research. A great amount of research is oriented towards the social, political and economic consequences of this so-called age of the 4th industrial revolution. One of the most important aspects of this transitional economic period is the characteristics of the internal technological change processes within organizations and the associated decision-making procedure.Introduction of new technologies can be handled with a technological determinist attitude, with a socio-technical systems approach or with a more radical processual approach. In this paper we present and describe the technological determinist approach that is dominant in the Central-European manufacturing sector.A case study method with qualitative research methodology is used to illustrate how this determinist attitude to technology is contributing to the development of work stress, control over groups of employees and impoverished jobs in a Hungarian manufacturing plant.**

***Index Terms*— new technology introduction, work stress, technological determinism, socio-technical systems approach, impoverished jobs, qualitative research, manufacturing plant**

I. Introduction

Academic interest and research just as popular media attention, the number of movies, tv-series and books is growing around the so-called 4th industrial revolution and its societal, political and economic consequences. The reasons behind the flourishing research field are most likely rooted in how fast-changing technology has already changed our lives from one generation to the other and the wide-spread fear in society that new technological solutions could make our skills and jobs unnecessary and obsolete creating new forms of dependencies. Researchers disagree about the potential consequences of the introduction of these new technologies, some of them predicting an end of growth [1], while other more optimistic about the potential benefits of humans and machines working together [2]. Many academics agree with the opinion that these technological changes will have a profound influence on political life and most importantly power relationship within organizations [3], [4].For this reason, it is very important to research how choices are made about new technology introduction, who get a chance to participate in these and what role and responsibility management should take [5].

Investigating the process and consequences of new technology introduction in a manufacturing plant can have a significance that goes beyond the case, as it can indicate potential risks and challenges that might soon rise in our local communities and societies. For a deep understanding of these processes and psycho-social changes, a qualitative research methodology is applied. This can unveil the complex process of work stress development in an organization and the massive changes that are affecting work identities, the physiological and mental health of the employees.

A. *Statement of the study*

New technology introduction in a manufacturing plant is a potentially significant contributor to the development of distress at work. This can lead to high levels of burn-out, alienation from work, impoverished jobs and severe negative consequences to the physiological and mental health of organizational members.

B. *Purpose of the study*

The purpose of the study is to highlight the critical nature of new technology introduction in a manufacturing plant. Besides describing the potential negative consequencesof various approaches and attitudes towards new technology introduction, the author also aims to promote more participatory, alternative ways, like the socio-technical systems approach. These approaches provide opportunities to involve organizational members, place responsibilities on human decision makers and aim a positive outcome for all stakeholders of the process.

C. *Research Questions*

1. What are the consequences of applying a technological determinist approach to new technology introduction in the case of a Hungarian manufacturing plant?
2. How is work stress developing during a new technology introduction and what consequences does this have?
3. What are the potential alternatives of the technological determinist approach of new technology introduction?

II. Literature Review

A. *Optimistic and pessimistic evaluations of new technological revolution*

There is a wide consensus concerning the advent and important consequences of the so-called 4th industrial revolution. Academics agree about the significance and drastic changes that this will bring into our social and economic life. Some researchers, like Robert Gordon, emphasize the already visible negative social consequences, like the growing social inequality, restricted access to quality education and social services and warn about a potential death of growth in the economy [1]. Other academics and consultants to influential corporations, like Eric Brynjolfsson argue for the potential benefits and positive changes that this could bring about and take a much more optimistic

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perspective [2]. There is, however, a common ground for all these often-opposing perspectives which is about the significant dangers the 4th industrial revolution means for our societies and how this can only be handled properly if we do not consider technology as destiny, but instead acknowledge the responsibility humans have about the development and introduction of technologies to work organizations and other social entities. In other words, humans need to take technology development and responsibility for introduction in their hands. This is a very significant social, economic and managerial dilemma, that was discussed thoroughly in previous decades and now receives a renewed attention due to this latest advent of industrial revolution.

B. Responsibility and participation in new technology introduction

Concerning the important aspect of taking responsibility and participation in the introduction of new technologies, we have some great theoretical overviews that provide a simple framework for understanding and comparison. Mullins [5] provides in his book a great overview of these approaches, which helps to differentiate actual practices in work organizations based on the importance they place on technological factors and social factors. As it can be seen in Figure 1, the now dominant approach of technological determinism is a combination of maximal importance given to technological factors and minimal importance given to social factors. In contrast,socio-technical systems or processual approaches offer an alternative in which social factors are given an increased or even dominant emphasis when introducing new technology to an organization.

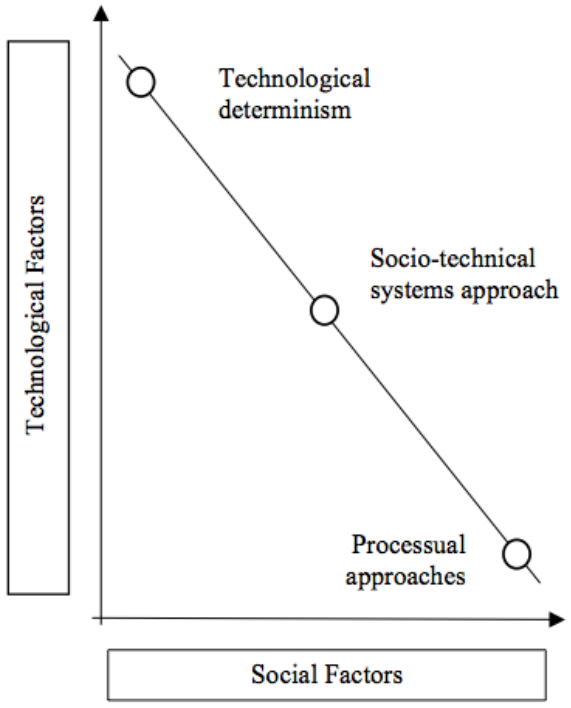

Figure 1 Approaches and explanations of technology adaptation in organizations based on Mullins [5]

As we can see in Figure 1, the technological determinist approach is an extreme position [5] that largely neglects social factors or requires their subordinated adaptation to the introduced new technologies. The explanation given by proponents of this approach takes an optimistic view on technology and allows it to have a determining role without human choices. Technological determinism often provides arguments based on a necessity for a loosely defined "progress" or risks of being overtaken by competition. The downside of this approach was already widely criticized during periods of earlier massive technological changes and authors like Blauner or Sayles have long proved its negative consequences of job satisfaction and human skills [5], [6], [7].

According to the alternative approach suggested by the socio-technical systems approach a new technology introduction is understood much more like a challenge of system design, which should be driven by a conscious organizational choice instead of some sort of perceived technical necessity [5], [8]. This approach developed by Trist and his colleagues by the highly influential Tavistock Institute concentrates largely on the choice within organizations [8], sometimes even letting social factors playing a more important role than technological factors during system design, but mostly neglecting the earlier, and highly significant stage of the process in which new technologies are designed and created [8], [9].

As we can see in Figure 1, the other extreme position is an approach and explanation that is giving priority to the social factors not just during organizational choices but also during decisions about what technologies should be designed and created. These approaches often referred to as "processual" [5] go back to the earlier tradition of the "labour process" perspective [10] that is highly critical towards current dominant, capitalistic approaches. Braverman and his colleagues do not blame technology itself for the experienced and predicted negative outcomes [5], [10]. They see technology as a tool in the hands of management which they use to increase their control, to de-skill, intensify and even eliminate jobs. It is because of these highly negative consequences that this approach is arguing for a wide social participation in the decision processes about what technologies should be developed and how they can be introduced to organizations [10].

C. New technology introduction and the development of work stress

During the previous review on different approaches to technology development, participation and choices during organizational introduction it was already indicated that the consequences of working with one approach or the other can severely affect organizational members. One of the most obvious and significant consequences is the development of distress at work which has an enormous literature of potential negative outcomes. The relationship between technology and work stress can be discussed from the point of view of ergonomics [11] or the socio-technical systems approach [8] itself. There have been a series of large studies conducted in the field of technology-driven stress. Concerning physical pains and strains, for example, Karasek and Theorell have found that up to 23% of heart disease could be prevented in the USA if high-strain occupations had more optimal strain levels [12]. Takahashi has investigated physical conditions like noise and light at work and has found that high luminance together with high levels of noise has contributed to high strain and fatigue levels and had a significant negative effect on mental activity levels of employees [13]. It was also proven multiple times that technologies which reduce the

number of workers being physically together (like telework) can create isolation and a decreased level of social support at work, which is strongly correlated to high distress levels and undesired mental states of employees [14].

The increasing amount of high strain jobs and the epidemic level of distress at work, together with all sorts of negative mental and physical consequences highlight the importance of the technologies we work with. In case we identify with the approach suggested by technological determinism then we would have to also accept all the issues that are created by these technologies. On the contrary, if we do not want to accept all the negative mental and physical consequences of the new "world of work" than we need to understand the influence of technology on our mental, social, political and economic life better. This understanding can serve our quest to be able to take technology into our hands and make well-informed and wise decisions about what technology to develop and create and what choices to make within organizations about potential introductions. The research presented in this paper is an attempt to improve our understanding of new technology introduction and the development of work stress, thus contributing to improved technology related decisions for the future.

III. Research Methodology

A. *Research field*

The research focuses on a Hungarian manufacturing plant, as an exemplary case-study field for a better understanding of new technology introduction, development and consequences of work stress. The researched factory is a foreign-owned small unit with only about 100 employees. The industry in which the factory is operating is highly sensitive to economic recessions and during these periods also fiercely competitive. The factory was chosen because of its small size and the frequent technological changes that were introduced to stay competitive and reduce production costs. The name of the company and industry must be kept confidential;however, the learnings of the study are mostly not specific to either of these. Hence in this study, we refer to the unit always as Factory T.

B. *Data collection methods*

Two types of data collection methods have been chosen for answering the research questions. Firstly, focus group interviews have been used because they are particularly suitable to explore interpretations, social relationsand communication patterns about organizational choices. As a second data collection method personal in-depth interviews were conducted with factory leadership, line managers and workers. This method has the strength of focusing on the topics that the interviewees find most important and relevant to the topic. Also, interviews made it possible to express the most personal and confidential concerns and gave the researcher the opportunity to develop the interview questions from one interview to the other. Both the focus group and in-depth interviews were semi-structured, continuously developed during the research and have targeted the multi-perspective and deeper understanding of the role new technology introduction plays in the development of work stress in Factory T.

C. *Data analysis methods*

For the analysis and evaluation of the collected qualitative data the author has used the NVIVO software, that was applied to both the coding and analysis of focus group interview and personal in-depth interview transcripts.

IV. Results of the Study

Based on the focus-group interviews and personal in-depth interviews it could be clearly established that regular workers have close to no influence on technology introduction in Factory T. Even the local factory management has reported that they simply play an executing role for technology-related decisions made at the top levels of the company. The implementation of new technology introduction often serves as a basis for their performance evaluation and is handled as a disciplinary issue. We can conclude that in the organization of Factory T new technologies are utilized by the owners and leaders of the corporation to improve their power position towards lower level management and employees. A very typical and clear manifestation of this "power game" could be observed in this company on the level of plant directors. During the economic recession in Hungary and the region, several factories have been shut down, but the directors from these factories have not been downsized, instead, they have been given a so-called "deputy director" job in the remaining factories. The "deputy director" position became a symbol of power and dependence in the remaining factories, usually it was interpreted as a message that in case of any disobedience (e.g. in case of new technology introductions) you are easily substituted. This power structure made it possible that any new technology introductions that seemed to serve competitivity or cost-effectiveness could be executed even in cases when the new technologies were not properly tested, not complying with national legislation or exposing workers to serious health hazards. This power dominated approach to new technology development in Factory T has resulted in very high levels of job strain and severe mental and physiological negative consequences, which are further elaborated in the sections below.

A. *Physiological consequences of high job strain in Factory T due to new technology introduction*

In the case of Factory T, a whole series of new technologies have been developed and introduced by the push style initiative of the corporate headquarters. Factory management and employees have only played a subordinated executional and adaptive role. In Figure 2 below readers can find in a summarized form the workplace conditions created by these series of new technology introductions and their physiological consequences on workers. It can be recognized that the introduced new technologies had clear technical deficiencies, which made them often also economically inefficient. The introduction of new technologies was implemented in a way that lacked both necessary physical resources and protective equipment and relied mostly on the intensification of jobs.

Workplace conditions created by series of new technology introductions in Factory T	Physiological consequences among workers in Factory T
-Extreme/changeable conditions of heat -Lack of physical resources (eg. protective drinks) -Deficiencies of the applied technology -Application of harmful materials -Overtime, night shifts -No usage of appropriate protective equipment (eg. noise protection)	-Colds and other respiratory illnesses -Skin diseases, skin irritation -Physical overload (motor diseases, risk of accidents) -Damage to hearing -Chronic diseases (enteric, vascular or cancer-related)

Figure 2 Relationship between workplace conditions created by new technology introduction and physiological consequences among workers, based on Szilas [15]

B. Mental consequences of high job strain in Factory T due to new technology introduction

Besides the above described physiological negative consequences, the series of new technologies introduced in Factory T have also been associated with a general perception of workers that their point of views, knowledge, understanding, interests, in some cases even their lives are not important. They have not been given any chances of participation or influence during decisions made about the development and introduction of technologies. This has developed in factory workers a sense of insecurity and unpredictability, they often became disillusioned or alienated from work. All these negative emotional states have resulted in feelings of meaninglessness and in some cases hostility and anger towards factory management and company leadership. In Figure 3 a summary is provided of the undesired emotional states developed by the series of new technology introductions in Factory T and mental hazards and damage among factory workers that can be linked to these.

Undesired emotional states of Factory T workers	Insecurity, Unpredictability Helplessness Disillusionment	Meaninglessness Alienation from work Lack of goals Loss of direction	Rage Hostility Anger
Mental hazards and damage among Factory T workers	High job strain and anxiety levels	Loss of identity Mood disorders Burn-out Depression	Aggressive behavior (towards managers, colleagues and themselves)

Figure 2 Relationship between undesired emotional states and mental hazards and damage among factory workers, based on Szilas [15]

V. CONCLUSION

The advent of the latest technological revolution has placed the classic dilemma around the introduction of technology once again in the center of academic and public interest. Researchers widely agree about the high potential mental, social, political and economic risks and difficulties associated with new technologies. There is,however, a significant disagreement about how exactly we could take new technology development and introduction again into our hands. In this paper three approaches to this challenge have been introduced, technological determinism, socio-technical systems approach and processual approaches. It was argued that in the case of new technology introductions a very significant attention needs to be paid to social factors to avoid severe negative consequences. Through a case study based qualitative research carried out in a Hungarian manufacturing plant, we have further supported the position that power dominated introduction of new technologies is massively harmful to both physiological and mental health of employees. In case we want to avoid these negative consequences, and in case we truly care about human life, then we need to take technology development and introduction back into our hands and give human stakeholders an opportunity to participate in the decision-making processes. This is the only way that we can regain control over technologies and have them developed in a direction that is serving human lives and communities.

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