

Strategic Model for Ergonomics Implementation in Operations Management

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Abstract

Contemporary organisations have to search for new strategic ways in order to improve economic effectiveness and work productivity, as well as to maintain human resources in long term. Managers should ensure open management of changes in order to motivate employees to participate in it delegating more responsibility to employees. This can promote trust, support employees' initiatives in operations improvement thus changing traditional organizational structure to flexible operations management. Therefore combined approach of macro- and micro-ergonomics in strategic operations management can result in effective improvement of labour productivity, management of technologies and healthy work environment. The developed model "Ergonomics implementation in operations management", based on the overview of the recent prominent literature, shows that changes in operations management due to ergonomics implementation stimulate satisfaction of employees, increase productivity, and decrease costs resulting in an improvement of the process and product quality.

Keywords: Model; Ergonomics; Operations; Management; Efficiency

Introduction

In the century of modern industrial civilization, production operations are closely related with a human at work and his work conditions that affect work productivity [1]. A number of new enterprises, especially the small and medium ones, at the beginning of their functioning do not have a clear long-term business strategy and the system that would ensure balanced interaction between the factors of production technology, human resources and the environment [2]. Such system could promote the product quality, corresponding to client's wishes, thus enabling the enterprise to successfully compete in the progressive business environment, as well as in the local and international market. Competition, based on the free market principles, is the basis of economics of any country [3]. Hence it is important to search for new ways and methods in order to promote work productivity and economic effectiveness of the organisation, maintaining human resources and product quality.

As world experience reveals, human factor or ergonomics is of great importance in operations management and increase in work productivity, especially, if proposals in the aspect of ergonomics are taken into account already in the stage of process designing [4]. Hence the issue of an improvement in the operations management in term of ergonomics is particularly topical. Misleading is the opinion that introducing modern production technologies, effect of human factor on the process is decreasing [5]. Employees, regardless introduction of wider and more modern technologies, are still subjected to hard manual work, monotonous work operations, harmfully forced postures at work, chronic work in night shifts. It can have a negative impact on work performance and workability thus causing decrease in organisation's productivity in general [6].

The work of operators of automated technological lines is often related to mental stress, temporal load and high responsibility work. In these cases, the overload and tiredness are caused by cognitive design and organisation ergonomics risks: long-term concentration on control panels, restricted time for prevention of different faults in certain work cycles, etc. Therefore it is necessary to find out and assess these risks in order to help any operator to choose a proper workload and techniques. It is part of ergonomics management, whose aim is to adjust the work process to a worker, changing their behaviour in positive direction, particularly emphasizing their loyalty to the organisation [7]. Nowadays, ergonomics is part of effective operations management in organisations being of great significance in entrepreneurship in order to ensure sustainable business. The approach in entrepreneurship, in which the ergonomics aspects and values are taken into account in operations management, can ensure improved business efficiency culture, and many of nowadays LEAN methods are in strong relation to ergonomics methods [8].

Author's studies suggest that expenses, invested in improving of the processes and ergonomic solutions, pay off in long term, which can be proved, applying economic analysis of costs-benefits [9]. Thus the problems which are being solved regarding the work nowadays are of incredible importance and should be taken into consideration by every business.

The aim of the research was to establish a strategic model for ergonomics implementation in operations management, basing on the theoretical background of ergonomics in order to improve the management of production operations. This study has focused on finding a solution to the necessity of ergonomics approach in operations management in production enterprises. The theoretical model and its implementation will enable organisations to apply the knowledge of ergonomics to production operations, in relation with interaction of technologies, work organisation and human resources.

Thus implementation of ergonomics in operations management in organisations could promote competitiveness in the market, which nowadays is extremely important for further growth of every business.

Analysis of Theoretical Conceptions of Operations Management in Relation to Ergonomics

Every organisation has its strategy and objectives, but operations determine how successfully it functions in order to achieve its goals. Operations management takes the leading role in any organisation, and every process results in values – goods or services that have their own value in ensuring the existence of the organisation.

On the basis of the idea of operations value chain usually the SIPOC (supplier → input → process → output → customer) principle is used [10]. Each exit of the preceding process serves as the entrance of the next process. Therefore the process should be arranged so that it would be effective, productive, controllable and adaptable. It should adjust to certain conditions, determined by organisation strategy, restrictions or rules. Such approach has become an effective management model in the world, and is able to ensure sustainable activity and development of big and small organisations [8]. One of the main preconditions in operations management is interaction of the employee involved in the process and organisation [11]. It can be considered that not always the introduction of new and expensive technologies facilitates an economic growth of the enterprise since in their implementation people participate, and efficacy of application of these technologies depends on people's knowledge, skills, and personal qualities, including workability. Hence, in operations management, attention should be paid to elastic techniques of work aimed at adjustment of technological equipment, facilities, and instruments to provide abilities and specific needs of employees [6].

Each organisation is individual therefore operations suitable for one organisation may be completely different from those in other organisation of the same branch. It can be concluded that in order to assess operations effectiveness, not only technological faults should be analysed thoroughly, but also human faults appearing in the course of the process, as they create additional costs and negatively affect the amount of production and product quality.

It is not a secret that any process in the course of time should be improved. Several trends in operations improvement have been reported in literature [5,12-14]. In contemporary entrepreneurship, achievements in process management are ensured by different approaches: the total quality management, benchmarking, "six sigma" management, management of changes and innovations, European Foundation of Quality Management (EFQM), methodology of evaluation of business excellence, lean production, international quality standards, etc. The world leading experts in quality management consider that continuous improvement of process quality together with quality breakthrough is the best solution in quality management [15]. This trend is aimed at adjustment of work and creation of conveniences for the employee, which in its turn improves his workability thus increasing the productivity.

A number of studies in the world have proved that effectiveness of an organisation is closely related to a human, performer of the work, whose skills and activities directly affect the results of organisation's activity [16]. An essential role here is played by ensuring of well-being of an employee in work environment. Well-being at work promotes employee's feeling of belonging and trust to the enterprise. Consolidation of this feeling and mutual trust significantly increase the

financial state of the enterprise [2,17,18]. Therefore it is important to find out coherence between an employee and the aim of the organisation and its effectiveness. One of such coherence is the relation between a human and work, which at a great extent depends on work load and workability of employees. This coherence is studied by a multi-disciplinary branch of science- ergonomics. The ergonomics development has long history [19] which has been developed as science discipline since 1949 [20,21]

Traditionally ergonomics is divided into: (1) the load ergonomics, e.g., an impact of physical load on human physiological systems; (2) the cognitive ergonomics, e.g., the psychic or mental, or emotional processes in the body, caused by performing work duties, working with the equipment, etc., [22]; (3) the organisation ergonomics, e.g., an implementation of new technologies, improvement of the existing ones, developing of work design, work organisation, etc. (Nemeth, 2004). Nowadays, this basic division is added by: business ergonomics, participatory ergonomics and rehabilitation ergonomics [18].

At micro-ergonomics level, the interactions of human-machine, human-technology, and human – tool, etc., are analysed. In the course of time it has been proved that orientation in ergonomics towards micro-level only does not reach effectiveness of the common work system in the organisation [23]. Hal W Hendrick established the macro-ergonomics conception defining it as "an all-inclusive approach to socially technical system in the common organisation and work system" [24]. Now it is believed that activities of macro-ergonomics in an organisation are based on the principle in which the employees themselves actively participate in the change of operations [25]. Hence it can be concluded that macro-ergonomics concentrates on work organisation and work system design, taking into account all specifics of a human, technologies and the environment, as well as the aspects of organisation management.

Ergonomics approach in operations management improvement

One of the factors that facilitate processes is the management of human resources, which includes not only organisational measures, but also ensures well-being at work. Care for an employee, creating proper work conditions, improving work organisation and involving employees in decision-making increase their workability and job satisfaction [26]. It can be recognized that one of the possibilities to improve operations is to make them safer and more comfortable, using an adjusted ergonomics intervention programme. It certainly requires a thorough process management and investments in technologies, including implementation of ergonomics in operations management and socio-technical system. Socio-technical system is a united, purposeful enterprise, comprised by people, and its task is to transform investments into results. Basing on theory, it is accepted to divide the socio-technical system in three sub-systems: technological, personnel and task development [23]. Evaluating the parts of socio-technical system, one can consider that ergonomics should be included in the structure of organisation's work system, as its solutions are important to personnel who organises and harmonizes the elements of this system, as well as makes possible the general improvement of technological and personnel sub-systems.

Successfully implemented ergonomics and continuous process management can result in the optimum functioning of socio-technical system, which ensures employees' safety at work, psycho-social comfort, improves the life quality and influences the motivation for

work. Therefore the modified model is offered which combines operations management and organisation strategy, and takes into account the socio-technical system, components and ergonomic intervention in planning and management system (Figure 1).

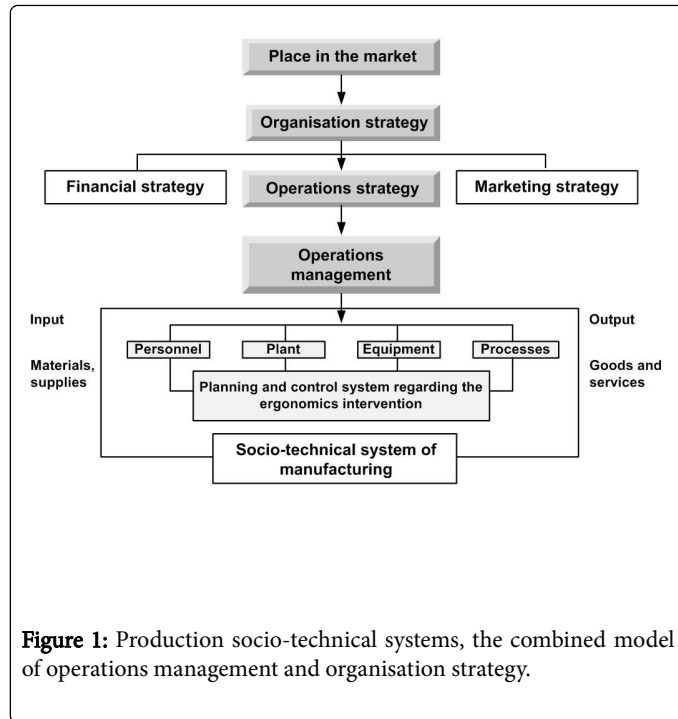


Figure 1: Production socio-technical systems, the combined model of operations management and organisation strategy.

The basis of successful changes is comprised by management's vision, thorough planning, determination of responsibility, training of employees, realized in process management [11]. It should be kept in mind that implementation of any changes requires its careful assessment, attraction of other resources in order to adjust its concordance with a concrete person and concrete work place. For example, making changes in technologies, several other issues should simultaneously be considered: (1) instalment and checking of technological systems; (2) plan of work; (3) training of employees and their support; (4) changes in the organisation in general; (5) participation of employees in the process of changes.

To solve these and other issues participatory ergonomics can be used, which relates to continuous improvement of the organisation in any of its processes [4]. Participatory (involvement) ergonomics – it is an aggregate of philosophy, process strategy, technique and instruments [27]. In ergonomic intervention measures, if they occur at the level of macro- and micro-ergonomics, employees have the possibility and power to apply their knowledge to solving ergonomic problems in their work activities. One can agree with the conclusion that involving employees in ergonomics process develops in its participants their self-confidence, competence, and independence, as well as promotes their personal growth and social contacts, considering it to be an important element in continuous improvement of overall processes.

Specialists in the area of ergonomics are not always able to persuade organisation managers to make necessary financial investments in introduction of ergonomic solutions unless economic benefit is proved [28]. H. Hendrick, working out measures of ergonomic intervention, pointed out that it is important to determine measurable costs and benefits to be acquired [24]. He has discovered that ergonomic

intervention, aimed at introduction of ergonomic solutions, increases efficacy of the organisation by 60-90%. Costs of ergonomic measures or solutions are easily understandable, as they are fixed financial means for improvement of the used equipment, acquisition of more modern equipment, training of employees, etc. However, it is more difficult to evaluate the benefits from ergonomics implementation, as they are related to decrease in costs due to illnesses of employees and reduced losses due to unproduced goods within a certain period [1]. In addition, there are benefits which are difficult to convert in monetary value, for example, satisfaction of employees, loyalty to the enterprise, etc.

Strategic Model for Ergonomics Implementation in Operations Management

Contemporary rapid changes in work content have caused challenge and stress in socio-technical system of many enterprises. Development of qualitative work conditions, emphasizing human centred approach and integrating ergonomics process in management, is one of the main conditions for sustainable development of an enterprise. Thereby work in safe and ergonomically favourable conditions is not only human, but also economics necessity. Therefore authors offer their model, Ergonomics implementations in operations management (Figure 2).

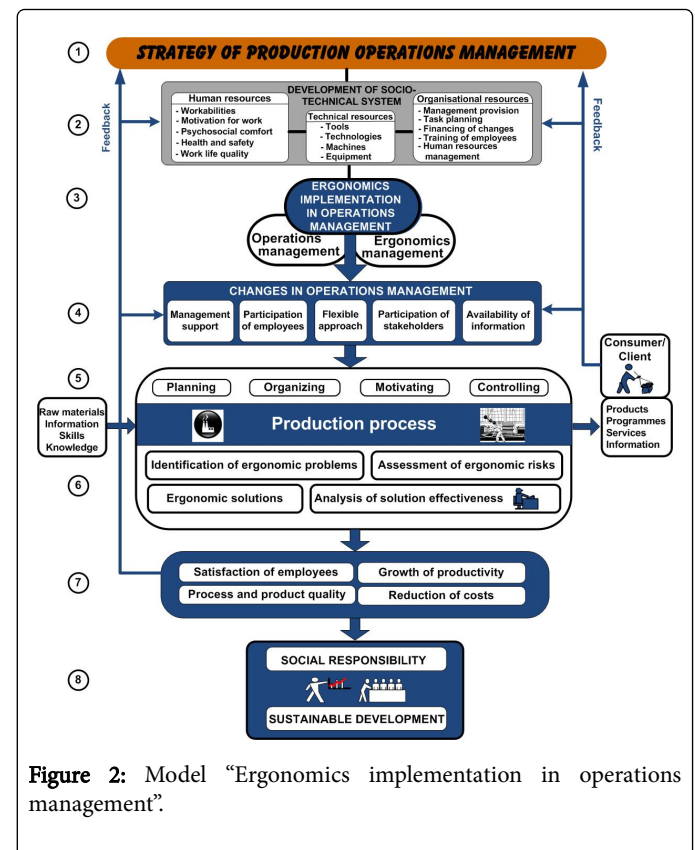


Figure 2: Model "Ergonomics implementation in operations management".

The model "Ergonomics implementation in operations management" (Figure 2) includes structure elements, which are complex and synergic. In the model, strategy of production operations management is based on the development of socio-technical system, which is characterized by (1) human resources (workability for work, motivation for work, psychosocial comfort in work environment, individual health and safety at work, as well as quality of work life in

general); (2) technical resources including tools, technological equipment, automated lines, etc.; (3) organisational resources, including division of work functions and tasks, planning, process management improvement, work organisation, training of employees, etc.

Authors propose that ergonomics implementation is provided by interaction between operations management and ergonomics management, which results in changes in operations management. These changes in operations management are a united aggregate of functioning activities, including not only elements of operations management, but also elements of ergonomics management. Thus in operations with implemented ergonomics, process and product quality is provided in conformity with the distinction model of EFQM [29].

It should be noted that support from management, employees' participation and access to information on ergonomics implementations in operations management are essentially important, since the lack of these principles significantly decreases efficacy of ergonomic solutions [2].

Elements of ergonomics management (Figure 2, position 6), such as identification of ergonomic problems, risk evaluation, solution implementation and analysis of their effectiveness, simultaneously help to control deviations in the process, thus preventing or reducing amount of defective articles. Changes in the operations management develop feedback, determined by a consumer/client as well as by employees. The model clearly reveals that a consumer/client is the primary developer of the feedback, the one who evaluates product quality, including its ergonomic design, and determines amount of the product, thus affecting production system (Figure 2, position 2) and strategy of production processes in the organisation in general (see Figure 2, position 1). This feedback is created by consumers'/clients' references that mainly reveal evaluation of the product model (technical, functional and aesthetic criteria), product quality, production amount and cost.

Significant feedback is created by employees as well. This link with employees is the strongest if the employees are motivated for work, receive support from the management, participate in decision making, and if they are involved in the development and implementation of changes. However, this link can be disrupted if employees have not been informed on goals of the organisation and operations management strategy, if they are not involved in the necessary changes, as well as in cases when employees, being afraid of job loss, do not want to report on process problems, including ergonomic risks at work.

In order to successfully implement ergonomics in operations management, one can suggest refusing the formal management principles and turning to flexible approach, including participatory ergonomics approach. In this relation, in the future research more in-depth analysis will be carried out in order to conduct case studies and surveys on practical use and the effectiveness of the model "Ergonomics implementations in operations management". Future research will focus also on costs and benefits analysis before (proactive approach) and after (reactive approach) ergonomics implementation in operations management, which is the approach, suggested in other findings [30-33].

Conclusion

Changes in work content have caused necessity to evaluate the operations management strategy, increasingly paying attention to a human at work. The model "Ergonomics implementation in operations management" has been worked out, taking into consideration not only the basic principles of micro- and macro-ergonomics and ergonomics management methods, but also the practical conclusions, which in the last decade worldwide have been used in a new direction of combining ergonomics and economics in business ergonomics. Those conclusions have been included in the structural elements of the model, showing consecutive actions for making changes in operations management - beginning with the development of social-technical system in ergonomics implementation in operations management (combining existing operations management elements and ergonomics management elements) and finishing with the analysis of the cost-benefits of ergonomic implementations. The model is complex and synergic since elements add to and influence each other. It results in social responsibility, which is the base for sustainable development of the organisation. Such model can be applied when changes are made regarding ergonomic risks in operations management, as well as for the improvement of strategy in organisations whose activities are related to production operations in different economic sectors. Investigation will continue in order to find out how the model "Ergonomics implementation in operations management" can be applied in praxis in various economic sector organisations.

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