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The Strategic Value of Ergonomics for Companies

Jan DUL

Rotterdam School of Management,Erasmus University Rotterdam, Rotterdam, The Netherlands

Abstract. The discipline of ergonomics studies the interaction between man and the designed technical and organizational environment. In product ergonomics, this knowledge is used to develop user-friendly products and in production ergonomics to design human-friendly (production) processes. Beside social goals, ergonomics can contribute to economic goals of an organization. With user-friendly products, a company can deliver benefits to its customers, which exceed those of competing products. With human-friendly production processes, a company can increase labor productivity and consequently can reach important cost-reductions. The growing consciousness of the importance of humans (customers and workers) for the success of organizations, implies that ergonomics can have a strategic value for the management of organizations.
In this paper a model is presented that shows the strategic value of ergonomics. Examples are given to illustrate this.
Keywords: Competitive advantage, labor productivity, human centered design, product development, process development

1. Introduction

According to the formal description of ergonomics, approved by the International Ergonomics Association, ergonomics deals with the design of products and processes in order to improve '*human well-being'* as well as '*overall system performance'*. Improvement of human well-being can be considered as the social goal of ergonomics, which is important for the users of products and processes (consumers and workers). Similarly, improvement of overall system performance -although this term is rather vague-, can be considered as the economic goal of ergonomics, which is important for the management of an organization that develops, produces or uses products.

This paper elaborates on the economic dimension of ergonomics. A model is presented which shows how ergonomics can be positioned in the value chain approach,

originally proposed by (Porter 1985). This approach is widely used in the business community. With the value chain model, the strategic value of ergonomics for companies can be explained. Two examples are given to illustrate this value: an example of product ergonomics, and an example of production ergonomics. Furthermore, the paper discusses the role of ergonomists to stimulate the use of ergonomics in organizations.

2. The Value Chain Model

In management, a business process is usually described as a chain of value-adding activities. The upper part of Fig. 1 shows that the process of product creation and product realization can be characterized by the chain: research, product development, process development, purchasing, production, and distribution.
The lower part of Fig. 1 shows that *product ergonomics* can add value to the process of product creation (research, product development), and that *production ergonomics* can add value to the process of product realization (process development, purchasing, production, and distribution).

In product creation, the management (the marketing manager, for example) can decide to implement an ergonomic strategy, which implies that a competitive advantage can be reached by developing user-friendly products.

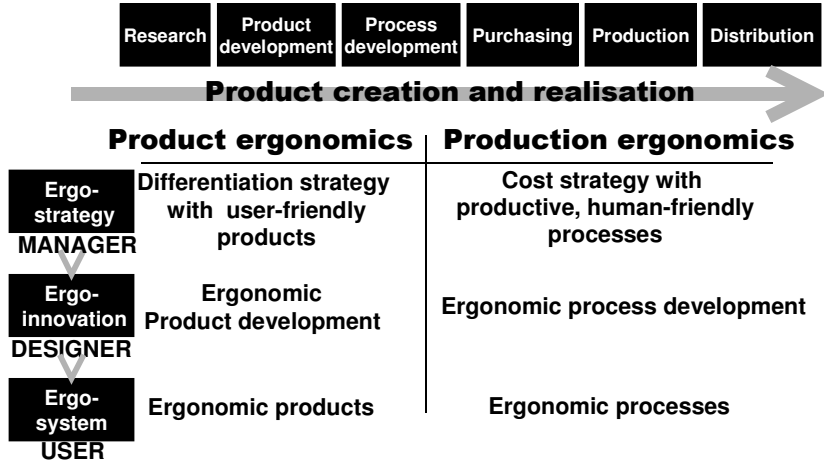

***Figure 1**: Ergonomics as part of the value chain of product creation and realization (Adapted from Dul 2003a).*

In product realization, the management (the production manager, for example) can decide for an ergonomic strategy as well. This implies that with human-friendly production systems, the labor force is more productive and that acceptable working conditions can be reached.

Both ergonomics strategies can be implemented by using an ergonomics innovation process in which product or process designers and ergonomists, as well as other stakeholders including users, are involved. This should lead to ergonomic products and production processes for users such as consumers and workers.

Organizations will give attention to ergonomics if:

- Customers demand ergonomics products or processes;
- Authorities define ergonomics requirements for the design;
- Designers give attention to ergonomics, based on their views on quality;
- Managers appreciate the strategic value of human centered design.

Below, two examples are given of the latter consideration, which also illustrates the model of Fig 1.

3. Examples

3.1 Product ergonomics

In 1993, AB Sandvik Saws and Tools (part of the Swedish Sandvik organization) decided to have a specific ergonomic diffentiation strategy to reach a worldwide leading position in professional hand tools (White and Birkinshaw, 2000). Part of the strategy was an 11 step ergonomics product design approach, developed by Ergonomi Design Groupen AB (Bobjer et al., 1995). This approach included three steps with user participation. In the past few years, different hand tools have been developed in this way, and introduced on the market as *Ergo tools*.

After the introduction of the Ergo-tools, the results of AB Sandvik Saws and Tools in 1995 showed an increased market share in markets where the company had already a good position, whereas no effects were seen in new markets, including the USA. In 1999, AB Sandvik Saws and Tools was taken over by Snap-On, Inc. from the USA, and the name of the company was changed into Bahco Group AB.

In its annual report of 2001, Snap-On reports an improvement of its market position, due to the introduction of new ergonomic tools from Bahco. The annual report of 2002 states that the growing market interest in ergonomics, can help to stimulate further growth of the company, and that the innovative power of Snap-On in the field of ergonomics is a differential competitive advantage.

3.2 Production ergonomics

Famostar Emergency Lighting BV in The Netherlands develops, assembles and sells emergency lighting. The company is market leader The Netherlands. It produces 200.000 systems each year and is rapidly growing.

In the old assembly process, a batch of parts were laid down on a table, and assembled and packed manually by workers who walked along the table. Finished products were placed manually on a pallet for further transportation.

Due to an increase of the product volume and due to lack of space, a project was started to redesign the assembling process (Rhijn et al., 2002). The batch-type of production was changes into a flow-type of production. Sitting workplaces were introduced, which allowed picking parts from boxes close to the body, and lifting equipment was introduced to reduce manual lifting.

The project showed the following results: labor productivity in terms of average number of products per person per day increased 69%, space requirement decreased 45%, manual lifting load reduced from 129% to 51% of the maximum allowable load, and arm posture worsened because the workers worked 12% longer with a 20-60 degrees elevated arm posture. Furthermore, the workers experienced a more complete working task, and an improved psychological work climate, since they were involved in the development of solutions. Overall, the results show that the assembling process was more productive and more human-friendly, although some nuances were found.

4. Discussion

The model and the examples show that ergonomics can have a strategic value for companies when the top-management decides for an differentiation strategy with user-friendly products (see Bahco example) or for a cost-strategy with human-friendly and labor productive processes (see Famostar example).

However, most organizations are not aware of such strategic value of ergonomics. Perrow (1983) mentioned several reasons including, the relatively small number of ergonomists that is employed in companies, the lack of control of these ergonomists over budgets and people, the qualitative nature of ergonomics, and the image of ergonomists as protectors of workers. Hendrick (1996) adds that there are too many examples of bad ergonomics, that many ergonomists presume that others are convinced of the importance of ergonomics as well, and that the benefits of ergonomics are not well documented. Furthermore, the following additional reasons could be mentioned:

- Most ergonomics activities deal with the social dimension of ergonomics and give less attention to its economic dimension;
- Ergonomics primarily deals with minimization of problems, rather than maximization of opportunities;
- Much ergonomics knowledge is available at operational level, however at tactical and strategic level the discipline is not yet well developed;

- And last but no least, in general, ergonomists do not communicated their knowledge towards the management and business community. An example of this is that only 47 ergonomics articles have been written in 97 leading management journals during the last 10 years (Dul, 2003b).

Recent efforts to integrate macro-ergonomics and micro-ergonomics (e.g. Zink, 2000) may help to improve this situation, and may stimulate that more managers appreciate the strategic value of ergonomics.

5. References

1. Bobjer, O., Bergkvist en H. Lohmiller WR., 1995. Development of prototype tools for field testing. Proceedings of the 2nd International Conference on Prevention of Musculoskeletal Disorders, Montreal, Canada.
2. Dul, J., 2003a. "De mens is de maat van alle dingen". Over mensgericht ontwerpen van producten en processen. ("Man is the measure of all things". On human centrered design of products and processes). Inaugural address. Erasmus Research Institute of Management, Rotterdam, The Netherlands.
3. Dul, J., 2003b. Ergonomics in management. *Ergonomics in the digital age*. In : Proceedings of the Triennial Congress of the International Ergonomics Association, Seoul, South-Korea.
4. Hendrick, H.W., 1996. Good ergonomics is good economics. Proceedings of the Human Factors and Ergonomics Society 40th Annual Meeting. Human Factors and Ergonomics Society, Santa Monica CA, USA.
5. Perrow, C., 1983. The organizational context of human factors engineering. *Administrative Science Quarterly* 28 (4), 521-541.
6. Porter, M.E., 1985. Competitive advantage: creating and sustaining superior performance. Free Press, New York, USA.
7. Rhijn, J.W. van, Looze, M.P. de, Groenesteijn, L, Groot, M.D. de, Vink, P. & Tuinzaad, G.H., 2002. Efficient flow and human centred assembly. The success of an interactive approach. In: *Humans in a Complex Environment.* Proceedings of the 34th Annual Congress of the Nordic Ergonomics Society, Linköping University, Linköping, Sweden, pp. 805-810.
8. White, R.E. , Birkinshaw J., 2000. AB Sandvik Saws & Tools: The Ergo Strategy. In: Crossan, M.M., Fry, J.N., Killing, J.P., Morrison, A.J. & White, R.E. (eds.), *Strategic Management: A Canadian Casebook.* 5th ed. (pp180-199), Prentice Hall, Scarborough ON, Canada.
9. Zink, K.J., 2000. Ergonomics in the past and the future: from a German perspective to an international one. *Ergonomics* 43 (7): 920-930.