

The strategic business value of ergonomics

J. Dul^a, W.P. Neumann^b

^a *Department of Management of Technology and Innovation,
RSM Erasmus University, Rotterdam, The Netherlands*

^b *Department of Mechanical and Industrial Engineering
Ryerson University, Toronto, Canada*

Abstract

The value of ergonomics is beyond health and safety. This discussion paper emphasizes how --while maintaining worker's health and safety-- ergonomics can add value to a company' business strategy to reach the ultimate business goal of profit, or intermediate business goals related to profit drivers like cost minimization, productivity, quality, delivery reliability, responsiveness to customer demands, or flexibility. We do not see ergonomics, in and of itself, as a strategy, ultimate business goal or intermediate business goal. However, we see ergonomics as an important feature of strategy formulation and implementation, since attention to ergonomics can contribute to many different aspects of business performance.

Keywords: strategy, business, economics, paradigm shift, future of ergonomics

1. Introduction

The International Ergonomics Association (IEA) describes ergonomics (or human factors) as *“the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance.”* This implies that ergonomics contributes to the optimisation of both human well-being (a social goal) and total system performance (an economic goal).

However, most ergonomics research and advice primarily deals with the well-being goal of ergonomics, in particular the prevention of musculoskeletal disorders., and other occupational health and safety goals Furthermore, in several countries ergonomics is closely linked to occupational health and safety

legislation. Under these circumstances companies experience ergonomics as extrinsic (lower part Fig. 1), and not as part of the strategy, business goals and planning and control cycles (upper part of Fig. 1). The current trend in western governmental policies to reduce command-control legislation and to increase support for voluntary initiatives is a threat for ergonomics as a health and safety perspective, because we do not believe that organizations will then spontaneously start ergonomic initiatives.

The position of ergonomists in organizations is not very strong. Perrow [1] argued that there are not many ergonomists working in companies, that they have no control over budgets and people, and that they are seen as protectors of workers, for example not blaming human errors on the workers but on the designers and managers of the systems. Hendrick [2] added that ergonomists, wrongly, presume that others are convinced of the importance of ergonomics. Helander

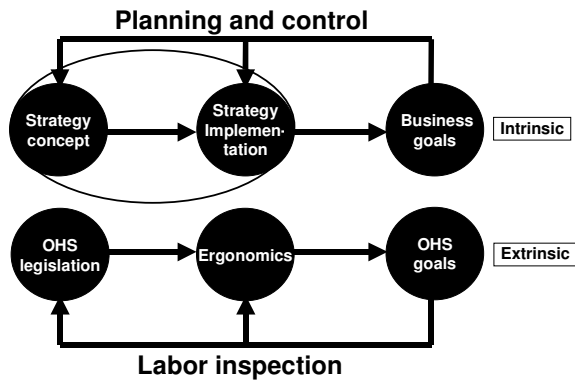


Fig. 1: Upper part: The relationship between strategy (strategy concept and strategy implementation) and business goals. Lower part: The present isolated position of health ergonomics. OHS=Occupational Health and Safety.

[3], listed seven common reasons that ergonomics is not implemented. He noted, among other things, that people think that ergonomics is to design chairs, ergonomics is common sense, and that organizations first design the technical system and then consider ergonomics.

We suggest a new direction for ergonomics, using its full potential in organizations, without being exclusively dependent on health and safety considerations (Fig.2). We consider 'strategy' and 'business goals' as useful connection point to internalize ergonomics in organizations, because strategy has top management priority and is normally intended to be broadly communicated and implemented in the organization.

This raises the question: "how to link ergonomics to strategy?"

2. Ergonomics and strategy

We distinguish three 'strategic arenas', which we use as a starting point for linking ergonomics to strategy. Each strategic arena represents a different set of stakeholders that might benefit from ergonomics:

- Corporate Strategy;
- Business Function Strategies;
- Cross-functional strategies.

In the corporate strategy area, ergonomics must show that it can add value to the corporate business strategy for realizing competitive advantage. In this arena, the top management of the organization is involved, as well as external stakeholders including shareholders. In the business function arena, depending on the

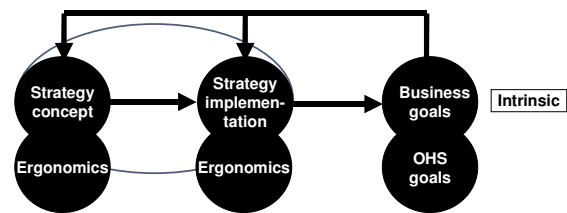


Fig. 2: Business ergonomics: Linking ergonomics to strategy and business goals.

business function (e.g. product design, production engineering, marketing, HRM), middle managers and the employees representing the business function will be primary stakeholders. Here ergonomics must show that it can support the chosen strategies, and the corresponding performance indicators of the functional field.

Cross-functional strategies involve two or more business functions, and hence several corresponding middle managers and employees from these business functions will be primary stakeholders.

Below we present some possibilities to link ergonomics to specific strategies in each arena.

3. Corporate strategies and ergonomics

3.1 Cost and differentiation strategies

Porter [4] suggests two basic corporate strategies that can be distinguished: a differentiation strategy and a cost strategy. In the differentiation strategy, the company produces and delivers products or services with unique features to attract consumers. User-centered products, created by ergonomic product design, can be such a feature [5]. In the cost-strategy, a company competes on the basis of the cost of the product or service. By ergonomic design of the production system, including ergonomic job and workplace design, or human work elimination by mechanization or automation of inefficient, unhealthy or hazardous tasks, the costs per unit can be reduced and labor productivity increased. Reducing costs and increasing productivity is an on-going activity in most organizations.

3.2 Resource Based View

According to the resource-based view (RBV) of the firm [6] a company can outperform other companies by the way the company combines its technical, human

and other resources. When people are considered to pose a key resource, it is important to use their capabilities and knowledge and to prevent its outflow by using ergonomics. The RBV attempts to reach sustained competitive advantage by choosing and developing resources that are valuable, rare, costly to imitate, and exploitable by the organization. By ergonomic job and workplace design, ergonomics can contribute to the maximization of the use of valuable, rare, and costly human resources, and hence to the maximization of sustained competitive advantage and to economic performance above normal.

4. Business function strategies and ergonomics

While there are many different business functions in a company to which ergonomics can be linked, here we mention just a few.

4.1 Product Design

Product design and engineering can benefit from the applications of ergonomics in both the design of the product for the end user and in design of a product that is easy to produce. All too often products are not designed to accommodate the physical or mental characteristics of the target customer. Better design, with attention to the user, can result in more desirable products [7].

Design for Assembly (DfA), or Design for Manufacturability (DfM) [8], is an approach by which the ergonomics of assembly and manufacturing is considered in the product design stage. By considering production ergonomics in the product design phase it is possible to avoid all costs associated with corrective ergonomics processes, with little extra investment in the design phase.

4.2 Production Engineering

Industrial work has become increasingly repetitive and monotonous. The resulting problems of demotivated and injured workers have long been known. Attention to ergonomics can support alternative designs that may result in systems, such as long-cycle parallel assembly flow systems, with superior performance [9].

Automation is another strategy by which performance may be increased and exposure to repetitive monotonous work decreased. It is important

to give attention also the tasks remaining for operators, not just the tasks that are automated away [10]. Integrating ergonomics into production engineering, so that solutions are optimal for both productivity and operator well being can be difficult due a 'clash of perspectives' between engineers and ergonomists [11].

4.3 Corporate communication/Marketing

In marketing communication the company's competitive product (or production) characteristics can be communicated to the customer. Positive product characteristics of ergonomically designed products like functionality, usability, health and comfort, can be communicated to the customer. With respect to production ergonomics, similarly to 'fair trade' products the communication may target the aware consumer. A barrier here remains the extent to which consumers are prepared to differentiate products based on the working conditions of their manufacture, and the extent to which credible information on the working environment is available.

Ergonomics can present a part of a company's 'corporate social responsibility' and 'corporate sustainability' platforms [12] in a society that is placing increasing demands on companies to be more than money making organizations. Thus the advertising of ergonomics as part of 'harmless product' or 'harmless production' campaigns can offer the potential consumer a better product, made in better working conditions, for a better world.

4.4 Human resource management

Good working conditions present one strategy for attracting and retaining high quality employees. The need to attract people to manual assembly jobs in Sweden was one of the driving forces of production system innovation away from traditional Tayloristic line production toward new more productive and attractive solutions [9]. Human Resources Management (HRM) departments have long been held responsible for employee welfare, even though they tend to have little responsibility for work system design. The gap between human resources and operations management (OM) has been noted and presents a challenge for the design of work systems that are motivating and productive [13].

While many HR strategies exist we mention only 'High Performance Work Systems' (HPWS) as one of these that incorporates elements of involvement and

employee empowerment consistent with existing 'participatory' ergonomics approaches, as well as job design. HPWS have shown themselves capable of increasing organizational performance [14], but appear to operate on the HR side of the HR-OM gap. Ergonomics could make the link here.

5. Cross functional strategies and ergonomics

Most of the common and well known management models, fads and hypes fit into this cross functional category. Lean Production, Business Process Reengineering, Downsizing, Total Quality Management, and the Service Profit Chain are examples of broader strategic concepts affecting different functions in the organisation, usually accompanied by a specific set of tools to implement the strategy. For these strategies to be successful several business functions must work together to realize an effective implementation.

5.1 Downsizing, Lean Production, Business Process Reengineering

The ergonomics and health and safety communities have negatively perceived Downsizing, Lean Production, and Business Process Reengineering. Vahtera et al. [15] have found risk of musculoskeletal disorders to increase by 5.7 times during 'corporate downsizing'. The individuals' perception of the downsizing process itself also appears to affect health [16]. Landbergis et al. [17], in their review of available literature, noted increased negative health outcomes are often associated with the adoption of Lean Manufacturing approaches. While it is tempting to look at these results and say: '*Strategy X is bad ergonomics*', this is perhaps not the right conclusion. In our view, strategy includes both a concept (a strategy plan) and its implementation. The extent and the way to which a strategy is realized in practice may vary with the gap between strategy and practice being apparently a more important indicator of (poor) performance than the strategy itself [18]. It is difficult therefore to determine the ergonomic consequences of production strategies directly without considering the specific implementation for each case. There may be a gap between the strategic concept and its implementation that is leading to poor ergonomics and compromising the effective realization of the strategy.

5.2 Total Quality Management and the Service Profit Chain

Total Quality Management is a general term for improving business processes by incremental improvements, involving 'all' business functions. For the implementation and management of this strategic concept, specific tools can be used. Many European organizations use the EFQM model (European Foundation for Quality Management). In this model 9 criteria for quality are considered including two for people (people enablers and people results). Ergonomics can be applied as part of a people enabling approach, and therefore can contribute to people results and total quality.

Quality has become an important competitive domain that has been seen to have links to ergonomics [19]. For example Axelsson [20] found that jobs with poor ergonomics were 10 times more likely to have quality deficits than jobs with good ergonomics, and Yeow and Sen [21] found a reduction of \$574,000 in rejection costs with less than \$1,100 in modifications and training which led to a 5.2% reduction in customer side deficits.

Heskett et al. [22] proposed the Service Profit Chain (SPC) model that relates employee satisfaction to customer satisfaction and further to financial performance of a service organization. Empirical studies suggest that the relationships between employee satisfaction, customer satisfaction and business performance exist if the employee-customer contact is more important [23]. Ergonomics can contribute to employee satisfaction, and therefore to the strategy concept of the SPC. A recent multiple case study showed that managers in service based warehouses decided for ergonomics improvements because of the expected effect on customer satisfaction, and not because of health and safety [24].

6. Final remarks

Our analysis suggests that ergonomics can contribute to many different company strategies and can support the objectives of different business functions like production, marketing and HRM. Discussions within the ergonomics community [25,26,27] showed that linking ergonomics explicitly to business strategies and goals, remains a great challenge for the ergonomics discipline. We intend to further these discussions in this IEA conference and invited interested readers to

attend the interactive session on this topic [28] For many ergonomists it means a paradigm shift, which requires a repositioning from health ergonomics to business ergonomics. However, by contributing to the shared goals of business performance, ergonomists will also be better able to reach their traditional objectives of well-being and health and safety.

Acknowledgements

This work has been supported by Erasmus Research Institute of Management of the Erasmus University Rotterdam, and the SMARTA theme of the Swedish National Institute for Working Life.

References

- [1] Perrow C. The organizational context of human factors engineering. *Administrative science quarterly*, 1983. 28(4): p. 521-541.
- [2] Hendrick H. Good ergonomics is good economics. *Human Factors and Ergonomics Society*: Santa Monica, CA, USA, 1996.
- [3] Helander MG. Seven common reasons to not implement ergonomics. *International Journal of Industrial Ergonomics*, 1999. 25(1) p. 97-101.
- [4] Porter ME. *Corporate Advantage: Creating and Sustaining Superior Performance*. 1985, New York: Free Press
- [5] Dul J. The strategic value of ergonomics for companies, in *Human Factors in Organisational Design and Management VII*, H. Luczak and K.J. Zink, Editors. IEA Press: Aachen, Germany. p. 765-769, 2003.
- [6] Barney JB. Firm resources and sustained competitive advantage. *Journal of Management*, 1991. 17(1): p. 99-120
- [7] Vicente KJ. *The human factor: revolutionizing the way people live with technology*. 2004, New York: Taylor and Francis. 351, 2005
- [8] Helander M and Nagamachi M. *Design for Manufacturability: A systems approach to concurrent engineering and ergonomics*. 1992: Taylor & Francis
- [9] Ellegård KD, Jonsson T, Engström MI, Johansson L Medbo and Johansson B. Reflective production in the final assembly of motor vehicles - an emerging Swedish challenge. *International Journal of Operations and Production Management*, 1992. 12(7).
- [10] Neumann WP, Kihlberg S, Medbo P, Mathiassen SE and Winkel J. A Case Study evaluating the ergonomic and productivity impacts of partial automation strategies in the electronics industry. *International Journal of Production Research*, 2002. 40(16): p. 4059-4075.
- [11] Kirwan B. Soft systems, hard lessons. *Applied Ergonomics*, 2000. 31: p. 663-678
- [12] Hardjono T. and De Klein P. Introduction on the European Corporate Sustainability Framework (ECSF). *Journal of Business Ethics*, 2004. 55(2): p. 99-113.
- [13] Boudreau J, Hopp W, McLain JO and Thomas LJ. On the interface between operations management and human resources management. *Manufacturing & Service Operations Management*, 2003. 5(3): p. 179-202.
- [14] Appelbaum E, Bailey T, Kalleberg AL and Berg P. *Manufacturing Advantage: Why High-Performance Work Systems Pay Off*. 2000: Cornell University Press.
- [15] Vahtera J, Kivimäki M and Pentti J. Effect of organisational downsizing on health of employees. *The Lancet*, 1997. 350(October 18): p. 1124-1128.
- [16] Pepper L, Messinger M, Weinberg J and Campbell R. Downsizing and health at the United States Department of Energy. *American Journal of Industrial Medicine*, 2003. 44: p. 481-491.
- [17] Landsbergis PA, Cahill J and Schnall P. The Impact of Lean Production and Related New Systems of Work Organization on Worker Health. *Journal of Occupational Health Psychology*, 1999. 4(2): p. 108-130.
- [18] Rho BH, Park K and Yu YM. An international comparison of the effect of manufacturing strategy-implementation gap on business performance. *International Journal of Production Economics*, 2001. 70: p. 89-97.
- [19] Drury CG. Global quality: linking ergonomics and production. *International Journal of Production Research*, 2000. 38(17): p. 4007-4018.
- [20] Axelsson JRC. Quality and ergonomics : towards successful integration, in *Linköping studies in science and technology, Dissertations*, 616. 2000, University of Linköping: Linköping. p. 362 s. ([2], 362 s.).
- [21] Yeow PHP and Sen RN. Quality, productivity, occupational health and safety and cost effectiveness of ergonomics improvements in the test workstations of an electronic factory. *International Journal of Industrial Ergonomics*, 2003. 32(2): p. 147-163
- [22] Heskett JL, Jones TO, Loveman GW, Sasser WE and Schlesinger LA. Putting the Service-Profit Chain to Work. *Harvard Business Review*, 1994. 72(2): p. 164-174.
- [23] Dean AM. Links between organisational and customer variables in service delivery - Evidence, contradictions and challenges. *International Journal of Service Industry Management*, 2004. 15(3-4): p. 332-350.
- [24] Janssen K, Van de Vecht H, and Wong YW. Employee and customer satisfaction are the most important motives for solving ergonomics problems. Bachelor thesis RSM Erasmus University. 2004, Rotterdam: Erasmus University Rotterdam.
- [25] Dul J and Neumann WP. Ergonomics contributions to company strategies in 10th International conference on human aspects of advanced manufacturing: agility and hybrid automation (HAAMAHA 2005), San Diego, USA, 2005.

- [26] Neumann WP and Dul J. (2005) WORKSHOP: The Strategy - Ergonomics relationship: Exploring and combining available knowledge to improve performance in Human aspects of advanced manufacturing: Agility and Hybrid Automation, San Diego, USA, 2005
- [27] Neumann WP and Dul J.. Workshop report: Ergonomics contributions to company strategies. In: Ergonomics as a tool in future development and value creation. Proceedings of the 37th Annual Conference Nordic Ergonomics Society (NES), Oslo, Norway, October 10-12, 2005
- [28] Neumann, W.P. and Dul, J. Linking Ergonomics and Corporate Strategy - A Round-table discussion, International Ergonomics Association IEA 2006. Maastricht, NL, this conference