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## Quality Management Facing Current Challenges – Entrepreneurial Quality and the Aachen Quality Management Model

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***Abstract—* Quality is seen as the intersection of customer requirements on the one side and the product characteristics on the other. This classical understanding of quality is insufficient and needs to be enlarged to a holistic, more entrepreneurial view. In a competitive market situation companies need to react quickly on individual customer requests. The new major challenge for quality management is to establish an overlap in the articulated and implicated customer demands, the defined management strategy and the actual companies' ability. The new definition of quality requires a new reference framework for quality management, which includes the different perspectives on quality and additionally faces market challenges. The introduced life-cycle-oriented approach is able to achieve a continuous and sustainable advantage compared to the competitor. The Aachen Quality Management Model creates a new reference framework and represents a paradigm shift towards management models like EFQM or the ISO 9000 family.**

***Index Terms—* Optimization, Production Management, Quality Management**

### I. INTRODUCTION

In the 1990s quality management was the insurance of fault free products and processes. The ongoing mass customization of the past years evoked, that quality management changed its focus. We postulate that modern, entrepreneurial **quality management is the handy making of organizational complexity of an enterprise to enable leadership towards entrepreneurial quality.** Thereby the moving target “customer” may not be lost out of sight. In the future, market oriented business management within dynamic and

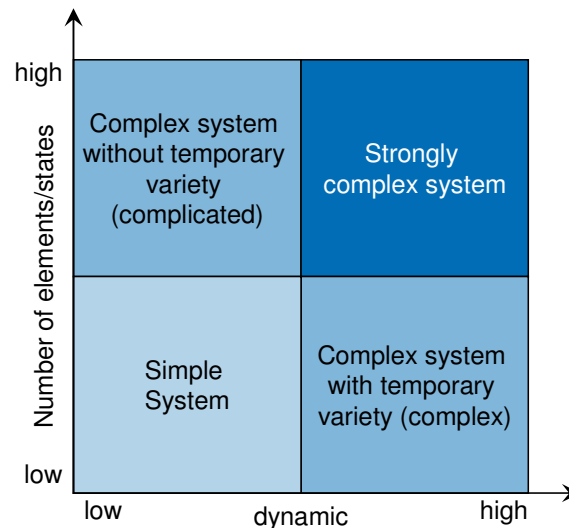
discontinuous markets successfully only be possible in that way.

In the same time it can be seen, that enterprises disappear from the global markets, although they met customer demands. They delivered high quality according to the classical definition of quality. Thus, a pure fulfilling of customer demands without respecting entrepreneurial surrounding conditions is not enough to survive in a global competition. Besides, the modern, entrepreneurial affected quality understanding is not only evoked by customer demands, but **requires uncoupling product costs and product prices** by a clever enterprise orientation as well as product positioning and design. Adjusting levers for uncoupling are for example the degree of innovativeness, the brand value and a systematic development of a high quality perceiving of products.

## II. LEADERSHIP AND ORGANIZATIONAL COMPLEXITY

At first, this chapter deals with the basic understanding of complexity in the context of this paper. Second, the organizational complexity in the context of quality oriented leadership will be discussed. Third, reasons for the increasing importance of the handy making of organizational complexity to enable leadership towards entrepreneurial quality will be dedicated.

Definitions of complexity differ significantly from each other depending on the authors. In the context of this paper we agree to Schuh [1], Ulrich [2], Malik [3] and others. Ulrich defines complexity through the number of states or conditions a system of several subsystems can be in and their interactions. Especially the variation of a system among time makes it complex and differentiates systems which are only steady, but consist of many subsystems. Thus, a system is complex, if it can be in that many conditions among the time, that the cognitive abilities of a person is overstrained to understand or even to control the system. Malik calls this number of conditions or states the variety of a system and tries to make it measureable. From his point of view, complexity is mainly the result of combinatorial analysis. Schuh classifies the degree of complexity into simple systems, complex systems without temporary variety (complicated systems), complex systems and strongly complex systems (see Fig. 1).



**Fig. 1: Classification of complexity [1]**

In this paper Organizational complexity does not deal with the organization as an institution. Organization is the planning and realization of a scheme. Hence, organizational complexity is, what has to be managed to be able to lead an area of responsibility effective and efficient to a certain goal. In other words, without a well managed organizational complexity, good leadership is not possible at all. Citing Malik [4] “Everybody of us developed to a leader, at least for leading himself”, the conclusion is, that everybody has a certain complexity to deal with.

Management of complexity gained a lot of importance, because production developed from single craftsmen to well networked companies with a high level of interaction. In the last two decades the dynamic development of technologies and enterprises boosted the importance of complexity management. The dynamic development in combination with an increasing number of product variants makes it more and more difficult to display enterprises’ processes as detailed as necessary to manage complexity of the enterprise by process management. Since processes are half-decent displayed with respect to the ISO 9000 family covering all products and variants, they are not up to date any longer. This way of gaining transparency seems to loose importance in the future.

The subsequent way to deal with organizational complexity will be to lead, rather to control “processes”

of enterprises. Processes in that way will continuously develop towards projects, for which reason a project-lifecycle displaying will occur in the future.

Another aspect is that the organizational complexity of reactive actions especially within the interface with product design and production processes is very high and not well performed yet. Shorter production phases of similar products increase the importance to learn from best practices and faults of other projects and products. Japanese philosophies as Mizenboushi [5] contain a careful handling with changes of products as well as field data from customers. Through a lasting training of these philosophies, the ability to manage the complexity of reactive actions, changes and field data usage is good. Therefore the methodological support is not that important as in European and American enterprises.

The third aspect is that there is a double integration tendency according to complexity management and quality management. On the one hand product creation processes are parallelised and therewith integrated in terms of the simultaneous engineering activities. The process oriented approaches of the ISO 9000 family and the EFQM are mapping this partly. As a consequence of integration, organizational complexity rises for the benefit of monetary and temporary savings. On the other hand, quality management develops towards a soft skill of employees and managers and is getting an integrative component of value adding processes or their enablers thereby.

### III. IMPORTANCE OF DECOUPLING PRICES AND COSTS

Before the definition of entrepreneurial quality can be discussed, the importance of decoupling prices and costs has to be stressed. In global competition, products, which are on the markets for a time, can be offered only with a little margin. Especially enterprises of low-wage countries produce ripe products in high scale reducing margins of competitors once they improved their production capabilities [6]-[8]. The result then, with competing low-wage enterprises, is, that marginal utility and marginal cost will equalize and the customer value of the product adjusts to the costs and, with a little margin, prices of a product [9]. Enterprises of high and medium-wage countries are not able to follow this price race. Adjustment levers,

which allow decoupling product prices and product costs, are of increasing importance. These are especially the degree of innovativeness, the brand value and a high quality perceiving without high production or material value.

These three key factors for decoupling allow increasing the customer value of a product in a subjective way. The tendency is that single objective product value will be the job of enterprises of low-wage countries. Subjective product value as add on to the objective value will be the challenge for high- and medium-wage countries. For this reason a single fulfilling of customer demands is not sufficient for success of high-wage enterprises although it still is a great challenge yet [10]-[12]. This objective will be taken into account in the definition of Entrepreneurial Quality and the Aachen Quality Management Model.

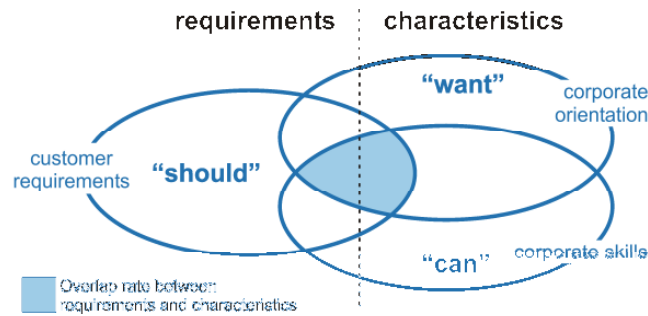
#### IV. THE NEW QUALITY DEFINITION

The question, which understanding of quality is the correct one, is philosophical. In the last two years a definition of entrepreneurial quality has been evaluated which seems to be appropriate to face the today's challenges of enterprises according to products and business activities. Quality as it is defined in the ISO 9000 is the overlap rate of explicit and implicit customer demands with the inherent characteristics of a delivered product. The fact, that enterprises disappear from global markets although they have delivered high quality shows, that this quality definition is not entrepreneurial.

In terms of the customer perspective, this classical quality definition makes sense and can be well argued. High quality for the customer means a proper fulfillment of his wishes including product's price. Therefore the buying behaviour and customer satisfaction correlates directly with the definition of quality respecting the customer perspective.

As a consequence, the internal perspective of quality seems to be incomplete. A singular orientation onto customer demands, as described in chapter 2, is not sufficient [13]. The corporate orientation is of great importance to decouple prices and costs. Therefore the willing ("want") of the enterprise is one element of the quality definition. As a contradiction to the willing, the enterprise is limited by its resources and skills –

the “can”. Together with the customer demands (“should”) the triangle of should, want and can have an overlap rate – the entrepreneurial quality (see Fig. 2). By this, the definition of quality from the perspective of the customer still exists. But realized products now are the result of the overlap rate between “want” and “can”.



**Fig. 2: The new definition of quality: Entrepreneurial Quality**

This definition of entrepreneurial quality allows three meta-level adjusting levers, which are of relevance in enterprises. The first lever can be moved from the perspective of the leadership/management. The lever is to position the “want” of the enterprise towards the “should” of the customer demands especially having in mind the innovativeness, brand value and the perceived quality. The second lever is operated from the operations perspective which enhances the adjustment of the “can” and the “want”. The third lever is moved by the customer perspective with the goal of maximum overlap rate between demands/requirements and characteristics which is the result of “want” and “can”.

## V. THE NEED FOR A NEW FRAMEWORK

Generally, a framework, which enables a holistic image of all company activities rather than only focusing on single aspects, is needed for the creation of an entrepreneurial quality management. Derived from the goals and challenges of the entrepreneurial quality management, new modelling demands for quality management emerge. Based on the characterizing terms for the performance measurement dimensions of production systems, a framework has to cover all relevant aspects to identify organizational losses. Therefore it also needs to consider the strategic objectives, the entrepreneurial conditions and the

corporate skills. For the identification of weak points, the information relations need to be illustrated product and process overlapping over the entire product life cycle.

Existing explaining and evaluating models like the ISO 9004:2007 series [14], or evaluating models like the EFQM Model, only emphasize on the increase of the overlap rate of customer demands and product features. The company orientation respectively the company's capabilities are not taken into account [15]. Due to their primarily value-adding-oriented view to the process, these models are further lacking decent elements to carry information into adjoining or prospective product generations as well as their corresponding development processes [16]. In fact, the consideration of product life cycles is not operationalized.

## VI. THE AACHEN QUALITY MANAGEMENT MODEL

The Aachen Quality Management Model (see Fig. 3) closes the gaps described in the previous chapters. It provides a scope of action, which allows to design the entrepreneurial quality management for a company by considering the strategic objectives, the entrepreneurial conditions and resources and the life cycle of products [17].



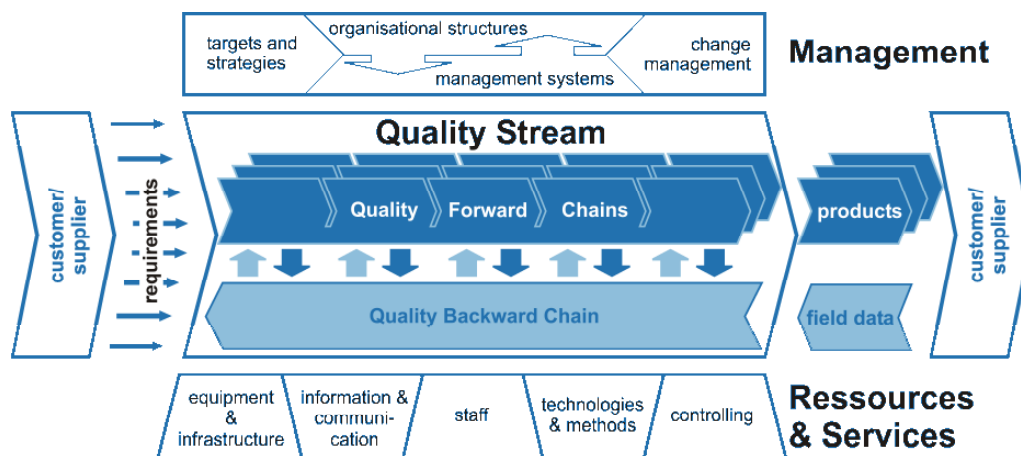
**Fig. 3: The main elements of the Aachen Quality Management Model**

The constituting elements of the Aachen Quality Management Model are management, quality stream and resources & services. Thereby, management mainly includes pursuing strategies and goals efficiently,

forming organisational structures and establishing a management system to support the process organisation.

The quality stream as the core element of the model refers to the processes within a company. The quality stream consists of two structural elements: the quality forward chains and the backward chain. The quality forward chains include the proactive and preventive measures per product group. The quality backward chain organises the reactive and corrective actions for all product groups. Control loops between the quality forward chains of different product groups and the quality backward chain enhance the model with elements of continuing improvements. The third element of the model, the resources & services, reflect the company's capabilities.

The particular characteristics of the different company attributes are described within the structure elements. Thus, the company's capabilities within the structure element resources & services, in the sections facilities & infrastructure, information & communication, employees, technologies & methods [18] and controlling can be displayed (see Fig. 4).



**Fig. 4: The Aachen Quality Management Model**

On the way to a waste-free fulfilment of customer demands, the illustration of information relations between different product groups and their creation processes is an essential requirement in order to identify informative losses [19]. Within the Aachen Quality Management Model, these information relations are



bottom-up-oriented.

Considering the perspectives, the Aachen Quality Management Model takes strategic objectives, the entrepreneurial conditions and the company's capabilities into account. Hence the model is even more than a new reference framework of entrepreneurial quality management.

## VIII. CONCLUSION

In this paper we figured out, that it is not sufficient anymore to fulfil customer demands, meaning to deliver high quality products according to classical quality understanding. A clever orientation of enterprises as well as their products gains importance. Therefore the new, entrepreneurial quality definition includes the company orientation and, as a contributing factor, the resources and skills of the enterprise. The definition of entrepreneurial quality interacts with the requirement of decoupling product costs and product prices especially in enterprises of high- and medium-wage countries.

Quality management in the context of entrepreneurial quality means the handy making of organizational complexity of the enterprise to enable leadership towards entrepreneurial quality. The main reason for the changing focus is that processes in enterprises increase their changing speed because of an increasing dynamic of markets and their variety and because of an increasing product variety. The resulting organizational complexity will not be manageable in the future by process management as it is known today. Process orientation does and will be exchanged by lifecycle orientation and reactive business activities gain and will gain importance. These factors as well as a double integration tendency of quality management lead to the new Aachen Quality Management Model.

The Aachen Quality Management Model builds the framework for the redesign and optimization of enterprises. With a new definition of quality combined with the company's three main perspectives, customer perspective, management perspective and operations perspective it allows a holistic description, analysis and improvement of the whole process and project landscape. Introducing the Quality Stream as the core element of the model and linking the backward chain via control and improvement loops to every

single forward chain it generates a life cycle oriented approach on product quality. The architecture and the inherent perspectives of the model can be used to design tools to increase the efficiency and effectiveness of enterprises enduringly respecting the key factors for decoupling product prices and product costs.

#### REFERENCES

- [1] G. Schuh, „Produktkomplexität managen. Strategien - Methoden – Tools“ 2nd ed., Munich: Hanser, 2005.
- [2] H. Ulrich, G. Probst, „Anleitung zum ganzheitlichen Denken und Handeln. Ein Brevier für Führungskräfte“, Bern: Paul Haupt, 1988.
- [3] F. Malik, „Strategie des Managements komplexer Systeme. Ein Beitrag zur Management-Kybernetik evolutionärer Systeme“, 4th ed., Bern: Paul Haupt, 1992.
- [4] F. Malik, „Führen, Leisten, Leben. Wirksames Management für eine neue Zeit“ new edition, Campus, Frankfurt, 2006.
- [5] T. Yoshimura, „Toyotashiki Mizenboushi Shuhou · GD3“ Tokyo, Nikka Giren 2002
- [6] M. M. Tseng, "Industry Development Perspectives: Global Distribution of Work and Market." presented at the 2003 CIRP 53<sup>rd</sup> General Assembly, Montreal, Canada.
- [7] F. Klocke, G. Schuh, F. Zohm *et al.*, *Zukunftsstudie Werkzeug- und Formenbau*, 1st ed., Aachen: WZL Aachen GmbH, 2005, pp. 1-3.
- [8] R. Schmitt, and C. Scharrenberg, "Planning, control and improvement of cross-site production process chains." presented at 2007 CIRP 40<sup>th</sup> national Seminar on Manufacturing Systems, Liverpool, GB.
- [9] C. A. Lovell, "Production Frontiers and Productive Efficiency," in *The Measurement of Productive Efficiency. Techniques and Applications*, 1<sup>st</sup> ed., H. Fried, S. Schmidt and C. A. Lovell, Ed. Oxford: Oxford University Press, 1993, pp. 3-67.
- [10] M. Spring, and J. Dalrymple, "Product customisation and manufacturing strategy," *Int. J. of Operations & Production Management*, vol. 20, no. 4, pp. 441-467, Apr. 2000.

- [11]O. Hauptman, K. K. Hirji, "The influence of process concurrency on project outcomes in product development: an empirical study of cross-functional teams," *IEEE Trans. Engineering Management*, vol. 43, no. 2, pp. 153-164, 1996.
- [12]M. Sumner, "Critical success factors in enterprise wide information management systems projects." in *Proc. of the 1999 ACM SIGCPR conference on Computer personnel research*, New York, 1999, pp. 297-303.
- [13]P. S. Adler, "Interdepartmental interdependence and coordination: the case of the design/manufacturing interface," *Organization Science*, vol. 6, no.2, pp. 147-167, 1995.
- [14]Managing for sustainable success - A quality management approach, DIN ISO 9004:2007 (Draft)
- [15]A. Gucanin, "EFQM-Modell auf dem Prüfstand. Forschungsergebnisse über Schwächen des EFQM-Modells für Excellence," *QZ*, vol. 48, no. 2, pp. 109-110, Apr. 2003.
- [16]M. Achilleos, G. Ioannou, "The development of an ISO 9000 Quality Management System to meet the requirements of the European Foundation for Quality Management (EFQM) Model - The Cyprus Telecommunications Authority's Case," *2000 Proc. 10<sup>th</sup> Mediterranean Electrotechnical Conf.*, pp. 128-131.
- [17]R. Schmitt, M. Betzold, and K. Hense, "Das Aachener Qualitätsmanagementmodell", *Masing Handbuch Qualitätsmanagement*, R. Schmitt and T. Pfeifer, Ed., München: Carl Hanser, 2007, pp. 38-41.
- [18]S. H. Kaisler, F. Armour, and M. Valivullah, "Enterprise Architecting: Critical Problems," in *System Sciences, 2005. HICSS '05. Proceedings of the 38th Annual Hawaii International Conference on*, 2005, pp. 224b-224b.
- [19]L. Feng, L. Feng, M. Luo, J. A. Ren, "Study on Integrated Quality Management System for the Life Cycle of Virtual Enterprise." in *Proc. WiCom 2007 Int. Conf. Wireless Communications, Networking and Mobile Computing*, Shanghai, 2007, pp. 5074-5078.

