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Variety Management in Manufacturing. Proceedings of the 47th CIRP Conference on Manufacturing Systems

Development of an assessment framework for Operations Excellence (OsE), based on the paradigm change in Operational Excellence (OE)

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Abstract

This paper presents the researched changeover from Operational Excellence (OE) to the new path of Operations Excellence (OsE). Operational Excellence (OE) predominantly deals with the efficiency (productivity), effectiveness (customer/market orientation) and optimization of production processes. In comparison, Operations Excellence (OsE) enlarges that perspective to see operations as setting lever by providing enablers as a central role for operational long-term success. The assessment of required against existing setting of enabler criteria in an organization (e.g., high performance culture, methods and instruments, employee empowerment, etc.) supports to become a plant's future health foreseeable and to identify its capability to achieve sustainability and excellence in terms of operations.

To support a methodical integration of Operations Excellence in organizations, an OsE assessment framework has been developed within the applied research project "IMFT". The model design containing the identification of relevant criteria and their cause-effect relationships is a key element of the present paper.

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Keywords: Operations Excellence, Operational Excellence, EFQM, Performance Measurement, Assessment, Enablers

1. Introduction

Today's competitive and globalized market conditions force organizations not only to respond reactively to survive prevailing challenges, but also to seek long-term success [1] by achieving excellence in their business.

The origin of this drive to change from quality and TQM to "excellence" is unclear, but is assumed to originate from EFQM (European Foundation for Quality Management) and certain management consultancies. "Academics and experts spent too much time on jargon building rather than dealing with real substance" [2]. In terms of operations, the buzzwords "Operational Excellence" (OE) and "Operations Excellence" (OsE) are among the most over-used in the consulting field of production optimization and are often considered synonymously. This misbelief underscores the

need for a distinction between OE, i.e., the exclusive focus on result-driven processes, and OsE, the promotion of operations-specific enablers and principles.

Therefore, this paper elaborates on the research of the origin and development of different point of views about excellence in operations, attended by the identification of responsible criteria and indicators and their assessment.

2. Challenge and objectives

As part of their desire to succeed and grow, organisations are correspondingly concerned regarding whether they are on the right track towards excellence and how their performance can be assessed [3]. To assist organizations in striving towards business excellence, the EFQM scoring system [4] provides a well-founded basis for self-assessment. The EFQM model,

Europe's answer to the American Malcom Baldrige Award and the Japanese Deming Prize, is widely accepted by both academics and industry. But application of the EFQM ratings, especially in terms of Operations Excellence, presents two substantial challenges for small and medium-sized enterprises (SMEs):

(1) The EFQM statements and scoring criteria used to review organisations' excellence are defined too generally due to the need to be applicable to a very wide range of different industrial sectors [5,6]. As a consequence, the self-assessment criteria resp. indicators need to be adjusted to fit to an organisation's specific requirements of the organisation [7] and adopt any industry-specific language [8]. But for many of organisations, the interpretation, definition, implementation and measurement of business excellence as well as the transfer to Operations Excellence is too abstract [9]. Therefore, it is necessary to adapt the concept of assessment in a manner that supports transparency of the cause-effect relationships of global organisational indicators to operations as well as their interdependencies to adjacent fields.

(2) Most assessment tools are designed for large organisations and barely consider the needs of medium sized enterprises [10]. Due to restricted time and monetary resources e.g., high efforts for preparation and execution, smaller organisations especially encounter problems applying the EFQM model. As a consequence, the need for a simplified and user-optimised version of assessment is clear [11].

As a result of these potential gaps, the Association of the Austrian Machinery & Metalware Industries (FMMI), an institution of the Austrian Federal Economic Chamber, and the Vienna University of Technology, Institute of Management Science, Division for Industrial and Systems Engineering (IMW) established the applied research project "Innovative Metal – Research & Technology Transfer" (IMFT). FMMI funds these activities over a period lasting at least three years to provide a methodology and language to be used to accelerate improvement across the sector and to create a culture of excellence that supports rethinking of aspects of SME's ranging from individual culture, management, and processes to stakeholder's minds. The resulting overall goal is to enhance enterprises' competitiveness and boost Austria's attractiveness as an industrial location. Therefore, IMW prescribes a two-stage approach:

- Step 1: Define an OsE assessment framework, that is sufficiently generic to suit all companies within FMMI, but also flexible enough to incorporate varying firm-specific traits. The model's design is intended to identify a clear set of prerequisites for excellent operations that would then act as criteria against which all decisions and actions of the assessed company could be judged. This paper is intended to target these key issues.
- Step 2 (outlook, follow-up research based on step 1): Design a systematic assessment, set up a system combining continuous self-assessment by the organization with a three-stage evaluation by external experts ("supervised-self-assessment"), as part of supporting the methodical integration of OsE in FMMI's SMEs.

3. Evolution of Operational Excellence (OE) towards Operations Excellence (OsE)

Many different approaches towards OE exist in the scientific discourse. A review of key literature offered more than 30 definitions and interpretations of Operational Excellence as revealed in Sections 3.1, 3.2 and 3.3. As the term OE/OsE per se is neither meaningful nor directly measurable, predefined indicators and criteria are used for its description and operationalization. As far as OsE is concerned, only a handful of approaches can be found in the literature. Those few descriptions, however, are illustrated and validated with several practical examples.

The growing attention paid to Operational Excellence in the literature can be categorized into three interrelated streams delineated by the authors with "OE x.0" as follows (Figure 1). OE 1.0 and 2.0 concentrate mainly on results ("What is excellence?") whilst OE 3.0 exclusively stresses tools ("How can excellence be achieved?") to encompass world-class operations. OE 4.0's approach is substantially responsible for the paradigm change to OsE 1.0 that identifies enablers as the source of OE ("What is needed to manage excellence?").



Fig. 1. Evolution and trend of OE and OsE

3.1. OE 1.0: Origin and first steps

In the late 18th century, Adam Smith was amongst the first to propose measures to maximise the output of production processes [12]. In the early 20th century, the assembly line process developed by Henry Ford revolutionised production, while Frederick Taylor, an intellectual leader of the efficiency movement, introduced the first principles of scientific management [13].

3.2. OE 2.0: Value discipline of cost minimization

First research activities conducted in the area of Operational Excellence (originally "Operational Effectiveness") were carried out by Porter [14, 15], later continued by Treacy and Wiersema [16]. They stated that a market leader should concentrate on one of three value disciplines and should compete in each of the other two: Customer Intimacy (best total solution), Product Leadership (best product) or Operational Excellence (best total cost).

OE's price-oriented perspective continues to be republished in contemporary literature, e.g., Ferrell and Hartline who

declared that companies who pursue Operational Excellence operate at lower costs than their competitors, allowing them to deliver goods and services to their customers at lower prices and better value [17]. After filtering for eight further propositions that quote or interpret Treacy and Wiersema, e.g., [18], four additional relevant constitutive criteria were identified for achieving OE 2.0: fast and timely operations or services, customer convenience, reliable products or service, and manageable bargains.

3.3. OE 3.0: Quality and Lean Management as key elements

Most OE 3.0 literature, e.g., [19, 20], is dominated by pursuit of activities to strip away waste and nonvalue-added activities to attain efficient and frictionless processes. Management philosophies such as total quality management (TQM) and Lean Management, tools like Six Sigma, Business Process Reengineering (BPR) and various combinations, e.g., Lean-Six-Sigma and Fit-Sigma [21], or principles and methods such as valuestream-based thinking, just-in-time (JIT), flow and pull, SMED, OEE, etc. are focus of extensive debate concerning the best of the best in terms of operations.

This approach is equivalent to a classic production system combined with consensus regarding the importance of customer orientation and the necessity of continuous improvement (CI). Although the utilization of Kaizen (PDCA) and the elimination of waste are often considered to be the main goals of Operational Excellence, they are only tools and activities to achieve it. *“Programs, tools, projects and personalities are insufficient to create lasting change. Real change is only possible when timeless principles of operational excellence are understood and deeply embedded into culture [22].”*

3.4. OE 4.0 & OsE 1.0: The changeover from Operational Excellence to Operations Excellence: enablers in the role of setting levers

More recent research activities with focus on OE were carried out by Gleich & Sautter [23], who described an enabler oriented framework.

According to their interpretation, *“OE is the development of enablers to generate competitive benefits in a dynamic environment based on the resources of an organization (adaptability). The composition and expansion of enablers is the basis for continuous improvement, change, and the optimization of business processes. Therefore, OE is the dynamic capability to realize effective and efficient core processes in the value creation chain utilizing technological, cultural and organizational factors in an integrative way and based on the respective strategy.”*

Based on several analyses of existing OE-concepts as well as on discussions within a dedicated industry-wide study group, Gleich and Sautter present six fields they identified as essential for long-term operational success (Figure 2).

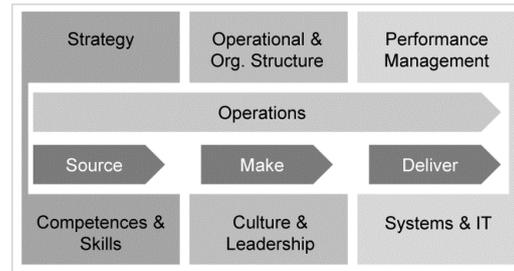


Fig. 2. Six fields for long-term operational success [23]

Schwientek and Schmidt presented a similar approach [24]. Both are among the few authors elaborating on the term “Operations Excellence” by describing three levels at the core of excellence in operations (Figure 3). The first level, strategy, provides companies with information on traveling their own path towards best practice. The second level, performance improvement, covers the rethinking of performance drivers and competitive levers such as cost structures and asset productivity. The third level concerns enablers that help support, measure, and control all operational enabler issues such as organization, processes, IT, and KPIs, with tangible values for companies.

Starting from research and development, continuing with purchasing and manufacturing and eventually encompassing supply chain management, these three levels cover the entire value chain.

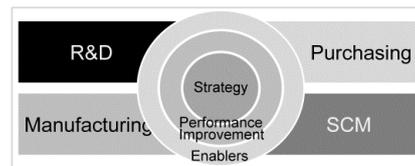


Fig. 3. Three levels & four fields of activities for implementation of Operations Excellence [24]

A more rigorous definition can be seen in Sutton’s declaration [25]. He argues that *“Operations Excellence means focusing strategically on maximizing the value that operations deliver to customers, through strong leadership, the power of people, the use of industry best practice and the application of value-add technologies. Operations Excellence enables sustained delivery of high-quality, cost-effective services and capabilities that provide exceptional customer value. Companies that leverage Operations Excellence as a strategic competitive advantage recognize that the effectiveness of their operation plays a central role in creating and sustaining customer satisfaction and loyalty.”*

Such a statement, especially the accentuation of strategic, and organizational, as well as technological, aspects, underscores the need to promote operational enablers as central to operational success. The three explained approaches are substantially responsible for the paradigm change from an exclusively result-driven view on the process level to an enabler’s perspective on the operations level. The aspiration to achieve Operational Excellence is being gradually replaced by desire to follow the path to Operations Excellence.

4. Definition of an OsE 1.0 framework

Numerous overviews of existing Operational Excellence constitutive frameworks and a limited number of Operations Excellence approaches can be found in literature, as shown in Section 3. Because every interpretation has a different focus, a

4.2. Assessment dimensions of OsE 1.0

The issue of vertical and horizontal fit is a key aspect of the assessment dimensions (AD) to be checked during the self-assessment and rated through external experts' scoring evaluations. The fundamental questions are

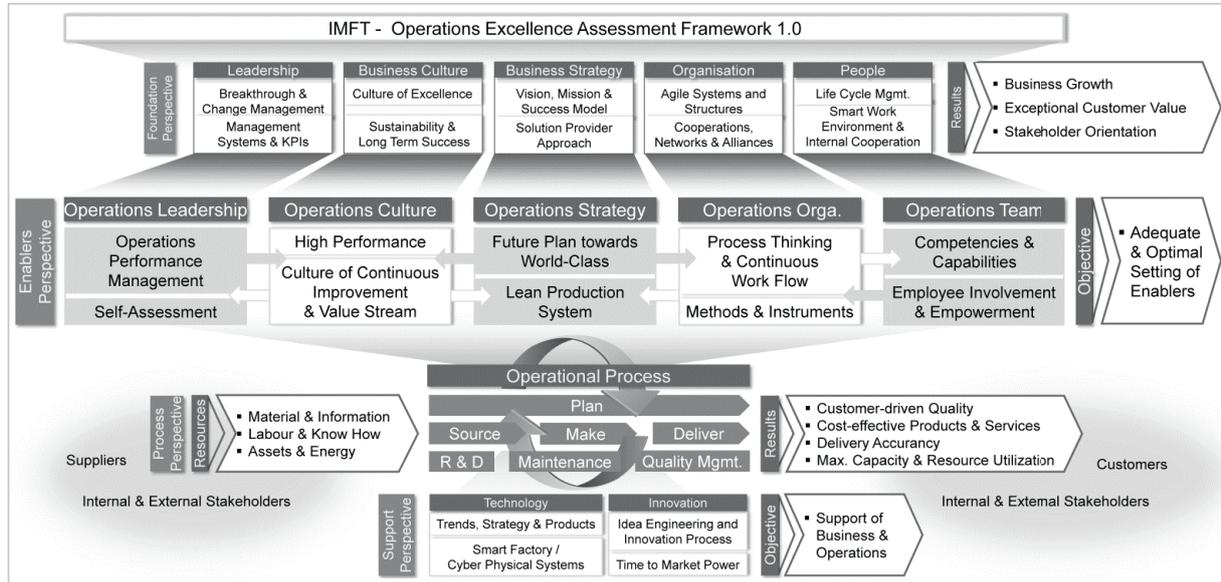


Fig. 4. OsE 1.0 framework from systems perspective

new agglomerated overview was devised (Figure 4) to be used as a more substantive basis for developing an assessment of Operations Excellence as required in Section 2.

Due to synergy effects (how things work together), the assessment design of Operations Excellence meets the challenge of identifying and reviewing the cause-and-effect relationships of enabler and results criteria rather than measuring and evaluating them in isolation.

4.1. Identification of OsE interrelationships

To identify the role, position and interaction of Operations Excellence in industrial companies, Porter's [14] generic value chain is used as reference. Hence, it can be deduced that Operations Excellence represents a key functional aspect with crucial vertical and horizontal correlations with other business-areas. The alignment of results with enablers creating them on different levels is hereinafter referred to as "fit."

"Horizontal fit" describes the sideways consensus of principles, concepts, systems, and tools within operations on a strategic, tactical, and operational level, respectively, between the operations management and the shopfloor.

"Vertical fit" stands for top-to-bottom (and vice versa) consensus between behavior on the business level, operations' attitude in its role as setting lever, and its impact on the process level. Therefore, OsE fulfills the essential task of providing an operating system that links and synchronizes entrepreneurial activities with the production process, and respectively, management with execution.

- how operations enablers correlate among each other (AD1)
- how operations characteristics have a bottom-up impact (AD2a) on the macro level of entrepreneurship and (AD2b) top-down on the micro level of processes
- how operations and operational processes are supported by technology and innovation criteria (AD3).

The supervised-self-assessment must determine the company's degrees of awareness and consideration towards interdependencies between enablers and results on different levels and their alignment to create excellence.

AD 1: Horizontal fit—Aligning enablers within operations

The first step towards excellence is conducting systematic rather than intuitive improvements. The implementation of Operations Excellence is not a project, but the start of never-ending development [20] as part of corporate culture e.g., "vision to be world-class" and continuous self-improvement.

The difference between mediocre and world class is not technology, but management and people [26]. Leaders must design, align, and execute systems with appropriate principles and methods to have the greatest impact on their results, and involving enablers that drive ideal, principle-based behavior. They must shift from thinking purely analytically to thinking systematically. Only then it becomes possible to assess a corporation's understanding of deeply-embedded enablers and its readiness to cope with change [29]. But OsE cannot be achieved exclusively through top-down directives from management to shopfloor. Excellence in operations includes

superior people-related performance [27]. People are OsE's ultimate architects, so cultivation of a deep culture where everybody is able to innovate will drive future improvement.

The alignment of managerial decisions, culture establishment, operations resources, competences and capabilities is linked through operations strategy, which forms a central element of the operations enablers.

AD 2a: Vertical fit—Aligning operations enablers with business enablers and results

Vertical fit rests on the premise that coherence between operational performance and overall business strategy takes higher priority than operational performance on its own. Neither excellent operations nor excellent performance can exist unless they fit to the business's top-level strategies [28]. The business strategy's plausibility and transparency make or break the success of its deployment top down to the operations and operative process levels. Operations strategy will always be derived from business strategy. In return, operations strategy and activities must have confirmed their bottom-up contribution to and consistency with the business strategy and their linkage to the plant's overall goals. *"Excellence in operations is about how the operations side of the business supports business growth as a strategic part of business."* [30]

The companies' path towards business growth requires excellence in all activities. According to Dalluege, an organisation's only route towards excellence is to use stakeholder needs as input for the development and assessment of a strategy and its respective guidelines. Furthermore, organisations should strive to continuously fulfil stakeholder expectations [8]. Consequently, OsE has the ultimate objective of satisfied customers [27]. Every choice made in an organization requires a central focus on the customer; this also applies to operations activities up through operational sub-processes.

This assessment dimension has to judge if *"policies, people, products and processes are brought into alignment so that operational expenses go down, profits go up, and companies blossom and prosper"* [31]. Balancing the dilemma of gaining best short-term operating results with meeting long-term business objectives, as desired by different stakeholders, should be a particular subject of review.

AD 2b: Vertical fit—Aligning operations enablers with operational processes and results

Based on AD 1 and AD 2a, Operations meets the challenge to configure operational processes across the entire value chain including interactions with clients, suppliers, and further stakeholders by providing an adequate set of enablers. Operations is responsible for stabilization, standardization, and value stream-based optimization of the transformation process from input to output. Therefore, *"the limited principle 'engineering creates, manufacturing makes, and marketing sells' is obsolete"* [26]. The OsE 1.0 framework assists companies to advance beyond the present state of sporadic attention to operations support layers (e.g., maintenance, quality management, administration). The process of new product development gets particular increased significance in

assessing excellence in operations [32]. Westkämper, Alting, Arndt highlight that in the future, not only the manufacturing process and resources themselves, but the whole product life cycle, including life cycle management and assessment, have to be taken as an integral part of engineering [34].

AD 3: Support fit—Aligning technology and innovation with business, operations and process objectives

A key issue in the discussion concerning OsE is the operations' strong dependence on upstream supporting activity, technology, and innovation management (TIM), that extends beyond the classical product development and production process given in AD 2b. TIM focuses on scouting, forecasting, and strategic development of next-generation technologies and innovations by considering and evaluating different future market and factory scenarios. Currently, cyber-physical-systems, smart factories, real-time data process diagnosis, and condition techniques represent examples that will become increasingly relevant for companies in coming years. TIM's influence on operations and the reverse are critical factor to achieving OsE. In addition to the demand that technology supports the production process' efficiency and effectiveness, assessment must identify if TIM, business, and operations enablers work in tandem without conflicts.

5. Case Study and Validation of the Model

In 2013, the OsE 1.0 model's approach was presented to and analyzed by 15 leading-edge SMEs (7 equipment manufacturers, 8 batch manufacturers) from the machinery and metalware industries. Model validation involved a three-day workshop with the management board, department heads of manufacturing, logistics and R&D as well as shopfloor workers. As first step, a standardized, open-ended interview captured the individual SME's practical understanding and experience about Operations Excellence in comparison to Operational Excellence. Two conditions, the SME's desirable ideal position in contrast to the current situation, were respected. Second, IMW introduced the OsE 1.0 framework. The participants discussed systematically the links of the four OsE 1.0 perspectives and classified the importance of result and enabler criteria according to a numerical priority scale. This analysis was critical for the integration or exclusion of criteria to establish the comprehensive but compact framework. Third, the industrial applicability of OsE 1.0 was evaluated by a survey with KPIs, a methodical questionnaire including a best practice benchmark. It was checked if certain enabler criteria, such as procedures or methods, are available and how they correlate with result indicators at SMEs. The empirical research pointed out that SMEs with approx. 100 employees indeed cover several aspects of OsE 1.0, but not completely consistent so far. Smaller SMEs (< 50 employees) only have sporadic implemented examples of Operations Excellence. All participants share the common opinion that the OsE 1.0 framework delivers an adequate basis to devise a detailed assessment for excellence in operations.

One central point of the debates concerned the integration of "technology and innovation management" into OsE. During the discussion, some surprising points and aspects were

brought to the companies' attention, of which they have previously been unaware, such as the relevance of strategic, systematic, and methodical management of future technology, compared with the operational improvement offered by the present approach of in-house manufacturing technologies themselves.

6. Conclusion

The topic of excellence in operations has increasingly gained researchers' attention, especially in applied sciences, over recent decades. However, past research activities have relatively over-emphasized the unilateral "result-driven" perspective of OE with limited corresponding concern for enablers, which forms OsE's focus - a shortcoming this paper attempts to address.

With the design of the OsE 1.0 assessment framework (Figure 4) and the identification of critical root-cause relationships, the first step of Duggan's demand that excellence in operations should be visually measurable [30] was achieved. Further steps must focus on the detailed composition of the assessment itself. Currently, IMW develops a strictly diagnostic, improvement-oriented evaluation approach. For data collection, two methodologies are focused. A standardized questionnaire serves to determine quantitative facts and an interview is used as qualitative analysis to scrutinize SME's enablers, results and their cause-and-effect relationships according to Section 4. Therefore, an evaluation scheme with maturity levels will be developed. The SME's self-reflection and the neutral assessment by IMW will allow to identify company's weaknesses and to derive prioritized recommendations for SME's future action.

Finally, it is argued that a general definition cannot be promulgated for the ideal state of excellence in operations. An individual assessment of every single plant is necessary [33]. Thus, the organization must accommodate changes of framework criteria and their interaction in future and recognize that the ability to adapt over time is a key criterion of excellence [28].

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