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Efficiency potentials and the extended regional infrastructure: requirements for a management model

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Abstract

This article addresses the question of how efficiency potentials within a regional production network can be identified and levered. The industry and geographical focus is on the manufacturing sector and Southwest Germany, respectively. Against this background, especially the sophisticated technical consumer goods and investment goods contribute greatly to the competitive advantage of the region as a whole. The contribution combines considerations of different theories and examines the field from multiple angles: (1) regions and factories as systems, (2) proximity, (3) competitive advantage. A systematic literature review (SLR) methodology is applied in order to substantiate each of the three pillars. The work results in a set of characteristics describing requirements for an analytical framework or management model in order to successfully shape a regions future by the systematic identification and leverage of efficiency potentials. The scope of action is the extended regional infrastructure, which comprises elements of various systems, such as economy, politics, administration, and science. It is argued that the different systems, as well as their subsystems (e.g. organizations within the economic or scientific sector), have to be recognized as generally independent and self-organized. Therefore, a key task is related to the coordination of systems which can be understood as the formation and configuration of a structural coupling.

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1. Introduction

The mechanical engineering industry is one of the most vital industries in regard to Germany and especially its southwestern part, accounting for approximately 1,000,000 and 300,000 jobs, respectively [1]. The regional orientation of production can have important benefits compared to a strict globalization strategy [2] which is why recent trends are indicating an economic regionalization [3]. A factory possesses a variety of linkages to different systems within a region, all of which contributing to its efficiency and clearly exceeding the linear supply chain. The total of these systems is referred to as the extended regional infrastructure. Efficiency, for the purpose of this study, is used in a rather generic way to describe the internal relationship between inputs to outputs [4]. The extended regional infrastructure is seen as the scope of action within which efficiency potentials are to be identified and addressed. Hence, the current research task is to conceive of requirements for an analytical framework which shall serve as the basis in order to analyze the extended regional infrastructure.

2. Methodology

The methodology of the article is twofold. A systematic literature review (SLR) is presented in order to build an argumentation basis. On this basis, a synthesis of the different strands helps to reflect critical success factors for the management of regions and to derive requirements for an analytical framework a region can use in order to systematically identify and lever efficiency potentials. A systematization of literature reviews seems to be vital in order to ensure a transparent and replicable process [5]. Hence, the SLR methodology was built upon a structured approach [6] and was

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composed as follows: An initial set of search terms for each literature pillar was developed and keyword-combinations were randomized using an MS-Excel environment. A particular keyword-combination was then applied to several databases, including: ScienceDirect, EmeraldInsight, SpringerLink, Taylor & Francis Online, and Wiley Online Library. Scanning the abstracts of the articles helped to develop a set of contributions for full-paper review. The reviewed papers also served as nuclei for the deduction of further impulses and keywords. In addition to the systematic search, well-known classics were considered, especially in the fields of factories and competition.

3. Results of the literature review

This section gives an overview over the reviewed literature which is structured by focus of content and methodology and is depicted in Table 1. For each content category a brief synopsis of various approaches is presented to provide a groundwork for the current contribution.

Table 1. Literature structured by content focus and applied methodology.

Main focus	**Methodology**		
	Conceptual	**Empirical**	**Review**
Regions / Factories as Systems			
Regional Transition	[7]-O; [8]-O; [9]-O	[10]-EI; [11]-EI; [12]-EI; [13]-SD; [14]-WL	[15]-SD; [16]-SD
Changeable Production	[17]-SL; [18]-SD; [19]-SD; [20]-O; [21]-O;[22]-O; [23]-SL; [24]-O; [25]-EI; [26]-EI	[27]-SD; [28]-SD; [29]-EI; [30]-SD; [31]-EI; [32]-SD; [33]-SD	[34]-WL; [35]-EI; [36]-SD; [37]-O; [38]-SD
Social Systems Theory	[39]-O; [40]-O; [41]-SD; [42]-O	[43]-WL	[44]-WL
Proximity	[45]-TF	[46]-SL; [47]-WL; [48]-WL	[49]-TF; [50]-WL; [51]-SD
Competitive Advantage	[4]-O; [52]-O; [53]-WL; [54]-O; [55]-SL; [56]-O; [57]-WL; [58]-SL	[59]-EI; [60]-O	[61]-WL; [62]-SD
Synergies	[63]-O; [64]-O;	[65]-TF	
Innovation	[66]-SD; [67]-WL	[68]-SL; [69]-EI; [70]-SD; [71]-SD; [72]-SL; [73]-SD	[74]-SL; [75]-TF; [76]-SL

Databases: WL (Wiley Online Library); SL (SpringerLink); SD (ScienceDirect); EI(EmeraldInsight); TF(Taylor&Francis); O(Other)

Factories, as well as whole regions are frequently described as systems in the literature [7,14–16,20–22]. Reason for this are that systems theory allows for a generic perspective, is able to link different domains, and provides the possibility to model evolution and change processes. In regard to factories, there are multiple concepts and approaches referring to production-related change, e.g. flexibility and agility [25,26,32], strategic flexibility [23], factory fitness [31], resilience [38], reconfiguration and changeability [20–22,24,33,37], bio-inspired systems [36]. On an abstract level, however, these concepts can be consolidated along two basic dichotomies (based on [20]): firstly, a shop-floor or production-based focus against a holistic factory or enterprise-based focus including structural elements; secondly, a rather passive utilization of an existing scope of action against the proactive generation of future opportunities. It can be stated that the approaches have evolved over time towards both a holistic and proactive focus. Besides the internal production processes strategy, human resource management, and linkages to customers and suppliers are building blocks of an effective changeability concept [31]. An important extension, however, is that not only systems along the linear value chain (suppliers and customers) are relevant. Rather there is a multitude of lateral systems which influence the performance of corporate change [7]. A vital feature in this context is to recognize those systems and to ensure compatibility among them.

Modern systems theory has its general origins in the scientific disciplines of biology and cybernetics of the 20th century [39]. Subsequently, systems theory has proliferated in numerous research fields including communication theory, social theory, and management theory [7]. In regard to sociology Parsons' theory of action shows that personalities do not simply sum up to the social system but develop a new order of system which describes their interactions on the basis of roles and mutual role-expectations [40]. Luhmann built upon Parsons' theory but did not assume defined functions within social systems [44]. He rather focused on the dynamic operations of systems and included the concept of autopoiesis [42] which was introduced by Varela et al. [41] in biological systems. The major deliberation was that systems define, organize, and reproduce themselves while continuously performing their own operations. Everything being part of the operations defined by the system belongs to the system, everything else belongs to the environment. This characteristic of operational closure is also used to describe and model economic organizations [43].

Proximity is a multi-facet concept that covers but goes well beyond geographical distance. Geographical proximity is measured as either agglomeration or dyadic distances [50] and partly considers also natural constraints, infrastructure or object-specific characteristics [45,51]. Organizational proximity is described by Torre and Gilly [45] as a certain arrangement of system relations and subsumes the similarity of reference systems and knowledge bases under it. A refinement of this structure distinguishes the field of organizational relations from the field of references and knowledge bases and extracts the latter as cognitive proximity [47,49]. Knoben and