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Risk-Value-Cost-based Optimization of Global Value-Adding Structures

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Abstract

Present methodologies do not adequately take qualitative factors into account in optimizing the distribution of value-added activities. This is where the method currently developed by the Fraunhofer IPA for a risk-value-cost-based optimization of global production networks comes in. Unlike previous approaches, this method considers qualitative criteria comprehensively, classifying them into risks and values, and analyzing them in an integrated manner to determine the global optimum. For comparing qualitative and quantitative factors, a multi-criteria optimization approach is developed, which is the first to deliver consistent results.

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Keywords: Value network, production network, distribution of value-added activities, qualitative criteria, risks, values, multi-criteria optimization

1. Introduction

In the past decades, companies have faced various waves of internationalization. Production networks have emerged through relocation and offshoring, acquisitions and sales, and have grown into global and complex entities [20]. Despite the clearly stated motives of either opening up new markets or cutting down on costs, the structure of the value network was only rarely planned within a long term strategy [16]. Instead, any opportunity was taken both to establish new sites, or for acquisitions and mergers [1]. This way, network structures developed, resulting from consecutive individual decisions, which, in their entirety, are suboptimal and fragmented [8]. The challenge companies are facing now is to optimize these production networks within the existing location structures by redesigning the value-added activities. The focus is on all value-added activities as defined by Porter [26] within the company's borders. Hence, value-adding structures distinguish from collaborative networks [5-6], value systems [6, 21] and virtual organizations [4].

The resulting shortcomings in value-adding structures are mainly because companies cannot resort to suitable methods to optimize existing value-adding structures [16]. A clear indicator is the massive failure of relocation schemes in general, but particularly of internal relocations of value-added processes. Within 2 to 2.5 years, 10 per cent of companies return the relocated production lines, 15 per cent after 4.5 years [16].

The reasons for reshoring listed in figure 1 shed light on what's going wrong in current planning [16-17]. It illustrates which criteria presently are not, or not appropriately, considered in the decision-making process for the value-adding structure [16-17].

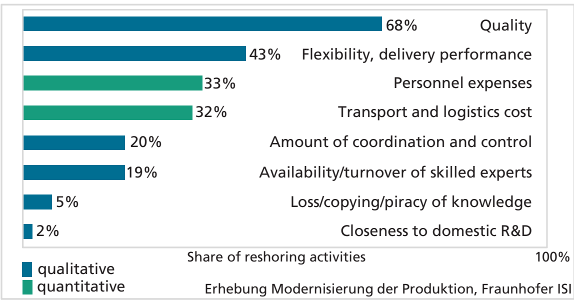

Fig. 1. Reasons for reshoring (imitation of [16-17])

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It is noteworthy that the emphasis is placed on qualitative criteria that cannot be valued in monetary terms, such as quality problems or declining delivery performance. Cost factors are exclusively mentioned in connection with the insufficiently considered effects of dynamic changes. Besides, the unconsidered qualitative criteria also impact the costs. For example, quality defects lead to high and underestimated costs for quality assurance, quality control and for supervising the sites with relocated value-added activities. This requires additional staff with immediate effects on personnel expenses. Accordingly, cost factors can also trigger reshorings if the qualitative criteria and their effects were not, or not sufficiently, taken into account in decision-making. On the whole, it becomes clear that, at the moment, the qualitative criteria are not, or not adequately, considered when planning changes to the value network [32].

Empirical studies confirm that currently used methods mainly result in a cost-based decision making behavior, leading to planning errors [16].

2. Design criteria used in current approaches for an optimal distribution of value-added activities

So far, the focus in developing methods for the optimal design of value-adding structures has been on costs. Small wonder that numerous approaches exist for distributing value added activities in a cost-effective manner (see literature survey in [9, 19, 32]). In 2008, a few researchers began to establish a relationship between the distribution of value-added activities and qualitative factors [10, 24, 32].

Ude, for instance, focuses on existing key performance indicator systems for networks [3, 14-15] to integrate qualitative criteria [32]. Kohler derives international aspects from trade barriers [19], Lanza employs change drivers as design criteria [20], while Friedli develops decision and design dimensions from so-called strategic excellence positions [12].

Ebensperger's benchmark-based approach centers on financial and qualitative assessment criteria and risk assessment [10]. Schmidt evaluates network scenarios according to the five design factors of market complexity and product maturity, factor cost advantages and transport costs, 'critical mass' technologies and economies of scale, global supplier markets and the projection of general macroeconomic conditions [29]. Mühlenbruch and Nyhuis provide a step-by-step procedure based on the modules of product structuring, international cooperative relationships, technology differentiation, as well as production stages and logistics design, using different qualitative criteria, derived from Kinkel's location planning methods and the change drivers of Hernandez [23-24].

Figure 2 surveys the design criteria described in the various approaches. It illustrates the deficiencies of each method in the use of the criteria, as each approach lacks any of the key criteria of other approaches.

		Ude	Kohler	Lanza	Ebens-perger	Friedli	Schmidt	Mühlen-bruch	Nyhuis
Costs	Factor costs	X	X		X		X	X	X
	Transport costs	X	X		X		X		
	Non-recurring costs	X			X		X		
	Amortization						X		
	Cost of capital		X				X		
Internal criteria	Times	X							
	Internal delivery performance	X	X						
	Flexibility	X				X			
	Product flexibility							X	
	Adaptability of production							X	X
	Quality	X					X	X	X
	Competence and productivity	(X)			X		(X)	X	X
	Complexity of technology								X
	Economies of scale, synergies, 'critical mass' technologies					X	X		
	Strategy			X	X				X
	Impact on employment							X	
	Sustainability								(X)
	Innovation speed								X
Partner criteria	Supplier structures			X		X	X	X	X
	Impact of global supplier market on overall network						X		X
	External market factors			X	X	X		(X)	X
	Market complexity and product maturity					X			(X)
	Competitors			X		X			X
	Logistics							X	X
National criteria	International aspects (taxes, customs, local content, exchange rate)		X			X	X	(X)	
	Political, legal, regulatory framework			X	(X)				(X)
	Economic development								X
External criteria	Environment			X					X
	Staff skills					X			X
	External knowledge					X			
	Know-how protection							X	X
	Image factors					X			
	General business risk					X			

Fig. 2. Design criteria used in current approaches for the optimal distribution of value added

The above list reflects the state of the art in the distribution of value-added considering qualitative factors. It shows that all approaches, except for Ebersperger's, include no other risks but the general business risk and the economic development in the catalog of design criteria. Although several approaches mention that there are positive and negative influencing factors, a clear distinction into success potential and risks is missing. As a result, risks are not considered in the scope of analysis.

Thus, the following section is concerned with risk criteria used in risk management for production networks.