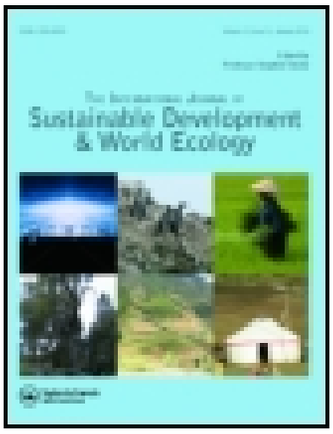

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Regionalisation and sustainability in the field of industrial production

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Key words: Regionalisation, industrial production, regional concepts, barriers, measures

SUMMARY

Regional business concepts are said to have huge potential to support sustainable development in industrialised countries (e.g. Stransfeld, 1999). However, whereas efforts have been made to implement regional concepts within agriculture and forestry, empirical findings show that regional concepts are only of minor importance to managers within industrial production (Rentz *et al.*, 2000). Considering this situation, the aim of the present article is to explain why regional business concepts have rarely been implemented in the field of industrial production. Therefore, in the course of the present article, a raster for the identification of relevant barriers on a personal, enterprise, inter-firm and macro-economic level will be developed and applied. Subsequently, suggestions for a set of measures to overcome these barriers to regionalisation will be given. The results have been identified in the framework of a questionnaire to about 30 decision makers of industrial companies within research, a project promoted by the German Ministry of Education and Research.

INTRODUCTION

In order to support nationwide sustainable development, the concept of sustainability has to become an essential factor in strategic business management (Ziegahn, 2000). Due to the enormous wastage of natural resources, as well as emissions in nature, this fact especially holds true for industrial production in industrialised countries.

Within the field of industrial production especially, approaches taking into account spatial proximity (regional concepts) are promising. This is, for example, because of the reduction of transport and packaging, the possibility to interconnect material and energy flows, as well as the creation of heterogeneous regional jobs. Whilst such concepts have already been realised successfully in agriculture and forestry, they attract little attention in industrial production in the era of globalisation which is characterised by global purchasing, global sales, global production and last but not least, by global communication.

In the following, first, underlying definitions of regionalisation within industrial production will be given. Subsequently, existing approaches to take advantage of spatial proximity in industrial production will be presented. Then, a raster for analysing barriers to regional business concepts in industrial production on a personal, enterprise, inter-firm and macroeconomic level will be introduced. This raster provides the basis for the following identification of a set of measures to overcome these barriers.

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REGIONALISATION

Generally speaking, the expression 'region' means a geographic area with a size ranging between spatial points and national economies. Apart from this general definition, there are a number of specific definitions in different subject areas. For the present problem, the definition which stems from economic geography is the most suitable. There, a region is defined as an aggregate of several spatial points which are similar in a number of characteristic features. In the context of industrial production, a region can be defined as an aggregate of spatial points (e.g. industry locations) which are mutually interconnected by material, information or energy flows.

The term regionalisation denotes a method to cluster locations on the basis of similar characteristic features or functional relations within regional sciences. However, in the present article, regionalisation of business concepts is defined as the increased concentration on regional production, purchasing or sales in order to support sustainable development on a company level. Figure 1 serves to visualize potential strategies of regionalisation in the area of industrial production. Therefore, a non-financial enterprise (in the following referred to as production company) is shown with its suppliers and customers as well as potential partners for regional cooperation, such as competitors and third organisations. Directed arcs are relationships causing material flows, other relationships are represented by undirected links. Possible regional business strategies are, e.g. purchasing from regional suppliers, selling to regional customers or co-operating with regional third parties such as research institutes, for instance.

Examples for regional concepts in industrial production

Regional business concepts are rarely being realised in industrial production. Nevertheless, there are a few approaches to regionalisation within industrial production which seem to be promising. In this section, examples for such concepts, namely industrial supplier parks, resource recovery networks and inter-firm energy supply concepts, will be presented.

A promising approach, taking advantage of spatial proximity within industrial production, is the concept of **industrial supplier parks** which is characterised by suppliers plants being situated on the premises of industrial companies. Industrial supplier parks are especially suited for production sites with high product complexity, e.g. those of the motor industry (Table 1).

Although industrial supplier parks are primarily

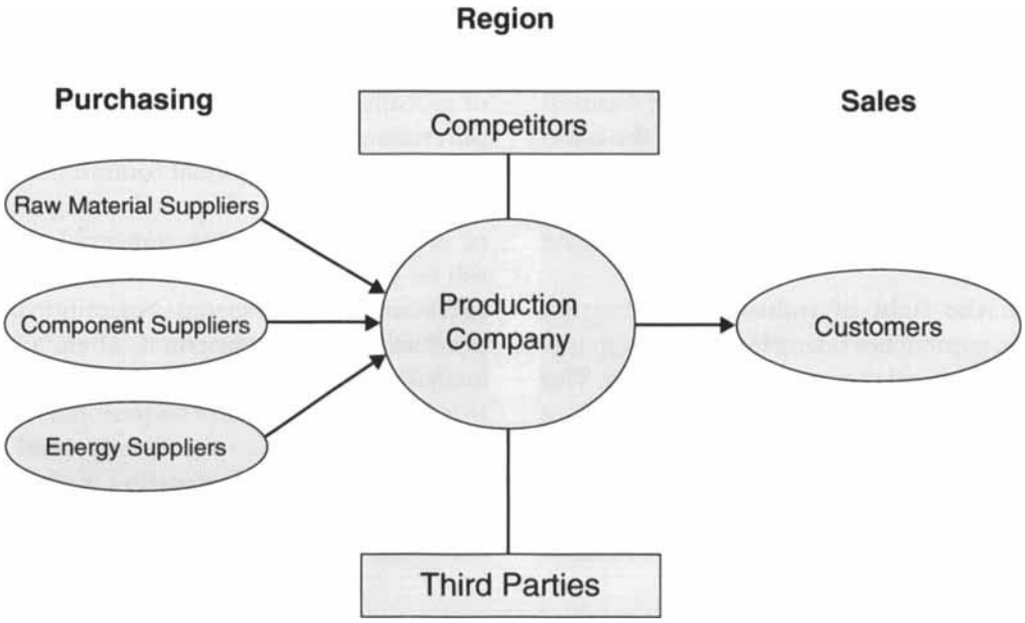

Figure 1 Regional business strategies for non-financial enterprises

Table 1 Examples for industrial supplier parks in motor industries in Europe (Rinza, 1999)

Producer	*Site*	*Number of suppliers*
Audi	Neckarsulm (Germany)	11
Audi	Ingolstadt (Germany)	10
Autoeuropa	De Palmela (Portugal.)	11
BMW	Wackersdorf (Germany)	11
DaimlerChrysler	Rastatt (Germany)	10
Ford	Saarlouis (Germany)	9
Ford	Valencia, (Spain)	28
Jaguar	Halewood (UK)	5
Seat	Matorell (Spain)	9
Vauxhall	Ellesmere Port (UK)	3
Volvo	Gent (Belgium)	Ca.10
NedCar	Born (Netherlands)	12

Table 2 Examples for resource recovery networks (Wietschel and Rentz, 2000)

Resource recovery network	*Number of enterprises*	*Spatial extension*	*Started*
Kalundborg (Denmark)	5	6 miles	1961
Styria (Austria)	30	60 miles	1993
Pfaffengrund (Germany)	14	3 miles	1996

implemented to realise economic benefits such as simplified possibilities to reduce manufacturing penetration, the avoidance of supply difficulties, and the reduction of transport costs and damages as well as costs of reworking, they may influence the ecological dimension of sustainability positively by reducing transport and packaging as well as related emissions. For instance, the integration of 10 supplier plants on the factory site land of DaimlerChrysler AG Rastatt enabled them to reduce transport by approx. 7.5 million truck miles.

Resource recovery networks (synonymous eco-industrial parks, industrial symbiosis, recycling networks) are a special form of inter-firm cooperation in order to interconnect material flows on a regional level, whereby the primary objective of the cooperation is to reuse the waste of the participating industrial enterprises as a valuable input within the network (Table 2). Other important reasons for the implementation of resource recovery networks are to ensure regular supply with raw materials in order to avoid bottle necks in production, to reduce the consumption of natural resources (e.g. water, oil, etc.) and to diminish environmental impacts in the form of lower emissions.

As in the case of Kalundborg, among others, about 20 000 tonnes of sulphur dioxide and 70 000 tonnes of fly ash per year are reused within the symbiosis. Although the main motivation for the implementation is to realise economic advantages, the organized and standardised reuse of waste materials within the framework of regional cooperation boasts a huge potential to support sustainable development in industrialised countries.

The energy supply of industrial companies is, by virtue of its high absorption of fossil energy resources and its emissions, a major determinant of sustainable development within industrial production. In this context, **inter-firm energy supply concepts** (synonymous: energy networks) which are characterised by a cooperation of companies for the joint utilization of power and steam generation facilities represent a promising approach to reduce generation costs as well as negative impacts on a company's contribution to sustainable development. Potential options thereby are the connection of energy flows, such

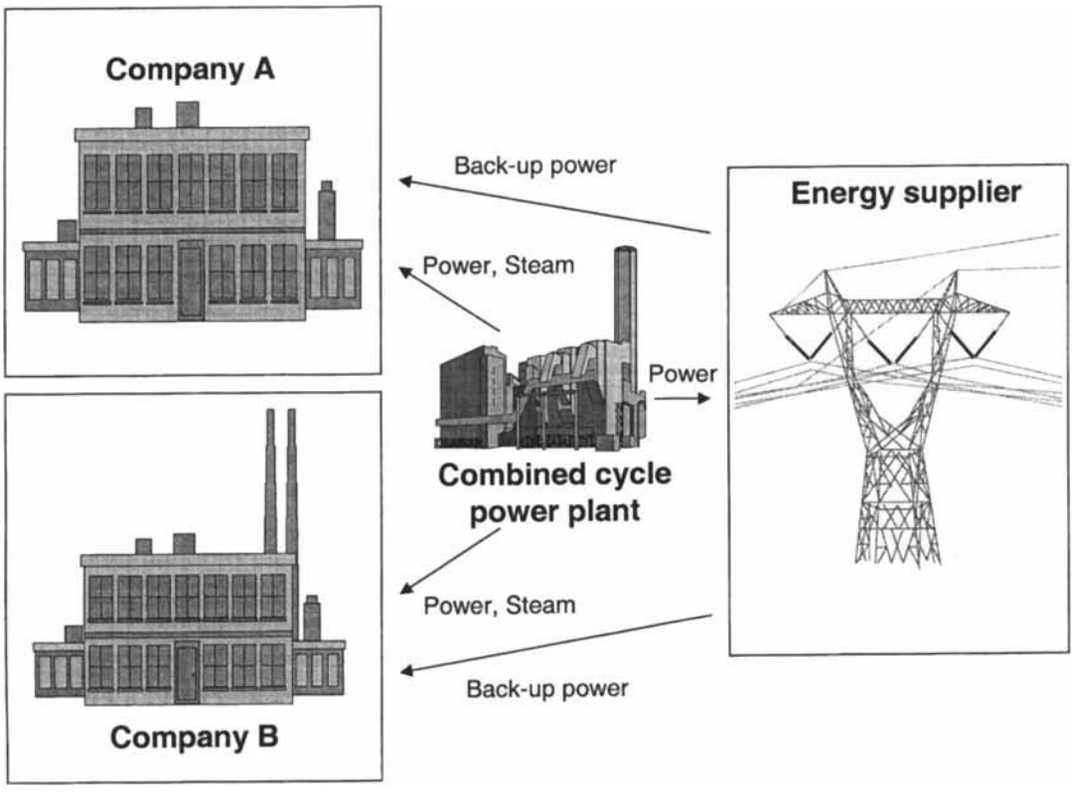

Figure 2 Inter-firm energy supply concept on the basis of combined cycle power plant

as steam supply, or the joint use of common combined cycle power plants in which power and steam are produced in cogeneration for the companies involved. The advantages of inter-firm energy supply concepts are the exploitation of economies of large scale, the compensation of energy demand curves, and the utilization of waste heat. Hence, the concepts of inter-firm energy supply are similar to resource recovery networks, with the main difference being that only energy flows are interconnected in the energy network, whereas resource recovery networks typically feature material flows which are residues of the production process. What both concepts have in common is the spatial proximity of the network participants and the potential to enhance the companies' sustainability performance.

An example for such an energy network is the cooperation of two companies, both with a high steam and a high power demand and an energy supplier. This pilot project is sponsored by the German Ministry for Education and Research (BMBF) and aims at identifying economic, ecological and social effects of inter-firm energy supply concepts which are based on existing energy supply facilities as well as on investments in new facilities. One of the options investigated is a joint use of a common combined cycle power plant in order to satisfy the high demand for steam and power (Figure 2). Since this regional inter-firm energy supply concept leads to lower energy costs and to lower emissions, it serves to improve the companies' economic and ecological performance. Moreover, additional jobs within the region are created.

BARRIERS TO REGIONALISATION IN INDUSTRIAL PRODUCTION

Although the regional business concepts in the field of industrial production presented above seem to have a huge potential in terms of contributing to sustainable development in industrialised countries, they have only been implemented in very few cases. The reason for this is the existence of numerous barriers to regional business concepts in industrial production. In

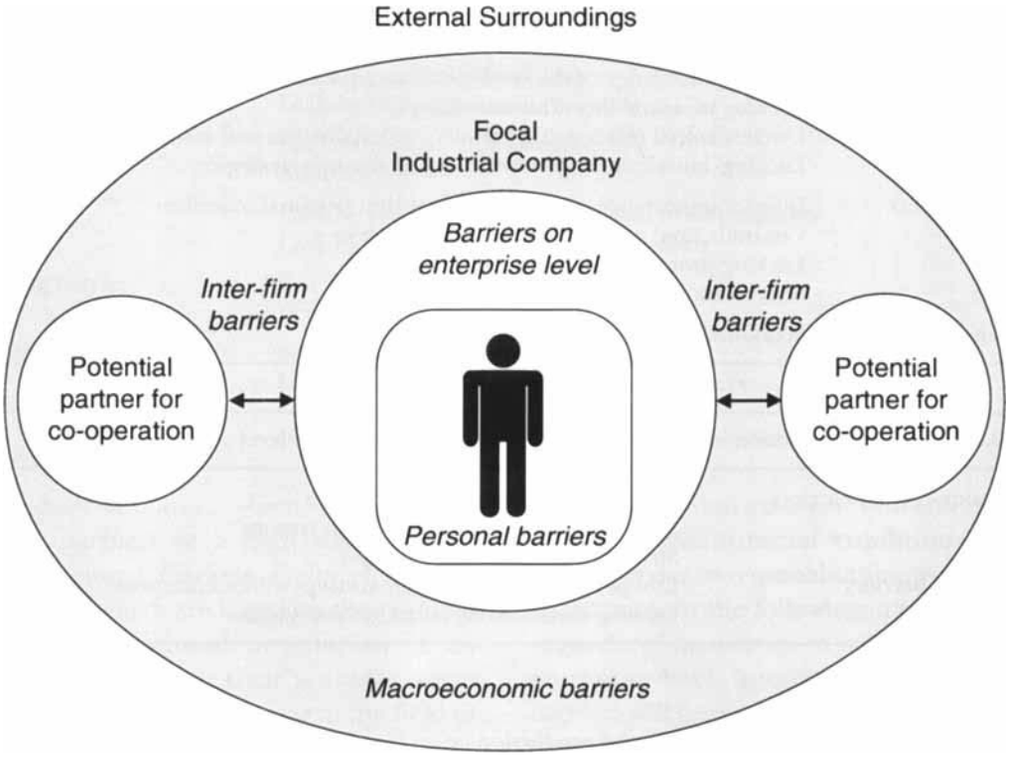

Figure 3 Barriers to regional business concepts (italic)

order to account for these barriers, the present section will give a raster which includes barriers on a personal, enterprise, inter-firm and macro-economic level (Figure 3).

Personal barriers to the regionalisation of business activities within the field of industrial production are related to individual resistance against an increased regional orientation in organisations. Such personal barriers may be subdivided in cognitive, motivational and situational barriers. Since neither the underlying concept nor potential strategies for regionalisation or their possible positive consequences for sustainable development are widespread within industrial production, cognitive barriers represent a considerable obstacle. Furthermore, there are motivational barriers on a personal level which relate to the fact that regional business concepts might fail because they are not in agreement with personal objectives of decision makers (although possible options are known within the company in question). Finally, resistance on a personal level comprehends situational barriers such as the workload of alternative tasks and pressure of time (Table 3).

Barriers on an enterprise level are due to the existence of company-specific conditions which hinder realisation of regional business concepts and comprise barriers in terms of communication or resource restrictions. In major enterprises with a hierarchical structure and/or strict functional divisions, communication barriers very often do prevail. These barriers to communication are characterised by the fact that information – especially initiatives for regional business concepts – will be passed only unassertively or not at all. One reason may be the lack of enterprise-wide sustainability information systems, which gather relevant status quo information as to the company's economic, ecological and social performance, as well as its targets for sustainability planning and thus provide a basis for sustainability control (Table 4).

In contrast to communication barriers, resource-related barriers rather occur in small or medium-sized enterprises (SME). Resource barriers come into existence because resources are assigned to projects with high priority whereas regional projects are attached importance to only in exceptional cases (Table 4).

Table 3 Personal barriers to regionalisation in industrial production

Cognitive barriers	Lacking knowledge of the concept of sustainability Lacking measurability of sustainability Unclear causal relationship between regionalisation and sustainability Lacking knowledge of potential regionalisation strategies
Motivational barriers	Inferior importance of sustainability within personal objectives Contradiction: globalisation – regionalisation Lacking promoters in companies Short-term planning
Situational barriers	Workload by other tasks

Table 4 Barriers to regionalisation in industrial production on an enterprise level

Communication-related barriers	Hierarchical structure of companies Lacking sustainability information systems Strictly separated responsibilities
Resource-related barriers	Low priority of sustainability concept within enterprise Lacking sustainability management systems

Table 5 Barriers to regionalisation in industrial production on an inter-firm level

Barriers to cooperation	Dependence on partners Insufficient communication between partners Insufficient trust Lacking continuity of cooperation Disclosure of confidential information Unknown cost-benefit ratio
Barriers to interconnection	Lacking quantity or quality of material and energy flows to be interconnected Lacking continuity of material and energy flows to be interconnected Considerable investments Long periods of repayment

In order to convert the synergy effects into money, regional business concepts may well be tackled jointly by several enterprises. A successful completion of such projects is prevalently hindered by **inter-firm barriers**. These consist of the conditions which aggravate an effective and efficient cooperation between firms and may be subdivided in barriers to cooperation and barriers to the interconnection of material and energy flows (Table 5).

According to the classification of the external surrounding of enterprises, macroeconomic barriers may be subdivided into mission-oriented and global barriers to the implementation of regional business concepts. The latter will in the following be referred to as macroeconomic barriers and may be classified into physical, political, cultural, technological and economic barriers. Physical barriers relate to the entirety of geographic and geological conditions. In the context of industrial production, especially, lacking natural resources within regional areas represents a considerable barrier to regional business concepts. Legal barriers are determined by the totality of legal regulations which regional business concepts within industrial production are subject to, such as provisions concerning the interconnection of material or energy flows within resource recovery networks or inter-firm energy supply concepts. Furthermore, the antitrust law may hinder regional cooperation of industrial companies. Economic barriers comprise restraints which result from the economic situation of the region in question, such as a lack of size of the

Table 6 Macro-economic barriers to regionalisation in industrial production

Physical barriers	Lacking regional infrastructure Lacking regional natural resources
Legal barriers	Requirement for official approval Antitrust law
Cultural barriers	Lacking publicity for the expression of sustainability Lacking preference for regional products
Technological barriers	Economies of large scale Downcycling
Economic barriers	Small size of regional industrial markets Lacking buying power of regional consumers

regional industrial market, absence of qualified cooperation partners or a high level of competition in regional markets. Cultural barriers include barriers which are based on the regional society and the regional population of an economic area, as well as their attitudes, views and consumer behaviour. Whereas in the field of agriculture there is already a preference for regional and sustainable products, there usually is no such preference for industrial products. Consequently, consumers are not willing to pay a premium for regional industrial products. Technological barriers are of prime importance as to regional value adding activities, since the exploitation of economies of large scale requires large volumes, both concerning recycling and production technologies. These volumes exceed regional quantities in many cases and thus impede the implementation of regional business concepts (Table 6).

MEASURES TO OVERCOME BARRIERS TO REGIONALISATION

In order to overcome these multifarious barriers to regional business concepts within industrial production both political and organisational action should be taken. Thereby, politics need to create a business environment that promotes sustainable development and regional business concepts, on the one hand. On the other hand, research has to be prompted to develop methods, tools and technologies which support the implementation of regional business concepts within research programmes. Whereas politics may improve structural conditions for regional activities, decision makers within enterprises need to implement internal conditions which are advantageous to regionalisation within industrial companies. In the following, a set of suggestions regarding measures to overcome personal, enterprise level, inter-firm and macroeconomic barriers will be given.

Tackling barriers on a personal level by political measures may include campaigns in order to increase the level of awareness of the expressions of sustainability and regionalisation. In this context, the fact that regionalisation may lead to sustainable development has to be popularised. Organisational measures comprise the promotion of sustainability and regionalisation within companies. Thereby, continuing training should especially be implemented in order to overcome cognitive barriers. Motivational barriers might be approached by including the concepts of sustainability and regionalisation within the formulation of a company's mission statement which would emphasize that both concepts are corporate objectives.

The main tasks of politics regarding barriers on an enterprise level are the promotion of research in the field of organisational sustainability management and information systems, including approaches to regionalisation, and to bring forward the implementation of such systems. Organisational measures should be designed to provide resources to projects improving the enterprise's sustainability performance, as well as to ensure the necessary communication within the production company. In order to attach great importance to measures concerning sustainability and regionalisation, the introduction of a sustainability information system might be

advantageous. However, since the invention of such systems has not yet reached market maturity or even an industry standard, industrial companies depend on internal developments.

Political measures to overcome inter-firm barriers should be aimed at facilitating regional cooperations and the interconnection of material flows, such as the implementation of regional waste material exchanges to create transparency of regional markets (Dioun, 1998), the introduction of regional cooperation centres or the promotion of pilot projects in the field of the regional interconnection of material flows, e.g. resource recovery networks, to demonstrate the feasibility of such networks. Measures on an enterprise level include the creation of a corporate culture promoting inter-firm cooperation, the provision of financial as well as personal resources to projects of regional cooperation and the formal institutionalisation of the cooperation so as to improve both information flows and efficiency.

Since the sphere of influence of organisational measures is rather limited to personal, enterprise-level and inter-firm barriers, macroeconomic barriers are usually subject to political measures. Nevertheless, companies may lessen the degree of economic and social barriers by means of marketing and thus help create a market for regionally produced goods. Additionally, political measures may be taken to promote regional products, by introducing a labelling system for regional products, for instance. Political measures also may include the promotion of small scale technologies to overcome technological barriers, such as economies of large scale that prevent regional enterprises from exclusively producing for regional markets in small numbers. Finally, political steps might be taken to reduce legal barriers. Thereby, means of regional politics and planning have to especially be taken into account.

CONCLUSION

Summarizing, one has to state that although there are promising approaches to regionalisation within the field of industrial production, such as industrial parks, resource recovery networks or inter-firm energy supply concepts, which boast huge potential to support sustainable development in industrialised countries, these approaches are rarely realised. The explanation is the existence of numerous barriers to regional business concepts. In order to derive a set of measures to overcome these barriers, they may be classified into personal barriers, barriers on an enterprise level, inter-firm barriers and macroeconomic barriers.

The present article gives an overview of such barriers within the field of industrial production in industrialised countries, as well as of potential strategies to implement regional business concepts. The results have been identified in the framework of a questionnaire to about 30 decision makers of industrial companies, within a research project sponsored by German Ministry of Education and Research.

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