Chapter 7

The Baden-Württemberg production and innovation regime

Past successes and new challenges

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Introduction

By the 1980s at the latest, the crisis of Tayloristic, bureaucratically organized mass production was obvious. In the highly industrialized societies of the Western world, the production of standardized industrial products at competitive prices was no longer viable. The comparative advantages these countries had enjoyed, primarily the competence and capital required for organizing mass production, had declined or lost their significance. This raises the question as to the remaining locational advantages: what products or services can still be profitably manufactured or rendered, given the labour costs in Western Europe?

Baden-Württemberg also faces this question. Initially, this may seem somewhat surprising when one considers that the region's success was based less on Tayloristic mass production concepts and far more on the flexible manufacturing of high-quality industrial products (Piore and Sabel, 1984; Streeck, 1991). Over many decades, flexible high-quality production enabled manufacturing companies in this regional state in south-west Germany to avoid price-based competition against which they could hardly have won. This manufacturing concept was successful as long as it was pursued as a complementary approach to mass production (and not as a radical alternative). The demand for investment goods, as well as for quality-orientated sophisticated market segments that could not be served by standardized products, was satisfied by companies whose special strengths lay in the flexible supply of high-quality products. With the advent of the much debated knowledge-based economy – this situation changed completely. In contrast to the post-war period of prosperity, companies are no longer faced with the decision of either turning out low-cost mass products or diversified quality products. What is now demanded are innovative high-quality, flexibly supplied and low-cost products and services. Lean production, development and marketing concepts are undermining the former complementary position between flexible specialization and mass production. This also undermines the former comparative strengths of industrial districts and other types of regional economies. One can no longer assume that there is a naturally evolved superiority of regional production and institutional networks characterized by a multitude of small and large industrial

and service companies, regional co-operation and supply relations between companies, as well as a supporting network of regional institutions (banks, training systems, research and development institutions, regional labour relations, etc.) (Pyke and Sengenberger, 1992).

This brings us to discussion on the strengths and the limitations inherent in regional production systems. Baden-Württemberg (or the greater Stuttgart area to be more precise; cf. Sabel, 1989), as well as the central Italian and French industrial districts, was frequently quoted as a prominent example of such regional systems. The success of these regions was attributed to the concept of flexible specialization, based on close co-operative relations between companies and general institutional conditions that barred companies from the option of hire-and-fire policies and drastic labour cost reductions, and thereby reinforced the imperative of permanent innovation (cf. also the concept of co-ordinated market economies generalizing similar observations; Hall and Soskice, 2001). Only adherence to collectively binding regulations and agreements was able to prevent companies from 'free-riding' (in the form of refraining from training or research investments, or wage-dumping practices, etc.), approaches that may appear efficient and rational in the short term, yet prove detrimental in the long term. Qualified employees in long-term working relationships, co-operation-based employer–employee relations and an intensive regional information exchange between different companies will facilitate the orientation to demanding high-quality market segments, and this orientation is also needed in order to secure safe jobs for the core workforce of unionized employees. Apart from general institutional conditions, co-operative supplier–buyer relations and regional company clusters (Porter, 1990; OECD 1999) are of considerable importance for the success of regional production and innovation concepts, as such company networks facilitate the smooth exchange of information and enhance technical and business competence (Powell, 1990).

Streeck (1991) takes the credit for freeing the concept of flexible specialization from a certain *Mittelstand* or neo-artisan romanticism. In the model of diversified quality production that he proposed, large-scale companies also find their place, whereas the close regional context is abandoned, and national, governmental regulation structures (labour law, training systems, etc.) are integrated into the model. The balance between competition and co-operation, which is central to flexible co-operation strategies, is not so much ensured by personal agreements and trust-based relations, but more by national institutions and legal and collective agreements. Streeck emphasizes in particular the significance of industry-wide wage agreements, uniform and national training regulations, and collectively bargained wages and working-hours agreements. Thus, regional and national training systems and industrial policies, industrial relations, professional and business associations, and regional and national financial systems, are the central pillars of such intercompany regulation structures and production regimes.[1]

Within the context of increasing worldwide competition, networked and regionally concentrated manufacturing structures and a 'rich' institutional environment are no longer regarded as adequate preconditions for success. Whether we look to government-supported scientific regions such as the Midi-Pyrénées, high-tech regions such as Silicon Valley, traditional industrial districts such as Tuscany, or metropolitan financial and service centres (global cities) – all of these different production and innovation concepts rely on a rich institutional environment and on close intercompany co-operation-based relations. With the rising significance of regionally anchored economic structures, the differences between the respective variants are of central interest. Although the concepts of flexible specialization and diversified quality production are primarily based on the strengths of regional production and institutional networks, the relative stability and consistency of regional production structures may also be associated with considerable innovation obstacles. The institutional stabilization of interorganizational networks is a prerequisite for the success of industrial districts, yet on the other hand this very stabilization may prove disadvantageous as it hampers the active search for new product and production concepts (Saxenian, 1989; Grabher, 1993). Regional or national lock-in effects tend to cement yesterday's success formulas as permanent institutions. In view of increased demands made on flexibility, quality and innovation, the stabilization of communication and co-operation relations (and the associated barriers between different employee groups, companies, branches and sectors of the economy) may begin to prove dysfunctional.

This possibility can no longer be excluded for Baden-Württemberg (Braczyk *et al.,* 1996), even though this highly industrialized German state with its 10.4 million inhabitants, and its 5 million employees is one of the most prosperous and most innovative European regions: this is reflected by a GDP of 295 billion Euros (2000; more than the Swiss, Danish, Finnish or Austrian gross domestic product), its per-capita average income of nearly 27,000 Euros (1999; well above the German (23,400 Euros) and European (20,000 Euros) average), and its research intensity of 3.9 per cent of its GDP (Germany: 2.3 per cent; European Union: 1.8 per cent). Its employment rate (percentage of population aged 15–64) is well above the German and European level (1999: 69.5 per cent in comparison with 65.4 per cent and 62.8 per cent), its unemployment rate well below these levels (1999: 5.1 per cent in comparison with 8.9 per cent and 9.4 per cent), the rate of European patent applications per million people (average 1997–99) is the highest of all European NUTS2–regions (416.4 in comparison with 227.3 in Germany and 119.4 in Europe) (European Commission, 2001).

Despite these impressive performances, the first symptoms of the limitations of the regional production became increasingly apparent in the first half of the 1990s. During the crisis between 1992 and 1994, the economy of Baden-

Württemberg suffered more than the other states of the former West Germany. GDP declined by 4.7 per cent (1993), the unemployment rate of the dependent labour force rose from 3.7 per cent (1991) to 8.7 per cent (1997). The crisis affected mostly the economic core region of Baden-Württemberg, the region of Stuttgart (cf. Krauss, 1999: 359). However, it was quickly overcome because the region could over-proportionally benefit from the unexpected boom of the automotive industry in the second half of the 1990s: In 2000, the GDP grew by 4.5 per cent, the highest growth since 1992. Employment numbers increased significantly during the last years of the 1990s. In October 2000, Baden-Württemberg's unemployment rate reached an eight-year-low of 5.5 per cent; the number of employees now is even higher than at the beginning of the crisis at the beginning of the 1990s (1991: 4,831,000 employees; 2001: 4,976,800 employees). Nevertheless, the fundamental situation of the region, especially its strong and also increasing dependence on two complex, but increasingly mature products (cars and machines) still persists. The share of service employment (1999: 57 per cent) is much lower than in Germany (63 per cent) and in the European Union (66 per cent) reflecting the classical industrial strengths of the region especially in the investment goods sector (car production, machinery, electrical equipment). Also, the economic recovery at the turn of the century cannot hide the fact that newly created jobs in the industrial core branches compensate only for a portion of the jobs lost during the crisis and that in fact, those branches in the long run are likely to further lose workers (the number of employees in the manufacturing industry declined from 1.5 (1990) to 1.2 million in 1999).

These indicators outline the limits, but also the potentials of the production and innovation regime to date. In the following discussion we will analyse this regime in order to shed light on this new situation and the ongoing transformation of the regional innovation regime.

In the following discussion we will initially describe the extraordinarily successful economic development that Baden-Württemberg underwent in the post-war years. These successes resulted in an economic structure that is presently proving problematic in view of the altered general conditions of the global economy. This will be followed by an account of the institutional environment in Baden-Württemberg (i.e. the research and development facilities, the vocational training system, industrial relations and financial services). These institutions represent a major precondition for special strengths in the area of advanced, predominantly mature technologies. However, the inertia of these institutions explains several weaknesses in the sector of new knowledge-intensive high technologies. In conclusion, we will summarize the strengths and weaknesses of the present production and innovation regime and point out some attempts at a new positioning of the Baden-Württemberg production and innovation regime.

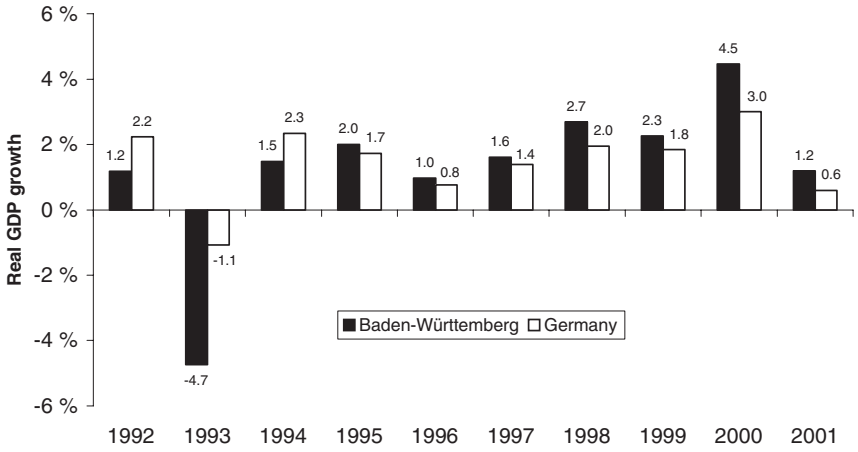
Industrial modernization of Baden-Württemberg after the Second World War

In the prosperous early post-war decades, Baden-Württemberg's economy succeeded in charting an extraordinarily successful course of development. This federal state, or *Land*, in the southwest of Germany – which has existed in its present form only since the fusion of the three *Länder* of Baden, Württemberg-Hohenzollern and Württemberg in 1952 – recorded higher growth rates than the entire Federal Republic. During the 1950s especially, the Baden-Württemberg economy expanded a great deal faster than the West German economy as a whole. However, from the 1970s onwards it also become apparent that Baden-Württemberg's economy was more strongly affected by recessionary phases than was the rest of Germany, thus reflecting the drawbacks of a strong export orientation (Figure 7.1).

This extraordinary growth was associated with the dynamic (catching-up) industrialization of the federal state. The agricultural sector, which had accounted for a quarter of the workforce at the beginning of the 1950s, dwindled very quickly, whereas the number of employees in manufacturing industry rose from 1.4 million (1950) to 2.3 million (1970), reaching an absolute peak value (with a 55.9 per cent share of the labour force in Baden-Württemberg – compared with a 48.9 per cent average on a national level). In 2001, the 40.3 per cent share of employees active in production industry was still considerably above the German average (1999: 34.5 per cent). Compared with other OECD countries (with the exception of Portugal and some Central European Countries), Baden-Württemberg (and Germany) still exhibits an above-average share of industrial employment (see Figure 7.4).

The successful industrialization strategy was based primarily on the investment goods industry or, more precisely, on the mechanical engineering industry, the automotive industry and the electrical engineering industry (see Figure 7.2). These three branches (and especially the automotive industry) form the economic backbone of the industrialization model of Baden-Württemberg. From 1950 to 2000 the number of employees in these three branches more than tripled (1950: 225.000 employees; 1991: 800,000; 2000: 700,000 employees), whereas the number of employees in the textile industry – the most important industrial sector in 1950 and a major factor driving the development of the mechanical engineering industry in the nineteenth century (Sabel, 1989) – declined to less than one-third of its original volume.

These three branches are at the centre of two relatively autonomous industrial clusters located mainly in the region of Stuttgart – the automotive industry and its suppliers (approximately 335,000 employees in 1998) and the mechanical engineering industry producing a wide spectrum of production technologies in mostly small and medium-sized companies. As well as these traditional clusters,



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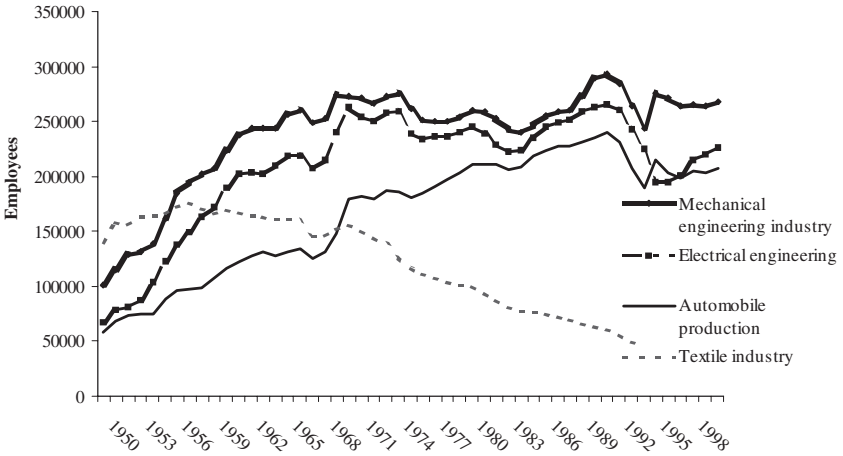


7.2 Employment in the core branches of the economy of Baden-Württemberg (1950–2000)
Source: Statistisches Landesamt Baden-Württemberg (2000)

in the past decades have emerged a new cluster of business-related software and service companies (such as SAP, IBM, Hewlett-Packard, or the once successful Brokat[2]) with 55,000 employees. Besides these three established clusters, different studies have identified some smaller, mostly local clusters (for example, biotechnology, multimedia, photonics, health).

The growth of the regional labour force is another indicator of the successful industrialization of the state (1950: 3.1 million; 2000: 5 million). During the

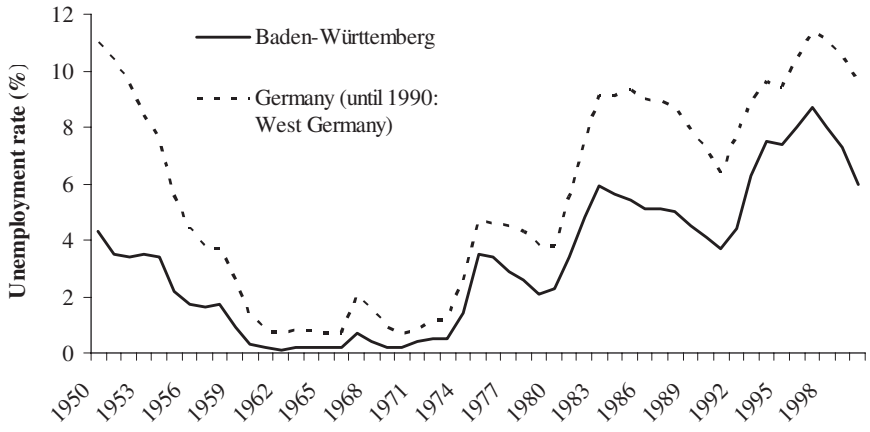
same period the total population rose from 6.4 million to 10.5 million. The influx of exiles from the former German regions in eastern Europe accounted for the first rise and was followed by the inflow of people from other federal states and abroad (the proportion of foreigners rose considerably in the period between 1959 and 1973, and foreigners accounted for 12.2 per cent of the population in 2000). The regional unemployment rate was always lower than the German average (Figure 7.3).

The export rates that exceeded the German average over decades are an additional indicator of the success of Baden-Württemberg's economy. In 1999, 29 per cent of the regional production was exported – a considerable increase since 1993 (23 per cent). This success can be attributed to the concentration of three branches of the investment goods industry (namely mechanical engineering, electrical engineering and the automotive industry). In 1999 the three core sectors of Baden-Württemberg's economy recorded 49.0 per cent (mechanical engineering), 55.4 per cent (automotive industry) and 46.8 per cent (electrical engineering) of their sales outside Germany. There can be no doubt as to the outstanding success of the economic development in Baden-Württemberg in the post-war years. These outstanding successes were reflected by a considerable rise in the number of employees (and the total population), high export rates, above-average growth and an unemployment rate below the national average.

Economic structures – an obstacle to innovation?

Baden-Württemberg's post-war prosperity was enabled by a co-ordinated ensemble of regional economic structures and general institutional conditions. In the following we will analyse regional economic structures in terms of the accumulated capabilities and the potential inertia and thus will show how the necessary transformation of the regional economy is difficult. In doing so, we will concentrate on possible lock-in effects resulting from the formation of regional clusters. We feel this approach is valid and justified, as the strengths of Baden-Württemberg's economic structure – consisting of many globally active corporations (DaimlerChrysler, Robert Bosch, IBM Deutschland, Heidelberger Zement, ZF, SAP, Porsche, etc.), a multitude of successful *Mittelstand* companies and institutions of world renown – have been adequately portrayed in other places (Sabel *et al.*, 1989; Herrigel, 1996).

As Table 7.1 shows, the growth rates of Baden-Württemberg's economy in the 1990s were below the national average – mainly due to the deep structural crisis at the beginning of the decade. At the same time, the branches with the highest growth rates – the financial and business services – expanded slower than at the national level. The regional shares of these highly productive and dynamically expanding services are close to the relatively low German average.



7.3 Unemployment in Baden-Württemberg and West Germany 1950–2000.
Source: Statistisches Landesamt Baden-Württemberg (2000)

Table 7.1 Economic and employment structure of the Baden-Württemberg economy (1991–2000)

	Gross value added (at constant 1995 prices)				*Employment*			
	% share of economy (1999)		*Development 1991–1999*		*% share of economy (1999)*		*Development 1991–1999*	
	B-W	*Ger*	*B-W*	*Ger*	*B-W*	*Ger*	*B-W*	*Ger*
Agriculture and forestry	1.2	1.0	41.9	19.1	2.2	2.6	–31.2	–37.3
Industry	32.3	24.0	–0.1	–4.5	30.6	22.5	–14.9	–24.5
Construction	4.4	6.0	–17.9	0	6.0	7.4	–7.7	1.1
Wholesale and retail trade, restaurants, hotels and transport	14.7	18.0	10.7	13.7	22.5	25.2	2.9	2.4
Finance, insurance, real estate and business services	27.0	30.0	29.3	38.0	13.9	13.9	45.4	42.1
Public administration, education, health, social work and other services	16.1	21.0	12.7	12.7	24.8	28.4	15.0	10.6
All branches	100.0	100.0	7.7	13.6	100.0	100.0	1.3	–1.3

Source: Statisches Landesamt Baden-Württemberg, 2000: Lange Reihen 1950–1999 and Statistisches Bundesamt, STATIS.

The question arises why, in spite of Baden-Württemberg's exceptional success in the investment goods industry, its economy did not succeed in staging a stronger reorientation to sectors promising greater growth potential. Why did Baden-Württemberg's economy fail to stake out a greater share in new areas such as information and communications technology, new materials, biotechnology, environmental and power technology, microsystem technology, and production services (Faust *et al.*, 1995), although the industrial, structural and institutional preconditions in each of the cited areas were certainly not unfavourable? This question also leads us to the inertia of established production structures.

In the following we will discuss three aspects of this inertia or resistance to change. First, we will document that the share of in-house production (value added divided by sales) of Baden-Württemberg's industrial companies is still above the West German average and is extraordinarily high by international comparison. As a high share of in-house production is frequently associated with disadvantages in terms of costs and flexibility, the high degree of integration of regional manufacturing may prove a considerable handicap in facing international competition. Second, we will demonstrate that the share of internally rendered services is exceptionally high and that Baden-Württemberg's industrial companies use external service providers to a very limited extent. This factor may also prove to be a handicap in coping with worldwide innovation, flexibility and cost competition. Third, we will illustrate that close regional integration and interlinking are primarily vertical, whereas regional co-operation activities mainly consist of supplier and service relations within an industrial cluster. Co-operation between competitors – a factor regarded as crucial for innovative product and production concepts (Piore and Sabel, 1984) – plays a relatively insignificant role in Baden-Württemberg.

On the way to lean production?

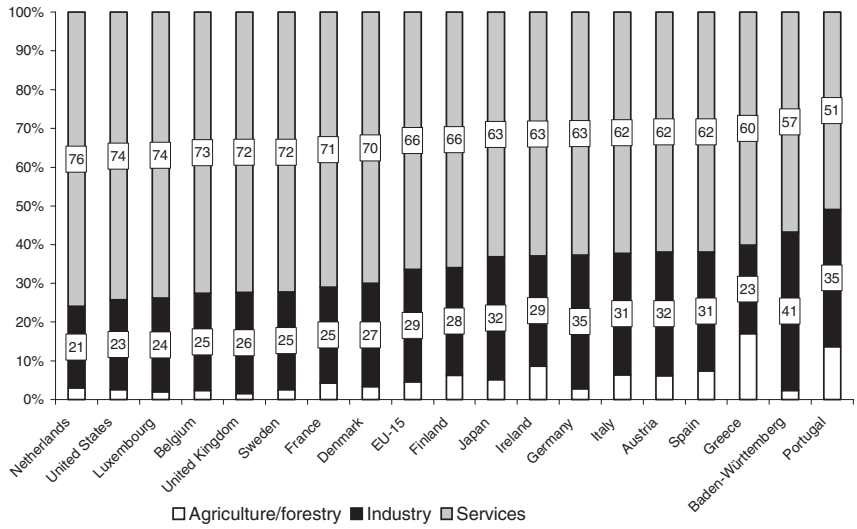
Considering the years of discussions on lean production concepts, make-or-buy or JIT ('just-in-time') issues, one could expect a considerable reduction of in-house production. Surprisingly, however, the average extent of in-house production of all companies in Baden-Württemberg has remained constant (1978: 49 per cent; 1990: 48.7 per cent; West Germany 1990: 48.2). This stability is the result of opposite developments: as the share of more strongly integrated service areas increased, the extent of in-house production in the manufacturing industry declined slightly (1978: 42 per cent; 1990: 40 per cent). As the average extent of in-house production in West Germany was recorded at 38.1 per cent (1990), Baden-Württemberg's industry can hardly be regarded as being in the vanguard of developments. Particularly in the automotive and the electrical engineering industry, the extent of in-house manufacturing has reduced considerably over recent years. Nevertheless, the share of in-house production in the electrical engineering industry

(1990: 50.2 per cent; West Germany: 48.1 per cent) and in the mechanical engineering industry (1990: 43.6 per cent; West Germany: 42.4 per cent) is still comparatively high. Only in the automotive sector (1990: 33.6 per cent; West Germany: 33.3 per cent) and in the food, beverages and tobacco industry was the share of in-house manufacturing considerably lower than the average in the manufacturing industry. The number of employees in Baden-Württemberg procuring supplies for the automotive industry increased from 84,000 (1993) to 142,000 employees (1998; cf. *Baden-Württemberg in Wort und Zahl*, July 2001). As a high degree of integration in manufacturing is associated with a lack of openness towards competent, specialized suppliers and service providers, a high degree of in-house manufacturing may well hamper a reorientation to innovative products and flexible sales market segments (Münzenmaier, 1995).

On the way to an industrial service society?

In connection with the high, although decreasing, extent of in-house manufacturing in Baden-Württemberg's industry, a high 'internal tertiary rate' of Baden-Württemberg and West German companies is notable. The differentiation and organizational segregation of manufacturing and service activities are far less pronounced than in most other Western industrial nations (Figure 7.4); in other words, companies perform a great many production-related services themselves. This is reflected by the high share of employees in the manufacturing industry who are active in the service professions (1993: 39.6%) or who are primarily assigned service tasks (1991: 41.9 per cent). These figures barely deviate from the West German average (38.8 per cent and 41.5 per cent, respectively).

The above was associated with the delayed development of the service sector. In comparison with other advanced industrial societies, Baden-Württemberg's share of service sector employment is relatively low (57 per cent in 1999; cf. Figure 7.4). The technology and export-orientated investment goods industries in particular, but also the consumer goods branches, use external service providers relatively little. Only a quarter of the input factors requested by the manufacturing industry are services (1990: 25.1%). Since 1978, however, this share has risen considerably. This is especially true for the automotive industry. In 1998, 53 per cent of the external supplies consisted of services (consulting, engineering, marketing, development, etc.). Baden-Württemberg's companies have also sourced an increasing volume from external suppliers (especially the electrical engineering industry, with 29.2%). After deduction of their own 'exports', Baden-Württemberg procures 4.6% of services required from other German states or from abroad (1978: 3.4%). Therefore, Baden-Württemberg's service balance is negative. Financial, transport and other services account for two-thirds of this negative balance.



7.4 The employment structure of the economy of Baden-Württemberg in international perspective, civilian employment by economic sector, 1999
Source: (ECD (2001a)

This points to a potential *vicious circle*. Especially in terms of sophisticated, manufacturing-related services, Baden-Württemberg's companies are unable to draw on regional external providers. As the use of remote or foreign external providers is associated with higher risks and transaction costs, companies refrain from procuring these services. This may pose an obstacle to globalization, innovation, flexibilization and diversification strategies, as companies are often not able to access or develop specific in-house competence and know-how (e.g. concerning Japanese customer wishes and tax legislation, efficient suppliers for biotechnological production techniques, or hardware/software solutions to specific problems, etc.). In many instances external services can be more efficiently developed, rationalized and systemized, whereas some customers may also benefit from the experiences of others. It cannot be generally assumed that leaner companies are actually more innovative and more efficient. But the extraordinary inertia of vertically organized companies will inhibit reorientation to new products and product models more strongly than the targeted access of innovative service providers and suppliers.

Innovation by co-operation between companies?

Intensive co-operation and communication networks within a region give rise to synergies that, according to the concept of flexible specialization, represent an important precondition for the success of industrial districts. In the case of Baden-

Württemberg, however, one must clearly differentiate between vertical and horizontal co-operation patterns. In Baden-Württemberg, the significance of vertical relations between suppliers and buyers is very high. In the age of internationalized production structures, Baden-Württemberg's manufacturing industry has retained a surprisingly high degree of regional sourcing. Of the required input factors, some 53 per cent of supplies are procured in 1990 regionally, 26.7 per cent from other German states and 20.4 per cent from abroad (Münzenmaier, 1995). In the mechanical engineering and automotive industry, the share of regional sourcing has even increased in recent years. This reflects the extent to which the companies of the three core branches of automotive, electronic and mechanical engineering are tied in regional clusters.[3]

Relations between potential competitors are horizontal forms of co-operation. In Baden-Württemberg they are far less significant than the concepts of flexible specialization would suggest (Schmitz, 1992: 95, 101; Cooke *et al.*, 1993). Based on a representative survey of West German mechanical engineering companies, Kerst and Steffensen (1995) were able to demonstrate that the number of co-operating companies in Baden-Württemberg is by no means above average (excluding research and development – in which in 1993 55 per cent of Baden-Württemberg's and 48 per cent of West Germany's mechanical engineering companies co-operated). The share of co-operating mechanical engineering companies in Baden-Württemberg (1993: 37 per cent) is on par with the West German average (36 per cent). Therefore, it is doubtful that there is a higher incidence of co-operation activities between competing companies in Baden-Württemberg than in other West German states.

The assumption that the structure of Baden-Württemberg's economy is more strongly determined by *Mittelstand* companies than the rest of the West German economy is also a misconception. Based on the average size of the regional companies, there is no difference between Germany and Baden-Württemberg (cf. Statistisches Bundesamt: Fachserie 4, Reihe 4.1.2, Wiesbaden). On the contrary, the prosperity of the regional economy is based on the success of a large number of big companies: in 2000 25 companies in Baden-Württemberg employed more than 10,000 people, 46 companies had a revenue of more than a billion Euro – among them DaimlerChrysler (416.500; 163 bn €), Bosch (198,000; 32 bn €), Röchling (41,650; 6.1 bn €), Bilfinger+Berger (40,700; 4.4 bn €) and ZF (36,400; 6.5 bn €).

It can be concluded that Baden-Württemberg's metal industry is interlinked by vertical supply and service patterns. The regional economy is organized in closely knit industrial clusters, thus facilitating the exchange of information and vertical co-operation with customers and suppliers. Horizontal co-operation activities (at least in the mechanical engineering industry) are no more prominent than in other West German states.

The extent to which Baden-Württemberg's manufacturing industry procures industrial input and services from external providers is as low as in other West German regions. The share of in-house manufacturing is around 40 per cent in both cases. Services account for only one-quarter of input, whereas two-fifths of the employees in manufacturing companies are assigned service tasks. This implies that Baden-Württemberg and German industrial companies opt primarily for internally organized – and not market-mediated – forms of co-ordinating production and service activities. This contrasts with other market-driven high-tech regions in the world such as California where many services are offered by numerous highly specialized co-operating firms. In view of increasingly short innovation cycles and global production, investment, distribution and sourcing strategies, this course of action may incur higher transaction costs in connection with lower innovation rates.

The primarily vertical co-operation patterns, as well as the high share of in-house manufacturing and the low share of external services requested by industrial firms, indicate that the marked concentration of Baden-Württemberg's economy on the investment goods industry (automobiles, machines, electrical engineering) can hardly be broken up by intercompany co-operation activities. As Baden-Württemberg's industrial core is characterized by advanced technologies (reflected by the gross value added per wage and salary earner and by the growth rate of gross value added), the region's productive specialization is associated with considerable risks: communication and co-operation opportunities outside of historically evolved and institutionally and organizationally reinforced trajectories ('paths of development') can hardly be utilized. It is these 'barriers to learning' – and not the 'maturity' of Baden-Württemberg's product range itself – that can evolve into a major obstacle on the road to innovation-promoting company strategies.

The institutional regulation structures of Baden-Württemberg's economy

The region has enjoyed decades of economic prosperity because of its skilled labour, co-operative industrial relations, well-developed research structures, state and national industrial policies, and close and long-term relations between banks and companies. Many analyses (e.g. Schmitz, 1992; Herrigel, 1993) have reconstructed in detail the specific elements of this success story. Here we will therefore confine ourselves to providing a brief overview of Baden-Württemberg's production regime and point out the potential limitations of these regulatory structures – limitations that only come into effect in the face of increased demands in terms of flexibility, innovation, quality and efficiency.

Research, development and transfer institutions in Baden-Württemberg

Baden-Württemberg has a highly-developed research infrastructure with a total of 97,000 R&D personnel (full-time equivalent).[4] The regional R&D intensity is with 3.9 per cent of the GDP (1999) one of the highest regional rates in Europe; it is higher than the research intensity of all other industrialized nations (with Sweden investing 3.8 per cent in 1998). This accounts for a significant proportion of past success. Research and transfer institutions have helped to consolidate and extend the chosen path of development. Here, the concentration of regional research efforts on the dominant industrial clusters has led to Baden-Württemberg becoming especially strong in the areas of medium-high technologies,[5] where significant technological leaps are associated with high expenditure. However, in high-tech and other promising fields, Baden-Württemberg has certain weaknesses. The existence of a well-established research and transfer structure and a high regional concentration of R&D personnel is clearly not sufficient for the development of new products that will be successful on the market. Nonetheless, strengths in medium technology are an important requirement for the development of new, future-orientated fields of technology. As far as the technology transfer to smaller and medium-size companies is concerned, Baden-Württemberg has a widespread network of specialized institutions, all of which belong to a state-wide umbrella organization, the Steinbeis-Stiftung für Wirtschaftsförderung (see Beise *et al.*, 1995).[6] In 1998, technology transfer became a private business activity and therefore was outsourced to a private firm called Steinbeis GmbH and Co. für Technologietransfer. This firm maintains a network of about 300 centres[7] for technology transfer, in most cases close to a *Fachhochschule* (university of applied sciences). These centres enable the small and medium-size companies to develop their technological expertise, products and product quality in close collaboration with professors at the Fachhochschulen. Nonetheless, only 15% of Baden-Württemberg companies rate technology transfer centres as important information sources for innovative activities; 32% say that universities are an important information source (Heinemann *et al.* 1995: 21).

For several reasons, this transfer concept – which has been exceptionally successful to date – is now being examined critically. First, the commercial aspects of innovation are having to be considered alongside the purely technological aspects. Second, now that globalization is even affecting *Mittelstand* companies, a greater degree of internationalization is required in technology transfer. Third, the traditional transfer concept requires very precise demands on the part of the companies. The ability to find innovative questions for the transfer centres is not something that can necessarily be taken for granted, especially among smaller *Mittelstand* companies. So, transfer centres can generally respond only to problem-solving tasks, which can be dealt with within the framework of the highly limited

contractual work at the Fachhochschulen (and to some extent at universities): From the companies' point of view, R&D co-operation in particular – i.e. jointly conducted R&D projects in which both partners are involved financially and extend their technological know-how – are under-represented in the transfer centres' spectrum of work (Beise *et al.*, 1995: 66).

Fourth, the restructuring of the regional economy is going hand in hand with a change in demand. What was once the central function of the transfer centres, that of 'systematically facilitating companies' access to new technologies – especially small companies' (Maier, 1989: 290), was going to become considerably less important. The number of transfer and consultation projects relating to the use of modern technologies declined by over 75 per cent between 1990 and 1994 (Steinbeis-Stiftung für Wirtschaftsförderung, 1994: 39), while the volume of individual projects has increased considerably (by about 60% on average). Greater involvement in the area of research-intensive high-tech will also be in much demand in the future.

Fifth, the regionalization concept of the Fachhochschulen is also coming under increasing pressure. Many external centres of the Fachhochschulen and associated Steinbeis transfer centres have difficulties fulfilling the demands of a blanket-coverage technology-transfer network. Only a quarter of the companies surveyed had taken up offers of technology transfer in the previous five years. Technology transfer was thus only being used by a limited group of companies. What is more, given their limited resources, it is doubtful whether the small external centres at the Fachhochschulen are in a position to provide companies with sophisticated and comprehensive consultation.

R&D intensity of the Baden-Württemberg economy

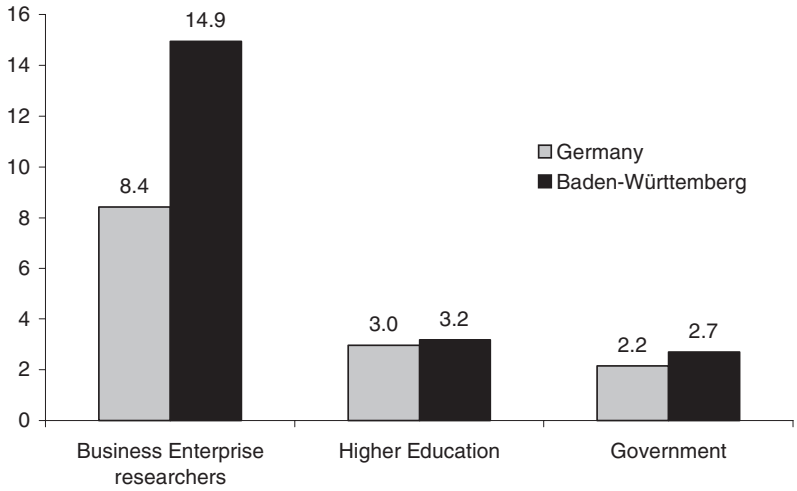
In terms of the research intensity of its economy, Baden-Württemberg occupies the leading position among the federal states. Nevertheless, due to its regional specialization profile, the competitiveness of Baden-Württemberg's high-tech products is limited in international trade. The reasons for the relatively limited success in high-tech exports are mainly to be found in the traditional specialization profile of Baden-Württemberg's R&D system. Despite a rise in young developing high-tech districts in the region, such as biotechnology or multimedia clusters, with newly emerging innovation networks and specific transfer structures, the major R&D capacity and technology-transfer institutions are still concentrated in the industrial core sectors.

Baden-Württemberg's research system differs considerably from that of the rest of West Germany. For example, the proportion of R&D personnel working in the Baden-Württemberg economy is unusually high: in 1997, 71.4 per cent of R&D personnel were working in industry, whereas in West Germany as a whole

this figure was only 62.2 per cent. Figure 7.5 shows that Baden-Württemberg employs considerably more R&D personnel per capita than the rest of the Federal Republic. The high R&D intensity of the Baden-Württemberg economy is also reflected in the rate of R&D expenditure per employee. In this respect, Baden-Württemberg occupies the leading position in Germany.

However, the R&D personnel in Baden-Württemberg's economy are distributed unequally among the different sectors of industry. As far as company research capacity is concerned, 94 per cent are in manufacturing industry, and around 80 per cent in the three core industrial sectors (Table 7.2). Compared to Germany as a whole, R&D intensity is above average, especially in Baden-Württemberg's vehicle manufacture (Figure 7.5 and Table 7.2).

It therefore comes as no surprise that patent registrations were well above the German average. In 1999 1,120 domestic patent applications per million inhabitants were registered at the German and 416 at the European patent office (Germany: 650 and 227; cf. Statistisches Landesamt, 2001 and European Commission, 2001). This is the highest ratio among all sixteen German *Länder*. In 1998, the most important technological fields (with more than 5 per cent of all patent applications) were: Vehicles and transport; Electricity; Engines or turbines; Engineering in general; Measuring, testing, optics; Building (Greif, 2000). Electronics, communication technologies, biotechnology, computing and information storage are characterized by lower patent figures. This concentration on more traditional technological fields can also be demonstrated in comparison



7.5 R&D personnel per thousand labour force (1997; full time equivalent)
Source: Bundesministerium für Bildung und Forschung (2000); Bundesbericht Forschung (2000: 547–552)

Table 7.2 Business Enterprise R&D personnel (FTE) in different branches of the Baden-Württemberg and German economy, 1997(%)

	Baden-Württemberg		*Germany*	
	No.	*%*	*No.*	*%*
Manufacturing Industry	63,935	94	262,916	93
among these:				
Chemical industry	4,434	6	49,012	17
Production and transformation of metal	1,282	2	6,933	2
Mechanical engineering	9,338	14	38,821	14
Data processing, electrical engineering	16,533	24	82,119	29
Automotive production	30,314	44	70,762	25
Other branches	6,369	9	34,792	12
Companies (total)	68,270	100	282,439	100

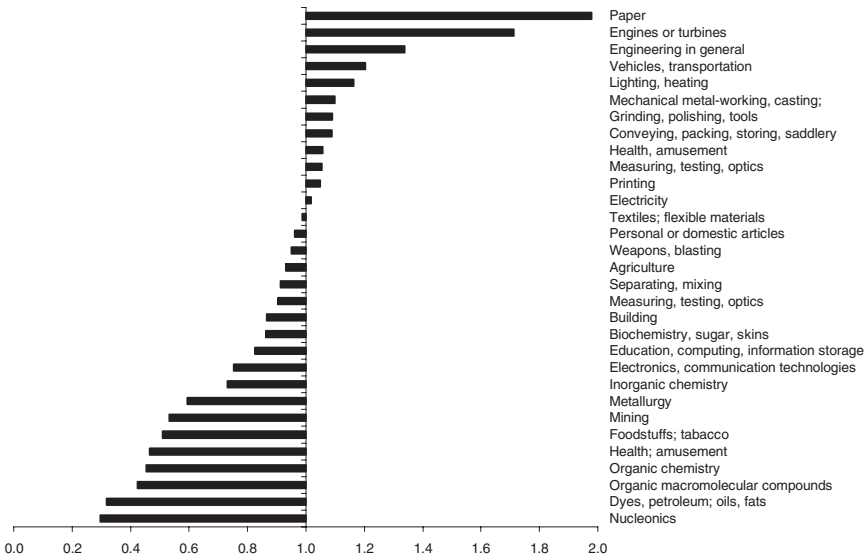
Source: Bundesministerium für Bildung und Forschung (2000): Bundesbericht Forschung (2000: 548–549)

with national patent patterns (Figure 7.6): Even in comparison with Germany, the regional R&D system is characterized by a specialization on technologies relevant for the construction of machines and cars. This strong concentration on specific technological fields in the second half of the 1990s was a major reason for the above average performance of Baden-Württemberg. But in the case of a downswing of these industries, it can have a profound negative impact on the regional performance.

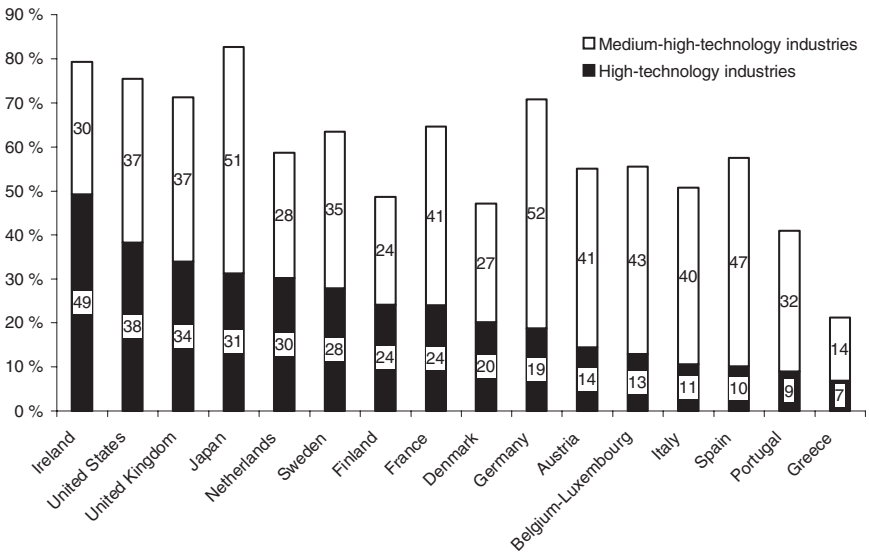
R&D-intensive economic sectors are of great importance in Baden-Württemberg, and the number of employees working in high- and medium-high-technology industries is also above the German average (1999: 92 per 1000 inhabitants in comparison with 55 in Germany; Statistisches Landesamt, 2001: 27). However, the weakness of Germany's and Baden-Württemberg's high- and medium-high-technology industries becomes clear when we consider the export structure of R&D-intensive products. In comparison to other highly developed countries, it is conspicuous that Germany has specialized in the field of medium-high-technology (cf. Figure 7.7). In Germany, only 19 per cent of all manufacturing exports are high-tech products (1999) – and the corresponding figure for Baden-Württemberg used to be even lower (*Baden-Württemberg in Wort und Zahl*, 12/92).

Vocational and further training in Baden-Württemberg

Baden-Württemberg has a well-established and widespread system of vocational and further training for skilled employees (Maier, 1989: 295–6). The strength of Baden-Württemberg's system of training is the high significance of practice-



7.6 Patent specialization of Baden-Württemberg in comparison with Germany, 1998
Source: Own calculations on basis of Greif (2000)



7.7 Share of high- and medium-high technology industries in manufacturing exports, 1999.
Source: OECD (2001b)

orientated training courses in Berufsschulen, Fachschulen, Berufsakademien and Fachhochschulen. According to Herrigel, the close ties between training and practice at local and regional level are characteristic of Baden-Württemberg. 'Formal ties are extensive and informal exchanges occur systematically in the region' (Herrigel, 1993: 230). This is not reflected in the qualification levels of the labour force: the share of employees who have finished a vocational training is nearly the same as in West Germany (1999: 61.7 per cent and 61.4%). Also the share of employees with an academic degree (8.4 per cent) and the share of employees without vocational qualifications (22.6 per cent) is nearly the same as in West Germany. This points to the fact that the vocational education system is not a regional particularity, but a nationwide regulation. In an international perspective, this means that the percentage of the workforce who have completed a tertiary education is much below the levels of Canada (1999: 43 per cent), the USA (39 per cent), Finland, Japan, Sweden and other advanced nations (OECD, 2001c).

In conclusion: the vocational training system in Baden-Württemberg has contributed significantly to the success of the regional economic model; the manufacturing-orientated production model and the vocational skills training model have had a mutually stabilizing effect. This is reflected, on the one hand, in a high proportion of vocationally skilled employees and, on the other, in an extremely well-developed training system. However, the outstanding importance of vocational training also means that its limitations and weak points present considerable problems, especially the rigid vertical and horizontal demarcations between defined vocational fields (Kern and Sabel, 1994: 606). The functional boundaries between the different training courses and between different occupational groups impede the processes of collaboration and innovation that run across different vocational fields. This has led to a crisis in the vocational training system, especially during the 1990s, and to a shift of vocational and further training into the companies, indicating an increasing distance between conventional forms of vocational training and the qualifications required and demanded by the companies (Heidenreich, 1998).

Industrial relations in Baden-Württemberg

The co-operative relations between unions and employers' associations are another central pillar of Baden-Württemberg's production regime. On the one hand, they prevent individual companies from resorting excessively to wage-cutting strategies, thus increasing the pressure for permanent innovation; on the other, they also allow a flexible, trust-based utilization of qualified employees by clearly separating industry-wide labour conflicts from within-company co-operative relations (Sabel, 1989: 25). If German labour relations can be described as a co-operative model of conflict regulation, then this applies in particular to Baden-Württemberg. For

one thing, Baden-Württemberg boasts the largest regional membership of the union IG-Metall after North Rhine-Westphalia: at the end of 2000, 18.5 per cent of the 2.7 million members of IG-Metall were resident in Baden-Württemberg. Also, Baden-Württemberg has come to be regarded as the mainstay of the unions, having been the battleground of many national wage conflicts. Second, the regional unions (especially IG-Metall, which still has 500,000 employees, i.e. 52 per cent of all Baden-Württemberg's DGB union members) have always played a leading role in Germany. This trade union formulated proposals for the industrial renewal of the regional economy, for example, proposals for reorganizing the mechanical engineering industry. The unions were involved in the selective corporatism between regional business, science and politics – even if only in a subordinate position (Heinze and Schmid, 1994).

The current globalization of the regional economy and the individualization of employment relations suggest that this regional system of industrial relations is building up to a radical change, which is set to sweep away the institutional basis for the former corporative regulation strategies. On the one hand, important regional companies are increasingly acting on a global level, on the other, the present crisis of industry-wide wage agreements and the trend towards company-level labour relations (with regard to wages and working hours) could shake the German system of employee–employer relations to its very foundations.[8] The tendency to devolve negotiations to company level, the threat of transferring production elsewhere, and the increasing chances of direct interest representation drastically reduce the influence of interest representation bodies.

The crisis of a successful production and innovation model?

In the previous sections we have described the productive and the institutional dimension of Baden-Württemberg's production and innovation regime. First, we analysed the structure of regional production in Baden-Württemberg and stressed the dominant position of the so-called capital-goods producing industry. The prominence of automotive, mechanical and electrical engineering explains the higher than average growth of production, export and employment; these branches were the source of Baden-Württemberg's post-war prosperity. However, this production structure may now prove to be an obstacle in adapting to new demands in terms of flexibility and innovation. First, established production structures and close-knit regional supply and service networks make it harder to tap into new market opportunities. These highly institutionalized structures and networks show a remarkable stability and continuity, the major innovations being performed mainly by incumbent firms. New companies play a relatively insignificant role and start-ups are encouraged to adapt their innovation strategies and behaviour as far as

possible to the established technology paths, in order to increase their chances of success or, inversely, to reduce their risk of failure (cf. Krauss, 1999). Second, industrial companies perform the greater part of production-related services themselves; the question that needs to be addressed here is whether this high proportion of in-house services inhibits not only the development of the service sector, but also the specialization and optimization of company-related services (e.g. management consulting, development, marketing, software development, logistics and financial services). Third, horizontal co-operation between companies in the same industrial sector is of minor importance in Baden-Württemberg, so that synergy effects (e.g. through joint market observation and research and development activities) are not utilized. These possible disadvantages are balanced against the strengths of a technically advanced, diversified and internationally competitive industrial structure; competence in production technology is an important basis for incremental, path-dependent innovations.

This production structure has been supported in the past by the establishment of a dense network of regional institutions (which are largely embedded and shaped by national regulations). Research and development activities, vocational and advanced training facilities, industrial relations and financial services have contributed substantially to the success of Baden-Württemberg's production model. However, this institutional environment has become so firmly rooted that a problem of lock-in is to be expected in the face of new demands.

First, despite the exceptionally well-established research and development system in Baden-Württemberg, successful exports are mainly achieved with advanced technologies; high-tech goods account for a relatively small proportion of the region's exports. This weakness in the high-tech sector is the downside of the region's extremely successful specialization in traditional technologies. Although this concentration on established technological trajectories is a sign of inertia, we should not overlook the fact that strengths in the field of 'mature' technologies are a good basis for success in the high-tech sector; however, this requires an intelligent recombination of existing potential, a diversification into new technological fields and the exploitation of new possibilities of utilization.

Second, in the field of education and further education, Baden-Württemberg's economy can draw on an efficient vocational training system and a higher-than-average proportion of youngsters leaving school with a certificate of secondary education. However, the regional vocational training system does share one of the weaknesses of the national education system: its orientation towards clearly defined fields of activity and occupational domains (instead of interdisciplinary, process-related qualifications). Such functional distinctions are proving an obstacle to interdisciplinary strategies aiming at greater innovation, economy and flexibility.

Third, Baden-Württemberg plays a leading role in the German system of industrial relations which has been described as one of the central pillars of a co-

ordinated market economy (Hall and Soskice, 2001). It is to be feared that the current crisis in Germany's labour relations will not be able to be compensated for at the regional or even national level. The challenges posed by the current process of deregulation, globalization and individualization of labour relations threaten the foundations of industry-wide interest representation, and this in turn undermines the basis of regional patterns of regulation. Apart from negotiations between management and works councils (and the focusing and channelling of potential conflicts that such negotiations allow), we are increasingly seeing direct forms of interest representation (in project groups, semi-autonomous working groups, quality circles, etc.). This phenomenon is undermining the possibilities for co-ordination at intercompany (and hence also regional) level.

In conclusion, we can observe a reinforcement of those industrial and institutional patterns that have proved successful in the past. This hinders attempts to adapt to new industries and services or to reorientate innovative efforts, training services, patterns of interest representation and financial services. Indications that the limits of the regional production and innovation regime have been reached have been registered mainly in the first half of the 1990s. The second half of the 1990s with its extraordinary successes especially for the German car industry meant an additional incentive to concentrate on the traditional technological fields. The region faces the challenge of using its current strengths to find a new place in the changing world of international competition, and this can effectively be achieved only by the path-dependent reorganizing of its traditional industrial structure and institutional framework in order to create the conditions for an innovative environment.

First steps on the way to a new production and innovation regime

In Baden-Württemberg the basic preconditions for a new production and innovation regime are exceptionally favourable, as the state is able to draw on a unique network of successful industrial companies and supporting institutions. Many globally operating, major corporations are active in the state, and this is associated with a concentration of many strategically crucial corporate functions (research and development, administration, controlling, marketing, IT integration, logistics, etc.). Such corporate functions, with high value added, are a key prerequisite for a strong position within global innovation and locational competition. Although the employment volume will continue to decline in the traditional industrial core areas, the automobile, mechanical engineering and the electrical engineering industry – and above all the services that will be developed on the basis of this product range – will continue to take centre stage. The strengths in these areas will form the basis and the starting point for the diversification and systematic development of a new range of products and services.

Thus, the reorientation of this regional production and innovation regime must consist of transforming the mature industrial cluster, on the one hand, and promoting new technology fields, on the other – a dual strategy that was proposed by the influential Future Commission Economy 2000 (*Zukunftskommission Wirtschaft*, 2000) in a report issued in 1993. This recommendation does justice to the fact that an exclusive promotion of new, high technologies alone is not enough to open up new growth opportunities and employment areas. Fundamental technical innovations usually come about on the basis of evolved strengths. The transformation of the industrial core of the *Land* will primarily arise through the basic restructuring and globalization of manufacturing and development activities. In the medium term, they are an important precondition for shortening the development cycles of new products and their 'time to market'. Various government policies are also driving the restructuring of industrial core sectors and a multitude of new institutions such as four software centres, five biotechnology parks, centres for fuel cell technology, for new traffic control systems, etc. have been put into place to support these efforts (Wirtschaftsministerium Baden-Württemberg, 2000).

Beyond the state's established core industries, some forward-looking approaches have also been emerging. Excellent opportunities are perceived for Baden-Württemberg in the biotechnology sector (Schell and Mohr, 1995: 2). With almost 400 biotech companies, which are mainly situated in four 'BioRegions' (Freiburg/BioValley Upper Rhine, the Rhine-Neckar Triangle, Stuttgart/Neckar-Alb, and Ulm), Baden-Württemberg is a rather successful site for this technology (Dohse, 2000). Of the seven biotechnology clusters that Dohse (2000) identified nationwide in Germany, two were (partially) located in Baden-Württemberg.

In the area of multimedia services, Baden-Württemberg is also well positioned, as it can draw on an efficient electronics industry, as well as many publishing companies and research and educational facilities (in spite of the lack of a sizeable film industry). The *Land* government has started several programmes in order to support the development of the multimedia industry. In 1996, it founded the 'Medien- und Filmgesellschaft' (MFG) which is to co-ordinate various media projects and to function as a hub for media-related activities. The Land also started a state initiative called 'Baden-Württemberg medi@', a collection of various media-related projects. Some of these projects have been designed explicitly to build upon existing sectoral strengths in Baden-Württemberg and to develop multimedia in these sectors. For instance, the use of multimedia for service tasks in the mechanical engineering industry and an online market for small and medium-sized enterprises are being promoted. Finally, the *Land* government presented, in 1999, a new strategic vision for the media economy of Baden-Württemberg ('Leitbild für den Medienstandort Baden-Württemberg'). This is an attempt to improve the visibility of Baden-Württemberg's media sector and to better co-ordinate the industrial policy aiming to support multimedia.

However, Baden-Württemberg seems to have difficulties in competing with outstanding media locations such as Munich, Hamburg, Berlin, Frankfurt or Cologne and to built a reputation as an important multimedia site in Germany. One of the reasons for this is the dominance of manufacturing and research functions in Baden-Württemberg's electronics industry, while the development of new applications and the content side are underrepresented in Baden-Württemberg's economy. Furthermore, it seems there is little interaction going on between the major multinational corporations such as Bosch or Alcatel SEL and the small, specialized multimedia companies. Moreover, the region is often criticized for lacking a stimulating cultural atmosphere, which is an important factor in attracting companies and personnel in the multimedia business (Braczyk *et al.*, 1999; Fuchs and Wolf, 1998).

The search for new product and production concepts is being supported by many new institutions (such as a regional innovation council or the above mentioned Medien- und Filmgesellschaft) as well as by expert commissions, a dense network of regional technology transfer institutions and industry policy initiatives. The Future Commission Economy 2000 (*Zukunftskommission Wirtschaft* 2000), appointed in 1992, gave the starting signal for the search for 'ways out of the crisis'. This was followed by the Innovationsoffensive with a funding of DM1 billion committed to new technical faculties, data highways, biotechnology parks, software centres. In 1994 an Innovationsbeirat was set up and this council developed, among others, proposals for creating a biotechnology agency, a microsystem forum and better computer facilities in schools. Within the context of a 'Future Campaign' (*Zukunftsoffensive*) the state government has realized these proposals since 1996. An additional DM1 billion has been invested in upgrading technical colleges, colleges of advanced vocational studies, universities, clinics, schools and libraries. Since 1997, the state government has supported the establishment and expansion of five biotech parks at Freiburg, Heidelberg, Esslingen, Ulm and Reutlingen/Tübingen with a total of 12.5 million Euro. Support has also been given to business start-ups, networked research projects and regional trade fairs. Start-up companies, for example, have been supported by subsidy programmes, investment shares, and a venture capital fund which was set up in 1998. Within the framework of the programmes 'Young Innovators' and 'Start-up Founders on Campus' the government has supported founders from universities and research institutes.

Experiments with new political approaches have been launched with the intention of initiating and supporting regional innovation networks. One of the most successful examples of these network strategies is the 'Technology region Karlsruhe' and its technology park 'Technology factory Karlsruhe' which since 1984 has been the origin for 150 companies, thus creating nearly 3,000 jobs. Other examples of these network strategies are the 'Innovative region Ulm'

(formerly Wissenschaftsstadt Ulm) and especially the already mentioned four biotechnology regions in Baden-Württemberg. Encouraged by a federal 'BioRegio' programme, several networking initiatives in four sub-regions of Baden-Württemberg with research potential in biotechnology research were set up by local actors in order to promote the development of a regionally anchored biotechnology industry. What was special about the BioRegio programme was an approach which offered to assist the development of regional biotechnology clusters, making regions compete with one another and then, in the final phase, concentrating on three selected, promising regions. The Baden-Württemberg Ministry of Science and Research also supported the development of biotechnology with a networked research programme. The sponsoring of regionally anchored biotechnology was part of a new policy geared to advancing new industries beyond the mature core branches. In 1996, one of the biotechnology regions of Baden-Württemberg, the so-called 'Rhine-Neckar Triangle' (partially located in two other German *Länder*), was awarded the coveted status of a 'model region'. Internationally renowned institutions such as the German Cancer Research Centre, the European Molecular Biology Laboratory, the Max Planck Institute for Medical Research, and the Centre for Molecular Biology at Heidelberg served as points of crystallization of this regional cluster. The winners of this Bioregio contest were assigned public subsidies of DM 50 million over a period of five years (from January 1997) that should provide the starting point for additional private investments. Much more important was that they received priority in the appropriation of funds from the Federal Research Ministry. These resources have been committed with the aim of improving the regional organization involved in the transfer of biotechnological knowledge in economic products and services. To this end, targeted assistance has been granted to advance co-operation between science, business, public administration and important societal groups.

The above mentioned 'BioRegio contest' also sparked initiatives in other regions of Baden-Württemberg as in the Greater Ulm region, the Stuttgart-Neckar-Alb area or in and around Freiburg. Here, increased efforts have been made to bring the relevant actors together and create greater networking and co-operation. However, the relatively important number of different sub-regions in biotechnology confronts Baden-Württemberg with particular problems, namely the impossibility of concentrating public resources on the most promising region: In Baden-Württemberg, the *Land* government therefore follows a particular approach to support the development of the biotechnology industry by subsidising biotechnology projects not primarily in the already prized model region of the Rhine-Neckar Triangle, but ensuring that the other emerging biotechnology regions of the *Land* also receive public funding (Krauss and Stahlecker, 2000; Dohse, 2000). An important element of this policy of the Land was the creation of a biotechnology agency (*Biotechnologie-Agentur*) which has the task of co-

ordinating Baden-Württemberg's support for the biotechnology industry in the different sub-regions of the Land. This reflects the attempt of the regional government to distribute public money evenly to all bioregions in Baden-Württemberg and not to accord special favour to the Rhine-Neckar Triangle. Similar to the case of multimedia, such a 'decentralized' approach is not completely undisputed, since the development of the biotechnology sector may need a concentration of resources on a relatively small number of fields and geographic areas. This points to the fact that a cluster policy which requires the regional concentration of public means is difficult to implement in such a heterogeneous, polycentric *Land* as Baden-Württemberg. The 'joint decision trap' analysed by Fritz W. Scharpf (1988) taking the example of the relationship between the federal and the *Bundesland* level, is not limited to this relationship but is also reflected in the relationships between the *Land* of Baden-Württemberg and its four 'government districts' (*Regierungsbezirke*) Freiburg, Karlsruhe, Stuttgart and Tübingen and its twelve subordinate regions.

The development of strategies of institutional learning remains a challenge to be mastered. While many 'institutionally poor' economic regions seek to adopt the seemingly exemplary institutions of other countries, Baden-Württemberg is faced with the challenge of restructuring and transforming an exceedingly rich institutional landscape. We have provided a relatively detailed account of this endeavour in the sectors of research and development, technology transfer, training and industrial relations. All of these challenges put the well-considered (and concerted) modernization of regional institutions at the top of our agenda. The expedient further development of communication and co-operation promoting institutions is therefore a central precondition for the design and rejuvenation of innovation-friendly environments. But it has also been demonstrated that institutional reforms and a transformation of existing productive structures are a difficult and extremely risky endeavour – especially when the global success of the dominant regional industries (especially the car and mechanical engineering industry) apparently make it unnecessary (at least temporally) to develop new institutional and organizational capabilities. These are the two facets of path-dependency: on one hand, it implies a singular accumulation of experiences, of technological and organizational know-how, of facilitating institutions; on the other, it also implies the difficulties in changing the existing industrial and institutional order in order to incorporate new technologies, new organizational competencies, and new qualifications.

Notes

1 The terms 'production' or 'plant regime' denote the institutionalized patterns of interpretation and behaviour within, between, over and beyond companies

that shape company product and production concepts and the conflict and co-operation relations between various employee groups and management. Production regimes can be institutionalized at the level of companies, corporations, branches, organizational fields (Scott, 1995), regions, nations and groups of nations. Industrial relations (including labour law and the organization of employer and employee interests in associations), as well as the general educational and vocational training institutions, can be regarded as the traditional institutional forms of national production regimes. Government industrial policies, the financial system, the distribution and sales market structures, and the respective branch and industry structures (including networks and integration between companies) can also be interpreted as institutionalized co-operation patterns between various protagonists in the economic system. The term 'production regime' is similar to the term industrial order proposed by Herrigel (1993) and Lane (1994).

2 Brokat, founded in 1994 in the Stuttgart Region, and specializing in software and support for electronic services, quickly became a strongly expanding company before finally running into insolvency in November 2001, then being forced to undertake a radical reorganization.

3 The state's mechanical engineering and automotive companies procured a considerable share of their total supplies (1990: 21.2 per cent of DM 91 billion) from Baden-Württemberg companies in the following branches: iron, non-ferrous metals, foundries, other mechanical engineering and automotive companies, the electrical engineering industry and the iron, sheets, metal goods branch. Given tight regional interlocking it can be assumed that, in addition to the 207,500 employees in the automotive industry (1987), 63,000 gainfully employed persons are active in other industrial branches as suppliers to the automotive industry. In 1987 15.7 per cent of all wage and salary earners in the manufacturing industry were directly or indirectly active in connection with the automotive industry (Münzenmaier, 1988: 521). In 1993, 84,000 and in 1998 142,000 regional employees procured supplies for the automotive industry. Together with the 193,000 employees in the automotive industry, 6.6 per cent of the total regional employment and 21.3 per cent of the industrial employment directly or indirectly provided by the car industry. The result of the automotive boom of the second half of the 1990s therefore is an increasing specialization in this product.

4 The 2000 federal report on research (Bundesministerium für Bildung und Forschung, 2000: 221) states that Baden-Württemberg was one of the regions of Europe with the highest concentration of research. The state research report of Baden-Württemberg in 1995 (Ministerium für Wissenschaft und Forschung, 1995) highlights that Baden-Württemberg is the state with the most universities and colleges in the Federal Republic of Germany. It has a well-established research infrastructure in the field of basic research and in applied research. This

infrastructure includes nine universities, two recently founded private universities, six Pädagogische Hochschulen (colleges of education), eight colleges of art, twenty-two state-owned Fachhochschulen (including sixteen with a technical orientation), ten private Fachhochschulen, seven colleges for administration and eight Berufsakademien (Bundesbericht Forschung 2000: 221).

5 Classification into low technology, medium technology and high tech is based on the R&D intensity resulting from the ratio of R&D efforts to the production value of the product or its product range. Products with an R&D intensity below 3.5 per cent are regarded as low, between 3.5 per cent and 8.5 per cent as medium, and above 8.5 per cent as high technology. This method can be applied in industrial sectors as well. The list of R&D-intensive industries need not necessarily be the same as the list of R&D product ranges (Gehrke and Grupp, 1994: 45). The OECD proposes in its "Science, Technology and Industry Scoreboard 2001" a similar distinction between high-technology industries (Aircraft and spacecraft, Pharmaceuticals, Office, accounting and computing machinery, Radio, television and communications equipment, Medical, precision and optical instruments) and medium-high-technology industries (Electrical machinery and apparatus, Motor vehicles, trailers and semi-trailers, Chemicals excluding pharmaceuticals, Railroad equipment and transport equipment, Machinery and equipment).

6 Similar services are also offered by other institutions, although on a smaller scale. An example in this case would be the chambers of industry and commerce (Schmitz, 1992: 110).

7 By the end of 2000 (31 December), Baden-Württemberg was hosting 301 Steinbeis transfer centres. While Steinbeis increasingly creates new centres also in other German and foreign regions, Baden-Württemberg still remains the main location of this organization (there are 127 Steinbeis centers in other parts of Germany and 8 centres abroad).

8 For example, the following statements by the chairman of the Baden-Württemberg metal and electrical industry association:

> A much bigger problem than the withdrawals [from the employer's associations] is the steadily increasing number of companies which negotiate individual contracts with their labour force and their works council without regard for the collective wage agreement. Such contracts include working hour models and wage settlements outside the wage agreement, e.g. longer working hours for no extra pay. Such contracts within individual companies … undermine the collective wage agreement. Unions and employers' associations should therefore have a strong interest in opening the existing wage agreements and establishing general conditions under which these company-internal contracts can be reintegrated.
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> (Stuttgarter Zeitung 1995: 13)