Regional Innovation Scoreboard 2003

Results for North-Rhine Westphalia, Bavaria and Baden-Württemberg
Compared with the National and European Performance

Modified and adapted following the European Innovation Scoreboard 2003

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0.1 Definition of the Objective

The following analysis is to identify the innovative ability and skills of the Federal Lands of Baden-Württemberg, Bavaria and North-Rhine Westphalia (NRW) and to represent them as Regionalized Innovation Scoreboard (RegIS) 2003[1].

In the following, innovation is understood to be the implementation of an idea or invention turning it into a marketable, new or improved product.[2]

The term 'innovative potential' includes, besides the mid- to long-term capacity to create innovation, the short-term input of resources (money, machines, human capital) with the intention to generate innovation.

0.2 Methodological Approach

This analysis is based on the assumption that the innovation potential of a region is not given exogenously but is decisively determined by a multitude of socio-economic, technical and political conditions.

Measurable comparative values have been defined by using suitable indicators to picture the basic aspects of the innovation potential. Individual indicators can be assigned to thematic areas (see Table 1, p. 5).

The Regional Innovation Scoreboard 2003 (RegIS 2003) largely follows the definition of the indicators used in the European Innovation Scoreboard 2003 (EIS 2003).

The present analysis aims at regionalizing the results of the "European Innovation Scoreboard"[3] which will also allow a comparison of the performance of the federal lands of North-Rhine Westphalia, Bavaria and Baden-Württemberg within Germany[4].

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[1] The comparisons are drawn for each of the Federal Lands and the European regions have been assessed each at a certain point of time. In addition, a dynamic perspective becomes visible by comparing various points of time. Moreover, certain indicators have been used to try and specifically assess the potential of a regional future innovative capacity. In the following, the term 'innovative potential' means the capacity concentrated in one region to generate innovation.

[2] At this point, we explicitly emphasize the difference between inventions and innovation as well their diffusion. Inventions are provable contributions to technological change without them necessarily being applied or implemented in practice. Many inventions and patents are not reduced to practice and remain without any effect on a country's economy. They only gain economic importance if they become innovations. Thus, innovation is the implementation of an idea converting it into a marketable or improved new product, a practical industrial or trade process or into new services. The innovation process therefore is the introduction of new products, processes, technologies and systems into the economy. Successful innovations diffuse among enterprises and countries; cf. J. A. Schumpeter (1935) and A. Brenk (1992).

[3] See http://trendchart.cordis.lu/Reports/Documents/SEC_2003_1255 _1_EN_DOCUMENTDETRAVAIL.pdf, published on 10.11.2003.

[4] Besides the international comparative data through the EIS relating to the EU-15, the RIS 2004 also includes a national extension, in particular relating to the federal lands of Bavaria and Baden-Württemberg which are comparable in terms of population size and economic power.

At the same time, a comparison with the EU15 performance puts the relative strengths and weaknesses of the federal lands and the Federal Republic of Germany as a whole in a European context. In particular, a comparison of the German lands, on which the focus is laid here, with the Netherlands, which are comparable in terms of size and population, is to put the analysis of the innovation potential on a strong basis.

The Regional Innovation Scoreboard 2003 contains a dynamic perspective as a second methodological element, comparing the up-dated results of 2003 with the results from the Regional Innovation Scoreboard 2001. Please note that the data used in RegIS 2001 have been updated in RegIS wherever possible. Preliminary figures and estimates have e.g. been replaced by confirmed data. This might result in minor changes in the figures as well as in the index values in the comparative assessment of RegIS 2001 and RegIS 2003 for the year 2001 under review, without having any significant impact on the substance and results of the analysis.

Unfortunately, some indicators used in EIS 2003 could not be included in the Regional Scoreboard 2003, since regionalized data were not available and a field research of this data by a survey would have considerably exceeded the available budget (financial and personnel resources). However, part of the EIS 2003 did neither include sufficiently current data. 12 indicators of the 28 indicators used in the EIS 2003 could be applied at a regional level within the RegIS 2003. In particular, indicator area 3 "Transmission and Application of Knowledge" could not be applied to the RegIS, since the indicators were established by an innovation survey conducted throughout Europe on the basis of a questionnaire whose results could not be broken down to the NUTS-I level (inter alia federal land).[5] Table 5 in the Annex gives a comparative overview of the data definitions as well as the related sources for the EIS 2003 and the RegIS 2003.

Three new indicators[6] have been added to RegIS 2003 which have been ascertained at German level. Although they are not included in the EIS, these indicators complete the analysis of the innovation potential in the regionalized analysis.

The following table provides an overview of the indicators used in the Regionalized Innovation Scoreboard and their corresponding indicators and modifications as compared to the EIS 2003 (if available).

[5] The same applies to e.g. the indicator "sales of 'new to market' products" in the enterprises. Moreover, no data were available for the patent applications of the German federal lands in the USA (USPTO patents).

[6] These are the indicators "Business R&D Employees", "Patents DPMA", "Participation in EU-projects".

Table 1: Comparison of Indicators used in RegIS 2003 and EIS 2003

	RegIS 2003 Regional Innovation Scoreboard 2003		EIS 2003 European Innovation Scoreboard 2003	
Thematic Area	Indicator	Definition	Indicator	Definition
HUMAN RESOURCES	**Indicator 1.1** S&T Graduates 20-29 years Observation date: 2002 and 2001	Numerator: Graduates aged 20 -29 years in the areas of life sciences (ISC42), physical sciences (ISC44), mathematics and statistics (ISC46), computing (ISC48), engineering and engineering trades (ISC52), manufacturing and processing (ISC54), architecture and building (ISC58) Denominator: Population aged 20 to 29 years	Indicator 1.1 S&T Graduates / 20-29 years Observation date: 2000 and 1999	Numerator: Graduates in the areas of ISC42 (life sciences), ISC44 (physical sciences), ISC46 (mathematics and statistics), ISC48 (computing), ISC52 (engineering and engineering trades), ISC54 (manufactu-ring and processing, ISC58 (architecture and building) Denominator: Population aged 20 to 29 years
	Indicator 1.2 Population with University degree Observation date: 2002 and 2001	Numerator: Persons with university or technical college degree Denominator: Population aged 25 to 65 years	Indicator 1.2 Population with tertiary educa-tion Observation date: 2002 and 2001	Numerator: Persons with tertiary education (ISCED 5 and 6) Denominator: Population aged 25 to 64 years
	Indicator 1.3 Lifelong learning Observation date: 2002 and 2000	Numerator: Participants in further education examinations of Chamber of Industry and Commerce Denominator: Population aged 25 to 64 years	Indicator 1.3 Lifelong learning Observation date: 2002 and 2000	Numerator: Participants in the following measures: initial education, further education, continuing in further education, training within the company, apprenticeship, on-the-job-training, seminars, distance learning, evening classes. Denominator: Population aged 25 to 64 years

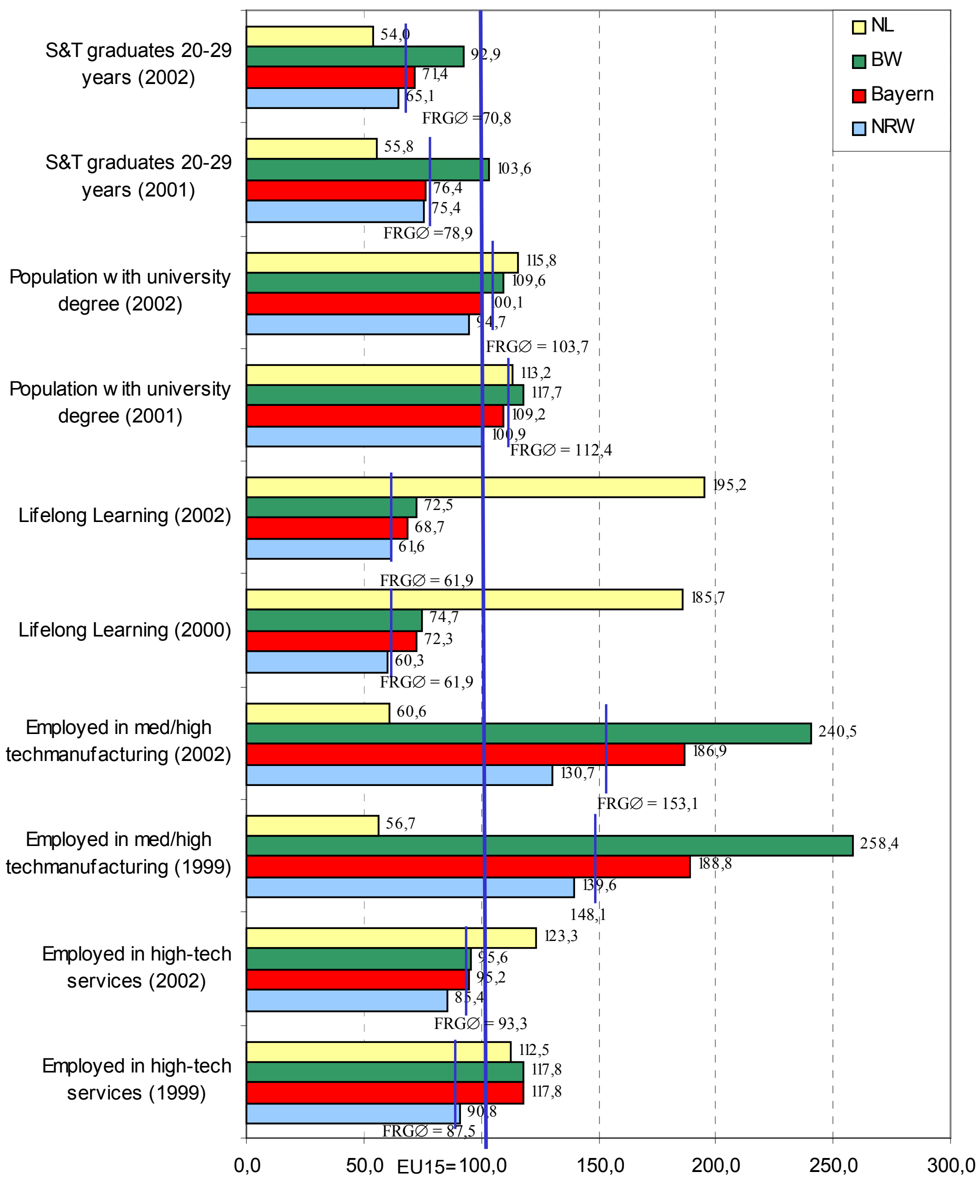
	RegIS 2003 Regional Innovation Scoreboard 2003		EIS 2003 European Innovation Scoreboard 2003	
Thematic Area	Indicator	Definition	Indicator	Definition
	Indicator 1.4 Employed in med-/high-tech manufacturing Observation date: 2002 and 1999	<u>Numerator:</u> Employed in the NACE-sectors manufacture of chemicals, and chemical products (NACE-Code 24), manufacture of machinery and equipment n.e.c. (29), manufacture of office machinery and computers (30), manufacture of electrical machinery and apparatus n.e.c.(31), manufacture of radio, television and communication equipment and apparatus (32), manufacture of medical, precision and optical instruments, watches and clocks (33), manufacture of motor vehicles, trailers and semi-trailers (34), manufacture of other transport equipment (35). <u>Denominator:</u> Total workforce	Indicator 1.4 Employed in med-/high-tech manufacturing Observation date: 2002 und 2001	<u>Numerator:</u> Employed in NACE sectors 24,29, 30, 31, 32, 33, 34, 35 <u>Denominator:</u> Total workforce
	Indicator 1.5 Employed in High-tech Services Observation date: 2002 and 1999	<u>Numerator:</u> Employed in the Nace-sectors of post and courier activities, national post activities, courier activities other than national post activities (NACE-Code 64.1), telecommunications (64.2), hardware consultancy (72.1), software consultancy and supply (72.2), data processing (72.3), data base activities (72.4), maintenance and repair of office, accounting and computing machinery (72.5), other computer related activities (72.6), research and experimental development on natural sciences and engineering (73.1), research and experimental development on social sciences and humanities (73.2) <u>Denominator:</u> Total workforce	Indicator 1.5 Employed in High-tech Services Observation date: 2002 and 1999	<u>Numerator:</u> Employed in the NACE sectors 64, 72, 73 <u>Denominator:</u> Total workforce

	RegIS 2003 Regional Innovation Scoreboard 2003		EIS 2003 European Innovation Scoreboard 2003	
Thematic Area	Indicator	Definition	Indicator	Definition
KNOWLEDGE CREATION	Indicator 2.1 Public R&D expenditures Observation date: 2001 and 1999	Numerator: Public R&D expenditures in the federal lands (GERD-BERD) pursuant to Federal Research Report 2004 Denominator: Gross Domestic Product in relevant prices	Indicator 2.1 Share of Public R&D in GDP Observation date: 2001 and 1999	Numerator: Difference between GERD and BERD according to Frascati manual definition in national currency and current prices Denominator: GDP as defined in ESA 1995
	Indicator 2.2 Business R&D expenditures Observation date: 2001 and 1999	Numerator: Internal business R&D expenditures pursuant to Stifterverband Denominator: Gross Domestic Product in relevant prices	Indicator 2.2 Business R&D / GDP Observation date: 2001 and 1999	Numerator: BERD pursuant to Frascati manual definition in national currency and current prices Denominator: GDP pursuant to ESA 1995
	Indicator 2.3 Business R&D Employees Observation date: 2001and 1997	Numerator: R&D staff, full-time equivalent Denominator: Employees subject to social insurance contribution	no corresponding indicator	
	Indicator 2.4 Patents DPMA Observation date: 2002 and 2001	Numerator: Patent applications at DPMA Denominator: Population in millions according to Federal Statistical Office	no corresponding indicator	
	Indicator 2.5 Patents EPO Observation date: 2001	Numerator: Patent applications at the EPO Denominator: Population in millions according to Federal Statistical Office	Indicator 2.4.1 EPO patents / population Observation date: 2001	Numerator: Patent applications at the EPO Denominator: Population in millions according to ESA 1995
	Indicator 2.6 High-tech patents EPO Observation date: 2001 and 2000	Numerator: Patent applications at the EPO in the areas of computer and automated business, micro-organism, genetic engineering, aviation, communication and semiconductors. Denominator: Population in millions according to Federal Statistical Office	Indicator 2.3.1 High-tech EPO patents / population Observation date: 2001 and 2000	Numerator: Patent applications in the areas of B41J, G06, G11C; 2 (Computer and Automated Business), C12M, C12N, C12P, C12Q; 3 (Micro-organism, genetic engineering), B64; 4 (Aviation), H05; 5 (Communication), H01L; 6 (Semiconductors), H01S (Laser) Denominator: Population in millions according to ESA 1995

	RegIS 2003 Regional Innovation Scoreboard 2003		EIS 2003 European Innovation Scoreboard 2003	
Thematic Area	Indicator	Definition	Indicator	Definition
TRANSMISSION of KNOWLEDGE	Indicator 3.1 Participation in EC projects Observation date: 2004 and 2002	<u>Numerator:</u> Accumulated participation in EU projects of 1st to 5th Framework Programme for Research either as prime-contractor or sub-contractor <u>Numerator:</u> Population in millions according to Federal Statistical Office, Statistics Netherlands and Eurostat	No corresponding indicator	
FINANCE & INNOVATION	Indicator 4.1 High-Tech Venture Capital Observation date: 2003	<u>Numerator</u>: High-Tech Venture Capital as stated by Bundesverbandes der Kapitalbeteiligungsgesellschaf-ten (BVK e.V.). This includes the sectors of electronics, industrial automation, computer hardware, software, semi-conductors, communication technology, biotechnology, medical technology, healthcare, pharmacy, environmental technology, financial services <u>Denominator:</u> Gross investment of BVK e.V.	Indicator 4.1 High-tech venture capital share, not indexed	<u>Numerator:</u> High-tech venture Capital according to EVCA includes the sectors of computer-related fields, electronics, biotechnology, medical/health, industrial automa-tion, financial services <u>Denominator:</u> Sum of early-stage-plus expansion capital
	Indicator 4.2 Internet Access Observation date: 2002 and 1998	<u>Numerator:</u> Households having internet access at home <u>Denominator:</u> Extrapolated total number of households	Indicator 4.4 Internet Access/use Observation date: 2002 and 2000	<u>Numerator:</u> Sum of the households having internet access at home and SMEs with own web site <u>Denominator:</u> Total number of SMEs
	Indicator 4.3 Volatility Rates Observation date: 2002 and 2001	<u>Numerator:</u> Sum of birth and death rates <u>Denominator:</u> Enterprises subject to turnover tax.	Indicator 4.7 Volatility-rates of SMEs, not indexed	<u>Numerator:</u> Sum of birth and death rates <u>Denominator:</u> Number of manu-facturing/services SMEs

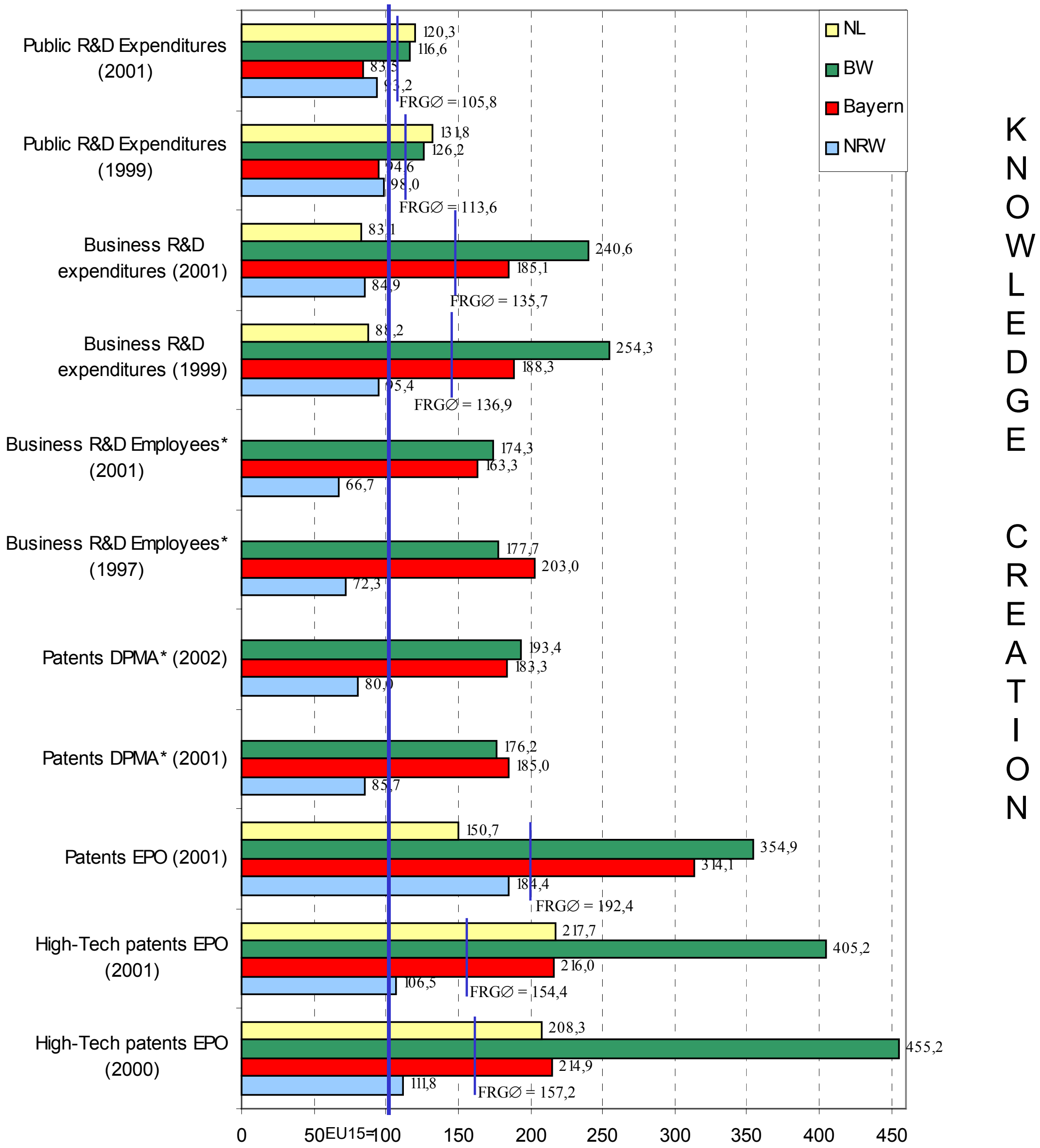
The tables 2 to 4 below show graphs of the survey results. When reading the following analysis, we recommend to have the regionalized indicator results shown in table 2 to 4 at hand, since they are analysed gradually.

Table 2: Regional Innovation Scoreboard 2003 - Results for North-Rhine Westphalia, Bavaria, and Baden-Württemberg (EU=100), human resources area



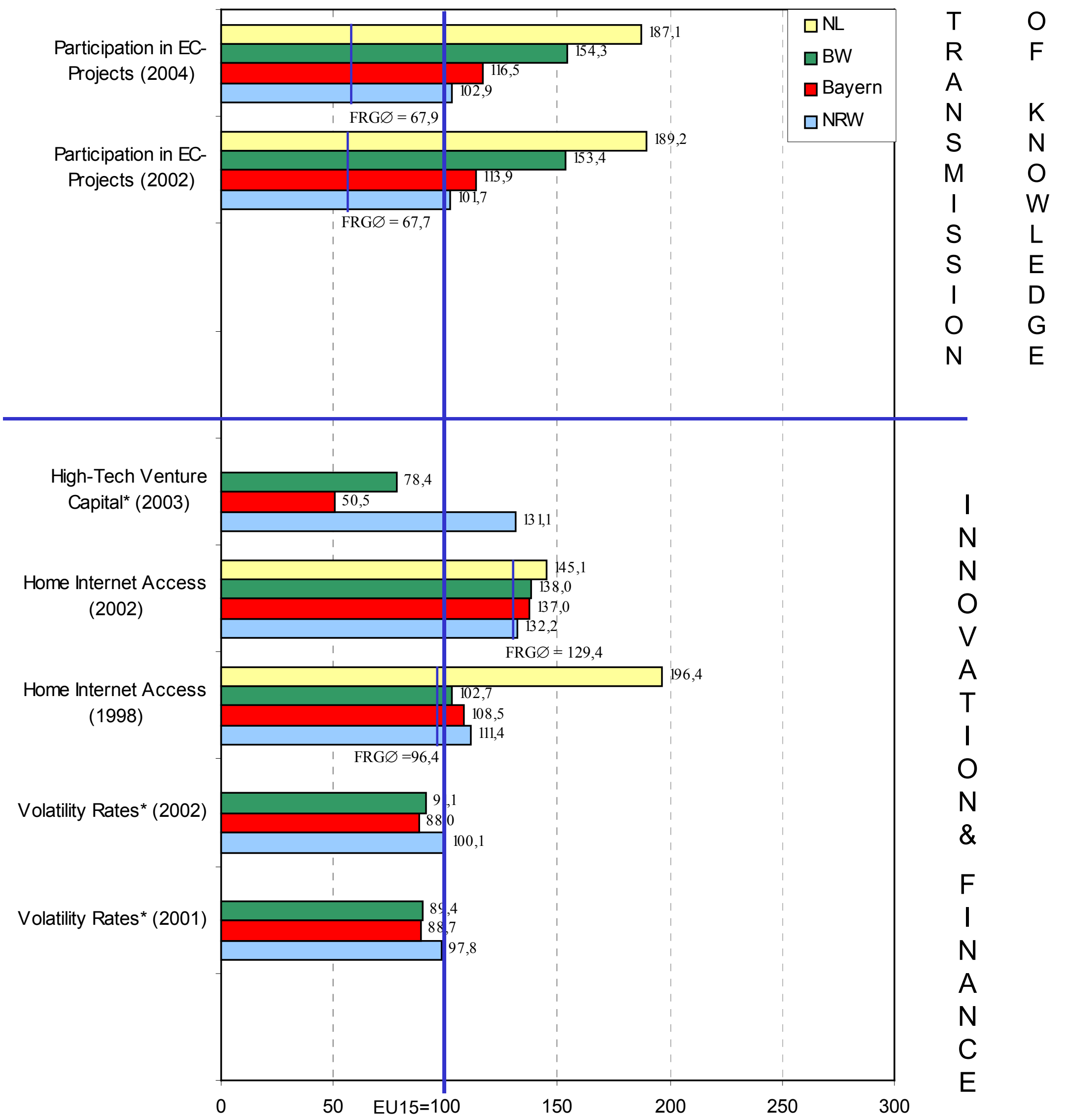
HUMAN RESOURCES

Table 3: Regional Innovation Scoreboard 2003 - Results for North-Rhine Westphalia, Bavaria, and Baden-Württemberg (EU=100), knowledge creation area



*Base: FRG=100

Table 4: Regional Innovation Scoreboard 2003 - Results for North-Rhine Westphalia, Bavaria, and Baden-Württemberg (EU=100), knowledge transmission and finance area



* Base: FRG=100

1. Human Resources

Innovations are marketable results of concrete innovative efforts. The probability that these innovations are successful mainly depends on the individual ability of persons, business enterprises and institutions to develop and implement new methods and processes[7]. The task of the public research and education system is to encourage and strengthen these abilities. Its effectiveness and efficiency strongly influence the regional innovation potential.

The future perspectives of economic success of a region, however, depend on the current efficiency of the research and educational system. Innovative developments are inherent in the structure of the educational system. Generally, they will only be reflected much later by measurable changes in the current innovative.

Indicators 1.1 and 1.2 attempt to describe the ability of the educational system to produce a sufficient number of qualified "innovation drivers".

In particular, indicators 1.4 and 1.5[8] are to measure whether the research and education system has met the requirement of adequately preparing the social players for the demands of a modern industrial nation.

1.1 Indicator 1.1 – S&T graduates 20-29 years

This indicator measures the number of academic graduates aged between 20 and 29 in scientific and technological subjects as share in the overall population aged between 20 and 29 at a certain point of time[9].

All together, the Federal Republic of Germany shows a decreasing trend. Compared to 2001, a decrease by 8 points to 71 index points had to be recorded in 2002.

In 2002, the relative position of North-Rhine Westphalia was worse than in 2001 in comparison to the European position[10]. In comparison to the reference value of EU15=100, North-Rhine Westphalia reached only 65 points in 2002 and its position thus worsened by 10 points against 2001. In real terms, this means that the share of the S&T graduates in the population aged 20 to 29 years has decreased from 4.4 per 1000 inhabitants to 4.2 per 1000 inhabitants (for comparison: the German mean in 2002 was 4.6 per 1000 inhabitants). Bavaria reached only 71 points in 2002 after having reached 76 points in 2001 and is thus within the national mean. Baden-Württemberg reached 93 points in 2002. Its performance was considerably better than the national mean, however, it decreased by 11 points as compared to 2001.

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[7] J. A. Schumpeter (1959)

[8] Employed in med-/high-tech manufacturing (Ind. 1.4) and employed in high-tech services (Ind. 1.5)

[9] Graduates of the following subject groups are included according to the European Scoreboard 2003: life sciences, physical sciences, mathematics and statistics, computing, engineering and engineering trades, manufacturing and processing, architecture and building.

[10] The absolute values are weighted according to the population figures and then are indexed for reason of comparability, whereby EU15=100.

The Netherlands reaching only 54 points in 2002 (against 56 in 2001) lag far behind North-Rhine Westphalia. They have lost further ground in relation to the EU.

Conclusion: Compared with the European performance, the number of graduates in scientific and technological subjects produced by the German federal lands is below average. None of the assessed German lands of North-Rhine Westphalia, Bavaria, Baden-Württemberg, nor the Netherlands, reached the EU15 mean. Moreover, the trend is negative in all assessed German regions.

1.2 Indicator 1.2 – Population with university degree

The objective of this indicator is similar to the objective of indicator 1.1. However, this indicator is geared to the number of persons with university degree aged 25 to 65 years as share in the population in this age group. The indicator thus measures the educational level of the population as a whole.

There is a downward trend in the assessed German lands. In the period between 2002 and 2001, Bavaria fell from 109 to 100 points. Baden-Württemberg reached only 110 points in the updated scoreboard after having reached 118 points in 2001. North-Rhine Westphalia even fell below the EU mean and reached only 95 points (101 points in 2001). This corresponds to about "13.4 persons" with university degree for every 100 persons aged between 25 and 64. The other federal lands not explicitly named here could not reverse this negative development eighter. The Federal Republic of Germany reached only 104 points in 2002 as compared to the EU15 after having reached 112 points in 2001.

The Netherlands could even improve their position in 2002 after having reached the strong position of 113 points in 2001 (plus 3 points).

Conclusion: The educational level of the German population decreased against 2001 in comparison with Europe, however, it is still above the EU15 mean. However, the federal land of NRW failed to reach the EU15 mean. The efforts made by the land regarding education have to be significantly intensified and the framework conditions and the possibilities to access educational measures have to be considerably improved.

1.3 Indicator 1.3 – Lifelong learning

Just like physical capital, human capital is subject to devaluation in the course of time. This half-life of knowledge[11] is caused by quantum leaps in knowledge[12] as well as by devaluation of knowledge through forgetting, if not used for a long time (e.g. through unemployment). Thus, the competitiveness of enterprises also depends on

[11] According to Paul Donders (creative planning of life) “for the time being we may assume that knowledge will double every four years, within the EDP area even every 1.5 years. Seen in the light of history, the speed of the increase of knowledge has multiplied within a very short period. While the medieval man had to process during his life as many pieces of information as you can find in a today's newspaper, the flood of today's information becomes so immense that you cannot keep a general overview.” Donders observed that the worldwide knowledge doubled in the period between 1800 and 1900. The knowledge then doubled in 1950, 1970, 1980; cf. http://www.oe-netzwerk.de/doc/Selbstcoaching%20durch%20Mind%20Mapping_Internetvorlage-335.htm

[12] This means that the accumulated, acquired and used knowledge is devaluated ever faster. After the invention of the automobile, e.g., the human capital of the coachman decreased in value.

the fact that the employees keep up with the increasing level of knowledge. On the other hand, lifelong learning is a fundamental prerequisite to remain attractive as "individual" in the competition for jobs.

Only if knowledge is kept at a sufficiently current level, the innovation process can be successfully designed as a driving force for competitiveness. Lifelong learning has thus to be understood as measure for the continuous modernisation of human capital. This indicator is defined as the share of all participants in examinations in further training courses (only examinations passed before a Chamber of Industry and Commerce) in relation to the overall population aged between 25 and 64 years. The periods of 2000 and 2002 were assessed.

The German national mean as a whole stagnated at only 62 per cent of the EU15 mean between 2000 and 2002. NRW reached 60 index points in 2000, however could slightly increase them and reached 62 index points in 2002, the same as the Federal Republic of Germany[13] as a whole. To give figures, this means that during the observed years three out of 100 inhabitants aged between 25 and 64 have participated in a further training examination before the Chamber of Industry and Commerce. Bavaria and Baden-Württemberg were above the national mean in 2000 as well as in 2002, however also failed to meet the EU15 mean. Bavaria reached 69 points in 2002 (against 72 points in 2000) and Baden-Württemberg obtained 72.5 points in 2002 after 75 points in 2000. Both Germany's and the individual federal lands' clear failure to meet the EU value is at least partly caused by the fact that particular importance is attached to the first vocational training within the scope of our dual training system.[14] Nevertheless, this qualification must not blind us to the fact that the established values reveal a need for action in order to promote lifelong learning, even if the inferior data depth of the regional scoreboard as compared to the European Scoreboard might influence the results and reduce comparability.

The Netherlands obtained 186 per cent of the EU15 mean in 2000 and reached nearly twice as much as the European (EU15) mean by increasing their result to 195 index points in 2002.

Conclusion: Lifelong learning or lifelong further training has not yet reached the required importance and dynamics in the FRG. The accumulated human capital is obviously not renewed fast enough in the assessed German lands in relation to the EU15 and in particular to the Netherlands. It is therefore necessary to design and implement concepts for vocational training and further training which enable a successful career despite the enormous changes within short periods. This necessity implies enormous consequences for the educational demands on our universities.

[13] We had to create "a mental bridge" to regionalize the results of the European Scoreboard 2003 (EIS 2003) for the Federal Republic of Germany, since the further training measures included in the EIS at European level were not available in the disaggregate form required for the German federal lands. Thus, the index value of 61.9 reported for Germany in the EIS 2003 is the basic value of "the calculus" for the regionalization. Confirmed data on the further training examinations before the Chamber of Industry and Commerce for Germany as well as for the individual federal lands are available. They make up a significant part of all the further training measures in question and serve as measure for the regional willingness to participate in further training measures in the calculation. Within the "mental bridge", the national number of participants in further training examinations before the Chamber corresponds to the index value of 61.9 Germany reached in the EIS 2003 and is used as initial reference for the subsequent comparison of the federal lands. In this way, the corresponding values of the individual federal lands could be established by using the rule of three.

[14] I would like to express my thanks to MR Becker from the Minstery of Economic Affairs and Employment in NRW for this explicit information.

They will have to focus their education and training on transmitting the ability to quickly acquire the latest developments in knowledge! This means that the main educational goal will be to convey methodical fundamental knowledge, even if application skills of course continue to be important.[15]

1.4 Indicator 1.4 – Employed in medium-/ High-tech manufacturing

Indicator 1.4 measures the employment in the medium and high-tech manufacturing trade as share in the overall population[16].

This indicator reveals the (still) traditional strength of the German economy in particular in the assessed federal lands of Bavaria (187 points in 2002) and Baden-Württemberg (241 points in 2002), but also in North-Rhine Westphalia (131 points in 2002).

Nevertheless: In relation to the EU, all assessed federal lands show a downward trend. Baden-Württemberg lost 17 points and fell from 258 in 1999 to 241 points in 2002. In the same period, Bavaria's position decreased from 189 to 187 index points.

In North-Rhine Westphalia, the index decreased from 140 points in 1999 to 131 points in 2002. This means - to give figures - that about 9.5 per cent of the entire workforce in NRW was employed in medium and high-tech manufacturing in 2002. In the same period, the EU reached only 7.4 per cent.[17] There may be objections that these developments are taking place at a high level and are thus part of a convergence process to be expected within Europe. However, the fact that Germany could improve its relative position as compared to the EU15 conflicts with this interpretation. In the period between 1999 and 2002, the index increased from 148 to 153 points.

The Netherlands, which are comparable to the observed German lands in size and number of inhabitants, could improve their position by 4 points, however they continued to considerably lag behind the EU15 mean reaching only 61 points in 2002.

Conclusion: The strong position of Germany in technology-intensive manufacturing areas continues to reveal one of the most important innovative sources, but also innovative advantages in the regional and European benchmarking. The fact that North-Rhine Westphalia still falls below the German national mean in the field of employment in technology-intensive areas is a matter of great concern. North-Rhine Westphalia is thus losing ground also in a traditionally strong area against the German trend as a whole.

[15] Cf. Matthias Göbel in www.lv1.ifkomhessen.de/halbwert.htm

[16] The employment is assessed in the NACE sectors 24 as well as 29-35 (manufacture of chemicals, and chemical products, manufacture of machinery and equipment n.e.c , manufacture of office machinery and computers, manufacture of electrical machinery and apparatus n.e.c., manufacture of radio, television and communication equipment and apparatus, manufacture of medical, precision and optical instruments, watches and clocks, manufacture of motor vehicles, trailers and semi-trailers, manufacture of other transport equipment).

[17] Please note that the regionalized data of the indicators 1.4 and 1.5 refer to "wage and salary earners", while the EIS 2003 arguments are based on the number of employees. However, the differences are very small in the comparison of data.

1.5 Indicator 1.5 – Employed in high-tech services

This indicator ascertains the share of the employed in the high-tech services sector in the overall workforce[18].

There is a downward trend for the observed federal lands in relation to the national mean as well as in relation to the EU15 mean. Bavaria and Baden-Württemberg each fell from 118 to about 96 points in the period between 1999 and 2002 and were thus only slightly above the national mean of 93 points. North-Rhine Westphalia reached only 85 index points in 2002 after 91 points in 1999 and lags behind the other federal lands in this area.

Similar to the results of indicator 1.4, Germany could improve its position as a whole as compared to the EU15 mean. Germany has now reached 93 points (plus 5 points as compared to 1999), thus approaching the EU15 mean. This result seems to suggest the conclusion that the Federal Republic of Germany is beginning to close the gap in the services area. However, the assessed federal lands of North-Rhine Westphalia, Bavaria and Baden-Württemberg appear not to follow this positive development.

The Netherlands improved from 112 points in 1999 to 123 index points in 2002.

<u>Conclusion:</u> Contrary to the German national mean, the number of employed in high-tech services are increasing in North-Rhine Westphalia, Bavaria and Baden-Württemberg. In comparison to the relatively strong position of Germany and the German federal lands in the area of technology-intensive employments, the relatively weak position in the area of innovative (production-related) services indicates Germany's particular need to catch-up.

1.6 Conclusion for this Thematic Area

All in all the indicators of the thematic area "*Human Resources*" give a negative picture of North-Rhine Westphalia, but partly also of the other federal lands and Germany as a whole. NRW's indicators are all below the national mean. Only within the area of employment in high-tech manufacturing (indicator 1.4), NRW is still above the EU15 mean in 2002. In comparison to Bavaria and Baden-Württemberg, which have a pioneering role in Germany, the situation is even worse.

It is difficult to draw an unambiguous conclusion for the Netherlands which are very similar in terms of size and population. In particular regarding indicator 1.1 and 1.4 NRW still enjoys clear advantages. However, there are strong correlations between the indicators "scientific-technical graduates" as well as "employment in med-high tech manufacturing". Moreover, the Netherlands have not been particularly strong in manufacturing high-tech products in the past. Against that, the dynamic perspective of North-Rhine Westphalia turns out negative, while there is an upward trend for the Netherlands taken as a whole.

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[18] Employment is assessed in the NACE sectors 64, 72 and 73 (post and courier activities, national post activities, courier activities other than national post activities, telecommunications, hardware consultancy, software consultancy and supply, data processing, data base activities, maintenance and repair of office, accounting and computing machinery, other computer related activities, research and experimental development on natural sciences and engineering, research and experimental development on social sciences and humanities).

As human resources are the basis for successful innovation activities[19], it has to be feared that the innovative potential of North-Rhine Westphalia will be persistently weakened in the future.

2. Knowledge Creation

While the indicator group 1 tries to evaluate the basis for successful innovative efforts, the analysis of the indicator group "knowledge creation" is concentrated on measurable inputs (2.1, 2.2, 2.3) and quantifiable results/outputs (2.4, 2.5, 2.6). In particular, the business R&D expenditures (indicator 2.2) can be interpreted as measure for the businesses' willingness to innovate and their preparedness to take risk. This preparedness to take risk is particularly determined by the capacities described in section 1 above in the human resource area.

2.1 Indicator 2.1 – Public R&D expenditures

Indicator 2.1 measures the public R&D expenditures of the federal lands[20] as share in the GDP in relevant prices in 1999 and 2001.

In North-Rhine Westphalia and in Bavaria, the public R&D expenditures increased from 0.63 per cent and 0.82 per cent, respectively, of the GDP in 1999 to 0.66 per cent and 0.83 per cent, respectively, of the GDP in 2001. In Baden-Württemberg, these figures decreased from 0.61 per cent to 0.6 per cent of the GDP within the same period. Seen in the European context, this means that Baden-Württemberg, reaching 126 index points, was above the EU15 mean in 1999, while NRW, reaching 98 points, and Bavaria, reaching 95 points, were slightly below the EU15 mean. In 2001, Baden-Württemberg still reached 117 points and Bavaria still reached 84 points compared with Europe. In the same period, NRW fell from 98 to 93 points, although the public R&D expenditures had nominally been increased. The national mean decreased, too. It dropped by eight index points and reached 106 points in 2001 (as compared to 114 in 1999). The Netherlands also fell by 12 points as compared to 1999. However, they reached 120 points in 2001 again, thus being well above the EU15 mean.

Conclusion: In relation to their economic efficiency, the three federal lands' R&D expenditures are far below the EU15 mean as well as the national mean. Against that, the public R&D expenditures of the other European countries seem to increase more strongly than those of the German federal lands do.

2.2 Indicator 2.2 – Business R&D expenditures

Indicator 2.2 measures the R&D expenditures by private businesses as share in the GDP. The observation periods are 2001 and 1999.

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[19] The special importance of the human capital of an economy for the innovative ability and the growth perspectives have been theoretically examined as well as empirically been proven within the last few years. Cf. New Growth Theory: et al. P. Romer (1986, 1990), P. Aghion and P. Howitt (1992), R.J. Lucas (1988), P. Segerstrom (1998)

[20] This is the sum of the R&D expenditures of the federal lands themselves plus the R&D expenditures of the Federal Government in the federal lands. (GERD minus BERD)

In the above period, Baden-Württemberg succeeded in stabilizing its index values at a high level as compared with the EU (1999: 254 index points; 2001: 241 index points). In Baden-Württemberg, the share in the GDP that the businesses spent for R&D is thus 2.5 times as much as the EU15 mean. Bavaria (185 points, minus 3 points) as well as the Federal Republic of Germany (136 index points, minus 1) could maintain their level in 2002 as compared to 1999 in the European context. In 2001, German enterprises spent about 1.76 per cent of the GDP and Baden-Württemberg's enterprises even spent about 3.13 percent of the GDP for internal R&D services.

The trend is going downwards for the Netherlands and North-Rhine Westphalia whose values were reduced from 88 (NL: 1999) to 83 (2001) and from 95 (NRW: 1999) to 85 (2001), respectively. For NRW, this corresponds to a share of 1.1 per cent of the GDP in 2001.

Conclusion: The business R&D expenditures decreased in NRW between 1999 and 2001. After the deterioration in 2001 against 1999, North-Rhine Westphalia failed to meet the national mean as well as the EU15 mean. This trend is particularly alarming since the R&D investments made by enterprises can be regarded as investments into the future and can also be interpreted as the enterprises' "confidence in the location". Against that, Germany as a whole maintained its position in comparison with the EU and the federal lands of Bavaria and Baden-Württemberg are clearly at the top. The big differences established in the levels of the R&D expenditures in Bavaria and in Baden-Württemberg on the one hand and North-Rhine Westphalia on the other hand refer, of course, to the different industrial cultures. In the case of NRW, e.g., the industrial culture is inseparable from the history of the coal, iron and steel industry. NRW has not yet been able to change into a location for R&D-intensive industries.

2.3 Indicator 2.3 – Business R&D employees

Similar to indicator 2.2, the share of the business R&D employees can be interpreted as the enterprises' willingness to innovate. Indicator 2.3 is defined as R&D staff in relation to the overall workforce. The periods of 1997 and 2001 were observed.

As this indicator is not included in the EIS 2003, the Federal Republic of Germany is used as measure (FRG=100).

In 1997, Bavaria, reaching 203 index points, as well as Baden-Württemberg, reaching 178 points, were considerably above the national mean (FRG=100 as it is the indexing basis). With 72 points North-Rhine Westphalia was below the mean in 1997.

From the dynamic perspective, all assessed federal lands lost in relation to the Federal Republic of Germany. In 2001, Baden-Württemberg fell back by 4 points, however still reached an index value of 174 points, thus being at the top of the federal lands compared nationally. Bavaria, the former top performer, lost 40 index points in the period between 1997 and 2001 and reached 163 points. NRW continued to lose ground and reached only 67 index points in 2001, after having reached 72 points in 1997.

In 2001, approx. 0.7 per cent of the employees worked in private R&D in NRW. This is about one out of every 140 employees. In Baden-Württemberg, approx. one out of every 50 employees worked in research and development in the same period.

Conclusion: North-Rhine Westphalia continues to lose ground with respect to the indicator "industrial R&D employees" as compared to the national mean.

2.4 Indicator 2.4 – Patents DPMA

"Patents DPMA" covers the number of patents applied for at the German Patent and Trademark Office (DPMA) per million population in 2002. As a comparison with the Netherlands or the EU would not be useful due to the "advantage of playing at home", the Federal Republic of Germany is used as reference value (FRG=100).

In 2002, Bavaria filed 14144 patents, NRW 9025 patents and Baden-Württemberg 12822 patents with the German Patent and Trademark Office. In a comparative assessment which took also the number of inhabitants in the region into account besides patenting (patents per million inhabitants), Bavaria's index value decreased from 185 (2001) to 183 (2002). Baden-Württemberg's index value for the comparison of performance of the assessed German federal lands increased to 193 points (plus 17 points) and took over the top position in the comparison of the national performance. North-Rhine Westphalia lost 5 index points as compared to 2001 and reached 80 index points (after having attained 86 points in 2001) and thus fell 20 per cent below the national mean.

Conclusion: In an important "measurable" indicator for the success of current innovative efforts, North-Rhine Westphalia fell behind in the national comparison.

2.5 Indicator 2.5 – Patents EPO

Indicator 2.5 measures the number of patent applications filed with the European Patent Office per million inhabitants. Indicator 2.4 and 2.5 are similar in theme and methodology. However, in the case of applications filed with the EPO, a comparison of the German performance with the performance of other EU member states makes sense. Therefore – in contrast to indicator 2.4 – the reference value is defined to be EU15=100. As the "European Innovation Scoreboard 2003" used this indicator for the first time, it cannot be assessed dynamically.

In 2001, the values for the assessed federal lands were considerably above the European mean (EU15=100). Baden-Württemberg (355) was at the top, followed by Bavaria (315), NRW (184) and the Netherlands (151).

The German national mean reached 192 index points in 2001. This corresponds to about 310 patent applicants per one million population.

Conclusion: In North-Rhine Westphalia, a relatively high number of ideas and innovations are registered at the European Patent Office. NRW is among the top performers in this area. However, in comparison with the national performance, NRW's performance is no more than mediocre.

2.6 Indicator 2.6 – High-tech Patents EPO

Indicator 2.6 puts the number of high-tech patent applications[21] filed with the European Patent Office in relation to the number of inhabitants. Similar to indicator 2.5, "High-tech Patents EPO" allows a comparison with other European states.

In the period between 2000 and 2001, Baden-Württemberg lost some of its lead (405 in 2001, i.e. minus 50 points as compared to 2000), however could maintain its top position at a high level. Bavaria stabilized its good position at the high level of 216 points. Returning to the initial values, Baden-Württemberg succeeded in obtaining about 128 high-tech patent applications per million population, while the EU mean reached around 32 high-tech patent applications per million population.

In contrast to this, the Federal Republic of Germany as well as North-Rhine Westphalia lost ground compared with the EU performance. Germany, reaching 154 points in 2001 (minus 3 points as compared to 2000), as well as NRW, reaching 107 points (minus 5 as compared to 2000), continued to be above the EU15 mean.

The Netherlands, however, could further improve their good result from 2000 and succeeded in reaching 218 points after 208 points in 2000.

<u>Conclusion:</u> Indicator 2.6 does not confirm the picture conveyed by indicator 2.5 for NRW. North-Rhine Westphalia clearly lags behind Bavaria and Baden-Württemberg in the area of highly innovative inventions and innovations within Germany. In comparison with the EU15 performance, NRW could only just maintain its position.

2.7 Conclusion for this Thematic Area:

The indicator group of "*Knowledge Creation*" largely continues the picture revealed by thematic area 1. Apart from indicator 2, which present the "patenting activities in detail" and shows that NRW could maintain its position at least within the European context, considerable weaknesses in NRW are revealed as far as the ability to innovate is concerned. The financial as well as personnel resource input in R&D is insufficient, showing a downward trend. The development of the output indicators corresponds to the alarming assessment of the current position of the input indicators.

In the light of the fact that this indicator group outlines a trend chart for the current innovation efforts (2.1, 2.2) and their results (2.4, 2.5, 2.6), the conclusion from the area "*Human Resources*" can be extended and it can thus be stated that the weaknesses of NRW's innovative potential inherent to the research and educational system are already reflected in current developments.

3. Transmission of Knowledge

The transmission of "produced" knowledge, apart from statutory protective mechanisms to secure innovational profits (patents, utility model protection), is *de facto* restricted by other circumstances (inter alia by re-engineering costs or by

[21] According to Eurostat, high-tech patents cover the area of computer and automated business equipment, micro-organism and genetic engineering, aviation, communications and semiconductors.

business secrets). In particular, the new models of endogenous growth[22], highligh the special role of the transmission of knowledge ("diffusion")[23]. Even under circumstances which do not enable a lasting economic growth (low number of highly qualified workers), a sufficient diffusion rate of new knowledge can induce an economically dynamic development. It can empirically be established that fields of competence and innovation clusters are built in regions characterized by dynamic growth. Such clusters are characterized by so-called "spillovers". In essence, this means transmission of knowledge. Thus, dynamic and efficient transmission of knowledge can be considered as a vital factor for developing regional competences and as a crucial determinant of growth.

Indicator 3.1 – Participation in EC Projects

This indicator covers the direct participation (as prime-contractor) and the indirect participation (as sub-contractor) in EU projects of the 1st to 5th Framework Programme for Research and puts them into relation to the population size. The observation periods are 05/2002 and 02/2004 and refer to values accumulated since 1984.

All of the three federal lands were above the EU15 mean (EU15=100) in 2002 regarding the participation in EU projects. The updated analysis shows that the German federal lands could further improve their performance as compared to the preceding years.

In 2004, Baden-Württemberg's participation in EU projects was clearly higher than the participation of the other federal lands in comparison with the national performance. This corresponds to 154 index points (plus 1 point as compared to 2002), followed by Bavaria (117 points, plus 3). North-Rhine Westphalia reached 103 points in 2002, after 102 points in 2002. The performance of the Netherlands is considerably better in 2004 (187, minus 2 points as compared to 2002).

Expressed in absolute terms, NRW counted 4883 and the Netherlands 7950 direct and indirect participations in projects of the European Framework Programme for Research until February 2004.

The Federal Republic of Germany as a whole clearly lagged behind the EU15 mean and reached only 68 points in 2002 as well as in 2004.

Conclusion: North-Rhine Westphalia could slightly increase its shares compared to the EU15 as well as to the Federal Republic as a whole in the last two years. The transmission of existing know-how seems to work better in 2004 than it did in 2002. This can be assessed as a positive signal, since the participation in EU projects not

[22] G. Grossman und E. Helpman (1991)

[23] Achieving a weighted balance between growth-promoting competition and the protection of intellectual property is the objective of the antitrust proceedings in force as of May 2004 in which new competition rules have been defined for technology transfer agreements.

See: http://europa.eu.int/comm/competition/antitrust/legislation/entente3_en.html#licensing or COM(2004)261 final

In principal, licensing agreements are prohibited under the European competition law. However, the Commission has issued a block exemption regulation as well as guidelines for the area of technology suggesting a reform of the existing exemptions in the granting of patent, know-how, and software copyright licences.

only makes one's own knowledge freely available, but the access to know-how of foreign partners is clearly improved as well. Taken as a whole, however, the performance of the federal lands of Bavaria and Baden-Württemberg is clearly better.

4. Finance & Innovation

After the invention of a new method, a service or a product, the overall success depends on successful marketing or its implementation into practice. However, the economic exploitation of an idea often fails, since there are not sufficient own funds or the capital markets do not make enough borrowed capital available.

In most cases, however, the innovative activities in the enterprises require sufficient financial means.

The development of an efficient debt market (especially equity capital) is therefore of particular importance for the less financially strong SMEs. Indicator 4.1 examines the efficiency of the capital markets.

Besides the ability to develop and put through new methods, the preparedness to do so is also of high importance[24]. Even if the potential and the other underlying conditions are suitable, there will be no chances for innovations in a society hostile to technology. Thus, a kind of "positive, technology-friendly mood" must be prevailing. Indicator 4.2 is to outline the preparedness of the population to deal with new technology.

Beyond this, indicator 4.3 is to show the fluctuation of the enterprises within the individual regions. Very high fluctuations are a sign of a high regenerative power and flexibility within a regional-economic structure.

4.1 Indicator 4.1 – High-tech Venture Capital

Indicator 4.1 shows the venture capital made available in growth-relevant areas (as share of the overall venture capital) for start-up and follow-up investments. Since the collected data of this indicator are very incomplete at EU level, a comparative analysis for the EU cannot be made. Thus, Germany is chosen as indexing basis (FRG=100).

From the view of "capital availability", North-Rhine Westphalia showed a relatively good performance, reaching 131 points as compared to the national performance. Bavaria (51) and Baden-Württemberg (78) considerably lagged behind the national mean. In NRW, about 55 per cent of all venture capital have been invested in the high-tech area. Bavaria's share amounted to only 21 per cent and the national mean was 42 per cent.

Conclusion: In relation to the other federal lands and to the Federal Republic of Germany as a whole, the market for venture capital is highly developed in North-Rhine Westphalia. As compared to other federal lands, the chances of funding innovative projects seem to be good.

[24] J. Röpke (1983)

4.2 Indicator 4.2 – Internet Access

Indicator 4.2 measures the share of the private households having access to the Internet in the overall number of private households. In this respect, this indicator may be interpreted as measure (inter alia) for the openness of the individuals to the new communications technology "Internet".

Moreover, access to the Internet is an indication as to how many persons are able to use the knowledge available on the web as well as to use the accelerated means of communication to exchange information.

In the period between 1998 and 2002, all of the assessed federal lands could increase their lead over the EU mean (EU15=100). Baden-Württemberg (138 points, plus 35) is now the top performer, followed by Bavaria (137, plus 29) and North-Rhine Westphalia (132, plus 21). NRW, however, lost its lead position to Baden-Württemberg.

In the Netherlands, the market was penetrated even faster. In 1998, the Netherlands reached 196 points, however their performance decreased to 145 points in 2002.

In 2002, the German national mean (129 points, plus 33) was considerably higher than the EU mean. According to an income and consumer sample of 2003 (EVS 2003) about 46 per cent of all German households had Internet access on 1 January 2003 (NRW: 47 per cent).

Conclusion: A large part of the German households now have Internet access. North-Rhine Westphalia does better than the national mean as well as the EU15 mean with respect to this indicator. This shows a relatively high preparedness to deal with forward-looking technologies. It seems that the Netherlands are even more prepared to learn about this technology, however the Germans, without hesitations, can be considered as very open to innovation.

4.3 Indicator 4.3 – Volatility Rates

The volatility rates are defined as sum of the foundations and liquidations (of all enterprises) in relation to the overall number of the enterprises subject to turnover tax.[25] This indicator, as the EU Commission states, is deemed as an indication of the

[25] According to the argumentation of the EIS 2003, indicator 4.3 is a measure for the regenerative power inherent in the market of the assessed economies. Higher volatility rates show the fast disappearance of uncompetitive enterprises from the market and their fast replacement by new enterprises. Therefore, higher numbers of foundations as well higher numbers of liquidations have to be assessed as positive – in the sense of a functioning competition. High volatility rates as a whole speak for high dynamics and increased competition in the market.

We think nevertheless that the line of argumentation underlying indicator 4.3 has to be assessed critically. As the same importance is attached to both foundations and liquidations in the volatility rates, statements as to the strength and the dynamics of the economy can only be made in a restricted way. An economy, e.g. having larger waves of business failures would be characterized by high values for indicator 4.3. It is questionable whether this speaks for the innovative power of a region. On the contrary: A dynamically growing economy need not necessarily have high volatility rates, for example if the number of foundations is high, and liquidations are rare. However, this scenario much more strongly indicates the innovative power and the competitiveness of the regional industries.

Higher values of indicator 4.3, in our opinion, should only be assessed as clearly positive, if the balance of foundations and liquidations shows acceptable values in the long term which have to be compared with the socio-economic starting position specific to the region.

intensity of competition and the regenerative power of the commodity and factor markets. Moreover, we chose the Federal Republic of Germany as indexing basis, since the indicator "volatility rates of SMEs" has only been introduced in the EIS 2003 for the year 2001 – however without Germany.

In 2001 North-Rhine Westphalia (98 points) outperformed Bavaria (88) and Baden-Württemberg (89 points), however only just missed the national mean (FRG=100).

NRW and Baden-Württemberg slightly improved their performance in 2002 as compared to 2001. NRW could defend its top-position against Bavaria which stagnated at 88 points in 2002, at the same level as in the preceding year, and against Baden-Württemberg which only reached 91 index points in 2002. In 2002, North-Rhine Westphalia exactly reached the national mean of 100 points and could improve its performance by 2 points, the same as Baden-Württemberg. In absolute terms, the sum of foundations and liquidations amounted to 179,700 in NRW, to 107,100 in Bavaria and to 840,300 in Germany as a whole.

<u>Conclusion:</u> In NRW, the sum of foundations and liquidations is significantly higher in 2002 than in 2001 and in comparison to the other federal lands it is clearly higher than in the federal lands of Baden-Württemberg and Bavaria. Contrary to the positive interpretation of the volatility rates by the EU Commission, we deem it appropriate to interpret this indicator more cautiously. After all, a high value of this indicator does not only reveal a high intensity of competition, but also allows the conclusion that the enterprises are confronted with a difficult market situation due to the high number of business failures. NRW reached higher values in 2002 than in 2001. It thus reached the national mean and leads over Bavaria and Baden-Württemberg. In relation to Germany as a whole, an approximation becomes apparent.

Taken as a whole, NRW shows an increase in the economic dynamics and in the intensity of competition.

4.4 Conclusion for this Thematic Area

The provision of funds to put innovative new ideas into practice is sometimes difficult in Germany with regard to the amount of provided venture capital. In this respect, there are striking regional differences: the venture capital market is significantly better in North-Rhine Westphalia than in Bavaria or Baden-Württemberg.

When considering the indicator "Internet access", it cannot be derived that the Germans are hostile to technology. On the contrary: at the beginning of 2003, every second household had Internet access and thus the possibility to obtain and share "knowledge" in an accelerated way. In my view, indicator 4.3 measuring the volatility rates only allows the cautious conclusion that the German markets have a high intensity of competition.

5. Summary and Conclusions

The capacity and ability of the German federal lands of Baden-Württemberg, Bavaria and North-Rhine Westphalia show an extremely controversial picture as compared to the national and European performance. The 15 indicators used in the Regional Innovation Scoreboard 2003, taken as a whole, illustrate the innovative profile specific to the regions, thus allowing analyses of the strengths and the weaknesses. The benchmarking exercise results are most telling if the entire regional picture, which is created by joining the individual results of the indicators together, is interpreted. Determined profound analyses of individual indicators are hardly helpful, as they imply the risk of over- and misinterpreting the indicators.

In the "Human Resources" area, the results for the federal lands of Bavaria, Baden-Württemberg and North-Rhine Westphalia as well as for Germany as a whole reveal a disaggregate picture. The number of university graduates as a whole, e.g., in particular in the subjects of natural sciences and engineering sciences, is far below the EU mean, showing a decreasing trend in the years 2001 and 2002. The findings with respect to the activities in the "lifelong learning" area are likewise negative. In this area, the European neighbours of Germany make far more intensive efforts on average. From the dynamic perspective from 2000 to 2002, the tendency of this result has not changed. This unsatisfactory finding is true for the assessed federal lands, too.

This result requires immediate action, since human capital is the basis for successful innovative activities. A worsening of " today's human capital" will, with some delay, result in a reduced "innovative ability" in the near future.

A positive ray of hope is the high number of employed in the medium- and high-tech industries. In this area, Germany is at the top compared to the European performance; nationally, Baden-Württemberg clearly leads over Bavaria and outperforms NRW by far. NRW is still above the EU mean, but continues to be clearly below the national mean. This is still mainly due to NRW's former coal and steel industry, but it is also understood that the structural change has not yet been completed. The obvious decline in the relative position of NRW in the period between 1999 and 2002 has to be assessed as critical.

In comparison with the positive employment in technology-intensive trade as a whole, the situation of employment in the innovative services fields in Germany and the assessed federal lands is average. In 2002, employment was slightly below the EU15 mean. However, in 1999, the performance of Baden-Württemberg and Bavaria was clearly better than the EU mean. This decreasing tendency to an average level is a cause of concern.

In the area of "creation of knowledge", the used indicators reveal a bipolar picture. In particular Baden-Württemberg, but also Bavaria reached top positions in the German and European comparison in the field of business R&D expenditures or the R&D employees as well as in the field of results produced by these R&D efforts, i.e. German and European patents. The comparisons drawn in the periods between 1997 and 2001 and between 1999 and 2002 do not reveal any negative trends. The indicator "R&D employees" at best reveals a striking decline in Bavaria in the relative ranking for the period between 1997 and 2001, which requires a more intensive analysis.

However, from NRW's point of view, the results are unsatisfactory. NRW considerably lags behind Bavaria and Baden-Württemberg as well as the national mean in all assessed areas. NRW reaches or exceeds the EU mean only in the patenting area (High Tech EPO). The performance of the Netherlands, which are comparable in terms of size and population, is considerably better than that of NRW in the area of high-tech patenting and even reaches the same level as Bavaria. In the area of public R&D expenditures, the Netherlands clearly lead over the German federal lands. Its business R&D expenditures, however, equal those of NRW, but are lower than the EU mean and clearly lower than the German mean as well as lower than the business R&D expenditures in Bavaria and Baden-Württemberg.

The analysis of the participation in EU projects shows that the Netherlands and Baden-Württemberg have used the knowledge creating co-operations in research more intensively than Bavaria and NRW. All three of them are above the E15 mean, while the German national participation clearly lags behind the EU mean.

The analysis of the indicators used in the area of innovation and finance leads to the conclusion that the Germans are by no means hostile to technology. In 1998, the German mean of Internet users reached the EU mean. In 2002, however, every second household had this fast rapid access to worldwide knowledge. This corresponded to clearly more households than in the European mean.

In the area of the venture capital market, NRW's position is far better than those of Bavaria and Baden-Württemberg are in comparison with the national performance.

Overall conclusion:

In the areas of human resources and knowledge creation, the assessed German federal lands have to make considerable efforts to catch up with their European neighbours, which requires an immediate and rigorous paradigmatic change in the German policy regarding university education. "Learning to learn" must become the priority of university teaching under the higher education policy.

We have to be cautious in the areas where Germany and the assessed federal lands have reached relatively good positions and have a big innovative potential as compared to the national and European mean. In particular, the high employment rates in the technology-intensive industries, but also the business R&D expenditures are still the source of many innovative products and ideas. This is documented by the absolute and relative successes of Germany in the patenting area, and in particular the successes of the federal lands of Baden-Württemberg and Bavaria. It is alarming, however, that from a German point of view there is a downward trend of the supposed "indicators of success" observed for the whole of Germany, even if it is still at a high level. It is necessary to immediately initiate the required analysis of the reasons and to conclude it as soon as possible to be able to take adequate counter-measures.

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Annex

Tabelle 5: Sources and comparison of the indicators of the EIS 2003 and the RegIS 2003

			Indexing base for comparisons of EU and FRG/federal lands (sources and data relevance)			
Number	**RegIS indicator**	**Source of indicator data**	**Data relevance of REGIS 2003**	**Source and relevance of EIS 2003**	**Data relevance of RegIS 2002**	**Source and relevance of EIS 2002/01**
1.1	S&T Graduates	Statistisches Bundesamt, www.destatis.de	2002	EU (2000), NL(2001), FRG (2001) from EIS 2003	2001	EU (1999), NL (2000), FRG (2000) from EIS 2002
1.2	Population with university degree	Statistisches Bundesamt, www.destatis.de	2002	EU (2002), NL (2002), FRG (2002) from EIS 2003	2001	EU (2001), NL (2001), D(2001) from EIS 2002
1.3	Lifelong learning	BIBB, Bundesinstitut für Berufsbildungen, Participation in examinations before the Chamber of Industry and Commerce	2002	EU (2002), NL (2002), FRG (2002) from EIS 2003	2000	EU (2000), NL (2000), FRG (2000) from EIS 2001
1.4	Employed in HT manufacturing	Mikro-census of the Federal Lands and Germany as a whole, stat. Bundesamt und Landesämter, BRD:www.destatis.de	2002	EU (2002), NL (2002), FRG (2002) from EIS 2003	1999	EU (2001), NL (2001), FRG (2001) from EIS 2002
1.5	Employed in HT services	Mikro-census of the Federal Lands and Germany as a whole 2002, statistisches Bundesamt und Landesämter, BRD: www.destatis.de	2002	EU (2002), NL (2002), FRG (2002) from EIS 2003	1999	EU (1999), NL (1999), FRG (1999) from EIS 2001
2.1	Public R&D expenditures	BMBF, Federal Research Report 2004, www.bmbf.de	2001	EU (2001), NL (2001), FRG (2001) from EIS 2003	1999	EU (1999), NL (1999), FRG (1999) from EIS 2001
2.2	Business R&D expenditures	Stifterverband FuE-Data report 2001 und 2003, www.stifterverband.de	2001	EU (2001), FRG (2001) from EIS 2003, NL (2001) from EIS 2002	1999	EU (1999), NL (1999), FRG (1999) from EIS 2001
2.3	Business R&D employees	Stifterverband FuE-Data report 1999 and 2003, www.stifterverband.de	New indicator developed by Zenit (FRG=100) (indicator not included in EIS 2003)			
2.4	Patents DPMA	Deutsches Patent- und Markenamt, Annual report 2002, www.dpma.de	New indicator developed by Zenit (FRG=100) (indicator not included in EIS 2003)			
2.5	Patents EPO	Eurostat, www.destatis.de	2001	EU (2001), NL (2001), FRG (2001) from EIS 2003	data not collected	
2.6	HT-Patents EPO	Eurostat, www.destatis.de	2001	EU (2001), NL (2001), FRG (2001) from EIS 2003	2000	EU (2000), NL (2000), FRG (2000) from EIS 2002
3.1	Participation in EC-projects	Cordis, www.cordis.lu (unter Datenbanken, projects, advanced search)	New indicator developed by Zenit (FRG=100) (indicator not included in EIS 2003)			
4.1	HT Venture Capital	BVK e.V., National data and data by lands:www.bvk-ev.de, Annual report 2003	FRG=100 (indexing impossible since no data are available for Germany)			
4.2	Home Internet Access	Income and Consumer Sample, statistische Landesämter, BaWÜ: www.statistik.baden-wuerttemberg.de, Bayern: www.statistik.bayern.de, NRW: www.lds.nrw.de	2002	EU (2002), NL (2002), FRG (2002) from EIS 2003	1998	EU (2000), NL (2000), FRG (2000) from EIS 2001
4.3	Volatility Rates	IFM Bonn, Institut für Mittelstandsforschung, www.ifm-bonn.org	FRG=100 (indexing impossible since no data are available for Germany)			