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Regional Foresight Scenarios in Germany —IT and the Media in Baden-Württemberg in 2020 —

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1 Introduction

The Research Project for Current and Future IT and Media Technologies and Their Use in Baden-Württemberg—FAZIT[NOTE 1][1] (Forschungsprojekt für aktuelle und zukunftsorientierte Informations- und Medientechnologien und deren Nutzung in Baden-Württemberg) has been operated in Baden-Württemberg in Germany under a sponsorship of the state government. A research report volume 15 "The IT and Media World in Baden-Württemberg in 2020—Four Kinds of Basic Scenarios"[2] was published in August 2008 as an outcome of the project. This scenario report is the second part of a trilogy that begins with research report Vol. 10, published earlier, entitled "Delphi Report: Future Information and Communication Technologies"[3] and ends with research report Vol.19, published in June 2009, entitled "New Market through IT and Media—The FAZIT Roadmap Process."[4] They provide detailed reports in three steps: the Delphi-study and its analysis, the development of scenarios, and the roadmap-making process.

Since these reports are region-oriented foresights, terms such as "nation" and "federation" are rarely mentioned except in the context of a comparison or relationship among other states and regions. Regional features and characteristics are reflected in the scenarios and the roadmap. This leads to a conjecture that there are circumstances specific to the state of Baden-Württemberg behind this project. There may be an intention to structurally transform from the currently dominant automobile and machine industries to the IT industry, or an intention to promote the IT and media industries.[5]

Another characteristic feature of the scenarios in FAZIT report Vol.15 is that each of the four basic scenarios describes the respective everyday life of four main characters in the form of specific stories. The world in these stories is not necessarily seen through rose-colored glasses; instead, they try to

[NOTE1] : FAZIT[1]

FAZIT is a research project funded by the state government of Baden-Württemberg, and it was implemented from 2005 to the spring of 2009 in order to study new markets for innovative IT and media technology. The project is made up of the survey of enterprises and the foresight. The surveys analyze short- and medium-term outlooks for the use of IT and the media by studying the IT and the media industries as well as key ICT user companies. The foresight consists of three parts; predictions of technological, social, and economic trends (Delphi surveys), descriptions of future feasibilities of the state (scenario-making), and steps toward new opportunities of market, business, and research (roadmap creation). The results were compiled into 14 research reports and 5 foresight reports by major topic such as outsourcing of business process, ambient society, or open access, etc.

The project, FAIT, was conducted by MFG Stiftung Baden-Württemberg, which has two joint research organizations. Zentrum für Europäische Wirtschaftsforschung (ZEW) was responsible for the survey of enterprises and preparation of statistical materials, and Fraunhofer-Institut für System- und Innovationsforschung (FhG/ISI) for foresight. The report introduced in this article has been prepared mainly by FhG/ISI.

describe plausible futures or social feasibility in an extensive and neutral manner as much as possible by introducing contrasting characters and settings. It is also quite interesting to see a combination of multiple methods having been used in the process of developing these scenarios; such methods include the matrix method, cluster analysis, and Delphi surveys.

Our article introduces the details of FAZIT report Vol. 15, which is the excellent outcome of foresight activities in the region and is characteristic in presenting neutral and specific scenario stories. Some local governments in Japan have presented the vision for the future of their region; however, their scenarios or roadmaps are not as detailed as those of FAZIT. Thus, the FAZIT scenario report will serve as a good reference for regional foresight in Japan. Overview of Baden-Württemberg and the foresight activities in Germany, incidentally, are described shortly in the notes at the end of this article.

2 Four kinds of Plausible Scenarios

2-1 Considerations on four issues

The first part of the report describes four specific stories representing Scenario A to Scenario D that are outcomes of the scenario-making process. And then detailed explanations of how these stories were drawn up. Of course, the four kinds of basic scenarios and the stories were not set up from the beginning, but were induced as an integrated result of background studies, trend descriptions, and a scenario-making process, etc. The basic scenarios described here are not normative scenarios that described desirable futures, but they are neutral and plausible scenarios. They describe a future that may actually happen in association with several issues.

During the scenario-making process, the following four specific issues were considered with respect to how the future environment surrounding IT and media will be like in Baden-Württemberg in 2020.

1) What kind of new ICTs are being used?
2) How will labor conditions have changed through ICTs?
3) How will the ICT industry have been developed in Baden-Württemberg?
4) What kind of achievements will IT and media have made in professional and continuing educations?

The four kinds of basic scenarios include some of the issues above, and each scenario focuses on one of the issues in particular: specifically, new ICTs (issue 1) are strongly reflected in Scenario B, labor conditions (issue 2) in Scenario A, ICT industry (issue 3) in Scenario D, and education associated with IT and media (issue 4) in Scenario C. Scenes from the everyday lives of the main characters are depicted in order to provide a specific image of the basic scenarios. Contrasting situations are also depicted by bringing the friends and former workplaces of the main characters into the story, which ensures the neutrality of the story. Individual technologies or devices appearing in each story are expected to be available by 2020 according to the Delphi study3] conducted in the preceding year.

2-2 Four stories: the outcome of the scenario-making process

Scenario A: "A Woman Working Flexibly through the Use of Virtual Environments"

Ms. A is a software engineer who has moved from a machinery company to a medical technology company. She is now engaged in the development and integration of software components that are embedded in products. On the first day of work at a new company, her colleague in the IT service team gives her explanations on the authentication system, automatic document management system, and company-wide integrated intelligent system. The video conference system and support software for project coordination are also explained. Thus, intelligent environment of her office is customized to reflect her personal preference. The ultrahigh-speed internet enables real-time simulation of software as well as online discussion on a proposal from project members around the world.

In a conversation with her colleagues during lunch break, Ms. A tells them that the company she previously worked for had moved its production abroad to reduce personnel costs and meet environmental protection standards, but was reluctant to introduce advanced ICTs and video conferences, which is quite different from the current workplace. At her current workplace, she can hold conference with partners abroad in a virtual environment, and telework is also an option. Although not all her colleagues agree, the outsourcing of production does not seem to pose a problem for industries within the state since the development and planning sections

remain in the state and outsourcing may help to get new customers. Nonetheless, her colleagues continue to discuss whether the state's stringent environmental standards will benefit the local industry or lead to its decline.

After coming back to her office, Ms. A searches for an e-learning course on computer tomography, but it is not offered. She then applies for a course for further education on basic medical technology. Though local universities offer these courses inexpensively, they do not meet the advanced needs for the business and public sectors. Knowledge transfer among universities and industry has yet to function in terms of the provision of educational programs. She recognizes the necessity for a higher level of continuing education that can enhance professional skills. She is one of the highly qualified employees and is treated differently from those who do not use ICT. She is interested in using new ICT for her career, but many other people use new ICT and network services only for entertainment purposes.

Scenario B: "An Empowered ICT User"

Mr. B is a production manager at a manufacturing company. As his vehicle enters a highway on the way to work one morning, he shifts the vehicle assistance system to the auto-drive mode, and starts reading e-mails and preparing a report using the voice recognition system, which turns his speech into written report. He also notices that a football match will be broadcast today from an e-newspaper that appeared on the front glass display. He then arranges to see the game with his son after work. The intelligent vehicle he is driving receives traffic information, chooses the best route automatically, and finds a parking space.

The company Mr. B works for has transferred its production lines abroad and is now able to compete globally. But even today, much of the research and development activities are performed in the headquarters in Baden-Württemberg, and instructions are delivered from the headquarters through the IT network system. After Mr. B arrives at the office, he holds a video conference with software developers in India and with the production planning team of the local office in Germany. After the conference, an inquiry is sent to his mobile personal computer, whose images can be projected on a computer screen and intelligent whiteboard. It is a job offer from a new environmental company that has created a boom in the state and is also globally successful. He declines the offer this time and recommends one of his colleagues. The environmental company is looking for an expert in the development of alternative energy resources for small-electronic devices.

Mr. B leaves his office at three o'clock in the afternoon and watches a 3D-broadcast of the football game with his son at the Palace Plaza. An intelligent projector displays a realistic holograph image of players on the field and he feels as if he were in the Olympic stadium where the actual match is taking place. Information about his returning home is sent by wireless to the central control system of his intelligent house, which automatically turns on the heater and the home media server. This media server stores all media, including the family's private videos and e-mails. After coming home, he works in his networked home office to examine the maintenance protocol of the production facility in South America. His son prepares for an exam by reviewing online lectures offered in a multi-media format. This educational program guarantees an education in accordance with one's own objectives and the learning plans are developed with the participation of potential future employers.

Scenario C: " New Academic Elite"

Mr. C is a professor of software engineering for intelligent environments at an excellent University. He engages in developing a new teaching module for graduate students in this morning. The module is highly practical; for example, it enables a company to provide teaching materials if the combination of sensor, software, transfer method, and terminal is only determined.

This university maintains close contact with private companies, having a favorable impact on career opportunities for both students and researchers. Professor C receives support from private companies not only for system design, but also for education materials, software, devices, and the shared use of experimental facilities.

At the colloquium which Professor C attends, participants are able to see the movies and simulation images used in the lectures in real time on laptop computers and Personal Digital Assistants (PDAs). Also, the personal computers and PDAs of the participants at remote locations are automatically

connected through an ad-hoc network. The content of the colloquium can be called up later to study for an exam or to use as a material of self-motivated e-learning.

Later, Professor C talks with his colleagues about the progress of research projects that he has launched. He is focusing on two researches in particular. One is an immersive system for entertainment and 3D role-playing with virtual-reality. Another is research on the recognition of intention, such as how to recognize and predict human behavior using sensors, a motion profile, and biometric data. This technology can be used to prevent terrorist from attacking by recognizing his intention. The consumer goods industry, department stores and automobile industry show strong interest in these research projects.

Professor C is satisfied with the current working conditions; however, those who work for universities not listed in the "excellence" category feel frustrated with their conditions. They do not receive fully financial support from the state and companies, and they must engage mainly in teaching instead of research activity.

Scenario D: The ICT Sector after Experimental Phase

Mr. D is the management executive of a medium-sized IT services company. Today, he gives explanations to new contract employees about the Computer Support Cooperative Work (CSCW) tool used for distributed project works. A large-scale trial experiment for virtual working styles was launched two years ago, and various automated equipments and environments such as virtual conference room and collaborative software had been tested. However, in the end, only this CSCW tool was adopted. This is because other equipments and technologies had neither improved the company's outputs and efficiency nor reduced its costs. The expertise of this company can be exploited potentially through personal contact and direct negotiation with customers and partners. So it was decided to shift back to the old method after all. That may be mainly due to the unique circumstance of this company because many other IT and media companies adopt and utilize automated tools successfully.

Mr. D's company used to carry out website creation and corporate network programming, but it is currently involved in ergonomic navigation systems and web services for automobiles. The automobile companies are its main customers at present. Although many experts suggested that adaptive systems would be promising, but in fact, the users did not respond favorably to new kinds of automated networks, automated terminals, or adaptive systems. In the end, these technologies are established only in the security region such as authentication and access control. Other adaptive systems like location-based services were also tested but the commercialization of them are not established yet due to the small number of users and the price issue. Consumers are becoming even more cautious about these technologies after

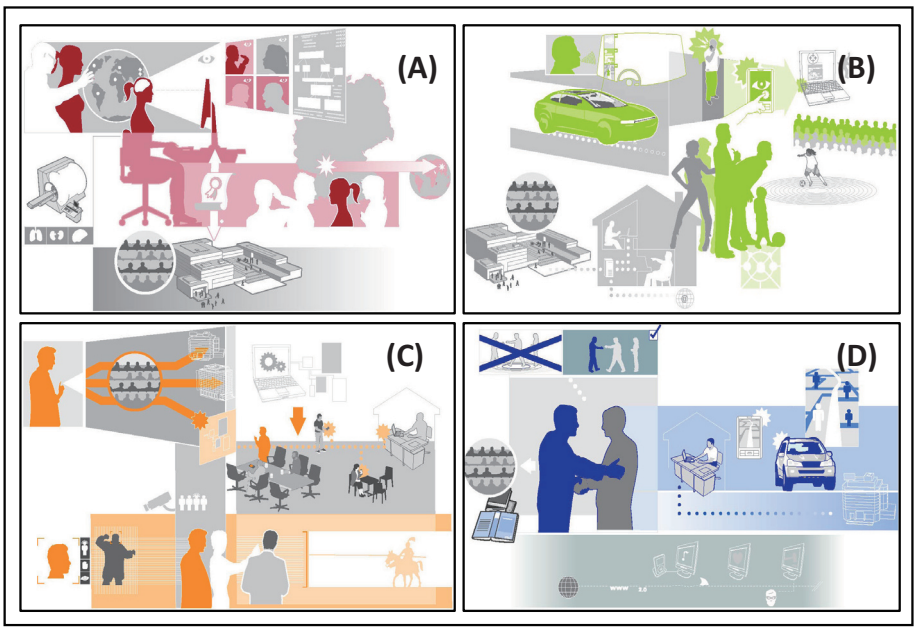


Figure 1 : Images of the Four Scenarios

Source : Reference[2]

cases of privacy abuse and scandals. In contrast, a social network of website is being used actively among friends and within communities. Thus, Mr. D's company is developing new services in this area. For instance, it would be promising to develop a membership service of car rideshare system using a non-commercial platform.

His company recruits on campus at the local universities but has not been involved very much in industry-academia cooperation through education programs or joint research. Overall, E-learning is scarcely functioning both at industrial firms and at universities. Although many learning materials are provided online, they are not used very much by employees and students. It is perhaps because they find them non-creative. There is not enough funding to integrate these materials into the latest intelligent system.

2-3 Characteristics of each scenario

Scenario A focuses on how the working life will have progressed and how the working environment will have changed by 2020 through the introduction of ICTs. It also mentions related topics, such as industry-academia cooperation and professional education as well as the outsourcing of production and IT-based offshore procurement. In Scenario A, the virtualization of the working environment has advanced, but new ICTs have not been universally accepted, revealing an uneven situation in 2020. This is because the frame of mind towards technological innovation, which varies from individual to individual, influences the acceptability of ICTs at workplaces, schools, and in private lives. Thus, the virtual environments for labor and education have been introduced in accordance with an individual level of acceptability. Consequently, there is a wide disparity between those who benefit from IT and those who do not. The scenario suggests that there will be no balanced benefits or criteria of goals if there are no overall guidelines about the development of IT and the media.

In a world like Scenario A, the economy and society are highly fragmented. In addition, the scenario shows that the knowledge transfer hardly occurs between universities and companies due to the poor networking, and that the most advanced education programs and tools are not available for the professional education.

Scenario B depicts a wide variety of uses of new ICTs in the personal environment together with interfaces of working and educational environments. The story as a whole is dominated by a positive atmosphere and expectations for new technologies without negative attitudes. In this scenario, network technologies have been widely adopted in everyday life. Residents create an always-on society, where they can get adequate services according to their situations and locations. The virtual environments for working, education and entertainment have also advanced greatly.

Residents consistently respond positively to technology innovation, which, in turn, promotes the further development of technology, creating a virtuous circle. Moreover, as a result of advanced knowledge, residents can acquire a wide range of expert knowledge by using new technologies and media. Students receive excellent professional education that ensures the future expertise of each student. Advanced ICTs are effectively used to facilitate offshore production, and the state policies for energy-saving and environment have made a favorable impact towards promoting new technologies. Scenario B is the only scenario where the society and communities maintain a feeling of togetherness.

Scenario C describes industry-academia cooperation through professional education and research activity in the ICT field. The important key of this scenario is knowledge transfer in science and technology, particularly in applied technology. While various cooperative relations between academia and industry are seen in 2020, universities split into excellent and non-excellent universities.

Scenario C is similar to Scenario A in the sense that they both point out the issue of fragmented society caused by advanced innovation. While there are competent and highly efficient researchers and companies, most people are not involved in the dynamic development of ICTs. For example, many companies have given up introducing virtual environments into the workplace and for education. Although residents are interested in and are aware of technological innovation, their acceptance of it is not necessarily high. This is the main cause of the social fragmentation. This kind of skeptical attitude toward the future is impressive in this scenario. However, Baden-Württemberg has still advantage because various methods have been adopted for knowledge transfer between academia and industry, and because

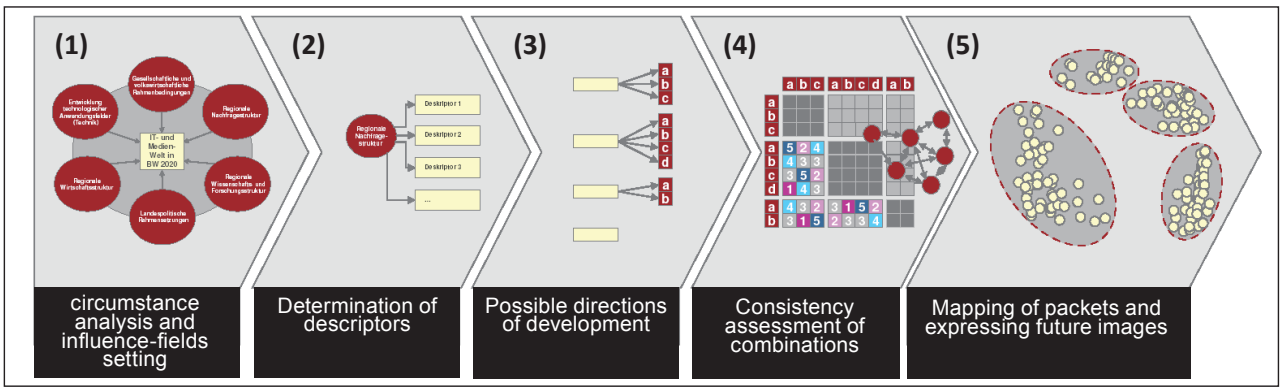


Figure 2 : Flow of Scenario-making Process

Source : Reference[2]

professional education has been successful.

Scenario D describes the development of the ICT industry in Baden-Württemberg. It starts with the preposition that not all the IT and media technologies foreseeable at present will lead to a successful business model. Various ICTs will have been developed by 2020 but many of the expected changes in the society are yet to be brought about. Thus, the ICT development period up until 2020 is considered merely as a trial period.

Scenario D as a whole is more pessimistic than the other scenarios. It presents situations where seemingly installable new ICTs are often left to stagnate without being accepted, particularly in working and personal environments. Residents have a low acceptance of technological innovation. Or rather, most of them are actually resisting digitization. Only the minimum extent of new technologies has been adopted, and it is far from a ubiquitous society. Scenario D is characterized by unity within small groups or organizations, and by fragmented society as a whole. Innovative methods of education, such as e-learning, have not been widely adopted and the importance of face-to-face personal contact is emphasized in the business world.

3 Method and Process of Foresight

3-1 Methodological approach: Outline of Process

The aim of this study is to understand as many elements as possible in relation to the future development of the ICT and media sectors in Baden-Württemberg. Therefore, it is insufficient to draw up an ordinary scenario that describes the specified development through discussions of individuals or a small number of people. In this section, possible development directions (or trends) are listed by combining several explorative methods, and the influences of mutual effects of developments are also considered.

The following six steps have been employed in order to establish explorative scenarios (Figure 2):

1) Analysis of the issues and circumstances, and setting of related influence fields,
2) Determination of descriptors and the verification study for them,
3) Discussions on possible development directions of the descriptors and figuring out them,
4) Evaluation of relevancy and consistency among development directions,
5) Assessment of the possible number of scenarios and mapping of foresight packets with software support,
6) Translation of the results concerning development directions into the future image.

Each of the steps is described in the sections below.

3-2 Defining influence fields

To extract key influence factors for the IT and

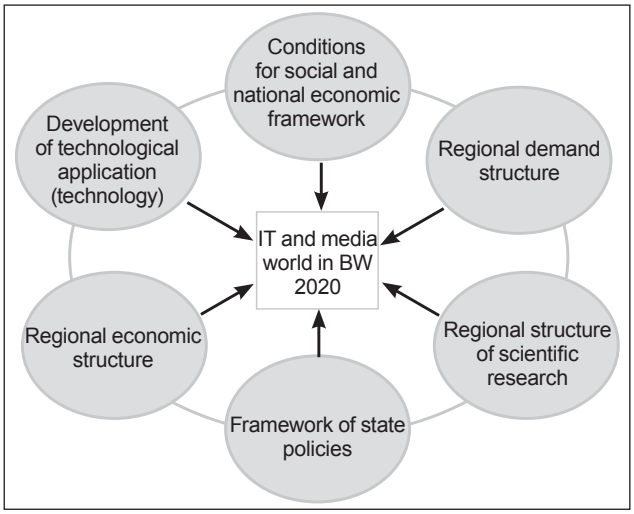


Figure 3 : Six "Influence Fields" on IT and Media Environments in Baden-Württemberg (BW) in 2020

Source : Reference[2]

media sectors in Baden-Württemberg, the current results of ICT monitoring were selected and some of the foresight results and other scenario processes were analyzed. The following issues were also considered in order to identify influence fields:

1) What will IT and media environments look like in Baden-Württemberg in 2020?
2) What themes will be most important, what sectors will be related to the development of ICTs, and how different will be the situation in Baden-Württemberg from that in other regions?
3) What kinds of IT and media technologies will be used by residents and companies in Baden-Württemberg? How will such technology have changed the life and work of residents?
4) How important are the IT and media sectors in Baden-Württemberg?

These issues were discussed at a one-day workshop of the project to identify six types of influence fields (Figure 3) that may critically affect the development of IT and media sectors. Among the six influence fields, one is associated with the technological development itself, one is the national framework, and the other four are regional influence fields particularly related to Baden-Württemberg.

3-3 Descriptors, their development directions, and feasibility

In order to prepare trends or descriptors for each of the six influence fields, an expert workshop was held on November 28, 2006. About 40 experts, including researchers in science and engineering and experts in IT and media industries were invited to participate, and 18 of them actually took part in the workshop. They were divided into two working groups to extract a series of descriptors and discuss the possible directions of development for these descriptors (Table 1). At the plenary meetings at the beginning and the end of the workshop, discussions were held on the most important themes for the future IT and media as well as the strengths of Baden-Württemberg. After the workshop, a verification study and justification for the identified descriptors and development directions were carried out based on the literature and internal expert's opinions.

The four stories of scenario A to D described earlier were prepared based on the total of 20 descriptors listed in Table 1. Each descriptor has two to four development directions and there are 51 directions in total. After omitting the development directions with no consistency or relevancy, 44 directions are listed in Table 1. The table also gives numerical values of the feasibility of each development direction in the four scenarios from A to D. The feasibilities are shown as percentages for each descriptor. The translation of the development directions to the future images and their relationships with the scenarios are described just after each story in the original FAZIT report. However, we describe the relationships in a later section according to the scenario-making sequence. The outcomes of the above-mentioned workshop by experts were used for setting up each thesis of Delphi survey conducted in May–June, 2007. The results of the FAZIT-Delphi study[3] were used to develop the scenarios.

3-4 Assessing consistency

To assess the consistency and relevancy among the possible development directions of the 20 descriptors, a week-long workshop was held, in which six experts of the Fraunhofer Institute for Systems and Innovation Research (FhG/ISI) participated. Firstly, the consistency of development directions in different descriptors was checked and rated at five-grade evaluation (Figure 4). If two of the development directions are inconsistent and conflict with each other, the score is 1. If they are poorly consistent, it is 2. If they are neither consistent nor conflicting, it is 3. If they are mostly consistent, it is 4. If they are highly relevant with each other, it is 5. When there was a contradiction, as in the score of 1, the combination was removed from the scenario making process since the occurrence of both development directions at the same time cannot be envisioned in 2020.

Two descriptors have four development directions, seven descriptors have three directions, and eleven descriptors have two directions. Thus, there is a total of 1,231(= $\{4\times(51-4)\times2 + 3\times(51-3)\times7 + 2\times(51-2)\times11\}/2$) frames to be filled with the five-grade score. This method can measure the consistency of both positive and negative directions. The consistency assessed in this way was used as a reference to narrow down the combinations of development directions described in the following section. It is also used for the factor analysis to determine the number of necessary scenarios.

Table 1 : Descriptors, their Development Directions, and Feasibilities (Unit: %)

	Descriptor	Development Directions	Scenario			
Development of technological application (technology)			A	B	C	D
	#1 Technological networking	(1a) Realization of always-on connection	2	29	0	0
		(1b) On-demand and customer-based networking	98	71	100	100
	#2 Adaptive system and sensor enabling services according to the situation and location	(2a) Widespread use	51	94	22	0
		(2c) Limited use	49	6	78	100
	#3 Virtual environments for work and education	(3a) Wide adoption of Virtualization	47	3	17	44
		(3b) Limited adoption of Virtualization	53	27	83	56
	#4 Virtual environments for entertainment	(4a) Widespread use	100	100	100	2
		(4b) Limited use	0	0	0	98
Regional demand structure						
	#5 Resident's openness toward innovation (acceptance of new use) in B-W	(5a) Consistent acceptance	32	98	9	0
		(5b) Excitement expressed in behavior	66	2	91	60
		(5c) Off-line	2	0	0	40
	#6 Budget for media-equipments and knowledge-	(6a) Large increase in budget for media	0	53	4	0
		(6b) Low budget but high level of expertise	100	47	96	100
	#7 Growth of self-supporting local communities	(7a) Independent community becomes significant	94	98	100	94
Regional economic structure						
	#8 Use of ICTs in existing sectors in B-W	(8a) Enhanced use of ICTs	0	41	4	0
		(8b) Partially successful adoption of ICTs	9	2	13	0
		(8c) Offshoring and outsourcing by ICTs	64	57	43	52
		(8d) Other influence factors	28	0	39	48
	#9 Development of the IT and media industries in BW	(9b) IT economy turns to international market, and media sector becomes a leading sector	43	78	43	0
		(9c) IT economy turns only to existing sectors, and media sector becomes a leading sector	53	22	52	0
		(9d) IT economy turns to international market, and media sector loses importance and prominence	4	0	4	100
	#10 Importance of BW as a place of various sectors	(10a) All businesses are local.	100	100	100	100
Conditions for social and national economic framework						
	#11 Social togetherness	(11a) Community with an uplifting feeling	34	65	4	21
		(11b) Social divide	66	35	96	79
	#12 Environmental protection and energy issues (Climate change and end of fossil fuel)	(12a) Environment-energy regulations damage German economy.	100	12	0	88
		(12b) The regulations strengthen the site by developing technologies	0	88	100	13
	#13 Work-life balance	(13a) Blurring between work and private life	21	22	30	10
		(13b) High flexibility	49	63	26	50
		(13c) Cocooning trend (Social withdrawal)	30	16	43	40
Regional structure of scientific research						
	#14 Network of knowledge and industries	(14a) Successful knowledge transfer as a decisive condition of the site location	2	88	100	15
		(14b) Limited knowledge transfer	98	12	0	85
	#15 Advanced research and access to the knowledge	(15a) The state economy develops due to competition among the elites.	36	14	78	42
		(15b) Wide access to knowledge and education by state scientific policy	64	86	22	58
	#16 Use of multimedia and online for learning (e-learning)	(16a) Common use of e-learning	2	24	0	0
		(16b) E-learning adopted only in specific fields as an adjunct	74	57	87	0
		(16c) E-learning yet to be established	23	20	13	100
	#17 Professional education for futuristic fields	(17a) Successful education on futuristic themes	77	98	100	94
		(17b) Important new trends are not covered.	23	2	0	6
Framework of state policies						
	#18 Innovation policies	(18b) State policies stress traditional sectors.	6	10	0	100
		(18c) State policies stress new sectors and downgrade existing sectors	94	88	100	0
	#19 The state initiative in IT and media	(19a) Active involvement in IT and media	11	41	0	0
		(19b) IT and media is less important theme.	89	59	100	100
	#20 Support for IT and media infrastructures	(20a) State investments on infrastructures	2	8	13	0
		(20b) Focusing on private economic activities	98	92	87	100

Source : Reference[2]

3-5 Mapping of packets and the number of scenarios

Two descriptors that show the four development directions of (a) to (d) create 16 combinations of development directions. In addition, there are seven descriptors with three development directions and 11 descriptors with two directions. Therefore, all possible combinations for a total of 51 development directions are 71,663,616 (= $4^2 \times 3^7 \times 2^{11}$). Each combination is called a "foresight packet" and one foresight packet has one development direction for each of the 20 descriptors. Since there are too many foresight packets as they are, the process for cutting down the number of packets is necessary. These foresight packets include the combinations of inconsistent and conflict development directions that were evaluated as a score of 1. Such inconsistent packets were removed first. Then, any foresight packet including 10 or more combinations with poor consistency, namely, a score of 2, was removed. Finally, 168 foresight packets remained, dominated by those with a score of 5.

Next, the following three methods were used to assess how many scenarios can be drawn from these 168 foresight packets:

1) Factor analysis (a Scree plot) that gives the number of independent factors from the eigenvalues of the correlation matrix that is a symmetric 51×51-matrix of the five-grade score on consistency.
2) Hierarchical clustering analysis using a dendrogram.
3) Mapping analysis, where similarities among the foresight packets are expressed by the distance in a three-dimensional space.

After these three methods were performed, it was concluded that there were four possible scenarios.

Figure 5 shows the similarity mapping for the foresight packets, but it is projected on a two-dimensional plane. Each dot represents one foresight packet. The dots are placed into four groups to be categorized into four scenarios, although some overlap appears due to the two-dimensional projection. One foresight packet has 20 development directions corresponding to 20 descriptors. However, when focusing on one descriptor of a scenario, there are multiple development directions as shown in, for example, (a) and (b). Based on that ratio, as well as considering other factors, the feasibilities of these development directions are shown as percentages in the right columns of Table 1.

3-6 Appearances of descriptors and scenario making

Each scenario story is created by means of translating the assessed feasibility percentage of development directions into a future scene. Although discussions from each stand point of six influence fields are provided in the original FAZIT report, this article introduces the discussions on two of them below, which particularly focus on regional characteristics. The numbers shown below correspond to the numbers for the descriptors in Table 1. Looking

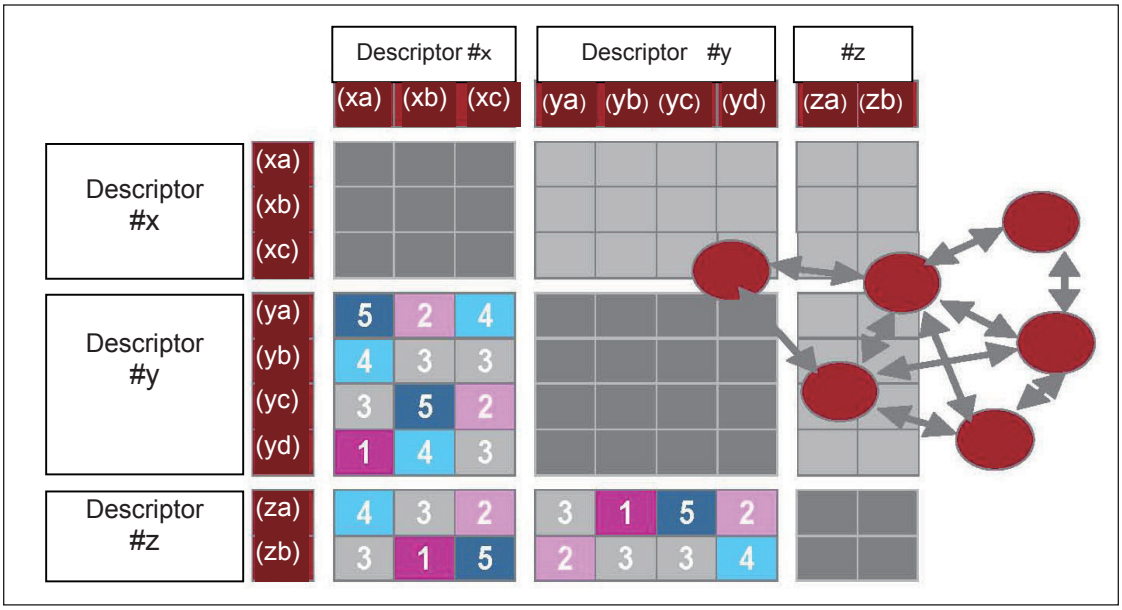


Figure 4 : Consistency Assessment of Combinations. Consistency between the Development Directions of a Descriptor and the Development Directions of Another Descriptor is Assessed According to a Five-grade Score.

Prepared by the STFC based on Reference[3]

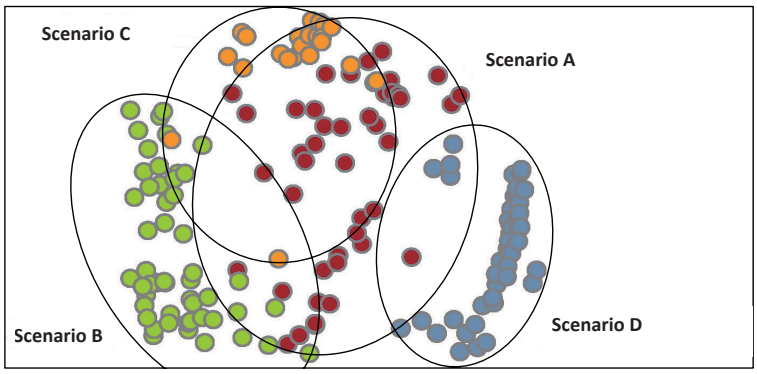


Figure 5 : Mapping of 168 Foresight Packets

Source: Reference[2]

at these discussions, one can better understand the relationship between the entire picture of scenario and its elements.

Discussion on"Regional Demand Structure"

In Scenario A, the residents have a wide variety of personal views on technological innovation, which influence the level of acceptance of ICTs in the workplace, in education and in personal life (#5). Since virtual environments are adopted depending on the acceptance level of each individual and each sector, there is considerable disparity throughout the entire society. The residents do not spend much money on the media although they have knowledge about advanced media technologies (#6).

In Scenario B, positive attitudes of residents toward technological innovation are consistently shown and the use of new technology is accepted by almost everyone (#5). Most residents spend a significant amount of money on the media (#6), which effectively influences technological development (#1 to #4), generating a virtuous circle. Furthermore, the residents have highly advanced knowledge and they enjoy the benefit of acquiring a wider range of professional knowledge through the use of new technology and media (#14 to #17).

In Scenario C, the residents are interested in and knowledgeable about technological innovation, but the level of acceptance is not necessarily high (#5) and not much money is spent on the media (#6). This remind us that there may be social segmentation between the small number of elites who benefit more from technological innovation and the majority of the general public who do not (#11).

In Scenario D, the residents' acceptance of technological innovation is low, and most of them resist the digitalization (#5). Thus, people do not invest much in media (#6), and the use of new technologies is limited to the minimum necessary (#1 to #4). The situation is far from a ubiquitous society as a whole.

A common feature found in these four scenarios is that a self-sufficient and independent society becomes important (#7).

Discussion on"Regional Structure of Science and Research"

In Scenario A, the networking between academia and industry does not advance, and knowledge transfer hardly takes place (#14). Universities carry out researches that are not related to the needs of industry, and companies are not interested in long-term research. Although the state's science policy enables the residents' wide access to knowledge and education (#15), advanced research tends to be performed only by a small group of elite professionals (#15). Some specific fields have adopted e-learning, but many fields have given up the online multimedia technology for learning (#16). Professional education has made some achievements through identification and integration of future themes; however, important new trends have often failed to be explored by putting stress on the existing fields (#17).

In Scenario B, knowledge transfer between academia and industry is successful in many areas, but there are still some areas in which no such knowledge transfer takes place (#14). Since wide opportunities for access to knowledge and education are offered to residents (#15), there is no social fragmentation between the elite class and the general public (#11) even though advanced research by the elite group is considered important (#15). E-learning is available to some extent, but it lacks a clear direction (#16). Professional education addresses future themes for individuals, and in that sense, students receive

favorable professional education (#17).

In Scenario C, various methods have been taken to enable knowledge transfer between academia and industry (#14). Research and education meet the demands of science and industrial educations (#14). The professional education is also conducted successfully (#17). These are the decisive advantages in this state. The state economy develops, owing to competition among the elites (#15). However, on the other hand, there are few opportunities for the general public to access advanced knowledge (#15) due to the limited use of e-learning (#16) together with other reasons. Thus, this scenario indicates the risk of becoming a digitally divided society (#11).

In Scenario D, knowledge transfer is limited between the industry and academia (#14). Despite such a difficult condition, professional education in future areas has made certain achievements (#17). Innovative educational methods such as e-learning do not spread widely (#16).

4 Similarities and Differences in Four Scenarios

As clearly seen in Table 1, development directions commonly found in four scenarios are "(10a) all businesses are local" and "(7a) independent community becomes significant." Both are important trends associated with the conditions of the regional economy and regional society. Based on these trends, it is predicted that the cooperation within region will become even more important and that a number of local and regional communities will come into being there in the future. In these regional communities, for example, the flows of foods and energy are independent from the global market, and the demand and supply thereof are regionalized by networking among residents in a new way. This trend toward regionalization does not mean going back to the past, but rather it is a driving force for innovation based on new ICT and on the consideration for the environment and safety.

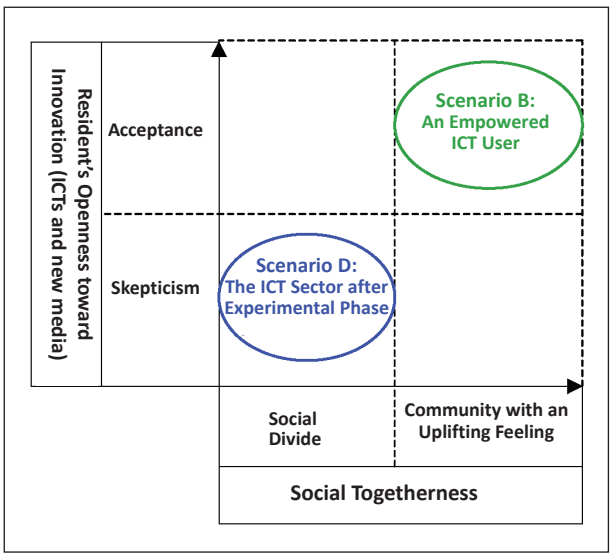


Figure 6 : Differences in Scenarios with Axes of Openness torward Innovation and Social Togetherness

Source: Reference[2]

Another similarity in development directions can also be observed in the combination of "science is successful in exploring new themes" and "outsourcing of production of the existing sector." The research institutes and educational organizations within the state are highly adaptable to the future, and are able to conduct research and development with the new themes. At the same time, however, a partial shifting of production to foreign countries is inevitable for the existing industries. The outsourcing occurs even in the IT industry. As the more advanced ICTs are adopted, the overseas production increases more than ever, promoting changes in the state's industrial structure.

The simultaneous trends toward globalization and regionalization seem contradictory. However, the adoption of advanced ICTs is beneficial to Baden-Württemberg as an excellent center of research and development and also effective for the development of local communities. It can be interpreted that the trend itself is oriented in a similar direction simply with different targets.

There are also some huge differences among the four scenarios. Particularly large differences are associated with "resident's openness toward innovation (#5)" and "social togetherness (#11)," which resulted in totally different scenarios. Such differences are shown in Figure 6, where two axes are taken; one axis represents "acceptance of new technologies" or "skepticism about new technologies," and another axis represents "social divide" or "community with an uplifting feeling." Scenario B and D are located on the opposite side of each other. Although Scenario A and C basically come closer to the position of Scenario D (to be specific, skepticism about new technologies and social divide), they are not shown in the figure because their characteristics are not as obvious as Scenario D. These very differences in the scenarios reveal the most critical issues about the future competitiveness

of Baden-Württemberg as an attractive center for the IT industry. Specifically, it is crucial to improve the residents' acceptance of the use of new ICTs and to prevent the society from fragmentation by reducing the digital divide, in order to avoid any negative developments as shown in Scenario D.

Additionally, it is concluded that the following three points are also essential: A global strategy of IT industry, development and provision of interactive media products, and the construction of technological infrastructures for networking society. If the existing manufacturing industry falls into a crisis situation, IT firms may also become embroiled in the crisis. An important key to avoiding such a consequence would be a restructuring of business operations to develop new areas of technology, such as medical technology and energy technology, in addition to the relationship with global partners. In particular, it is essential for the media industry to establish a concept of interactive media, with a thorough focus on the development of media integration, while making use of the existing strengths in publication and internet-related services. In order to realize an "always-on" society, it is also important to develop the technological infrastructures that bring about social networking, such as telecommunication networks for all residents, intelligent traffic information systems, and online-learning systems.

5 Remarks

Germany has been developed decentralization of power from federal government to state governments, and its development of land is balanced with large cities dispersed. Japan, in contrast, is quite unbalanced, with an over concentration in the Tokyo metropolitan area. Particularly in the policy for the advanced science and technology, decentralization is not practically functioning. To revitalize local areas and regions, it is important to have, not short-term, but rather long-term foresight and visions based on the analysis of regional characteristics. In that sense, the FAZIT report shows a great example. That report presents a useful method where successful and unsuccessful scenarios are examined and compared after the discussion of how to transform the industrial structure if there is a declining industry in the region. Although the FAZIT report introduced in this article focuses only on the information and media industries, the method used there can certainly be applied to regional foresight for other new industries.

[Reference] Background of Implementation of Regional Foresight Project

Overview of Baden-Württemberg

Germany is made up of 16 federal states, and its governance is decentralized under the Basic Law. Regarding research-and-development budget, the amount of public funding is 30% of the total fund from public and private sectors. The federal government and the state governments provide a roughly equal share of the public funding. Thus, the state governments also play an important role in research and development in the country.

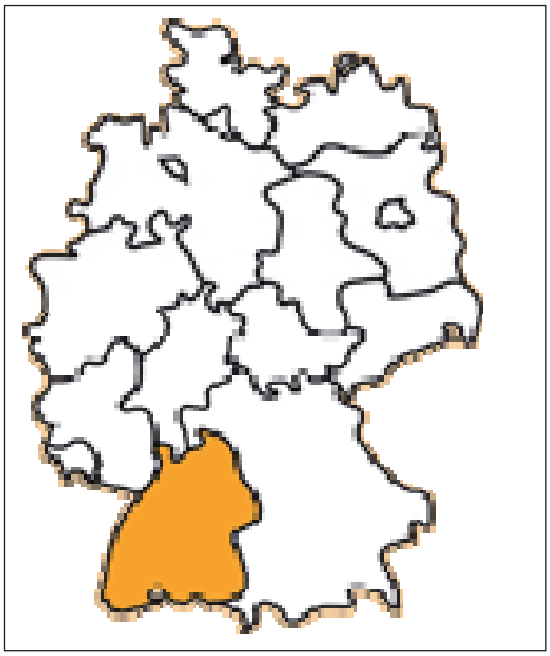
Baden-Württemberg is located in the south of Germany and is bordered by France and Switzerland. Baden-Württemberg is the home of the automobile industry (Bosch, Daimler, Porsche, etc.) and some other global companies. Many branches of Japanese manufacturers are also located around Stuttgart. The proportion of sales of state companies is 15.8% for the automobile industry, 9.9% for the machine industry, and 6.8% for the IT and media industries.[5] There are many higher education institutions and major research institutes in Baden-Württemberg. As a result, research and development is being conducted actively in the state along with Freistaat Bayern (capital: München) and Nordrhein-Westfalen (capital: Düsseldorf). Baden-Württemberg occupies only 10% of the land and population of Germany, but its R&D expenditures (80% of which comes from industries) and number of patent applications account for approximately 30% of the country's total.

Foresight activities in Germany

In Europe, the European Commission has supported foresight activities with network management (monitoring of activities), manual preparation, and holding of conferences. Under such conditions, various foresight projects have being implemented by Europe as a whole as well as by each country and region. The monitoring report 2007[10] made an analysis of foresight project information in a total of 56 countries and 9 regions around the world. According to the report, about 70% of 517 projects targeted nation-wide foresights and 15% targeted regional foresights. In Germany, however, the number of regional foresights

has increased during the last decade. The report says that the half (19 out of 39) of the foresight projects conducted in Germany targeted regions.

The Federal Ministry of Education and Research (BMMF) in Germany has conducted nation-wide foresight projects since the beginning of the 1990s. The Futur[11], launched in 2001, received much attention with respect to the participatory approach, where various people try to identify future research themes through their successive discussions. A new nation-wide foresight process began in 2007 and it is currently at the final stage. Besides Baden-Württemberg, Bayern, Rheinland-Pfalz, Sachsen-Anhalt, and other states have conducted regional foresight projects.



Location of Baden-Württemberg

Source: Reference[6]

Area: About 35,751 km^2 (10%, Third)
Population: About 10.75 million (13%, Third)
Capital: Stuttgart
GDP: € 353 billion (15%, Third)
R&D expenditure: € 14.4 billion (25%, First)
(4.28% of GDP, whereas 2.54% of GDP at a federal level)
Number of patent applications: 13,638 (29%, First)
Higher education institutions: 68 (17%, First)
Main research institutions:
Research institutions under the Max-Planck Institute: 12
Research institutions under the Fraunhofer Institute: 15, etc.

In the bracket, the percentage in the country and the ranking among the 16 states are indicated.

Overview of Baden-Württemberg

Source: Reference[7-9]

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