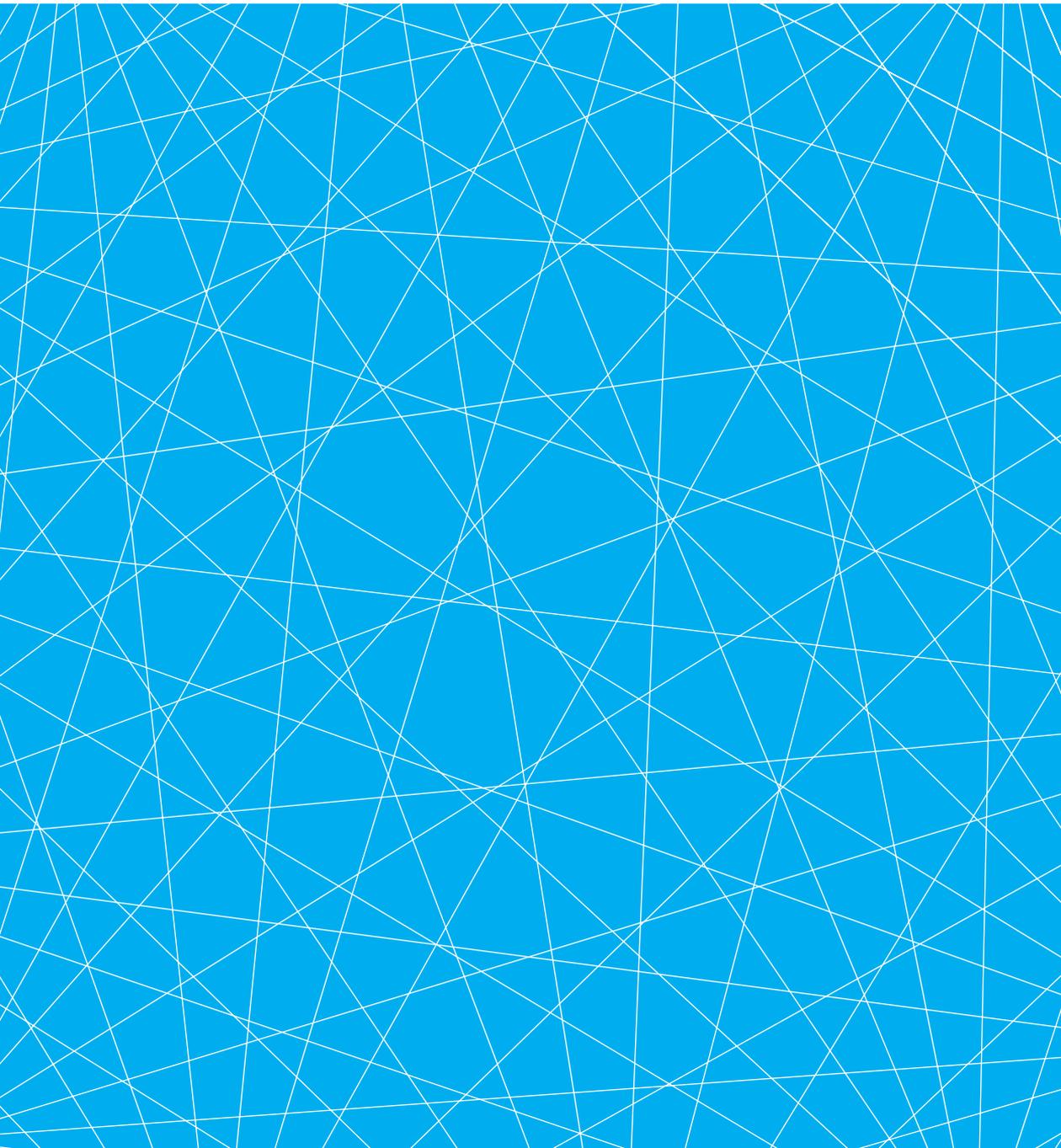


# Germany 2030

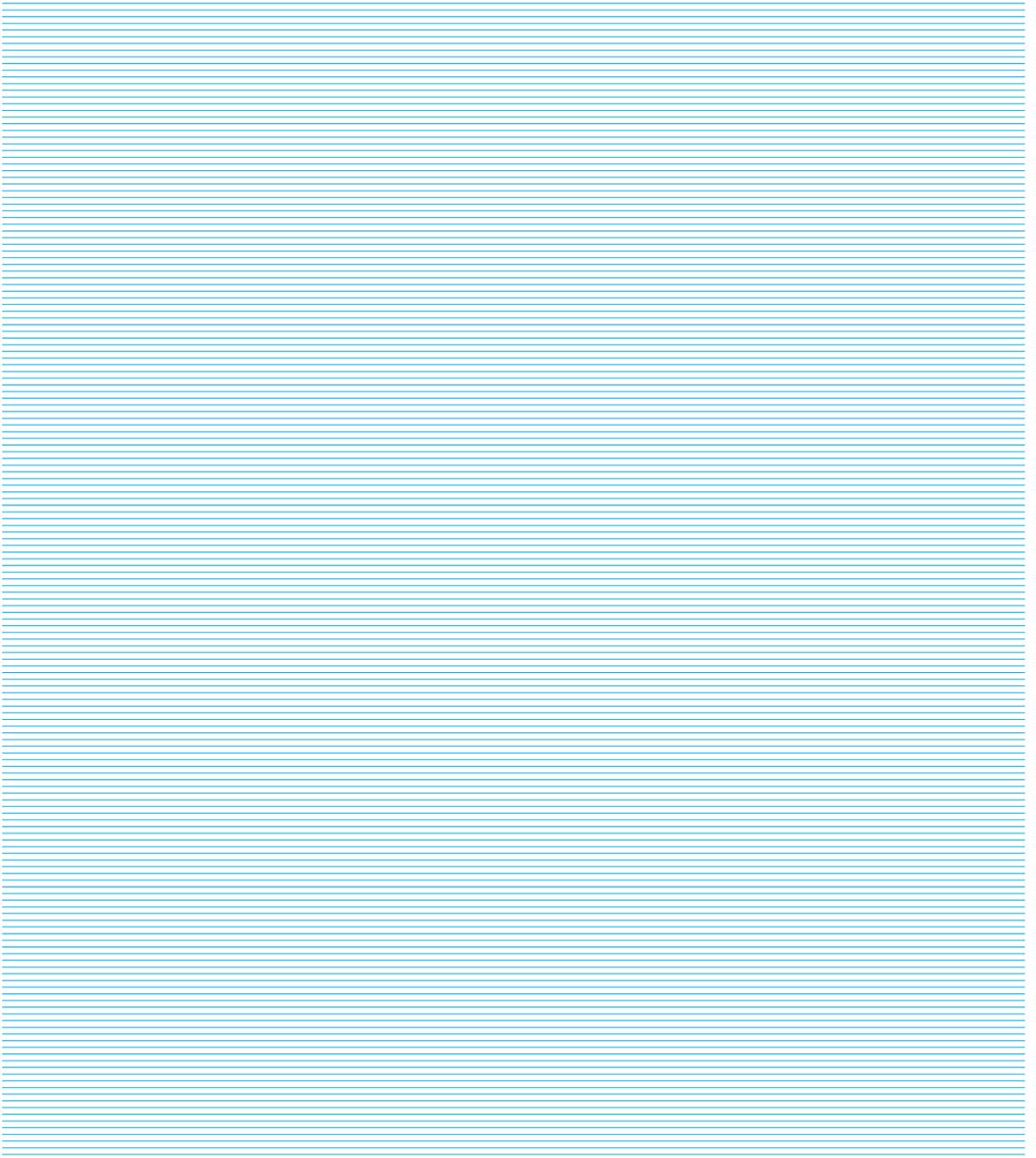
## Future perspectives for value creation



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## **Germany 2030**

Future perspectives for value creation



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# Foreword

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In this study the BDI is looking to the future: the BDI working group “Innovation Strategies Geared to Value Creation”, composed of experts from business enterprises and BDI member associations, submits its assessments for the future of value creation in Germany 2030. The study was commissioned by the BDI/BDA Committee for Research, Innovation and Technology Policy and was supported by Z\_punkt, an institute concerned with strategic questions of the future. The results go beyond the extrapolation of trends or the condensing of existing studies on future research. The analysis focuses on the disruptions and possible developments which could have a major impact on the manner and the extent of what we in Germany produce and consume. In concrete terms: what radical technological, economic and social changes can be expected by 2030 and what possible effects can they have on value creation and jobs in Germany? How can the opportunities be grasped and the risks minimised? How should the overall political framework be devised, especially with regard to the promotion of research?

These questions require an ongoing discussion in the business community, academia, society and among policy-makers to which this study seeks to make a contribution. Whatever the diversity of the judgements and conclusions expressed, they all share the common goal of strengthening Germany as an industrial nation for the future.

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The study was commissioned by the BDI/BDA Committee for Research, Innovation and Technology Policy. It was carried out by the members of the working group on “Innovation Strategies Geared to Value Creation”, which was set up by the committee and was supported by Z\_punkt, The Foresight Company, a consultancy for strategic questions of the future.

The contents are not to be identified with existing BDI positions, nor do the statements, assessments and recommendations of individual authors or groups of authors reflect the opinions of all authors or of the business enterprises they represent.

Constituting a discussion paper, the contents reflect the evaluations and conclusions which call for a debate on the future of value creation in Germany. The study seeks to make a contribution to the discussion of the opportunities and risks posed by technological change in business, politics and society. The paper is aimed at all interested parties in the general public and was thus deliberately written in generally understandable language and with an extensive glossary.

# 1. Management Summary

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The nuclear catastrophe of Fukushima and Germany's switch in energy policy are a clarion call: Germany, Europe and the world are undergoing a phase of rapid change. The dynamism which has built up in the finance and currency areas, in ecological and demographic questions, added to the high volatility in many economic and social fields, all these factors point to a future in which change will not be the exception but the rule, a future full of turmoil and upheavals. That is the basic assumption of this study.

What technical, economic and social upheavals can be expected by 2030? And what possible impact will they have on value creation in Germany? In presenting this qualitatively oriented forward-looking study, the "Innovation Strategies Geared to Value Creation" working group of the BDI, supported by Z\_punkt The Foresight Company, is consciously breaking new ground<sup>1</sup>. The primary objective is to assess the opportunities and risks for value creation over the next two decades and to initiate a broadly based discussion on how value creation and consequently jobs can be preserved in Germany on a sustainable basis.

In the process it becomes clear that new forms of constructive and cooperative interaction between politics, society and industry are necessary. This cooperation should also find expression in viable future business models for enterprises. The most important findings of the study:

Classical boundaries between sectors are disappearing. New comprehensive spheres of activity and forms of cooperation are emerging. With regard to health, for example, the focus is on the individual within large groups of patients, his genetic make-up, his behaviour, and his own individual environment. Personalised medicine takes account of these factors. In research, interdisciplinary thinking is finally winning through. Branches no longer regard each other as alien but cooperate provided that they can participate in a common business model. Tailor-made supply packages of products and services are winning ground. The classic sectors are increasingly

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1 Along with the short version, as presented in this brochure, a download of the German long version is available: [www.bdi.eu/publikationen\\_zukunftsstudie.htm](http://www.bdi.eu/publikationen_zukunftsstudie.htm)

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losing importance. In the areas of health, nutrition and cosmetics, for example, new target-oriented alliances are emerging.

Value creation in 2030 demands a systemic and integrated understanding of innovation. Mobility, for example: the centre-stage is no longer taken by the automobile as a symbol of individual transport but by the provision of intelligent mobility which transcends individual modes of transport. It is imperative to decide on quality objectives: what kind of mobility do we actually want, at what price and on what conditions? New players are entering the market: producers of post-fossil propulsion systems or batteries, energy and IT suppliers. Municipalities and regions are taking on more responsibility and are redefining public transport as an integral part of international mobility. Networked information services are bringing about seamless mobility encompassing all modes of transport.

Omnipresent information dissemination will tend to win through in all sectors and areas of life. An “Internet of Things” will come into being where not only human beings but also objects will exchange information autonomously. The outlook is for an autonomous and global control of decentralised production processes in real time. The physical and the digital world will be linked. Knowledge-based systems help to control complexity. The blending of the systems harbours immense potential – but also risks. In future, IT security will play a major role.

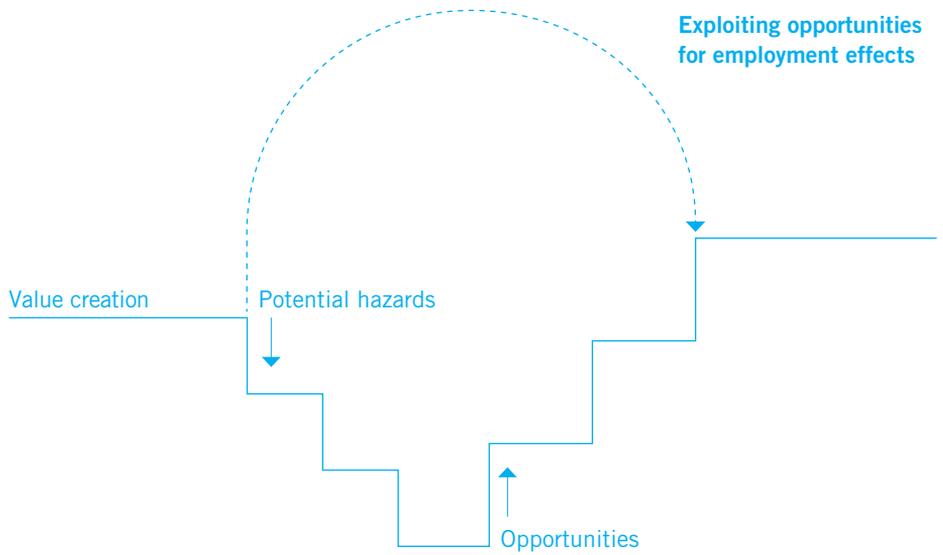
The value creation of the next two decades will ultimately be shaped by sustainable solutions. Germany is an industrial nation with few raw materials. Security of supply is and will remain an issue with high priority. Whether it be the switch in energy policy, the enhancing of resources efficiency or recycling loop systems, a sustainable innovation strategy will take account of many-sided and unconventional approaches. And there are definitely export opportunities in the area of sustainable infrastructure. That applies to power station technologies, storage systems in the context of the smart grid and to energy efficiency – growth markets of the 21st century.

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Future business logic requires a new orientation of stakeholder and customer relations. Even today, customer communities in the internet already exercise considerable influence. Their strength lies in the openness of their communication. Positions in the market place – of producers, suppliers, customers and NGOs – are already shifting. Business enterprises can fall victim to this dynamism, but they can also use it to their own advantage. Success will come to those capable of forging new alliances. But a note of caution must be added: as a result of growing complexity, it is becoming increasingly difficult to control processes. That is another reason why emotional bonding for customer and brand is so important. Future-oriented products and services, for an ageing society for example, require communication which extends not only beyond sectoral boundaries but also includes the customer as an innovator.

Change is frequently triggered by new discoveries in science and technology. Yet implementation in the market takes place only on condition that the proper infrastructure, environment and business models are all in place. That is why the opportunities and risks for value creation 2030 make their presence felt not least in the labour market. It is the human being who is at the centre of the business world. For him there must be a bridge from the old to the new world of employment.

Figure 1:  
Value creation and employment effects



## 2. Procedure

Figure 2:  
Project design

### **Trends**

Current trends of value creation

### **Disruptions**

Candidates for breaks in trends

### **Areas of activity**

Cross-sectoral categories of need

Change is omnipresent. It is picking up speed and its complexity is increasing, so much is apparent in all branches of industry. Uncertainty is a feature of the business environment, both in competition and in the markets. And Germany's economy is interlocked with the global economy to a special degree. Social and economic upheavals in the coming two decades are already making themselves felt. They will lead to radical changes in the processes of value creation. A planning projection would therefore seem to be indispensable. And yet, how do high volatility, an uncertain overall framework and the development of a future-oriented innovation policy all fit together? And what does that mean for the value creation of the German economy?

That is the background against which the BDI working group "Innovation Strategies Geared to Value Creation" awarded the commission for the present study<sup>2</sup> to Z\_punkt The Foresight Company. The results are based on a methodological approach specially developed by Z\_punkt and on intensive and constructive discussions with the members of the working group.

<sup>2</sup> For the long version see footnote on p. 8

**Analysis of the impact on value creation**

**New paradigms**  
Superordinate patterns in value creation

**New focuses of investment**  
Guidelines for industry

**New alignment of practice of promotion**  
Guidelines for politics

The changes already making themselves felt are frequently of a disruptive nature – by definition they cannot be predicted. That makes it all the more vital in future to investigate fundamental upheavals and to assess the consequences for value creation at an early stage.

Exploring possible opportunities and risks promises a substantial increase in awareness and opens up options for action. Changes can be rapid, violent and radical. Those who make allowances for disruptions are better prepared for the increasingly volatile conditions under which the German economy can and must operate up to 2030.

The demands made on the investigation are considerable, those made on the range of instruments no less so. A journey through the project (see fig. 2) seeks to make this clear. Where do we stand today? The starting point is described with the help of current trends in value creation (chapter 3). These include, for example, the reduction of in-house production depth, a general intensification of knowledge and changed customer requirements. Subsequently, five intersectoral spheres of activity are considered more closely: mobility, climate and energy, health and nutrition, communications and security. The

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selection corresponds to the “High-Tech Strategy 2020” of the German government<sup>3</sup>. There are also super-ordinate issues affecting all areas, such as a lack of technology acceptance.

This is followed by the decisive step. Possible obstacles to value creation, known as disruptions, are identified. They form the special methodological approach of the study (chapter 4). These disruptions are breaks in trends and cannot simply be extrapolated from existing trends. Their emergence creates to some extent completely new framework conditions which the present study describes in entry scenarios. Should the disruptions actually take place, a major impact on the structure of value creation in Germany must be reckoned with. External shocks can also have an impact as well as the arrival at tipping points: continuous developments in the interplay of various factors lead to a point where the situation topples over. From then on there is serious instability. In the business community we often experience such breaks in trends in the form of non-linear developments. One need only think of the bursting of the dotcom bubble in March 2000.

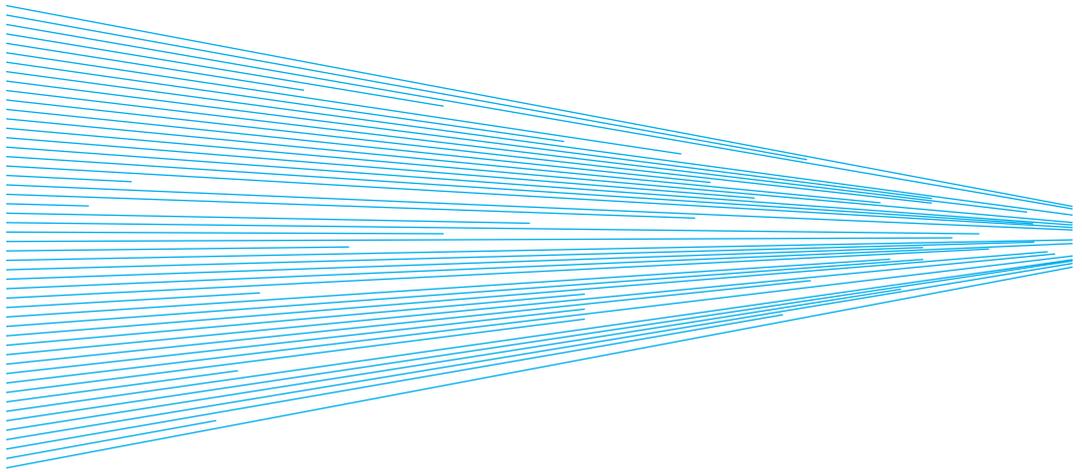
The disruptions are arranged according to the five areas of activity addressed as well as the topics affection all sectors. Of 325 possible disruptions that were originally identified, 28 finally remained which were then subjected to a thorough analysis (chapter 4; here 18 of the 28 disruptions investigated are set out). The decisive selection criteria for the members of the working group on “Innovation Strategies Geared to Value Creation” were the force and breath of the impact expected.

It is the goal of the selection process to identify candidates for major changes in the structures of value creation. As a rule they are issues which are already being discussed, but whose relevance has not yet been felt in the markets.

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3 Federal Ministry of Education and Research (Ed.): Ideas. Innovation. Prosperity. High-Tech-Strategy 2020 for Germany. Bonn, Berlin 2010  
<http://www.hightech-strategie.de/en/index.php>

Figure 3  
Disruption analysis



In general: approx. 125 disruptions  
Areas of activity: approx. 200 disruptions

**28 Disruptions**

**IDENTIFICATION**

- Criteria:
- force of impact
  - degree of novelty

- Procedure:
- surveys and workshops
  - branch analyses
  - analysis of reciprocal effects

Z\_punkt

**SELECTION 1**

- Criteria:
- force of impact
  - breadth of impact
  - foresight knowledge
  - manageability

Z\_punkt

**SELECTION 2**

- force of impact
- breadth of impact
- foresight knowledge
- manageability

BDI and Z\_punkt

**DESCRIPTION**

- Components of description:
- cause/trigger
  - character/description
  - change
  - displacement degree
  - novel effects
  - need for action

BDI and Z\_punkt

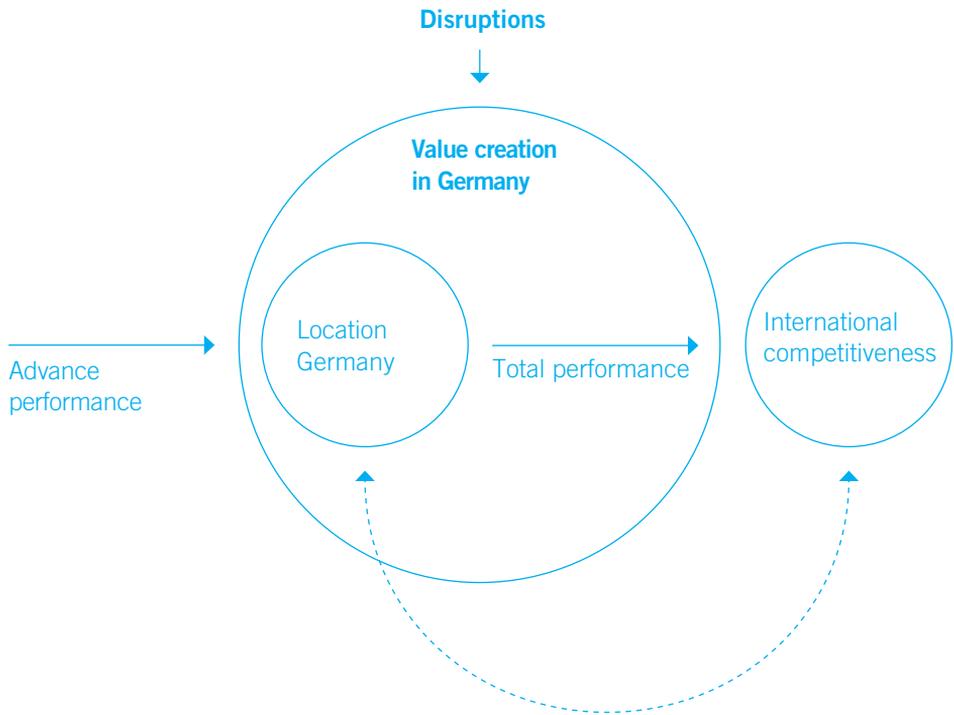
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Subsequently the initial factors are described for the entry scenario of the disruptions. The emphasis is not on predicting disruptions but on the early assessment of possible consequences on value creation. Here the opportunities and risks become clear. The outlines of new patterns of value creation emerge and the scope for action for politics, industry and society becomes visible. Participants in the BDI working group “Innovation Strategies Geared to Value Creation” have estimated the opportunities, risks and effects on the gross value creation in the economy and on employment. Naturally future prognoses are subject to a high degree of uncertainty – all the more so against the background of the dynamic and complex changes shaping future value creation.

The effects of a disruption of value creation must not be considered in isolation. What is decisive is the dynamism which arises from the interplay of various trends. This releases unimagined forces, resulting in a change of paradigm (chapter 5): The “rules of the game” change. Value chains are subjected to a redesign, new value clusters come into being. Both the change in the “rules of the game” and the new composition of the value chains require far-sightedness in adjustment – the central message of the study. This affects, for example, the interconnections within traditional branches and also those in new branches. Communication and interaction are the locomotives driving thrusts of innovation and previously unknown business models.

Paradigm shifts have a major influence on the international competitiveness of the German economy. Its location factors are thereby called into question and must be adapted. Safeguarding value creation in Germany in the long term requires intelligent and efficient cooperation between the participants in society, politics and the economy. If need be, a new mode of cooperation will have to be found. This is the aim of the recommendations for a value creation oriented innovation policy and a value creation oriented culture of innovation (chapter 6). The prime goal is to maintain the competitiveness of the German economy.

Figure 4:  
Disruptions and their impact  
on value creation in Germany



# 3.

## Trends and driving forces of value creation

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A trend is a development lasting several years and empirically documented. Trends usually run a steady course, cyclical changes and fluctuations do not affect them, nor do changes of course or sharp rises. As a rule trends follow a clear direction, their course is robust.

Trends describe a continuation of events according to the principle “business as usual”. That is why they can be seen as forming the necessary backdrop needed for deviations, disturbances and disruptions to become visible. The present condensed version of the study takes as examples six of originally 15 central trends in the area of value creation, describing them from an inter-sectoral and global perspective.

The selection of the 15 trends is based on a survey among companies and associations in the BDI working group “Innovation Strategies Geared to Value Creation” and on detailed research by Z\_punkt the Foresight Company.

Figure 5: Current trends

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## TRENDS AND DRIVERS OF VALUE CREATION

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**1 Growing importance of inter-sectoral, international value creation partnerships**

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2 Continuing globalisation

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**3 Reduction of production depth – reduction of value creation depth**

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**4 Craving share of services in value creation**

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5 Knowledge intensification of value creation

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**6 Change in customer requirements**

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**7 Individualisation and personalisation of supply**

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8 Automation of process stages

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**9 Digital integration of processes**

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10 New intelligent logistics concepts

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11 Increased use of materials with new properties

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12 Change in raw materials situation

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13 Increasing importance of waste management and recycling technologies

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14 Increasing importance of sustainability

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15 Diversity management

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### **Increasing importance of inter-sectoral, international value creation partnerships.**

Future technologies are biotopes for new cooperation between enterprises from different branches of industry. In the field of electromobility this involves not merely the classic automobile manufacturers but also energy utilities and participants from the IT sector. Strategic alliances such as these are increasingly deciding over success or failure, across national borders. On the horizontal level, new areas of knowledge and additional groups of customers are becoming accessible for the individual enterprises. Along the value chain, this provides enterprises with the opportunity to integrate further services but also raises the danger of losing core competences and thus value creation. From product to service can also mean service instead of product. It is not necessary to own an automobile in order to drive a car – mobility as a service thus illustrates a new business opportunity.

Partial cooperation with competitors (coopetition) only makes sense when no direct competition is to be feared and when it offers substantial cost-cutting potential. International competitors which supply other markets are practically an invitation to be coopetition partners. Joint development of components or products is already common in the automobile industry.

Open innovation goes one step further by actively including customers, strategic partners and – in the pre-competitive stage – even competitors in product development. The driving forces of these developments are globalisation, the potential of joint business opportunities and shorter product life cycles. They also prompt enterprises to communicate their innovation processes openly and to optimise them.

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### **Reduction of depth of value creation**

The sustained success of enterprises rests on being strategically positioned. Apart from financial and personnel resources, competitiveness crucially depends on how enterprises specialise in a particular area of the value creation chain and thus develop a core competence. One direct consequence is a reduction in depth of value creation. In the automobile industry (OEMs) it is around 20 percent.

The driving forces behind this development are a growing dynamism of innovation and the rising pressure of costs. In many cases outsourcing has been and still remains the solution. A precondition is that services and production processes can be standardised.

In the global economy some regions have emerged with special competences and their own profile. They have become ideal locations in which to outsource certain parts of value creation. For example, India acts as a global services centre for IT-based services. China has gained a reputation as the workbench of the world. However, in future it may be that processes once outsourced are shifted back again to a growing extent. The reasons are rising wages and economic policy reforms in the relevant regions.

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### **Rising proportion of services in value creation**

In manufacturing industry a paradigm shift is taking place: enterprises are transforming themselves from mere producers of products into suppliers of integrated solutions. The dividing line between goods and services is dissolving. This trend is becoming increasingly clear in mechanical engineering. Companies are not merely supplying products but also ancillary services such as maintenance. Or they may act from the outset as operators with the service then replacing the purchase of the product. The same applies equally to medical technology, optics and the electrical industry.

### **Change in customer requirements**

The packaging of product and service not only keeps the competition at a distance, above all it helps the customer. Without doubt, in times of saturated markets, customer retention takes on more importance. Success only comes when the enterprise succeeds in establishing a lasting emotional bond with the consumer.

Service-orientation requires special know-how. Conventional market research is frequently not sufficient. Opening up to the service idea therefore demands of the classic industrial enterprise that it changes its own corporate culture. Knowledge of customer requirements must also be meaningfully integrated into the processes and be comprehensively exploited.

Products for a growing customer segment 50+ are increasingly following a design that does not make their users look “old” but rather gives them the feeling of “eternal youth” and discreetly masks their personal weaknesses. Examples are the current boom on liner cruises, fitness studios for the elderly or cars that are simpler to get into and offer the driver assistance. The “new senior citizens” are more mobile and healthier than previous generations of the elderly and have more money to spend. This development is a direct result of demographic change and the spread of prosperity in society. Smart, long-lasting and timeless design has a future.

---

Convenience is much more than fast food. A broadly based trend is pointing towards an intelligent lightening of the load of daily life. Pressure of time, mobility and an enormous flood of information which has to be grasped are the driving forces of this development.

Many customers proceed on the principle: let's improve the world while shopping. And that applies not only to food. In the case of consumer goods, travelling and dwellings, ecological and social dimensions are becoming the centre of attention. However, customers are not prepared to go without their accustomed amenities or high quality. There is a growing market for products with higher ecological and social standards. Yet in times of growing transparency through NGOs and the social web, an "ecological halo" (greenwashing) is becoming a genuine risk for enterprises.

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### **Individualising and personalising supply**

The need for individualising in all areas of life is unbroken – and will remain so. The potential of mass production for mature markets is increasingly exhausted. In order to meet the refined needs of their customers, enterprises are faced with the lasting task of greater differentiation of the product and services portfolios. One possible solution is mass customisation, producing for individual customers. Buying the right bicycle, if it is not to be one off the peg, is no simple matter any longer.

Another route is offered by modular production, which has long become common in the IT sector. For enterprises new channels of communication have decisive advantages, at the digital level these are user toolkits and product configurations. Customer requirements are becoming more demanding and are more transparent than ever before, yet the cost of product development must still be cut even further.

Internet and e-commerce platforms create user-friendly distribution models. Where sales and distribution are concerned, limitations imposed by shelf area and showrooms are things of the past. The digital path means a broad spectrum of niche products reaches a critical mass. In this way a variety of micro-markets has come into being alongside the mass market.

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### Digital process integration

Standardisation and digitalisation go hand in hand. The digital penetration of enterprises is continuing apace, whether in marketing, sales, service, procurement, production or logistics. After the e-commerce wave, increased attention is now being turned to optimising internal processes and those between enterprises. The advantages are obvious: efficiency, flexibility and a general acceleration. The template is the real time enterprise in which all relevant information is available in a digital model. Decisions and options for action are modelled with computer assistance – and can be seen in the planning of factory and construction progress.

With cloud computing the starting bell has now sounded for another round in the progress of information technology in industry. The process follows the logic of outsourcing. With scale effects and flexible service models – the software no longer on the hard disc but as a service – major economies are possible in spite of increasing the extent of service. At the same time, there is increased dependence. Data protection and security of the outsourced data have to be guaranteed. Experts have a clear vision of the virtual enterprise of the future. It consists of a network of firms and free-lance personnel, it works project-related, and its customers are integrated as co-producers. However, such extremely flexible structures with temporary corporate goals and flat hierarchies have problems of their own. They start with the training of personnel, continue with labour law, and end in an (intended) blurring between free-lance and salaried staff, between work and leisure time.

# 4.

## Disruptions – opportunities and risks for value creation

Whereas trends lead to more or less clearly foreseeable changes in value creation, the impact of the list of disruptions on value creation in the year 2030 is complex and hardly calculable. Yet despite all uncertainties, opportunities and risks have to be surveyed and assessed. New alliances, changed competitive structures, and innovative business models are emerging. Bottlenecks affecting resources are not only conceivable but probable; in the digital age, knowledge and technology are decidedly fluid. It is a constant challenge to keep them available and develop them. And what must not be forgotten is the social acceptance which is necessary if new solutions and services are to endure at all.

Figure 6: List of disruptions

If disruptions become virulent, they pose a significant hazard for value creation and thus for employment. However, for enterprises which recognise the change in good time, opportunities open up. In order to grasp them, not only the enterprises and their decision-makers but also large parts of the population must be ready for new tasks. Obstacles along this path are frequently a lack of education and cultural barriers. Whether these can be overcome depends on the readiness of society and its institutions, namely kindergarten, schools, universities and state institutions. But it is also up to each individual. Behind value creation stand human beings with their experiences and their biographies, with children and families. For them there must be a bridge from the old world of employment to the new. The new world must offer jobs for as many people as possible, while granting them access to the necessary qualifications and remaining open for changes.

Subsequently the disruptions (18 out of 28 investigated) are first outlined in an entry scenario and on this basis there follows an analysis of the impact on value creation.

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#### **AREA OF ACTIVITY – MOBILITY**

**1 Mobility changes from product to service business**

**2 New competitors change the mobility market**

3 Automation of traffic flows

4 Massive reduction in traffic volume

5 Breakthrough of new logistics systems

**6 Integration of mobility and energy networks**

**7 Electro-mobility leads to new value creation structures**

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#### **AREA OF ACTIVITY – CLIMATE AND ENERGY**

**1 Far-reaching decentralisation of energy supply**

2 Worldwide faster and more consistent switch to renewable energies

3 Major dependence on energy imports

**4 Struggle for new sources of raw materials and energy**

5 Technologies for exploiting CO<sub>2</sub> find wide application

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#### **AREA OF ACTIVITY – HEALTH AND NUTRITION**

**1 Personalised medicine experiences a breakthrough**

2 Massive curtailing of public health care

3 Systems suppliers change competition in health sector

**4 New convergence markets arise in nutrition sector**

5 Sustainable nutrition industry wins through

**6 Shortage of resources in agricultural sector.**

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#### **AREA OF ACTIVITY – COMMUNICATION**

1 Individualised media use becomes standard

**2 “Internet of Things” opens up completely new business potential**

**3 Community-based customer behaviour detonates traditional business models**

**4 Knowledge-based systems at the centre of future value creation**

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#### **AREA OF ACTIVITY – SECURITY**

**1 Increased system complexity – higher potential hazard – global extent of damage**

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#### **INTER-SECTORAL FRAMEWORK CONDITIONS**

**1 Lack of acceptance for technology in Europe**

**2 Declining quality and investment holdup through lack of skilled labour**

**3 Reciprocal effects in global finance and currency system and the arrival of new players**

**4 Development of international trade relations with question mark**

**5 Complete internalisation of external costs**

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## Area of activity – mobility

We face great upheavals in global mobility. The driving forces are manifold: growing regulation in the climate and environment area, high price volatility in the raw material sector and intensification of competition stemming from producers in emerging countries. For example, in Germany the automobile industry has for decades occupied a key position in the nation's industry. Now competitors from outside the sector are encroaching onto this territory. New alliances and strategic partnerships with operators previously alien to the sector will be decisive for safeguarding the market position.

New propulsion systems and continuing IT integration in cars, buses, trains and aircraft, together with the attendant infrastructure lead to value creation structures undergoing lasting change. This includes, for example, electro-mobility and the intermodal linking of various transport carriers.

Connectivity in the mobility sector will continue to advance. Seamless mobility is the demand to guarantee a safe, efficient and sustainable transport of people and goods. This gives rise to reciprocal effects with the energy sector and the IT branch. Disruptions in the business sector are the result. The main emphasis lies on the benefits for the economy as a whole, but also for each individual, with a cut in traffic congestion, increased safety and better protection of the environment.

Figure 7:  
Disruptions in the mobility area of activity

POSITION	DISRUPTIONS	EMPLOYMENT	VALUE CREATION
1	Mobility changes from product to services business	-/(+)	-/(+)
2	New competitors change the mobility market	-/(+)	-/(+)
3	Automation of traffic flows	+	+
4	Massive drop in volume of traffic	-	-
5	Breakthrough of new logistics systems	+	+
6	Integration of mobility and energy networks	+	+
7	Electro-mobility leads to new value creation structures	-	-

## Mobility is changing from product to services business

---

### Entry scenario

In 2030 mobility will be marked by a change of values in society. The key words are: climate protection and sustainability, urban quality of life, time efficiency and the rediscovery of the region – not least as a result of higher transport costs. Traffic bottlenecks and congestion will increase through lack of maintenance and inadequate expansion of infrastructure. High energy prices for fossil energy sources will lead to more transport offers.

If the development of today's smart phones is projected into the future, an omnipresent and highly networked computerisation of the whole of everyday life is conceivable. Successful concepts in the market make possible a seamless, uncomplicated and economical door-to-door mobility, by plane, train, car or bicycle. In cities cars will be speedily found and used when needed.

## Effects

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The opportunities for suppliers consist not only of providing fleets of cars and infrastructure but also of information services which make total journey planning possible with switching between different modes of transport – thanks to real-time traffic information, traffic control systems, mobility maps, access technology, and ticketing, all stemming from one source. Public transport develops into a platform supplier, traditional car manufacturers become providers of mobility services. The preconditions are: Focus on the customer, readiness for cooperation and for financing new infrastructures.

This requires a fundamental cultural change from manufacturers and operators; a move away from the engineering-based product towards an integrated solution and systemic services innovation. This brings us to the risks. It is a fact that the principle of “using not owning” can mean demand for vehicles will fall. Jobs can be lost at precisely the traditional component suppliers. While new jobs are created for new components, such as batteries or electric motors, on the other hand competences are gradually lost for combustion engines and gearboxes. The electric motor is revolutionising the whole power train and brakes and steering as well. This is a systemic new approach. The question is only, who will benefit from it and where. On balance, a negative effect on value creation can be predicted. Losses in development and production cannot be offset by a new range of services offered.

## New competitors change the mobility market

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### Entry scenario

In the emerging nations new competitors are gaining ground with significant market shares and customer segments. In the private car area it is particularly Asian manufacturers with much lower development, production and distribution costs who are dominating the low-cost segment with its huge potential for growth. Low-cost production is hardly possible in Germany. Should it be forced through by global competition, this would be a disruption impacting on the labour market and the whole of society. German manufacturers should aim to counteract any such trend with higher quality. Higher quality means higher prices. The precondition must be an intensification of research and development, something which must also be understood by the politicians.

## Effects

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When electro-mobility and mobility services increase in general, new players previously alien to the sector also claim a share of the business: for them it is an opportunity, for traditional automobile manufacturers and their suppliers it is more of a risk.

In the automobile sector traditional enterprises can also benefit when they cooperate with the new actors, or if they consciously set themselves apart from the low-cost suppliers with little product variety. In the field of electro-mobility additional opportunities arise through enterprises developing and producing their own e-components, through innovative platform strategies, and the manufacture of new composite materials. Risks for value creation arise for enterprises whose sales potential is cut by the market entry of new competitors. In the long term there is a danger that customers will adopt a low-cost, high-quality mentality. That would impair readiness to pay appropriate prices for high class products.

Train and aircraft construction is also faced with competition from the Far East. Capacities and technical quality have reached a level which enables the new contractors to supply international markets: local to local is followed by local to global. Aviation can be predicted to be a growing market, which reduces the risk to sales, unless competition is distorted by extreme protectionist measures. Competition is growing for suppliers through new aircraft concepts in the medium haul area. At the same time, for Germany's suppliers to aircraft construction there is potential since they make a contribution to the new competitors being able to offer products at world market level. German manufacturers already have a lead in substitutes for scarce raw materials and in recycling. Here they can continue to raise their profile.

In the premium automotive segment there is a fundamental danger that jobs will be lost. New demand in the labour market comes from the sales and distribution structures of foreign manufacturers and in mobility services. In view of the growing market, an increase in jobs is also to be expected in aircraft construction. However, the total sum of the impact on the labour market is neutral at best.

## Electro-mobility leads to new structures of value creation

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### Entry scenario

A key technology of electro-mobility is the battery. A major increase in energy density – a shift away from lead and towards the lithium-ion accumulator – was what made the boom in new electric vehicles possible in the first place. In the year 2030 electro-mobility will have finally made the breakthrough. This means new players force their way into the market, there is a shift in traditional power relationships, classic core business disintegrates. New players in the game, for example, are also municipalities and their utilities, and enterprises which have specialised in managing vehicle fleets. Electric vehicles are especially well-suited for short journeys: they are the classic last-mile vehicle. All in all, electro-mobility will lead to complex value create networks with traditional automobile manufacturers and their suppliers, energy supply enterprises, software producers, the operators of account settlement systems and mobility service providers and user communities. The relative market power of the players will crucially depend on their skill in forging alliances.

## Effects

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Enterprises which enter the market with new supplies at an early stage have an early-mover advantage. It can be predicted that the value creation proportion of batteries (in plug-in hybrids and purely electric vehicles) including the services round the energy storage system will be considerable, even if the accumulators become lower in price. In contrast, the previous key technology, the powertrain, will relatively decline in importance. Battery technology is resource-intensive. Not only lithium but also cobalt, nickel and copper are used along with high tech raw materials such as neodymium for the control electronics. For all these resources it must be stated that Germany does not have them, or not enough of them, which without any doubt puts security of supply in jeopardy to a degree which must be taken seriously!

Electro-mobility contributes to the long-term safeguarding of jobs in the German automobile industry. Higher productivity in the manufacture of the electric motor possibly constitutes a negative impulse for employment. For the development of gross value creation it will be crucial whether the major parts of the core component of electro-mobility, the battery, can be produced in Germany. The assumption so far must be that only batteries for the top segment will be produced in this country.

## Integration of mobility and energy networks

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### Entry scenario

The expansion of electro-mobility requires new forms of energy provision. The drawbacks of batteries are foreseeable yet remain: high weight and volume. This foils efforts to reduce vehicle weight by light weight construction. Yet energy-efficient and thus carbon dioxide reduced mobility is becoming more and more necessary. A solution could emerge by 2030 at the latest if the electric current required is generated and supplied along the mobility networks – perhaps even regained and stored. Intelligent solutions tend to be decentralised solutions. They embed the generation of renewable energy in dwellings, offices, storehouses, city districts or factories and integrate the function in smart energy networks.

## Effects

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In this case transport services from door to door are calculated in kilowatt hours per kilometre. The costs vary according to the place and time of day and also according to the weight and pace of the goods to be carried. The change in the energy system, with less diesel/petrol and more (transport) current, makes new regulations and control systems probable. In future there are likely to be differentiated tariffs, which charge costs according to time or form of use, such as for haulage or for private households. All these harbour opportunities.

The development of electro-mobility integrated into the energy network of the future demands major investment, both in technology and in infrastructure. In the long term this can certainly produce improvements in the general transport situation, competitive advantages and also savings in the energy sector. The effects of creating the infrastructure on the German labour market are positive. It is obvious that the investment also carries risks. Traditional transport enterprises which do not keep pace with this development lose market shares.

On balance, the integration of transport and energy networks leads to a positive development, with regard to both employment and value creation.

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## Area of activity – climate and energy

Climate change, an emerging shortage of strategic resources and their consequent increase in price enforce a rethinking in the energy and raw materials sector. Global population growth is continuing. The global population will rise from the current seven to eight billion by the year 2030. The economic catching up processes in the emerging and developing countries must be added to these factors. As a consequence, demand for resources increases.

The remodelling of energy systems and the raising of resource efficiency are risky projects which also involve substantial costs. Success depends on the close interlocking of different fields of competence and industries. Reliable plotting of the course by the politicians is a precondition. In any case, the remodelling of energy systems depends to a decisive extent on social acceptance. That is demonstrated by the current debate. In particular, the balancing of the interests of those affected locally and of those benefiting beyond regions has not yet matured. New forms of compensation could make their contribution. A central issue is decarbonisation, the avoidance of carbon dioxide emissions, whether in energy generation, in mobility, and in industrial processes in general. One alternative would be the material utilisation of the climate gas.

Figure 8:  
Disruptions in the climate and energy area of activity

POSITION	DISRUPTIONS	EMPLOYMENT	VALUE CREATION
1	Extensive decentralisation of energy supply	+/(-)	+/-
2	Globally a faster and more consistent switch to renewable energies	+	+/(-)
3	Extensive dependence on energy imports	-	-
4	Contest for new sources of raw materials and energy	-	-
5	Technologies for CO <sub>2</sub> exploitation find broad application	+	+

## Extensive decentralisation of energy supply

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### Entry scenario

Carried along by political discussions and moods which increasingly turn against globalisation, against infrastructure projects and big industry, the pendulum swings in policy-making for energy. It swings away from centrally organised structures with great power and towards decentralised power generation in small-scale networks, although the increased use of location-bound wind and solar power demands major innovative integrated grids.

The precondition for every concept is for the course to be clearly mapped out at the political level, accompanied by lasting acceptance by the general public. In the case of a sustained preference for decentralised energy supply there would be consistent installation of combined heat and power units in buildings. Progress in photo-voltatics, in wind power, biogas and electro-chemistry could lead to a downright boom in renewable energies. If the decisive building blocks for new concepts in energy supply do not find blanket acceptance, this could also lead to disruptions.

## Effects

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When the impact on value creation is considered, a picture emerges with light and shadows. Decentralised energy generation benefits SMEs, especially in the installation and maintenance of the plant and in heat insulation. Large-scale production means prices are cut. In aggressive competition, Asian producers of photo-voltaics and wind power plant gain ground. At the same time, the dependence on the weather of decentralised energy generation pushes up energy prices and increases land consumption. Power generation costs rise, consequently Germany becomes an electricity importer, value creation falls.

Such a scenario is strongly promoted by political framework conditions. This applies to enterprises but also to investors and private households. Yet the framework ought to extend beyond Germany and create comparable conditions throughout the EU. The instruments of energy and climate policy should be coordinated in the process in order to preserve the competitiveness of market participants. If Germany leads the way down this path it can continue to extend its international lead in decentralised energy supply, the integration of different energy sources and of storage technology.

Through the development and production of small-scale infrastructure, value creation increases on the one hand, yet on the other a major shift in branch structure is to be expected. As a result of higher electricity prices, an exodus of energy-intensive branches of industry is possible. Drawing a final balance of the effects of the change of strategy on employment and value creation in Germany is therefore possible only to a limited extent.<sup>4</sup>

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4 Some good indications are offered by the study “Klima- und Strukturwandel – Chancen und Risiken der deutschen Industrie”, IW-Analysen No. 69, Cologne 2011

## The contest for sources of raw materials and energy

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### Entry scenario

Germany is a country with few raw materials. The global transformation process is now redrawing the geopolitical map for energy supply. For example, large parts of natural gas deposits are situated around the Caspian Sea. In the region China will offer stiffer competition with Russia. In Africa, Chinese and European interests continue to clash in exploiting the rich sources of raw materials and energy. Strategic raw materials are an important issue here. The altercations about Chinese export restrictions for rare earths which are needed for controlling electronic devices are only a foretaste. Trade restrictions are spreading.

## Effects

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Germany also has its unconventional sources of raw materials: among them are landfill mining and urban mining. When price relations change, these sources become the focus of highly specialised suppliers with new technologies for access, logistics and exploitation. This covers mineral raw materials as well as metals. The cradle-to-cradle principle could be in the ascendant as well as the trend to closed-loop cycles for materials and goods. If raw materials are to be re-introduced into economic cycles, however, a redesign of many products is essential. Re-use and recycling must already be taken into consideration at the design stage. National and European regulations are necessary for this. They should be justified with respect to price relations.

Despite all the opportunities, the fact remains that Germany, as an industrial nation with few raw materials, is at serious risk from shortages of supply for important resources. Growing demand for raw materials from African nations and a nascent rivalry between China and Europe lead to further price increases for raw materials.

The bottom line is that a perceptible loss of value creation in Germany is looming. Rising import prices are a threat to the depth of value creation and to the competitiveness of the relevant branches of industry.

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## Area of activity – health and nutrition

The health sector is in the process of becoming one of the most important future markets of all. A number of strong driving forces are leading to rising demand for health products and services, the most important being scientific and technological progress in medical technology, pharmacy, and bio-technology. One example is the development of imaging procedures in radiology in recent years: from a simple X-ray to computer-assisted cross-sectional imaging which depicts the whole body in detail in the shortest of time. So what will be possible in another two decades?

Individualised forms of therapy occupy a key position in the emergence of new value creation potential. The integrative momentum of future value creation can be seen particularly clearly in so-called personalised medicine: research which bursts the bounds of individual disciplines, and branches which are no longer alien to each other but interact more and more. New offers arise with tailor-made services; products and services blend into hybrid systems offers. Here, once again, it is information and communication technology which enables the exchange of knowledge and cooperation to a previously unknown degree. The electronic health card now being developed is only one building block in this development.

Human beings have an inherent desire for a long life in good health. Already today new challenges are emerging with people living appreciable longer. Medical possibilities reinforce the need for information and prevention. Search engines make it easier for people to take on the responsibility for looking after their own health. Converging trends are likely to lead to tipping-point disruptions in health insurance (limiting to serious risks, novel combinations with own preventive care) and in health care (more competition, the elimination of segmentation, for example between doctors with their own practices and hospitals).

Figure 9:  
Disruptions in the health and nutrition area of activity

POSITION	DISRUPTIONS	EMPLOYMENT	VALUE CREATION
1	Personalised medicine experiences breakthrough	+	+
2	Massive restriction of public health care	-/+	-/+
3	Systems suppliers change competition in the health sector	+/-	+
4	New converging markets arise in food sector	+	+/-
5	Sustainable nutrition management wins through	+	-
6	Shortage of raw materials in agricultural sector	+	-/+

The growing convergence between branches is not least to be seen in the nutrition industry. New technologies find their way into the conventional food market. The old boundaries between food and pharmaceuticals are dissolved. The blending of health and nutrition sectors leads to far-reaching changes in value creation processes. New markets come into being with new players.

## Personalised medicine achieves a breakthrough

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### Entry scenario

It starts with innovation. Progress in molecular diagnostics and the low-cost analysis of bio-markers open up new fields of activity. This applies both to preventative health care and therapies. The traditional assessment of patients according to age, sex and family history is supplemented by far more precise and thus far more effective features, such as can be found in each individual at the genetic level. This is already happening today, such as in the treatment of bowel cancer or leukaemia. However, the application of such approaches to other health problems still requires more basic and translational research, which is currently taking place. Personalised medicine is likely to achieve its breakthrough by 2030 – starting with selected groups of patients for whose complaints the genetic and other causes will have been sufficiently researched.

## Effects

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The effects of personalisation are not to be underestimated. The starting point is data. It can be predicted that value creation will first take place in the strong growth area of prevention and diagnostics, including with the help of special sensors or implanted chips. Measurements are followed by evaluation and visualisation of the data and their transformation into information that can be applied. The convergence of medicine and information technology leads to new business models. Many kinds of IT support services, such as data transfer and monitoring patients in their own four walls, will give a further boost to personalised medicine. The fact that the health data of many individuals are permanently on hand will also have a major influence on nutrition, the world of work, and even on lives at home. The opportunities also include individualised wellness offers linked to sport and travel.

New financing models for diagnostic procedures, forms of therapy and medicaments bring opportunities for patients but also harbour significant risks. Blockbusters (medicaments for large groups of patients) will to some extent be replaced by “mini-busters” (niche products) – presenting a higher financial risk for pharmaceutical enterprises. The development will also lead to large quantities of sensitive personal data being on hand. Many people will wonder whether their medical history is any business of the state, insurers, or employers. Fear of the arrival of the “glass patient” will be more strongly voiced – not least by doctors whose methods of treatment become more transparent and open to comparison.

Personalisation of medicine will lead to an opening of markets for private contractors and a new wave of privatisation of the costs. Multi-class medicine depending on the information available (ex post) would provoke considerable resistance in society. New services and products lead to positive employment effects and value creation rises. However, rising health insurance charges could impair international competitiveness if they continue to impact on labour costs as is the case with the existing regulations and are not borne by the individual. Rising contribution for the recipients of state benefits, financed by the state, could lead to a disruptive limitation of treatments paid for by statutory health insurers.

## **New converging markets appearing in the food sector**

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### **Entry scenario**

In future food will not merely taste good and be healthy but at the same time promote health and even beauty. The boundaries between food and medicine and also cosmetics will evaporate.

Pharmaceutical companies supply food that is good for the health. Food producers penetrate sales markets with health relevance: health food shops, drugstores and chemists. Cosmetics manufacturers move into the food and health areas. All three operators, pharmaceuticals, food and cosmetics manufacturers, exert their influence on agriculture in order to secure their raw materials base and to control it in their own interests. Biotechnology and genetic engineering gain importance. In traditional agriculture seeds become the factor deciding success.

## Effects

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The main risk for this development lies in social acceptance. Are the substances which have a biological effect really safe? And what about side effects and damage to the environment? In order to be able to answer questions such as these, considerable investment is necessary in research and development, together with marketing and public relations work in order to counter public misgivings. New legal regulations come into force. Raw materials markets constitute a limiting factor, and here it is above all the rare substances which presuppose rich biodiversity.

New products lead to positive employment effects. New value creation processes are possible in agriculture.

## Shortage of raw materials in the agricultural sector

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### Entry scenario

There are serious food crises in Africa, Asia, and Latin America. The number of those starving rises dramatically. The reason is the scarcity of the most vital raw materials for agriculture: water, fertilizer, and effective crop protection agents, such as pesticides. Land available for crops is lost. Other areas are degraded. The extensive cultivation of energy plants and animal feed leads to a further drop in plant food production. Rising oil and gas prices have a huge effect on the cost of fertilizer. The share of conventionally used and highly industrialised agriculture of the total area of land used for agriculture could fall.

However, before these changed framework conditions lead to under-nourishment, sickness, and death for many human beings, the disruptive emergence of genetically modified organisms (GMO), some of which, for example, can cope better with a shortage of water, opens up new opportunities. Aridity and extreme weather affect areas outside Germany in particular. They could benefit from GMOs. Nevertheless, the food market in Germany could become a supplier's market with domestic agriculture gaining competitiveness. Increased competition for land benefits enterprises which offer solutions close to urban centres, including vertical farming with elaborate crop sequences at top level. Second-generation bio-fuels which are no longer based on crops but on plant waste provide farmers with additional revenue. In view of the huge global problems, including for the security situation, there are political changes in the regulation of bio-technology.

## Effects

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Agricultural enterprises in regions remote from markets and lacking favourable natural conditions benefit from new competitive opportunities. Enterprises in the food and animal feed industry which rely on imports are confronted with volatile and steeply rising purchasing prices.

Employment in the German agricultural sector remains stable because rising costs can be passed on to those consumers who tend to reject genetically modified food. There are more jobs in the chemical industry and in agricultural technologies. On balance, the effect for value creation in Germany is likely to be around neutral to slightly positive.

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## Area of activity – communication

The future of the internet has only just begun. It is steadily pervading all areas of life. Virtual networking, flexible forms of cooperation and organisation are catapulting communication into a new dimension.

Enterprises find themselves increasingly confronted with new customer communities and must orientate their value creation processes more closely than ever to the needs of their target groups.

Machines react directly to the spoken word, knowledge management in enterprises is revolutionised. The real world – living spaces, vehicles and highways – is equipped with sensors, and information and communication technology. It merges with the virtual world and the world of people. The “Internet of Things” is born.

Figure 10:  
Disruptions in the communications area of activity

<b>POSITION</b>	<b>DISRUPTION</b>	<b>EMPLOYMENT</b>	<b>VALUE CREATION</b>
1	Individualised media use becomes standard	+/-	+
2	The “Internet of Things” opens up completely new business potential	+	+
3	Community-based customer behaviour bursts the bounds of traditional business models	+	+
4	Knowledge-based systems at the centre of future value creation	(-)/+	+

## The “Internet of Things” taps completely new business potential

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### Entry scenario

Intelligent surroundings and interacting objects facilitate people’s lives. Traffic flows can be optimised to conserve resources. Products are equipped with a memory that can communicate with its environment. Robots recognise their physical environment and can act independently. Production and logistic processes are further automated, renewable energies can be better utilised and people at home are supported inconspicuously (ambient assisted living).

The “Internet of Things” opens up enormous business potential in the areas of automation, logistics, automobiles, health, aging population, environment, energy, business processes and security. Industrial production will undergo a fundamental change. Technical systems will themselves take over management, control and planning.

## Effects

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Great efforts are being made in this area, namely in the USA and China. Interdisciplinary work in research and development is becoming a critical factor in success. Systems and domain know-how forms the technological base. In particular, the transfer of research results to applications must be speeded up. Sustainable business models and precisely tailored customer solutions must be developed. Only if Germany consistently exploits the innovation potential of the internet can it continue to play in the top league. Education and training are a decisive precondition. This means knowledge and routine in handling the digital media in particular.

The impact on employment is positive owing to the major business potential and the good starting position of German industry in relevant applications. Gross value creation benefits above all through a rise in productivity.

## **Community based customer behaviour bursts the bounds of traditional business models**

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### **Entry scenario**

The internet is becoming not only increasingly pivotal for business activities but is also more and more forming the platform for customers. Customer communities thereby acquire increasingly stronger negotiating power as against suppliers. The open exchange of experiences of the internet collective means not only a clear rise in product transparency. Information about bad workmanship and poor service spreads in a matter of hours. Even sporadic product deficiencies can lead to an abrupt loss of trust. That is why high product quality is crucially important in the age of the internet as never before. The internet confers on customers the ability to compare offers much more quickly and to change their supplier. At a remarkable speed customers act, fluctuate and replace suppliers. However, the attacks of these communities do not always conform to the rules of fair play.

## Effect

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In the marketplace the positions of competitors, suppliers and customers are in motion. Business enterprises can be steamrolled by this dynamic process, or they can exploit it for their own ends. Pride of place is taken by emotional customer and brand bonding for which the foundation stone is credible and professional communication. Solutions such as cloud computing and software as a service have great potential for binding customers. However, the variety of applications, coupled with general cost pressure and a drop in prices, generates special market structures whose dynamism far outstrips that of the classic displacement competition. In addition, early customer bonding promises not only an improvement in products but also that their further development will be oriented to demand.

German industry is in good shape to face these challenges. German brands enjoy an excellent reputation the world over. That is why a slightly positive effect on employment is to be expected. The same applies to gross value creation.

## Knowledge-based systems at the centre of future value creation

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### Entry scenario

All steps in a business process are supported by knowledge-based systems. At any time staff can call up data and information, irrespective of where it is to be found. In the process new context-related knowledge is generated. Routine tasks are automated and tend to be eliminated. By means of knowledge management and knowledge-based systems, enterprises and production processes can be controlled in real time, drawing on information from all over the world. Technical systems also exchange knowledge independently. Robots or software agents which carry out control tasks are examples. These also include automatic production systems. Knowledge-based systems play a key role in the “Internet of Things”. The end result is increased productivity and efficiency. Whether in the health sector, the mobility or energy industry, comprehensive information is the foundation for a variety of new business models – data as the “virtual gold” of a networked economy.

## Effects

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As always, there is a downside. Data protection and data security take centre stage. Criticism from numerous sceptics leads to improvements. It is often demonstrated in practice that knowledge management is no trivial matter. Being swamped by information is and remains an issue and the same applies to data graveyards. Above all, knowledge and knowledge transfer in organisations are always attached to people and are part of the corporate culture. Knowledge confers power and therefore must not be the privilege of individual persons. It is precisely in this field that information and communication technology makes a significant contribution through the development of intelligent algorithms for powerful search engines.

Numerous services arise around knowledge-based systems, for example in further training. These opportunities will be grasped not only by the major players but also by niche enterprises. Whereas routine jobs will cease to exist, at the same time new jobs will arise for software specialists, architects of knowledge-based systems, systems administrators and specialists for intelligent agents and associated job profiles. The employment effect is positive. For German industry knowledge-based systems also contribute to enhancement of export capacity. This results in a positive effect for gross value creation.

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## Area of activity – security

The world of the future will also be a vulnerable world. And its vulnerability is heightened by the networking of complex systems, the virtualisation of business processes and the automation of work processes. Contemporary civilisation is especially dependent on its infrastructure, which will be all the more true in future. Especially worthy of protection are the areas of energy, including all the utility supplies (gas, water, district heating), health, transport, communications, and naturally the supply of food for the population and of raw materials for industry. The mutual interdependence of the systems will become even more intensive, especially with regard to mobility and energy. In all branches of industry the issue of security is taking on far greater relevance.

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Figure 11: Disruptions in the security area of activity

<b>POSITION</b>	<b>DISRUPTIONS</b>	<b>EMPLOYMENT</b>	<b>VALUE CREATION</b>
1	Increased systems complexity – greater hazard potential – extent of global harm	+	+

## **Increased systems complexity – greater hazard potential – extent of global harm**

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### **Entry scenario**

The scenarios for threats are as diverse as the targets under attack. They can be triggered by environmental catastrophes, potentially in dimensions never previously experienced, with the principal cause being climate change. Cases of technical failure can also be responsible, with other possibilities being terrorism or white collar crime. As a rule, the perpetrators are hard to identify, they often employ an element of surprise. Targeted attacks on critical points – the water supply or power stations, for example – can cause dramatic damage and hazards. Cascading effects are always possible, in future even more so with increasing interconnectivity. The “Internet of Things” is ultimately a technology which drives the networking of systems forward to a decisive extent. There is a corresponding degree of potential harm, for example by targeted viral attacks on IT systems or other forms of cybercrime.

## Effects

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The vulnerability of infrastructure is equivalent to the vulnerability of society. At risk are state institutions, IT-based business processes, organisations, firms and administrations, industrial complexes and transport systems, gatherings of people and major events. This list alone makes it clear how fragile what we call normality has become. The targets of attacks are frequently persons who are not involved or only present by chance. Those affected feel both helpless and powerless.

As the threats increase, so does interest in defence against them. Security standards are tightened up, if not voluntarily then by regulation. Suppliers of effective solutions in security issues will meet with major demand. These include digital protection mechanisms, high-performance security software and consultancy services. The susceptibility of supply networks can possibly be countered with additional capacity to absorb and cushion disruption and by increasing reserves. As a rule, higher safety standards also mean higher costs.

German enterprises depend on complex security products and services which determine their competitiveness to a considerable degree. This is true of the software branch, for example, but also of the whole supply infrastructure, from electricity to food. The know-how of German industry must also be safeguarded. Direct and indirect employment effects ensue from all of these factors. A leading position for Germany in security technology and know-how harbours major export potential.

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## Super-ordinate framework conditions

The following disruptions are not assigned to particular categories. Their effects are felt across the boundaries of all sectors and are general issues. They focus on the overall framework conditions of value creation, whether of a social, political, or macro-economic nature. Ongoing monitoring of this overall setting is part of the standard repertory of future policy for associations and enterprises.

Figure 12:  
Disruptions in the area of super-ordinate framework conditions

<b>POSITION</b>	<b>DISRUPTIONS</b>	<b>EMPLOYMENT</b>	<b>VALUE CREATION</b>
1	Lack of technology acceptance in Europe	+ / (-)	+ / -
2	Declining level of quality and investment blockage through lack of skilled labour	+	+ / (-)
3	Reciprocal effects in global finance and monetary system and emergence of new players	-	-
4	Question mark against development of international trade relations	-	-
5	Complete internalisation of external costs	+	+

## Lack of acceptance of technology in Europe

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### Entry scenario

The risks of new technologies are often considered to be greater than the opportunities. This applies especially to genetic and nanotechnology, and equally to major technological projects. The public feels great unease about the dangers for human beings and the environment.

The reason for clinging to the status quo is inadequate communication between politicians, enterprises and the public. As a result, many technologies that have already been developed are not put to use. In comparison with other regions, Europe risks losing out owing to a widespread attitude of rejection. Long and complicated decision-making processes also impede rapid implementation of projects from the idea to the product ready for market.

## Effects

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This development gives rise to few opportunities. At best the makers of sustainable products, from food via clothing to de-centrally generated, renewable energies, can benefit from it. The expansion of new infrastructure is delayed or is cancelled. This includes: expanding airports, constructing smart grids or offshore wind parks. Public investment in research into new technologies falls. As a result, industry relocates its research and development activities in regions more friendly to innovation, in Asia and North and South America. The consequences for growth and competitiveness in European industry are dramatic.

Such developments indicate a clearly negative influence on employment in Germany. At first manufacturing industry is hit, followed by the services sector. A slump in gross value creation is probable. Real incomes fall by international standards.

## **Declining level of quality and blockage of investment through lack of skilled labour**

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### **Entry scenario**

The reasons for the future lack of skilled labour are manifold. The demographic development is a major factor: fewer and fewer young people, more and more elderly ones. The number of young people entering the labour market is falling. There is no shortage of ideas on how to counteract the shortage of skilled labour. They range from measures to cut the number of trainees abandoning training to recruiting suitably qualified personnel from abroad. If these measures fail to have results, the lack of skilled workers and top-level staff will be dramatic by the year 2030. This applies above all to professions linked to mathematics, engineering, science, and technology, and also those in health and nursing care. The development has serious consequences for the innovative power of technological companies. Parts of enterprises will be moved abroad. Germany will steadily lose ground as an industrial location.

## Effects

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If intelligent procedure is followed, there are also opportunities in this development. Value creation shifts to enterprises which make effective use of their skilled staff. The degree of automation rises. There is an expansion in work that is mobile and independent of location. Enterprises focus on synergy effects by using skilled personnel from partners in value creation, for example through open innovation and project work. There is also greater automation in medicine and nursing care, for example in monitoring nursing care patients via the internet.

However, the risks predominate. Enterprises which are not able to secure the skilled personnel they require fall behind in the competitive process. They cannot compete in the innovation race. This is partly the result of high wage costs, if indeed the wages level can be held to. Value creation moves to other regions, such as Asia. If things go well, German firms relocate or create new locations abroad. If they go badly, the whole value creation migrates. A reduction in employment can be expected above all in the export industry and the health sector, along with jobs in mathematics, engineering, science and technology. In extreme cases, whole areas will be relocated if key posts cannot be filled. Value creation in producing industry falls. The profits of the suppliers of automation technology will not be able to make up for this loss.

## **Reciprocal effects in the global finance and monetary system and the arrival of new players**

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### **Entry scenario**

Global regulation of the financial markets in the G-20 framework remains difficult. It is possible that the banks slip back into risky speculation. At the same time, many central banks are keeping to their policy of credit-oriented expansion. And a realignment of global monetary policy is not yet in sight. The high level of sovereign debt in many countries will put a strain on national budgets for many years to come and can lead to falling investment ratios. In this context a double dip, another monetary and financial crisis, is definitely possible. The effect will be to steer the global economy into a protracted recession. Ultimately, sovereign states are the guarantors of stability. Yet since they are already heavily in debt, their room for manoeuvre in any subsequent crisis is severely limited. Packages running into billions to stimulate the economy are unlikely.

## Effects

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In this situation enterprises which have a high level of equity capital are better placed for competition. Yet the decisive factors for withstanding a renewed crisis are a broad, cross-sectoral portfolio of products and services and orientation towards markets of the future. New players such as international sovereign wealth funds from oil-rich countries or China invest in expanding enterprises or buy them up. Naturally, dependence on investors also has risks attached. Yet the chances predominate of reducing protectionist tendencies.

Other risks for the case of a double dip are more obvious. Governments will attempt to cope with a difficult situation in the labour market or in the economy generally by imposing more regulation. That could impose constraints on enterprises and result in the closing of some locations. Moreover, there remains the risk of inflation, caused by expansive monetary policy and excessive national debt, though hyperinflation is not likely. All the same, a distinct rise in inflation rates is bad for growth and employment, not least because a slump in tax revenues and a high burden of debt forces governments to undertake further cuts in investment.

As an exporting nation, Germany would be hard hit by any break-up of the euro zone and another global economic crisis. The level of employment would be likely to fall, sales would plunge and a massive slump in value creation would be the consequence.

## Question mark against the development of international trade relations

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### Entry scenario

The global volume of trade has been rising for years. After the financial and economic crisis it declined at first but on an optimistic assessment the signs are again pointing to growth in the coming years. But things can change. We are assuming increasing protectionism in the raw materials sector and a strategic shortage of mineral and energy raw materials in the Middle East, Russia or South America. If these tendencies become really serious, industrial nations with few raw materials could try to protect their domestic markets with import tariffs, border adjustment measures, or production subsidies. Free world trade would suffer greatly.

## Effects

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High tech enterprises rely on strategic raw materials, as is illustrated by some examples: indium for LCDs, tantalum for condensers, yttrium for lasers. In Europe protectionism leads to lost output. Even enterprises which relocate their production in raw materials producing countries are disadvantaged as against domestic industry. Not merely high-tech enterprises but also energy-intensive branches such as the steel industry experience competitive disadvantages. Chemical and pharmaceutical enterprises which depend on complex chains of supply for raw materials and input products face a serious threat from supply bottlenecks. The loss of international sales markets creates turmoil for the German automobile industry. Substantial falls in exports force enterprises to cut jobs and wage levels.

On the other hand there are opportunities, though rather few and far between. A sustained scarcity of raw materials benefits those enterprises in particular which open up their own sources of raw materials, enhance their resource efficiency or can substitute critical raw materials. Opportunities for growth also arise for industries which offer new support technologies and infrastructure, for example satellite-assisted geo-services or robots for mining.

On balance, the effect on employment is markedly negative. However, some new employment opportunities arise in local trades and in the services area. Gross value creation also suffers. A trend to rising domestic demand cannot make up for losses in exports.

## Complete internalisation of external costs

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### Entry scenario

The European Union becomes convinced that robust ecological carrier systems are crucial for the long term health of national economies. The environmental impact of products and services are priced. In the meantime the necessary indicators and measuring instruments are available so that the mechanism with which we are familiar from emissions trading (EU-ETS, Emission Trading Scheme) is applied branch by branch to the whole of industry. Whether greenhouse gases, emissions in the atmosphere, water or earth, activities which impair biodiversity, all ecological dimensions are covered. The measures of internalisation grow hand in hand. Apart from penalties, bonus payments are gradually made for proactive measures in the setting of industry.

## Effects

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Massive restructurings are the consequence. For example, the comprehensive ETS system hikes up logistic costs, especially for transport by road haulage and from overseas. Local suppliers are the ones who benefit. For the end customer there is greater transparency since the prices now tell the ecological truth. Market opportunities are enhanced for those who were previously niche suppliers. The system of bonuses and penalties also offers incentives to economise on material or to prolong product life cycles. Suppliers of modular products which can be easily repaired can benefit from this. In contrast, those enterprises lose out which do not adjust their products and production processes quickly enough to the changed conditions. Energy-intensive areas of industry such as aluminium production can be expected to migrate. The increase in cost of energy will lead to serious setbacks in nearly all areas of industry. Aviation and tourism will suffer since the price of air travel will rise.

The traditional branches of industry are likely to be seriously challenged with the internalisation of external costs. As a result of massive restructuring, in the short to medium term many jobs will be moved abroad. This will affect the automobile industry, of central pivotal importance for Germany, as well as plant and mechanical engineering. On the other hand, in the medium to long term new jobs will be created in innovation-driven branches. A significant drop in value creation cannot fail to occur. Yet this can be possibly offset in the fields of renewable energies, environmental technology and work-intensive product services. In the medium term the most likely outcome is an increased level of employment with lower income per head.

# 5.

## Paradigm shift in value creation

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Now that the possible disruptions in the five major areas of activity have now been investigated, it should be possible to gain further insight from the analysis into future value creation. A closer scrutiny of the results from overall perspective of all branches of industry and enterprises reveals some general patterns. Five central findings on the long-term change in value creation, known as the paradigm shift, were identified as part of the project. It becomes clear that things do not become simpler but more complicated. And volatility rises.

### **Cooperation management between sectors becomes the critical factor for success in innovation systems geared to value creation.**

The boundaries between branches of industry have long been fluid. The decisive step into the future is an offensive interlinking within traditional branches and with new ones. This produces innovation and new business models. Providing inexpensive, uncomplicated and seamless mobility for the customer is a matter for players from the automobile industry, the energy sector and the IT industry as well as representatives from cities and local authorities. After all, electric automobiles also have to be parked and recharged. The switch from car to plane or bicycle should be simple and relaxed. This requires platforms with diverse competences and the ability to devise product-service innovations, not least the active management of the interfaces in the new hybrid value creation structures.

Single enterprises in isolation will tend not to be a position to establish the decisive innovations in the market. The winners will be those who succeed in enlisting the vital stakeholders for joint strategies. The task involves assembling the competence of internal and external knowledge workers in a way that is flexible and project-related. It is a question of temporary partnerships and the acceptance of solutions for the user.

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### **In the change from partial to holistic innovation**

Systems innovation across sectoral boundaries and the development of integrated value creation chains have one decisive precondition: the development of new business models. Seamless mobility requires of players from diverse branches that they create new packages of products and services. These consist, for example, of vehicles, with real time traffic information, traffic control systems, access technology and other services. In many cases there is a wider dispersion of profits, but also of risks.

Germany's innovation scene today is dominated by products, services, and processes. In future, business models will be given closer consideration from the outset, together with the attendant financing instruments and criteria. The perspective of the user is decisive.

### **Sustainable innovations provide the central leverage of value creation.**

If the fossil-based world energy system has to be decarbonised in the long term and shortages of raw materials demand resource-extensive economy, then no branch of industry will be able to escape. The process is driven not only by ecological but also social requirements, with innovations in the technical and social areas. Step by step the issue of sustainability is asserting itself in all markets, a development which blurs traditional branch boundaries and gives rise to new value creation chains. For enterprises, greater importance is attached to new instruments which take account of the holistic approach of sustainability. Innovation which is fit for the future becomes the main driving force of growth.

Real scarcities and changed values initiate the transformation which responds to the new economic necessities. Industry's material flows and exchange processes are re-configured because awareness grows of longer term scarcities.

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## Formation of new alliances – from shareholder value to stakeholder value

Enterprises operate in increasingly complex systems of products and services, making new business models necessary. Moreover, they have to coordinate their business activities more closely with diverse interest groups in order to preserve their licence to operate. One example is provided by the internet customer communities already mentioned, which substantially strengthen the position of the end user in the market.

While enterprises fundamentally remain oriented to profits, they are subjected to public debates. The concurrence of orientation to profit and to the good of the community repeatedly takes centre stage in discussions. Indeed, business activities come under increasing social pressure to justify themselves. All this produces the future need to include very early on the various stakeholders – social groupings, NGOs, and above all the customers – in business processes. This facilitates innovation. If there is a failure of communication, problems of acceptance can soon emerge in the relationship of business and politics with society in general. This is currently becoming clear in the planning of new energy infrastructure, with debates over sites for wind turbines and routes for new power lines. Enterprises have to learn to enter this playing field and to find a balance between the expectations of the various claimant groupings.

Enterprises, especially those in markets close to consumers, are rewarded if they succeed in actively including customers and stakeholders in various stages of value creation – in development, production, or sales.

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### **Change from classic planning processes to management and control of complexity**

It is becoming increasingly difficult to plan markets. Uncertainty and instability in the competitive environment are part of the new normality. Controlling them is becoming the central challenge. Yet that is by no means all. Raw materials prices fluctuate, the political setting changes, economic cycles grow shorter, crises alternate with booms. The vulnerability of the increasingly virtual business processes grows and cyber attacks are a constant threat.

Enterprises can react to high volatility by adjusting to it, for example by concluding long-term agreements for raw materials. They can also subject their markets to permanent monitoring and improve their own reaction speed. This amounts to a change of system, abandoning the classic planning process and switching to the control of complexity, possibly by interlinking different systems components and operators. Organisational forms change accordingly, moving away from linear-hierarchical structures towards the management of flows of capital, goods and material in decentralised networks. The focal point of value creation moves in the direction of “intelligence” (software, brainware) of products, towards the acceptance of utilisation concepts and new service-oriented business models.

## 6. Future perspectives for value creation in Germany

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Germany requires a new innovation policy oriented to value creation. The technology orientation which has so far been dominant is reaching its limits. An open society that is capable of learning needs expanded forms of participation, new rules of the game and responsibilities. It is a matter of developing a new culture of innovation based on the participation of the groups affected and which aims at a basic consensus in society. The new culture of innovation requires inter-branch cooperation, an overall environment and policy-making devised for the long term. Not the least of its requirements is a new understanding of the common challenges and the recognition that the complex problems can only be mastered by the interaction of industry, science, politics and society. In this light innovation can be seen today as affecting the whole of society. It is to make a contribution to the great challenges of the 21st century, whether they be issues of food and health, land utilisation and the development of urban spaces, climate change and energy, mobility and information, or shortage of resources and security.

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## 6.1 Recommendations for innovation policy geared to value creation

The recommendations were drawn up by members of the working group “Innovation Strategies Geared to Value Creation”, supplemented by representatives of the BDI (see appendix). They derive from the disruption analyses of the present study and are based on existing proposals, for example those from acatech and the Fraunhofer Gesellschaft. A selection of 23 recommendations follows.<sup>5</sup> Selected points of five questions of research promotion were addressed. There was an awareness that optimisation of the use of scarce public funds was required along with a deeper and quantitative analysis.

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5 All recommendations in the German full-scale version under [www.bdi.eu/publikationen\\_zukunftsstudie.htm](http://www.bdi.eu/publikationen_zukunftsstudie.htm)

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## Area of activity – mobility

### **National mobility strategy**

The promotion of electro-mobility is currently enjoying maximum attention. Technical issues, such as propulsion and storage systems, play an important part. In addition, Germany requires a multi-modal mobility strategy to make transport fit for the future in the long term. This includes the improvement of traffic flows, the reduction of resource consumption, increasing the efficiency of all means of transport in order to cut negative environmental effects, better linking of means of transport and not least the maintenance of affordable mobility. The goals should be laid down in a national mobility index, prioritised and subjected to ongoing monitoring in their implementation. For example, the authorities at municipal and regional level could set out criteria on the status quo of mobility and inform what exactly they wish to achieve in future. Ultimately customer demand is crucial, but the sustainability requirements must be taken into consideration.

### **Intelligent transport infrastructure and inter-modality**

Optimising the whole mobility structure is to the benefit of the public, industry and the environment. It should continue to be an important goal of German transport policy. The development of information, communication and traffic control systems should therefore continue to be the object of research. This applies especially to IT-assisted interface management for seamless mobility from door to door covering all transport means required. However, as yet there are no adequate findings on how transport featuring inter-modality would affect the financing of infrastructure. Apart from promoting research it would therefore be expedient to support pilot projects in the field of intermodal transport systems. Appropriate scenarios should be devised to explore the conditions in which inter-modality can be financeable and can promise success.

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### **Socio-ecological mobility research**

In the medium term the behaviour of transport users will radically change. In order to understand and anticipate these processes, the continuation of socio-ecological mobility research is recommended. This includes in particular investigations into mobility behaviour (inter-modality and multi-modality) and into the attitude of users and of society towards certain modes of transport.

### **Aviation research**

It is to be expected that the boom in commercial aircraft will continue, while competition becomes keener at the same time. In order to preserve a leading position for the German aviation industry in the commercial aircraft market the targeted promotion of research continues to be necessary. One main emphasis must be on the eco-efficiency of aviation. In the long term, the growth expected must not impose too undue a strain on the environment. Flying must become carbon dioxide neutral, which means new concepts for propulsion systems, lightweight construction and weight reduction, improvement in aerodynamics etc.

### **Electro-mobility competence**

Domestic car sales are stagnating. In contrast, electro-mobility can provide growth in a foreseeable term. The “national electro-mobility development plan” should be used to gain Germany a lead in electro-mobility. Establishing Germany in battery competence by targeted research promotion would be a necessary approach in order to reduce dependence on other manufacturing countries. Other issues would be the subsidising of infrastructure for research and production plant along with the promotion of cooperation between branches of industry.

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## Climate and energy area of activity

### **Framework conditions for favourably priced and efficient energy**

A secure, globally competitive, reasonably priced and efficient energy supply is a must for every national economy. In order to achieve this goal, there must be the proper framework, both nationally and internationally. This requires major expenditure on research and development. This means both basic and applied research and development, for example in chemicals and plant construction. There must also be an expansion of intelligent electricity grids with adequate storage capacity and flexible demand control, along with a rise in efficiency on both sides, in energy generation and consumption. There is also still major potential in buildings, in insulation and heating technology.

### **Uniform European energy strategy**

The switch to a decentralised energy system mainly supplied from renewable sources takes years and indeed decades. A uniform European energy strategy is necessary for this transformation to succeed. Legislation and other rules and regulations must be harmonised, and trans-Europe grid infrastructure must be expanded. Varying energy strategies, such as those of Germany and France, should also be harmonised. Comparable competitive conditions should be brought about and the total cost of revamping the system should be limited. At the same time dialogue with relevant social groups like NGOs should be stepped up. The linking up of energy systems will give greater importance to local infrastructure. This should be in a cross-border context. Regional consensus is just as important for success as international cooperation.

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### **Energy conservation and recycling economy**

In certain areas of industry, such as steel and non-ferrous metals, major savings in materials and energy are conceivable through recycling. Recycling concepts thus promise major potential for value creation. By means of targeted promotion, it should be possible to develop technological processes which accelerate still further the economic effectiveness of recycling and the recovery of raw materials.

### **Power station and efficiency technologies**

The exploitation of renewable energies probably offers Germany substantial opportunities for exports, especially in power station and efficiency technologies. Markets of the future also include new storage systems, which will provide decisive leverage for a long-term conversion of energy systems. German enterprises should secure access to the growing markets in good time. Official foreign trade policy can assist these endeavours, for example in tapping solar energy in Greece or North Africa.

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## Health and nutrition area of activity

### **Clinical research for personalised medicine.**

In order to advance the breakthrough of personalised medicine, not only increased basic and translational research is necessary but also anticipatory clarification processes regarding the question of costs. Cost reductions through more efficient and targeted treatment can counteract cost increases, such as those caused by the development of medicines for smaller groups of patients. Here the health care strategy of statutory and private health insurance organisations takes on key importance. Personalised medicine still requires a high degree of social acceptance through foresight in patient and data protection as well as the promotion of high safety standards.

### **Interdisciplinary research networks**

Research promotion should concentrate more closely on interdisciplinary research networks and clusters of excellence in the convergence fields of agriculture, pharmaceuticals, nutrition, and life sciences. Great significance also accrues to basic and applied research which investigates more closely the links between nutrition and long-term physical and mental health, especially in order to do justice to the challenges of an aging society. The whole field of initial and advanced training should be on an interdisciplinary basis and also flexibly devised in order to adapt to changing requirements.

### **Preventative health care and translational research**

In the health and nutrition sector the aim must be to establish new models of collaboration between industry, science and society in order to promote translational research and integrated preventative health care. Moreover, independent and anticipatory risk and acceptance research must be developed for green bio-technology. Finally, it must be assumed that the issue of food and nutrition will continue to be met with extreme sensitivity in public perceptions.

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## Area of activity – communication

### **Promotion of information and communication**

Open standards and protocols are recommended for promotion in the framework of the linking of technical systems at the European and international level. The promotion of research activities in “service sciences” and open innovation approaches is also recommended along with educational campaigns on data protection and the responsible handling of information and knowledge. This is backed up by a transparent information policy guided by the increasing interlinking between the digital and the physical world and by the drawing up of clear guidelines for the protection of intellectual property, especially with a view to the growing (virtual) integration of innovation processes.

### **Knowledge-based IT solutions and use potential**

At the centre of developments should be the intensification of research into issues of knowledge-based technical systems and also the “Internet of Things”. Further use potential should be tapped by scenarios and the micro-simulation of possible applications. This includes a rapid prototype implementation. The same applies to an accelerated transfer of the results of research and development into marketable products and applications. New business models should be developed which also actively include customers in the devising of processes and services, for example by means of cooperation with influential customer communities.

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## Area of activity – security

### **Handling of sensitive data and threats**

General awareness for handling sensitive data and threats should be sharpened by long-term information campaigns. However, these are not credible as long as there are blatant breaches, for example in handling personnel data. This must be avoided for good. This requires concerted efforts from science, politics, industry and social interest groups. In business enterprises there should be better interlinking between internal and external IT experts and security specialists.

### **Complexity of security questions**

In science, research and development new methods of risk analysis must be developed. They should take heed of the growing linking between diverse systems and the resulting complexity of security issues. This is especially true of new, global interaction. Finally, there must be endeavours to improve cooperation between suppliers of security systems, in particular in the development of international standards for security mechanisms.

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## Overall framework

### **Promotion of acceptance of technology in Europe**

Businesses, associations and politicians should develop instruments to detect very early on those currents in society reacting to technological developments. This can permit a reaction to trends and critical debates such as can be observed in social networks. However, it is probably even more important to develop proactive high tech scenarios, the social, ecological and economic use of which can be clearly communicated. In the field of energy supply this could be the “CO<sub>2</sub> neutral city”. In the communication of scientific and technological potential and the description of the use of relevant solutions it is imperative to inform the public and customers as early as possible and to actively include them. Developing communication formats “between equals” is primarily a political task. The development of a picture of the future by Germany and Europe, including technological dimensions, is strongly recommended.

### **Counteracting lack of skilled labour**

Vocational training and upgrading is a cornerstone of innovation strategies geared to value creation. While new markets are appearing, whether in electro-mobility or in security, new training opportunities should be provided from the outset by state and private suppliers. One way of alleviating the lack of qualified staff is to extend people’s working life. Each year longer that people work raises value creation in Germany by 3 billion euros. In the long-term the German government is called upon to ease entry to the labour market further for highly qualified personnel.

### **Encouraging entrepreneurship**

Not the least important part of the package of measures for innovation strategies geared to value creation is encouraging entrepreneurship. Official policies should ease and financially support new business set-ups. In their turn, business enterprises are called upon to motivate their employees to spot market opportunities and to development ideas and business models.

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### **Stabilising the global finance and monetary system**

Against the background of a looming global economic crisis, the government should work flat out to devise means of sustaining the financial and monetary system. The central function of the financial system was and remains to finance the real economy – today a return to this is more necessary than ever before. The “systemic relevance” of individual finance institutions harbours potential for blackmail. This must be counteracted by suitable measures. This includes the demerging of financial institutions. The foundations of a viable financial and monetary system are monetary stability and the consolidation of public finances.

### **Strengthening security of supply of raw materials**

The national raw materials strategy should be extended to cover Europe. Top priority continues to be free trade in raw materials. In addition, there are other ways of accessing raw materials. These include purchasing alliances (at national or enterprise level), the establishment of raw materials funds or partnerships with countries rich in raw materials (securing raw materials in exchange for transfer of technology and value creation). In order to forestall bottlenecks in resources, know-how in mining technology must be preserved and extended to related technical areas (urban mining, deepwater mining).

### **Strengthening recycling technologies**

The cradle-to-cradle (c2c) approach relies on qualified personnel. Training and further training takes on special importance, particularly in the areas of materials technology, product design and chemicals.

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### **Complete internalisation of external costs**

The internalising of external costs and of external yields is essential for innovation strategies geared to value creation. One classic instrument for internalising external yields is state promotion of research. In internalising external costs experience shows that regulation by official policy is more effective than voluntary commitments by industry. In order to avoid distortions of competition, regulation should be accompanied by international agreements. If that should not prove possible, one feasible means would be to impose tariffs on goods imported from countries in which external effects are not priced in. WTO rules should also take account of this. External effects should be implemented within a time schedule that is both ambitious and economically sensible. This could minimise the economic dislocations.

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## 6.2 Recommendations for innovation culture geared to value creation

### **Promotion of inter-sectoral cooperation**

As the leading organisation of German industry, the Federation of German Industries (BDI) should perceive the dissolution of classic boundaries between branches of industry as an opportunity. Change will come in any case and should therefore be anticipated and shaped in the interests of industrial enterprises. As a partner for innovation and value creation, the BDI should participate in devising new patterns of value creation.

It is therefore recommended that a working group “Inter-sectoral cooperation and new patterns of value creation” should be founded within the BDI. A clear assignment should be formulated with a definite time schedule: open questions of significance in this field will be discussed and investigated; solutions geared to practice will be framed. Important issues in this area are the opportunities for and limits to cooperation, the design of legally binding partnership models, the importance of intellectual property, the development of project economy structures and globally integrated value creation models.

Restrictions are to be analysed and proposals devised for overcoming them. Throughout the results should have the effect of guiding action and of helping enterprises in their implementation.

### **New partnerships and forms of participation**

Innovation policy geared to value creation requires partners. Up to now the main point of contact has been the politicians. It will continue to be their task to create infrastructure and the overall framework and to allocate the necessary financial resources. Politicians are recommended to act beyond the high tech strategy and to institutionalise the interdepartmental coordination and interlinking of areas of policy (family, education, integration, research and development policy) with relevant activities by parliament in the field of innovation promotion (for example the commission of enquiry or the office for technology impact assessment).

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Fundamental goals of innovation policy should be discussed and determined in public debate. The work in the existing bodies on research, technology and innovation policy (from the Industry-Science Research Union<sup>6</sup> to the High-Tech Strategy for Germany of the Federal government to the national platform electro-mobility) should be opened up for all players in society through panels for continuous dialogue.

In this connection representative forms of politics could be supplemented by consultative and plebiscite-type elements. Experiences such as were made in the government ethics commission or the round table over the Stuttgart 21 railway project could make a contribution. Such activities require social acceptance. They should be designed for the long term, independently of the lifetime of a single parliament.

### **Shaping by participation**

The BDI should send a clear public message for innovation and value creation in Germany. It is to be focused on a technology-oriented project for the future which the Federation selects with its partners. It is recommended that it be linked to the Industry-Science Research Union<sup>6</sup>.

In this way a project could be created securing new ways of participation in an integrated innovation strategy, a training facility in which financing questions, administrative procedures and new incentive systems can be tested. Web-based dialogues should accompany the project.

The experience gained benefits all those participating: enterprises, research institutes, cities, chambers, citizens' action groups, consumer associations, the public and the politicians. It would be an invitation to a new culture of innovation in Germany.

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6 A consulting committee to the Federal Minister of Education and Research

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### **Orientation as precondition for rational policy making**

Innovation policy is social policy. In a joint initiative the federal government and the BDI should kick start a broadly based process to develop models, scenarios for a Germany 2030 that is fit for the future.

While the scenarios were being developed it would already become clear what obstacles have to be overcome, what compromises have to be made, and above all, what opportunities would arise to secure value creation in Germany on a sustainable basis. The results should be used to identify new clusters of value creation. In turn, recommendations could emerge which serve to frame goals for research and innovation policy in order to tap markets of the future.

The model scenarios serve as an entry to a long-term learning process. It would be a success if the issues of innovation and value creation in all their complexity were to move closer to the centre of attention. The model scenarios should naturally serve as orientation for those in industry and politics.

### **Foresight as a condition for change**

German enterprises are often committed to a culture featuring engineering and technology. These companies in particular would do well to focus more on their customers and their requirements when developing products and services. Political, social and cultural developments are namely decisive for understanding future markets. Against this background the BDI is recommended to support enterprises and associations in creating an independent foresight competence. This applies especially to research and development.

Focusing on the interests of the customer is something for which a wealth of experience is already in place which can be exploited. There is research into technology and risk. There is also an exchange of experiences between companies with corporate foresight activities. The areas of policy-making and administration also need to build up foresight competence. There are already some beginnings in the field of regional foresight. It is recommended that they be further expanded.

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### **Innovative power of social consensus**

An innovation strategy based on value creation depends crucially on whether society accepts the solutions that are aspired to. Acceptance does not fall from the skies. It rests on experience and therefore has to be convincingly imparted. It is the result of the interaction of various groups and their demands. The respective positions should be made transparent and advantages openly addressed. The public does not like the feeling that they are being made use of in a manner counter to their own interests.

The status quo in the framing of goals in research and innovation policy in Germany reveals an asymmetric picture. Traditionally the focuses are decided by industry, science and policymakers, based on expert opinions and economically determined. On the other hand, there are social issues affecting human existence and how people live together. As science progresses, these issues take on added importance when new technologies affect basic questions of human existence, such as in nanotechnology, biotechnology, genetic engineering and information and communication sciences.

Although both sides belong together, the debate often takes place in separate forums, not least for reasons of time. It is therefore recommended that fundamental decisions on innovation strategy be discussed at an early stage and key points be identified for a social consensus that is as broad as possible. The prior conditions must be created by those in politics, science and industry. These include new participation procedures and a much improved communication of science with the help of educational institutions and media.

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## **Innovation with culture**

Germans are not hostile to innovation. This is demonstrated by the spread of the internet and mobile end devices without there having been a need for a discussion on acceptance. This was because the cultural and economic advantages were obvious. In this way work, communication and interaction were revolutionised in a short space of time. Innovation that is to achieve lasting success requires a certain culture and it is precisely this that needs to be developed.

The formation of an innovation culture is a long-term process and the players in it are assigned different roles. The politicians create the overall framework, the scientists face up to discussions and the business community opens up and develops user-friendly solutions.

It is recommended that in future all goals and programmes of innovation policy should make a clear contribution to fostering a culture of innovation. The corresponding indicators should be developed and maintained on a practical basis. The criteria include transparency, participation, need and user orientation, new patterns of competition, reliable framework conditions and the ability to learn in projects.

## **Growth, prosperity and sustainability**

The issue of sustainability has long since progressed beyond the sphere of environmental policy. It has now become a central component of research and technology policy and at the same time a task for all departments. This success can only be explained by the fact that the players concerned all link the topic with an alternative logic of economic operations which promises to guarantee livelihoods.

Whether the classic growth parameters comprehensively represent the good of society is called into question. The setting up of the commission of enquiry "Growth, prosperity, quality of life – ways to sustainable economic activity and social progress in the social market economy" should be seen against this background.

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So far the composition of the commission of inquiry reveals clear distancing from members of the business community. The federal government is therefore recommended to include representatives of business and the BDI in the work of the commission. The BDI is recommended to draw up its own proposals on the question whether a highly developed society like Germany can measure its success simply by quantitative growth parameters alone. The three dimensions of sustainability – economy, ecology, society – are indispensable.

### **Sustainability as a success factor**

Many enterprises achieve substantial growth rates in green markets. The share of value creation and the number of jobs in this area are steadily increasing. Nevertheless, in many enterprises sustainability has so far been understood as a supplementary task.

It is recommended that enterprises should comprehensively integrate and implement sustainability in their innovation and strategy processes. Examples of how this can be done are clear self-set objectives and monitoring implementation by indicators (key sustainability performance indicators).

Sustainable future markets of restricted to the areas of energy and mobility. In fact they extend to all areas of industrial production. An integrated and holistic view is the key to economic advantages. What is positive is that with sustainable products and solutions the question of acceptance does not arise.

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## **Technology development and viability for the future**

Global megatrends shape the markets of the 21st century: demographic change, urbanisation, scarcity of resources and climate change. The answer, if there is one, to such complex issues lies in systems solutions. So technological competence continues to be demanded, competition in innovation and quality becomes more important. Competition through price undercutting is not a promising strategy for Germany in any case since in many cases it would mean a loss in value creation and income. On the whole, conditions for German industry to continue on a successful path of growth remain good.

However, in the emerging countries serious competition in the field of science and technology is gaining strength.

Furthermore, radical technological change is confronting classic manufacturing industry with new challenges. The response lies in flexible framework conditions in the areas of education, the labour market and mobility. However, that alone is not sufficient. Germany must retain its ability to develop central future technologies, to convert them into solutions tailored to meet needs and to make them marketable by accompanying services and business models.

A central role in all areas of technological progress is played by the processing of information and knowledge. It also helps the integration of various components into the systems solutions already mentioned. Personalised medicine or the “Internet of Things” are examples. The demands made on the management of complexity increase substantially. It is therefore recommended that in science and policy-making there should be a stronger emphasis on systems innovations as the subject of interdisciplinary research promotion, with the focus on a holistic innovation approach.



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**LEGEND**

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+	Positive effects on employment or value creation
-	Negative effects on employment or value creation
+/-	Initial positive then negative effects to be expected which on balance practically cancel each other out
-/+	Initial negative then positive effects to be expected which on balance practically cancel each other out
+/-(-)	Initial positive then negative effects to be expected which on balance are positive
(+)/-	Initial positive then negative effects to be expected which on balance are negative
-/(+)	Initial negative then positive effects to be expected which on balance are negative
(-)/+	Initial negative then positive effects to be expected which on balance are positive

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# Glossary

Those acting socially are described as actors. There is a distinction between individual actors (persons) and collective actors (organisations, enterprises, states). They have in common that they can be contacted, i.e. are available for communication. Relevant economic actors are described as stakeholders.

## Actor

In business studies the concept of the strategic actor is used in connection with the modelling of business processes. The task is to explore which actor has an influence on a business project.

Schreyögg G. (1999): Strategisches Management – Entwicklungstendenzen und Zukunftsperspektiven. In: Die Unternehmung. Jg. 53 (1999) Heft 6

Clustering means the grouping or joining of features and/or variables on account of similarity

## Clustering

Raithel (2008): Quantitative Forschung: Ein Praxiskurs. Wiesbaden

Changes often have a disruptive character. The impact of disruptions is considerable. Disruptions result from breaks in trends or from plausible prolongations of existing trends – both with profound effects on the structure of value creation in Germany. External shocks can also impact as well as arrival at tipping points. In the business world we often experience such breaks in the form of non-linear developments. Whether disruptions will actually occur is not certain. However, if they are taken seriously, they open eyes for possible fundamental social upheavals with far-reaching consequences for value creation. This gives rise to opportunities and risks.

## Disruption

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**Foresight  
(a look into  
the future)**

The overall concept of foresight means an extensive set of methods and analytical instruments of research into the future. A knowledge-based and interdisciplinary procedure is common to them all. The length of time with which foresight concerns itself with can range from a few years to several decades. The variety of perspectives makes foresight especially relevant for corporate strategy planning.

Burmeister, K. / Neef, A. / Beyers, B. (2004): Corporate Foresight. Unternehmen gestalten Zukunft. Hamburg.

**Indicator**

A feature that points to a super-ordinate development.

In empirical research an indicator describes a limited sample taken from a quantity of empirically verifiable data with the help of which generalising statements can be made. In industry indicators are understood as pointers to the development of the economy or the economic situation in general. Example: falling purchasing power as an indicator of an economic crisis.

Koch, J. (2004): Marktforschung. (4th impression). Munich

**Informatisation**

Informatisation is a process of generating and using information in order to be able to produce further information. The essence of informatisation lies in translating information into a material object of cooperative human activity, for example into a vehicle. The concept is mostly used with a more special meaning: the penetration of all life areas of society by information and communications technology, especially the computer and the internet.

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The practical application of an idea to solve problems is described as innovation. In industry there is a distinction between three basic forms: the manufacture of new products or products with clearly improved properties (product innovation), a change in procedures for making a product (production or process innovation), and a new way of organising production and sales (organisational innovation). Innovations can meet with success in the market but can also be failures.

## Innovation

Corporate identity describes a long-term, strategic framing of corporate objectives and defines how the goals are to be met. As a part of corporate identity the enterprise assessment mostly aims at achieving a consensus on values between the management and employees, at strengthening the feeling of togetherness and also providing practicable and consensual rules in case of crisis.

## Corporate identity

Corporate identity assessment seeks to develop a corresponding corporate model that is viable for the future and to adjust it to specific needs.

Kiessling W. / Babel F. (2007): Corporate Identity – Strategie nachhaltiger Unternehmensführung. (3rd impression). Augsburg

Modelling aims at a (simplified) image of reality in order to capture essential modes of action and the causality of real processes. Modelling is distinguished from simulation in that it remains of a purely theoretical/hypothetical nature and is not reproduced experimentally/virtually. Economic models describe presuppositions (a priori) of economic structures and processes, such as the influence of individual behaviour on market developments.

## Modelling

Kirchgässer, G. (2008): Homo oeconomicus: Das ökonomische Modell individuellen Verhaltens und seine Anwendung in den Wirtschafts- und Sozialwissenschaften. Tübingen

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<b>NGO</b>	Non-government organisation
<b>Paradigm shift in value creation</b>	General patterns in the change in value creation seen from an overall perspective transcending individual branches of industry or enterprises. These include a trend to the dissolution of separate branches, sustainable innovation as a lever of value creation and a necessity for controlling complexity. In general the paradigm shifts in value creation demonstrate that circumstances do not become simpler but more complicated. Volatility increases.
<b>Parameter</b>	<p>A defining property or feature. A parameter can be a defined variable which helps to identify and describe processes and developments. Expanded definitions describe parameter properties which are situated outside the object under observation, which is why the term can be used synonymously with influencing factor.</p> <p>Bossel, H. (2004) Systeme, Dynamik, Simulation: Modellbildung, Analyse, und Simulation komplexer Systeme. Norderstedt</p>
<b>Portfolio</b>	<p>This term originating from the financial sector describes the sum of products, services and brands supplied by a business enterprise. In strategic management portfolio serves as an analysis criterion for determining the market position of an enterprise. The goal in the creation of a suitable portfolio is the balance between diversity and concentration on core competences.</p> <p>Jung, H. (2006): Allgemeine Betriebswirtschaftslehre (10th impression). Munich</p>

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Trend or complex of trends that determines or characterises a field and its future development. It is of no account whether the key factor determines the field as a cause (e.g. as external influencing factors) or whether it describes its central effects. The concept of the key factor is an attempt to make an assessment or judgement from among the variety of influencing factors (trends and also action options of important actors) in order to reduce the complexity of the problem to a manageable level.

### Key factor

Weak signals is a term for developments or trends which appear only slight at the time they are discovered but which have the potential to become key factors in the future of organisation and enterprises. Consequently, weak signals harbour the danger that they can easily be overlooked or underestimated. For example, at the start of the internet age many in the business community considered www to be a temporary technological gimmick of no economic importance.

### Weak signal

Röttger, U. (2001): Issues Management. In: Nolting, T. / Thießen, A. (ed.): Krisenmanagement in der Mediengesellschaft. Wiesbaden.

Stakeholders are groups with vested interests who have a direct or indirect connection with an enterprise or venture. In contrast to the shareholder approach which concentrates on the interests of those holding equity, the stakeholder approach aims at a balance between the interests of various relevant status groups. These include internal stakeholders (staff, managers, proprietors) and external stakeholders (customers, suppliers, investors, state, society).

### Stakeholder

Ulrich, P. (1999): Was ist gute Unternehmensführung? Zur normative Dimension der Shareholder-Stakeholder-Debatte. In: Kumar, B.N. / Osterloh, M. / Schreyögg G. (ed.): Unternehmensethik und die Transformation des Wettbewerbes: Shareholder-Value – Globalisierung – Hyperwettbewerb, Stuttgart.

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## Strategy

Targeted and planned thought and action based on the long term. Strategies aim to stabilise expectations in view of an unknown future. Strategies enable or facilitate decisions in uncertain conditions. The term originates from the military sphere and is closely related to the term 'tactics'. In industry strategy is understood as meaningful sequencing of the operations of an enterprise with the aim of securing a lasting competitive advantage.

Lühmann, N. (2006): Organisation und Entscheidung. Wiesbaden

Porter M.E. (1999): Wettbewerb und Strategie. Frankfurt am Main.

## Scenarios

Scenarios are consistent and plausible alternative images of the future. In contrast to forecasts, scenarios are hypothetical. It is uncertain which of the possibilities, which detailed aspects of the scenarios will actually occur. Taken together, scenarios illustrate the most significant driving forces which future developments depend on, provide an overview of linked effects and describe possible consequences.

## Trend

The term describes a gradual, sustained and generally continuous development – in contrast to cyclical swings, erratic fluctuations or the arrival of something essentially new. Trends can be distinguished from short-term fashions by having a sustained effect over several years. Moreover, they are robust, do not change abruptly and continue in the same direction. Trends have a corresponding lasting effect on concrete living conditions and thus fulfil the conditions to be taken as a point of approach for the strategic planning of enterprises.

Müllert, A. / Müller-Stewens G. (2009): Strategic Foresight: Trend- und Zukunftsforschung in Unternehmen – Instrumente, Prozesse, Fallstudien. Stuttgart.

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## Cycles

Cycle is a term for the temporary, periodic decline and increase in certain observable phenomena. Cycles are marked by regularity, demonstrate continuity and are thus suitable for making forecasts. One example of the application of cyclical thinking in the field of economics are so-called economic cycles, which proceeds on the assumption that economic performance runs in cycles depending on paradigms and technological developments, whereby longer and shorter cycles overlap.

Raudenbush (2005): How Do We Study What Happens next. Thousand Oaks/Chicago.



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