



BDI

Bundesverband der
Deutschen Industrie e.V.

INDUSTRIAL POLICY DOSSIER

Germany`s Prosperity Rests on Innovation.

Theses on German industrial policy

January 2016

- **In the coming years, prosperity in Germany will have to be generated through technology and knowledge to an increasing degree.** Technological progress will become the sole driver of growth in the long run as growth contributed by labour and capital declines in the face of demographic change. Germany must now chart the course for this transformation.
- **Radical technological change will slash marginal costs, opening up completely new business models.** This will change value added in key sectors including mobility, healthcare and energy, and increase integration with services.
- **Germany must take more concerted action than it has so far to set the course for industrial policy going forward.** Although Germany still boasts a range of outstanding benefits as a business location, it must tackle weak points in the start-up environment, venture capital, public investment and regulatory parameters for key technologies.
- **The strategic priorities of German industrial policy must continue to be the deepening of the European single market and the international trade and investment regime.** Bilateral and multilateral trade policy has moved into rougher waters while the untapped potential right here in the European Union is wholly underestimated.
- **In the digital world too, a good balance must be found between productivity and social cohesion.** While this vision is still forming on the horizon, the political course taken now will determine whether it will turn into a positive or a plaintive reality.

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Thesis 1: Germany is poised to continue its transformation into an industrial knowledge society until 2030. This development harbours huge economic opportunities but will require a modern industrial policy with a strong emphasis on education, research and technological progress in order to flourish.

In the course of the next fifteen years, Germany's economy is set to step up its development towards a knowledge society with modern services, new industrial value added and a high pace of innovation. Germany's growth will be driven primarily by technological progress and become increasingly knowledge-intensive. The factors of capital and labour will no longer be able to contribute noticeably to growth due to demographic trends (Johansson 2013). The consequences of these fundamental factors for economic policy have not yet been taken on board in all fields.

Good economic position but major political concerns

Many people in this country are asking themselves in what position Germany will be in the medium term, in 2030 for example, politically and economically, at home and abroad. The signs of change in world politics, in technology and in societal developments loom large and have triggered widespread concerns about job security, social cohesion, the environment and the standard of living. Germany's robust economic and structural position in the last two years has overshadowed the much more formidable long-term trends.

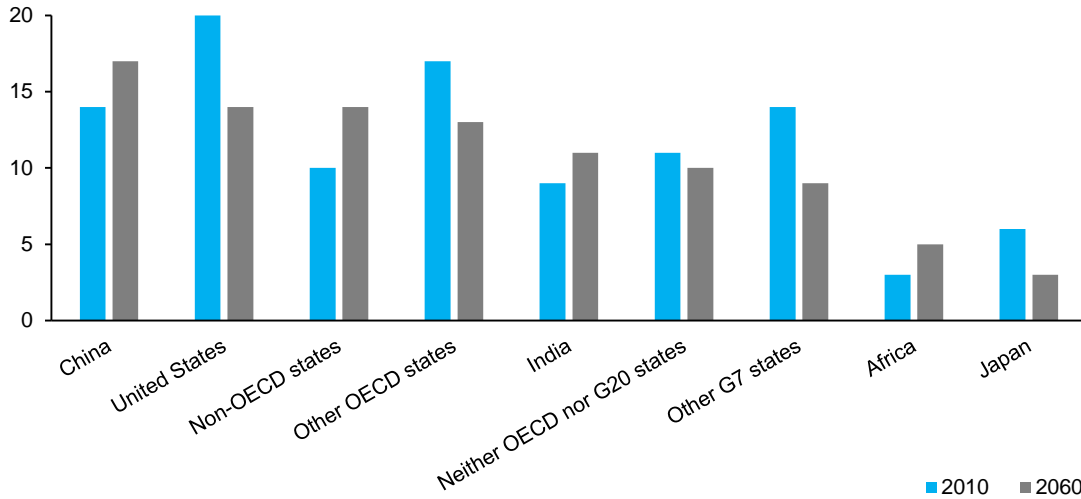
Rise of Far East and South has reshuffled the cards

In the last few years, the rise of the Asian economic regions, momentum in North America and the upturn experienced in some African and Latin American countries have all boosted the global economy. On the other hand, negative factors such as the political conflicts between Russia and some of its neighbours, the threats posed by international terrorism and the risks to the climate have moved to the forefront. This myriad of changes has created insecurity as to the position of Germany in the world and the appropriate response to take in its economic and foreign policy. The latest wave of refugees fleeing from the war in Syria and other unstable regions in the Middle East and North Africa has intensified this insecurity.

The changes in the global economic powers are the easiest to foresee. Regional contributions to global economic growth will shift substantially in the next few decades. By 2030, the OECD is predicting that China's and India's share of global economic output will particularly increase, with strong growth coming from Africa by 2060. The share of traditional industrial countries will decline substantially, while growth in emerging countries (non-OECD states) is predicted to rise from the 40 percent recorded in 2012 to 60 percent by 2060 (OECD 2014a). The shares in world exports will display a similar shift, but not quite as pronounced.

At the same time, technological progress is viewed alternately with sheer anxiety or bold hope depending on the tone of the news that day. All agree that the future of value creation in German manufacturing and services in the next generation and beyond will depend decisively on whether the country manages to bring together better qualified labour with a modern capital stock and cutting-edge technology in the broadest sense, while continuing to produce globally competitive goods and services and stabilise its high social security expenditures.

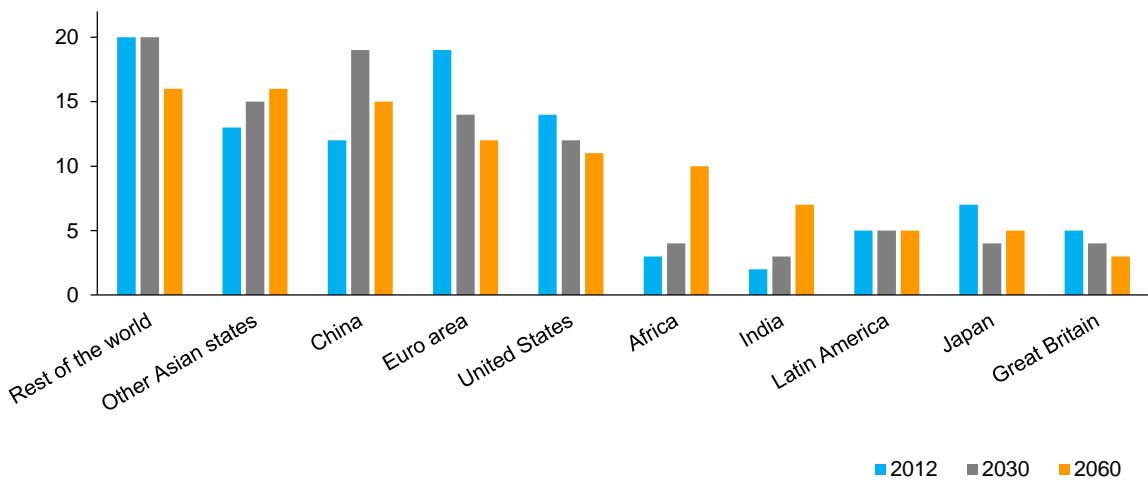
Major changes in composition of global output over the next 50 years, in percent of global GDP



Source: OECD 2014a.



Share in world exports of non-OECD states rising considerably



Source: OECD 2014a.



Future prosperity and new technologies

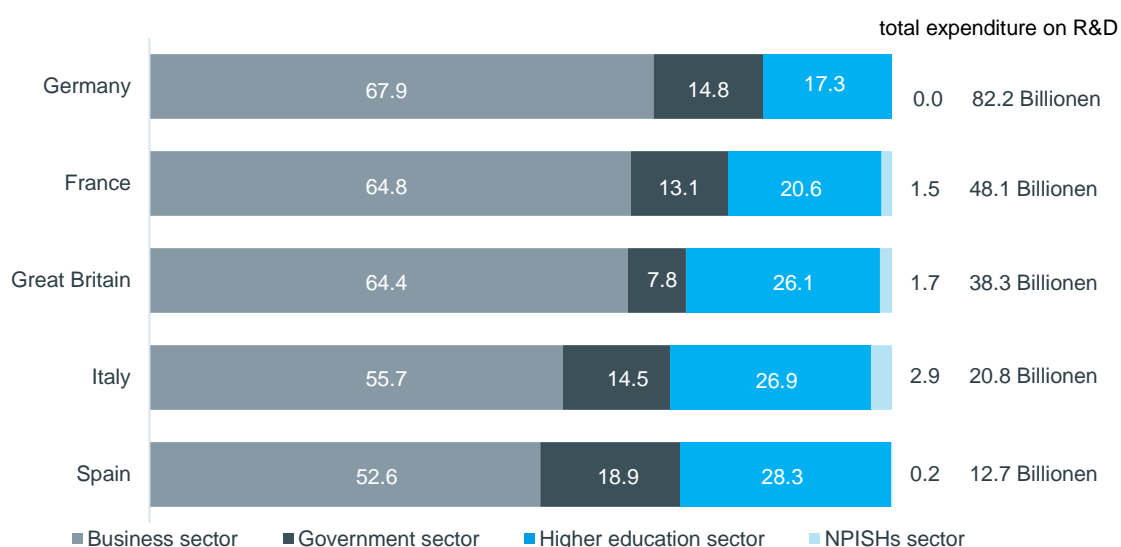
Increasing growth potential will require not just broadening the scope of jobs available, raising the skill levels of employees and expanding gross fixed capital formation but also increasing productivity, which is bolstered by investments and innovation in industry and society. After all, technological progress delivers an important share of growth in highly developed economies. The foundation of our standards of living of tomorrow must be laid by the investments we make today, and this does not mean investing only in plant and equipment. This means investing in the brightest minds, the best employees, the best technical systems and machines, world-class education and research, the innovative integration of different systems, excellent legal parameters and well-defined property rights in order to pave the way towards a market economy based on the spirit of competition with a good social, ecological and economic balance.

Securing prosperity for the long term is built on continuous and, in historical terms, sometimes also abrupt increases in the productivity of our economic activity. And the productivity of tomorrow will be driven by knowledge and the intelligent combination of the factors labour, capital and knowledge.

Boosting productivity through inventions and knowledge

Germany is transforming into a knowledge economy in which the commercial use of knowledge will become increasingly important. Germany already occupies a leading position in research and development in Europe, even though some smaller countries expend greater amounts per capita. German enterprises have purposefully invested heavily in research and development in the last few years, accounting for two thirds of total German research expenditure. This commercially relevant knowledge is not just tied to tangible patents, brand rights, registered designs and organisational capital but is increasingly becoming a business model for industries that have hitherto focused primarily on industrial production. Germany was still not the forerunner in intangible assets, at least not in 2007 (HRE/DIW 2014, Expert Commission 2014).

Shares of expenditure on R&D, by sector in percent



Source: Eurostat



International research is unfortunately not advanced enough to allow for very robust recommendations for economic policy, but some indications will be addressed below. Studies conducted by the OECD indicate that

the accumulation of knowledge-intensive capital through investments in process and production innovations has flagged in the last few years, a trend which even the dramatic advances in information and telecommunications have not been able to stem (OECD 2015 a and b). The OECD shows that companies at the global cutting edge of technology have recorded particularly high growth (average annual growth of 3.5 percent in labour productivity since 2000), while leading national companies and above all SMEs have fallen behind noticeably with growth low at around 0.5 percent in terms of labour productivity (OECD 2015 a). The OECD emphasises the importance of basic research, innovation-friendly environments and flexible, competitive product markets when it comes to increasing productivity across the whole economy.

Germany has ranked in the mid-range in cross-comparisons of hourly productivity trends since the 1970s but is currently around 15 percent lower than the US (2013) and, in absolute terms, only just behind France and the Scandinavian countries and far higher than most other countries. Information and communications technology (ICT) users as a group only contributed marginally to growth in productivity in the non-agricultural business sector (OECD 2015c). The individual production factors contributed unequally to growth. Although labour still contributed to growth from 2007 onwards and wages were neutral, capital intensity contributed the lion's share of growth, while total factor productivity as an indirect gauge of technological progress provided a negative contribution to real growth.

Growth and distribution should be improved in the long term and in equal measure

If we succeed in raising productivity and growth potential through increased technological progress with better and secure jobs, new mobility and better health, there will be greater opportunities for social integration and a better distribution of income. But technological progress can also, and especially with an inadequate regulatory and distribution policy, lead to a prolonged period of inequality in opportunities, income and assets. The government and society at large are called upon to find new approaches in social policy to adapt to these technological developments – a discourse which has only just begun (see e.g. OECD 2014b; Rajan 2010; Stiglitz 2015, 2012).

Thesis 2: Germany has become a world champion in economic globalisation. The overwhelming public consensus on a good balance between global market integration and welfare policy of the last fifty years (i.e. a social market economy) is crumbling. Anxiety regarding globalisation is on the increase. This is also reflected in the public's support of political parties.

Germany's economic reality has been marked by international interdependence for a very long time and to a very strong degree, and this has resulted in a large number of different responses to globalisation emerging in its foreign economic policy and social policy. In an international comparison of welfare state structures, Germany ranks at the middle of the pack.

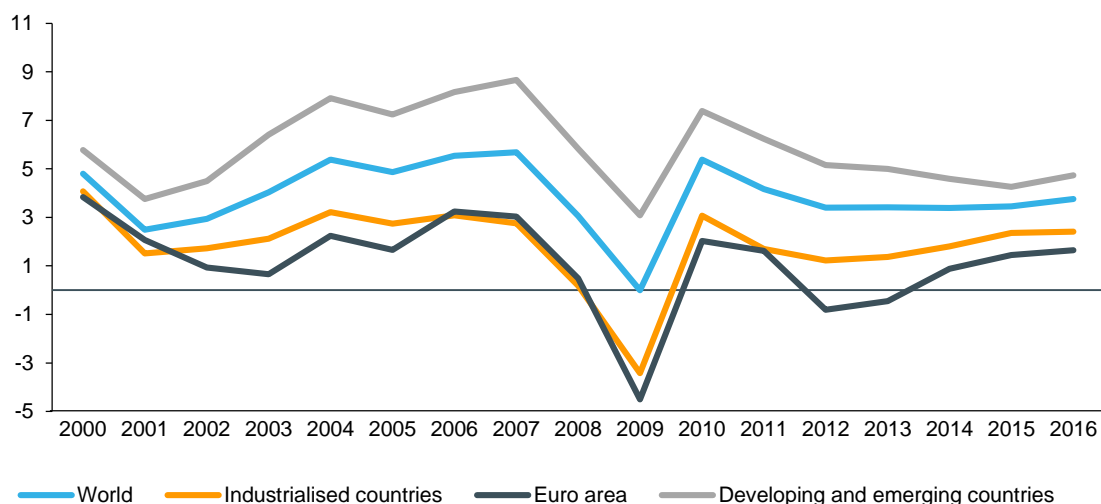
The internationalisation of the economy and the rise of emerging countries

In the last fifteen years, Germany's globalisation profile has deepened considerably. This reality has yet to sink in completely with the public. The reasons for this development are widely known, but still bear repeating. The combination of technological progress and the end of the old global divide between Western countries and socialist states, over one generation ago, led to around three billion people (in China, India and Russia) being newly integrated into the international division of labour and created new markets, while also triggering severe adaptation processes for workers and business leaders in the Western world.

And how could it possibly have been any different? The return of China and India onto the map of the global economy in the last three decades has undoubtedly been the biggest factor. The return of Eastern and Central Europe into the European community of states and the global economy has further advanced the international interdependence of Germany. The five large waves of democratisation and the move towards a market economy in Latin America, Africa and in other countries of the world have also contributed to this trend.

These large-scale political developments have injected substantial growth impetus into the world economy for the last two decades as developing, transforming and emerging countries usually exhibit a higher rate of growth than established industrialised countries. The long-term effects of the major financial and economic crisis in 2008–09 and several demographic and country-specific factors have given the IMF good ground to considerably downward adjust the growth potential of even major emerging countries in its latest report. Their lead over the industrialised countries, however, is little changed overall. The rate of growth of emerging countries is still about twice as high as that of industrialised countries as their growth potential was also downwardly revised (IMF 2015). The same trends are also reflected in the real rates of growth.

GDP: real growth over the previous year, in percent



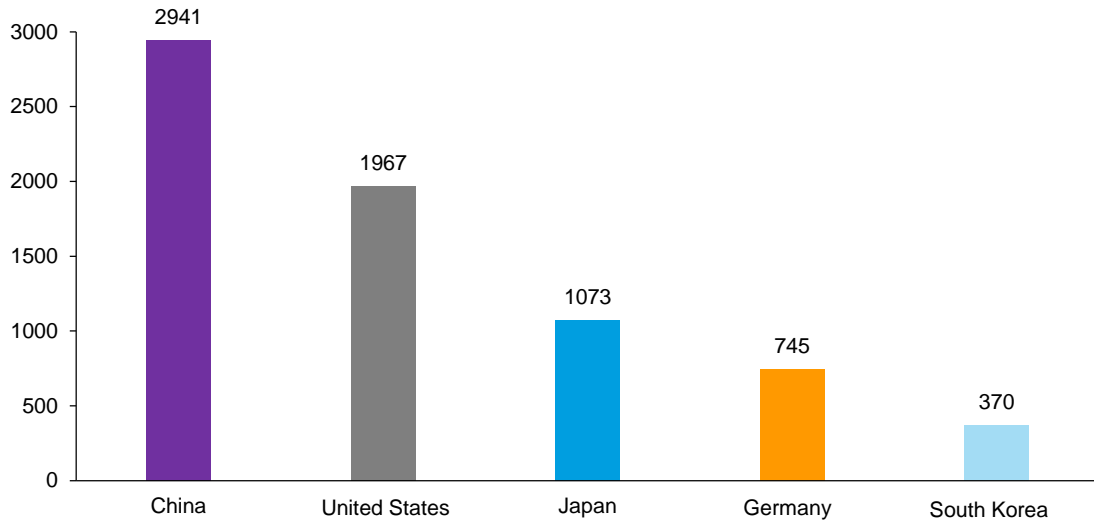
Source: IMF, April 2015



Germany's economy is becoming increasingly international

These trends have not created any insurmountable problems for Germany and, following a restructuring of the German economy a little over ten years ago, have even led to substantial welfare gains. The economic and social reforms from 2000 to 2005 and the consistent promotion of education and research over the last ten years have set the course in several important ways. A range of new solutions for negotiations between companies and works councils or employer associations and trade unions have played a hand in responding to this new competitive situation. In this way, Germany has managed to stabilise its share of global manufacturing value added at just below 7 percent (for comparison: China: 26 percent; US: 18 percent; Japan: 10 percent). Germany is now the fourth biggest industrial nation in the world and the largest industrial producer in Europe (with a share of just under 31 percent).

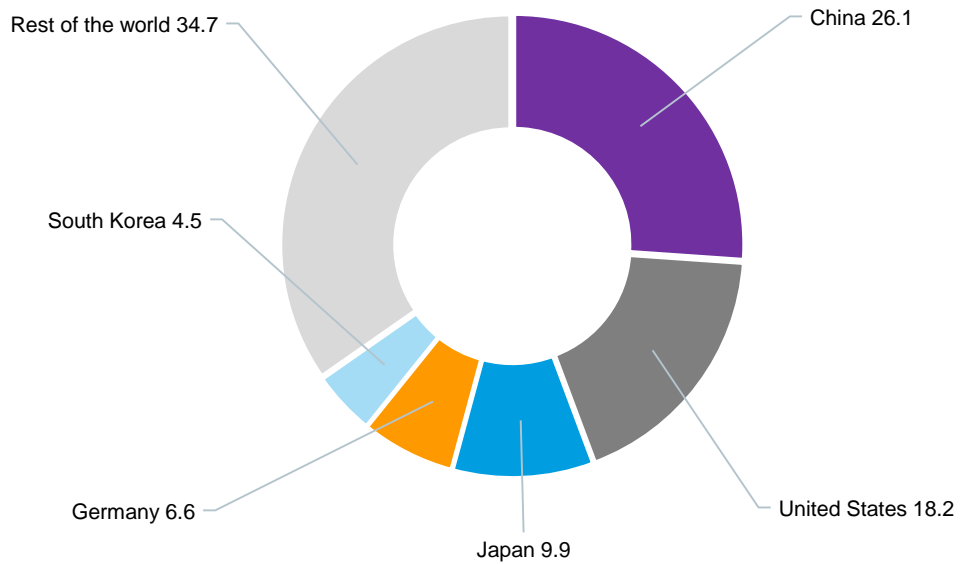
German industrial gross value added in comparison, in billion US\$



Source: World Bank



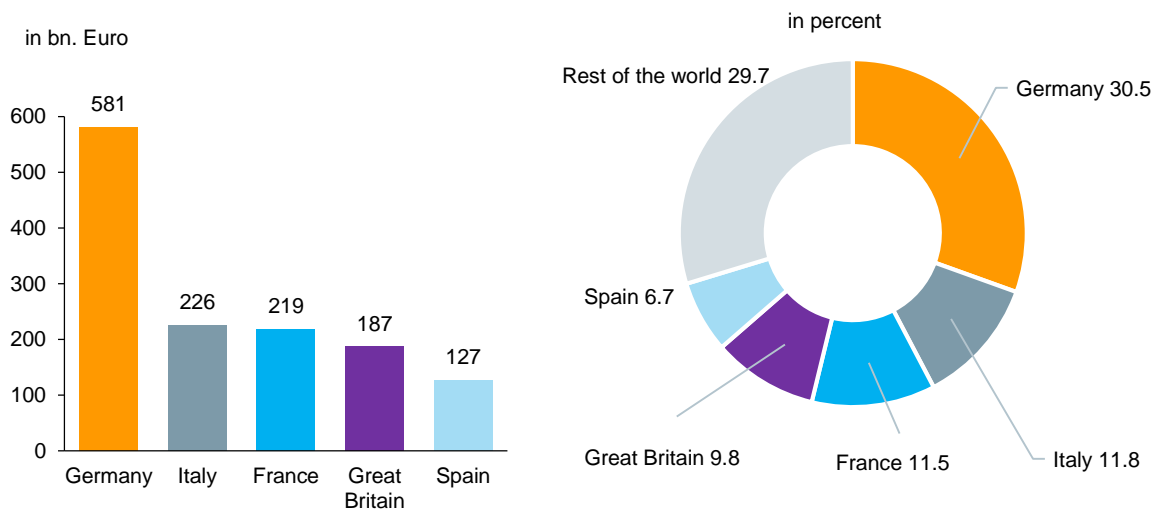
Share of global industrial value added, in percent, 2013



Source: World Bank



German industrial value added in a European comparison, 2014



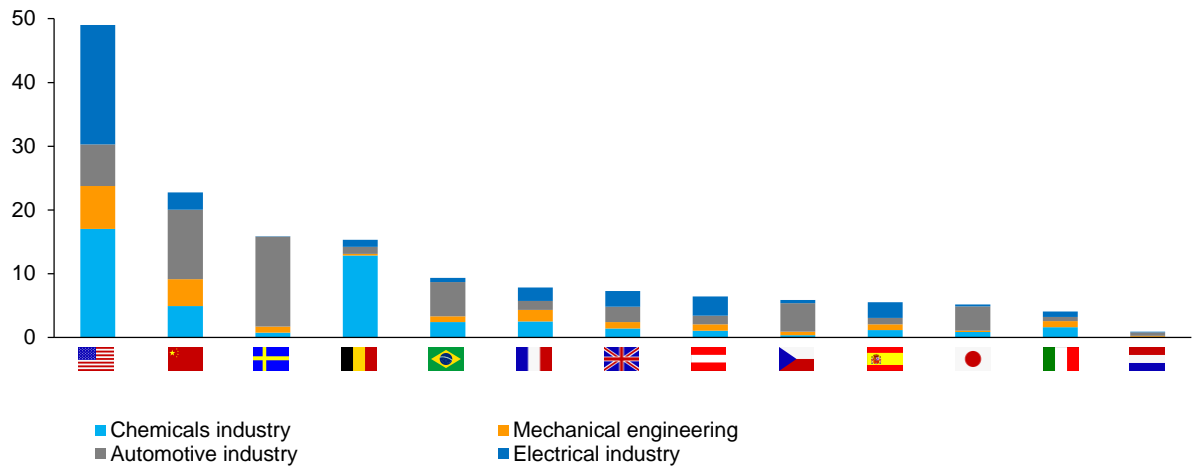
Quelle Eurostat



Most companies had already seized the new opportunities at the start of the last decade in an extensive wave of consolidation, before the Agenda 2010 reforms. These companies cut their costs, expanded their operations in Asia and other new markets, increased their ties to Central and Eastern Europe and adjusted their corporate strategies with the trade unions. Most industrial enterprises had managed to regain their competitive strength by the middle of the last decade.

There followed a decade in which the international operations of German industry underwent an extremely dynamic and surprisingly steady expansion in efforts to tap the market opportunities in the new countries. This trend continued almost unabated, despite the major crisis of 2008–09, the subsequent crisis in the euro area, the Arab Spring and the ups and downs of the Chinese economy. This is a success story of German enterprises that few have yet grasped. Much happened with the “Made in Germany” but this phenomenon has not yet received the attention it merits in all its aspects by the German public. It is also often implied that Germany is not interesting as a business location anymore anyway.

Foreign shareholdings by industry and target countries, in billion Euro



Source: own calculation with data from Deutschen Bundesbank

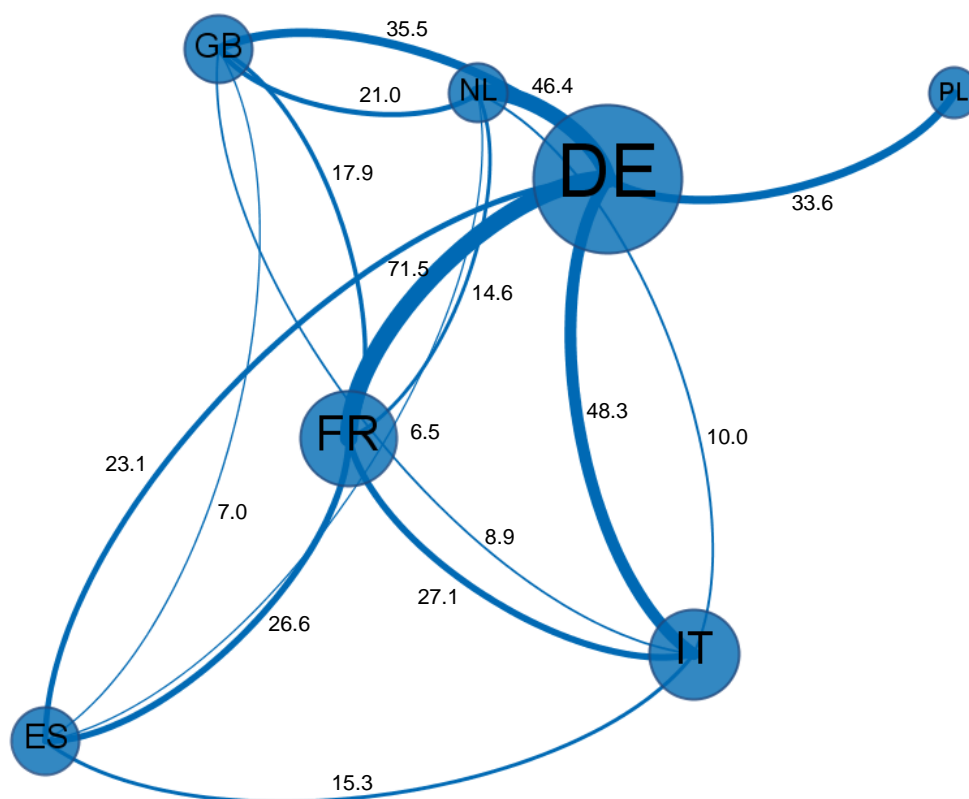


Value chains and research alliances are special factors in Germany

Germany has so far managed to retain and even deepen most value chains in industry, to forge closer links to industry-related services (BDI and IW Consult 2015, Cologne Institute for Economic Research 2013) and to realign its value chains to fit with the new market realities. Studies have shown how closely logistics, transport, various other services and industrial production processes are woven together in a large network of intermediate products, capital goods and consumer goods manufacturers. This high degree of connectedness of the German economy across many industries and several key service sectors only exists in this form in very few other countries such as Italy, the Republic of Korea and possibly, in the future, China.

On account of its size and structure, German industry is still at the heart of the European network of value creation. The internationalisation of production has led to a dynamic growth in the import of intermediate inputs, far exceeding that of final consumer goods. The main driver of this trend was the so-called "hub industries" that make complex products and buy-in numerous intermediate inputs, both from manufacturing and services. There are large networks for intermediate inputs with numerous different economies (see chart).

Input interconnectedness, in billion Euro, 2011



Sources: IW Consult, OECD



Another special feature of Germany are the closely-knit ties between the private sector and research in large-scale research institutes, institutes of applied research and development, and entrepreneurial R&D activities. In the last few years, Germany has steadily increased its integration of public and private institutes and locations of science and research on an international level as well. This model has so far been seen to such a degree only in Asia, specifically in Japan and South Korea.

Germany's specialisation profile can only be upheld through internationalisation

Like no other large industrial country, Germany is very strongly integrated in the European economic area, in global trade, in global investment flows and in the international division of labour. Unlike many other industrial nations, Germany has retained the focus of its economic value added in manufacturing. Especially investment goods, but also durable consumer goods, have come up against a dynamically growing demand from developing and emerging countries. There are a number of reasons to believe that Germany will only be able to retain this profile with advanced internationalisation. However, there is also potential for dynamic growth in domestic value added in certain industries and service sectors that have proven to have comparative advantages for many years in the past (e.g. insurance services, research and development services, and measurement and control systems). On a macroeconomic level, the still relatively low absolute contributions to economic output of these industries is not yet sufficient to transform the profile of specialisation of Germany in

any profound way. There are of course also big opportunities for dynamic growth in strongly domestically-oriented sectors such as education, healthcare and nursing.

Germany has a surprisingly pronounced globalisation profile

A study published by the McKinsey Global Institute investigated how open national economies are in the exchange of people, capital, information, and in conventional goods and services flows. The outcome is surprising. Of all the large national economies in the world, Germany currently has by far the strongest globalisation profile, ahead of the US, which despite being the biggest economy is much less integrated with the rest of the world and ranked third after Hong Kong (McKinsey Global Institute 2014).

Measured by the global share and intensity of cross-border flows, Germany ranks third in goods, fifth in services, seventh in finance, fifth in mobility and second in data and communication. The 53 percent increase in flow intensity recorded between 1995 and 2012 is far above average. In terms of overall connectedness, the next positions go to Singapore, the United Kingdom, the Netherlands, France, Canada, Russia and Italy. Japan ranks 21st, while China takes 25th place.

Economic globalisation is promoting political discourse, but causing fraying along the edges

Germany is consequently, unlike any other large industrial country, directly economically affected by almost all phenomena that occur in any corner of the world. The German population is therefore exposed to the consequences of international developments time and again. It is no coincidence that the German government is endeavouring to resolve conflicts and solve problems through its foreign policy. Security conflicts among trade partners can all too quickly impact on the jobs and profits of German enterprises. The examples here are well known.

New conflicts creating insecurity among the population

At the same time, the conflict between Russia and the Ukraine, the scandals among secret services and, not least, the refugee crisis, have all bred a deep insecurity among Germany's citizens. The persistent difficulties in stabilising the countries in the euro area and the associated financial risks for the public creditors and taxpayers, also in Germany, have further intensified this anxiety. Germany's foreign policy DNA, which in its seventh decade after the Second World War is still defined by European integration and multilateral cooperation, is also vehemently opposed to the neo-Victorian traits of the world economy and world politics (Posen 2013). These have become dominant in the post-hegemonial non-European region with their traditional balance of power structures and have found a counterpart within Europe in the form of a revival of albeit temporary bilateral and intergovernmental power structures.

This last development has emerged on the back of the requirements of the crisis management in the years of the euro area crisis but may well continue for some time to come. All these international phenomena have not yet sufficed to shake the very foundations of the traditional attitude of the internationally-oriented and pro-European elites but have exposed it to stormy weather.

Public opinion still supports international orientation

Opinion surveys still show that the majority of Germans continue to support an open world trade system, European integration and the euro (e.g. Pew 2015). However, there are political forces on both ends of Germany's political spectrum that are questioning the consensus that has lasted for the last seven decades among the German population on these issues, and calling for a return to a purportedly more manageable national policy space. This movement is gathering force despite the widely spread understanding that Germany will only be able to increase its capacity to act through deeper integration in Europe, divided political sovereignty and a continued delegation of competencies to the communal institutions of the European Union vis-à-vis the new Asian superpowers, Europe and the US.

A changing political landscape

The trends in internal politics in the last few years clearly show that the political parties that range from sceptical to opposed to further European integration and the world economic order have built up support among the population and are represented in local and federal government. Germany now has a fair share of critics of European integration and internationalisation that are beginning to constrict the room for manoeuvre of those political parties that have traditionally been oriented towards global free trade and liberal investment regulations, European integration and transatlantic cooperation. Our political leaders are still managing to keep on course, but whether they will succeed in the future is, in the face of the growing uncertainties emanating from world politics, more of a hope than a certainty.

Thesis 3: Over the next fifty years, Germany may well become the slowest growing large economy in the world. Demographic change will cause the contributions to growth of labour and capital to decline to very low and even negative levels in the next few decades. The only real way to stimulate Germany's growth potential will be to increase total factor productivity, which is basically technological progress. This understanding hardly features in the political discourse in Germany.

Germany's growth potential is under considerable demographic pressure

The long-term impact that demographic change will have on the growth potential of the German economy are still far from being fully appreciated. In this context, it is worth noting some of the consequences identified by an outstanding OECD study (Johansson et al. 2013).

- Over the next fifty years, the population of Germany will decline considerably. How pronounced this trend will be will largely depend on net migration figures. Migration has slowed down the ageing of Germany's population at a rate far above average in the last twenty years. Without a continued high net migration of labour from abroad, the population of Germany would shrink by 30 percent by 2060; with migration it is more likely to be 20 percent.
- At the same time, Germany's working population is declining because of the growing proportion of people that are no longer in the workforce, and will drop from over 65 percent in 2011 to under 55 percent in 2060. The labour participation rates among the 15-plus age group will drop by just under ten percentage points by 2060.
- Even if we boldly assume that capital intensity remains constant despite ageing, as it has done in the past, the situation in Germany would be as follows: the simple deployment of capital and labour will, on average, pull down growth over the next fifty years. A little stabilisation should enter into the equation through better-educated workers.

- Germany's long-term growth potential is almost wholly dependent on technological progress. Going by the development of total factor productivity, which reflects technological progress, Germany should be able to attain annual growth of 1.5 percent, which is slightly above the average of 1.3 percent seen in the last few years but is still at the lower end of the 42 economies investigated. In the model calculation, per annum productivity growth in China is estimated at 3.7 percent, in Indonesia at 3.2 percent and in India at 3 percent.
- On account of the structural developments on the horizon for its sources of growth, the German economy is set to have a growth potential of only 1.25 percent until 2060, which is the weakest growth of all the 42 economies investigated. Germany is thus bringing up the rear in this respect.

Such long-term studies are by their very nature liable to errors and structural breaks, but this does not make their conclusions any less plausible given what we know today. It is informative that other authors put Germany's growth potential at an above average rate of 2 percent based on a structural observation of Germany's specialisation profile on industrial value added and an increasing integration of upstream services and customer service (Rürup and Heilmann 2012).

The latest wave of refugees could, in the medium term, increase Germany's growth potential. The leading economic institutes in Germany forecast that migration would have a positive impact on growth potential in its 2015 joint autumn report (Projektgruppe Gemeinschaftsdiagnose 2015), as does the OECD, which raised potential growth by 0.2 percentage points (resulting from +0.6 points for the factor labour and -0.4 points for the contributions of capital and factor productivity) (OECD 2015 c: 38f.).

Thesis 4: Despite the positive trend in employment over the last decade, the capital stock of the Germany economy is ageing in many manufacturing industries and in its public infrastructure. Reviving investment activity in Germany to modernise its capital stock is therefore a high priority, all the more because technological progress and the further development of value chains will not be possible without it.

The trends in the German capital stock and investment activity over the last twenty-five years have been characterised by a clear differentiation. Total investment activity has remained weak following the reunification boom in the 1990s, also on an international comparison (see Frisse and Deutsch 2016 i.E. on the following).

Weak public investment activity

The diagnosis that the public sector has invested too little in infrastructure (transport routes, municipal infrastructure, broadband, and other areas) over the past years is now met with broad consensus, and efforts are gradually being made to remedy the situation (Expert Commission Report "Strengthening Investment in Germany" 2015). For our purposes, it suffices to point out that investments in the maintenance of transport routes must be stepped up, exceeding the amounts budgeted for 2014, and that channels should be opened up to increase private sector financing. On a federal level, this need has been taken into account in several resolutions of the Grand Coalition. The next few years will see federal investments into transport routes and other areas of federal infrastructure increased substantially and the launch of a new range of PPP projects in transport route construction.

Increasing municipal investment activity, in turn, will require a targeted reform of the federal financial relations and expanding the toolbox for promoting investments. Investment in digital infrastructure is largely financed by the private sector, but is still likely to need impetus from the state. Germany's federal and state governments have just recently extended their investment promotion schemes. Other fields in which the parameters need to be improved are detailed in the federal government's Expert Commission Report.

Weak private investment activity

The investment trends in the private sector are more pronounced. Investment behaviour here is mixed (HRI/DIW 2014, Heymann 2014). While the capital stock of the private sector has aged substantially since 1991, there are differences between the individual industries and types of investment. The comparatively weak development of residential and commercial construction activity should be factored out of the analysis as it is merely a correction following the boom in the mid-1990s, demographic change, the regulation of residential property markets in general and other factors. A closer look at other investments shows that the investment activity of companies in plant and equipment has been more positive. This is also true on an international comparison.

Investments in the industrial sector weaker than in services

The investment patterns also vary between the large sectors of the economy. The development of investment in the service sector considerably exceeded the development of investment in manufacturing. Real net fixed assets have increased substantially since 1991 in the service sector but have declined in the industrial sector. A primary factor causing this decline is the very weak investment trend in buildings. Furthermore, on account of the booming machine and vehicle fleet leasing business, economic activity that was previously recorded as equipment expenditure is now entered into the books as leasing and can no longer be properly recorded statistically (Frisse and Deutsch 2016 i.E.). Global demand, which has been sluggish since the financial crisis; restrained growth of world trade; and the low capacity utilisation rate in the industrial sector, which only tipped above average in 2015, are all major explanatory factors for the weak investment activity, which has been further constrained by rapid technological change and high political uncertainties in the wake of the crises and wars in North Africa, the Middle East and the Ukraine (see also IMF 2015, OECD 2015b, EIB 2015, Eichert 2015a).

Investment in manufacturing plant and equipment and closely related services, taken as a whole, looks better with a solid 8 percent of growth between 1991 and 2012. However, the only large industry that recorded strong rates of growth was the automotive industry while the other large industries experienced low rates of either positive or negative growth. Several small, primarily energy and labour-intensive industries or those with structural shifts on the demand side, have suffered in part hefty decreases. These industries have reduced their capital stock in Germany. High growth, on the other hand, was recorded in investment in industry-related services, transport and storage and in IT services. Investment intensity in manufacturing is also trending downwards. The development of net value added, in contrast, is pointing up in almost all large industrial sectors and in the service sectors specified above. The same applies to productivity.

Research investment at a high level

The level of investments in research and development in Germany is high overall and private sector investment is also high. In the large industries, R&D investments are at between 40 and 60 percent of gross capital investments. Other fields of intangible assets (e.g. organisational capital) developed rather weakly (HRI/DIW 2014).

International investment activity buoyant over the past decade

Interesting by contrast is the development of direct and indirect investments of German companies in foreign companies, which have increased notably in the last ten years in almost all industries, some starting at a very low level. The sum of investments in 2012 was at around 290 billion euros. Seen overall however, the situation is not satisfactory from an economic policy perspective as such a low level of investment at home across many industries tends to result in insufficient stimulus to bring about technological progress, the increase of productivity and overall economic growth.

Future investments will no longer fit into the old patterns

Future investments by those industries that manage to retain their competitiveness will largely be directed towards interconnected systems and capacities for data use and knowledge creation, with the objective of being able to offer complete bundled products including smart services. Organisational innovations are therefore likely to be just as important as physical assets. Domestic and foreign investment in successful industries is set to grow in equal measure. It will be crucial for companies to retain enough room for manoeuvre to maintain a modern capital stock and face the structural transformation with its employees, and for government to create a conducive environment for establishing new businesses, to regulate the markets in a competition-friendly manner and to make the markets attractive to venture capital and start-up financing.

Then, particularly knowledge-intensive and highly complex products and services will be able to stand the tide of competition, while labour and energy-intensive industries are likely to continue to bow under the hard pressure of adjusting to global competition with business locations that offer lower electricity prices or labour costs. There are no indications that the disadvantages caused by the lower electricity prices in the US will level out in the medium term.

Germany is definitely on the path to becoming a knowledge-based economy and should accept this structural transformation, adapt the education and training system accordingly, address the reallocation of resources and create a suitably supportive environment. It is to be expected that companies will be the first to address these challenges, but the government, social partners and the population at large will have to deal with the implications of a knowledge-based economy to a much greater extent. The conventional image of "industry" will in future have less and less in common with reality.

Thesis 5: Technological progress and social trends will cause a fundamental shift in economic activity over the next few years. Information and communications technology is an important development but is not the only rapid development currently taking place. New opportunities are arising especially in medicine and healthcare. The networked economy also opens up many opportunities for the energy industry.

The networked society opens up new opportunities

The biggest technological trend today is undisputedly the availability of very low-priced and mobile-accessible information and telecommunications technology. While the digitisation of communications and the internet are not especially new phenomena (for an extensive discussion of the digitisation issue, see BDI 2015a, b), it is only recently that the new technology has enabled real quantum leaps in user benefits, frequently even without increasing the price or at a very low price as the costs of data collection and processing have dropped dramatically and are not connected to use. Information available for zero marginal costs in many fields of application opens up completely new patterns of behaviour, services and business models (Brynjolfsson and McAfee 2014, Rifkin 2014). Currently, these fields are above all consumer goods and services for consumers themselves but application is now beginning to spread to business-to-business services and increasingly to industrial value added itself. Businesses in many German industries are facing the classic innovator dilemma in which they have to operate old and new business models in parallel (Christensen 1997). In some industries, we are already seeing organisational divisions, spin-offs and separate start-up financing companies to deal with this dilemma.

Industry 4.0: Opportunities for productivity and resource efficiency

In Germany the buzzword "Industry 4.0" describes the concept of cyber-technical systems in which production and distribution processes are optimised in a networked manner and transformed into new business processes (Acatech 2014, Acatech / Promotor Group 2013; Bauernhansl et al. 2014; BDI 2015b; BITKOM/Fraunhofer IAO 2014; German Federal Ministry of Economics and Energy 2015; Sandler 2013; Pfeiffer 2015). The Industry 4.0 discourse particularly addresses the new technological possibilities that are being increasingly offered by advanced process automation and control and the networking of machines, which provide the means to achieve higher productivity and resource efficiency, make products much more individual and change value creation on a global level. Issues of system architecture, infrastructure, security and work organisation naturally play a large role in this context. The new possibilities of analysing big data also open up opportunities in many other fields (Schönfelder and Cukier 2014).

The importance of software and of having a better IT process chain management, from purchasing to maintenance, than the competition is increasingly characterising business models. The market has moved from one dominant proprietary model to a mixed selection of proprietary software solutions and open source solutions. Software that is developed in open structures is exposed to entirely different dynamic processes than the traditional closed source systems with heavily protected intellectual property rights where the diffusion of knowledge takes much longer and is much more long-winded and controlled (see the perspectives of Schmidt and Rosenberg 2014, Lanier 2014). New technologies and open structures are enabling new business models in across an array of different sectors ranging from culture, to mobility, to healthcare and education.

All these changes are not reflected in any significant way in the official statistics on growth and productivity, but there are indications that we will begin to see this in the next few years (see the debate between Brynjolfsson and McAfee 2014 and Gordon 2012). The markets are undergoing such rapid change that it is inevitable that economic theory, research and official statistics will lag behind. Although it is possible to roughly chart the digital infrastructure and consumer usage patterns, the productivity drivers of digitisation have not yet been extensively investigated (see OECD 2014b, German Federal Ministry of Economics and Energy 2014).

A simple new measurement of the contribution of information and communications technology to innovation activity, investments and productivity by the OECD (2014c) does, however, already show the positive effects. Germany only ranks mid-range among the OECD states in the contribution of its information and communications technology sectors to gross value added and in the lower third in the development of labour productivity in these sectors. However, the contribution of ICT industries to the general development of productivity is comparatively good. In 2012 Germany placed eighth in the ranking of the largest ICT goods exporters in the world and has been able to more or less hold onto this position since 2000, while the US and Japan have lost world market share to China. Taking goods and services exports together, Germany even took fifth (after China, US, Japan and South Korea), with a market share of around 7 percent and recorded a slightly higher share of domestic value added than foreign final demand for ICT goods and services (OECD 2015). The proper statistical measurement of digitisation will nonetheless extend beyond the intermediate inputs provided by the ICT industry to industrial and service users and will need to cover their own digitisation. The data will then reflect the economic reality.

The market system and innovation

Whilst these developments are only just emerging, today's market leaders are already generating high profits with globally scalable business models. But the market leaders of yesterday may today already have missed the latest trend and be replaced by other temporary oligopolists in three years' time. Although these are not in essence new phenomena, they do raise questions regarding the regulation of competition, the right allocation of property rights and the design of the market in the broadest sense. Politics and regulations are lagging behind the rapid developments and endeavouring to keep pace. In some fields it currently looks as if they are losing the

race and the markets around the world, especially for IT-supported consumer services, are simply creating the standards themselves before the complex issues of the digital economy can be clarified sufficiently to enable a clear legal framework to be established for these markets. The EU is at least making efforts to address some of these issues with its package of measures for the digital single market. Around the world, the regulation of these markets is advancing at a rapid pace, both through framework legislation such as the EU basic data protection regulation and the setting of standards by individual companies in the private sector, or private sector initiatives such as the Industry 4.0 platform or the Industrial Internet Consortium in the US. It is clear that this setting of standards will have consequences for industrial policy for a long time to come.

Other social trends

Shortage of energy and raw materials

Digitisation is not the only significant trend currently (see BDI 2015b, Deutsche Bank Research 2007). We are dependent in general on the availability of electricity and energy at economically and environmentally acceptable costs, and this has led to a wide range of business innovations, efficiency increases and state regulation. Hardly any country has as yet managed to find and maintain a good balance between the triple objectives of energy policy in the medium term. The world is still searching for a solution here. The third industrial revolution heralded by some experts (Rifkin 2013), which includes a transformation towards a more decentralised energy sector, is based on a technically feasible scenario. And yet many countries are clearly suffering from transitional problems and costs. As the regulatory framework for the pricing of carbon emissions through a Pigou tax or emissions trading systems is still very weak in many areas of the world, climate policy is having to make do with a number of "second-best" tools. The EU does have the European Emissions Trading System as a centralised instrument for regulation, but both the individual member states and the EU itself interfere with this system with a large number of parallel and often technology-specific instruments. There is no consistency here, no hierarchy of targets and instruments, not only between the member states and at the EU level, but also often within the countries themselves. Inconsistencies and overlaps ensue, which in turn lead to inefficiencies and obstructions in decision-making and in implementation. From an overall perspective, it is particularly energy supply – whose capital stock was invested in the long term – that is facing high investments and write-offs in the transition to a more decentralised, interactive, electricity grid that also includes producers and other resources for electricity generation. Germany is in this respect an especially clear case of bitter conflicts of interest, where the opportunities of an extensive shift to renewables are as high as the costs, given that the potential of renewables has already been tapped extensively, the scheduled phase-out of nuclear power and the growing strains on coal-fired power generation. The financing of the transition to renewables through national levies on the electricity price (especially the renewable energy levy but also the network charges) is coming under increasing pressure due to globally falling energy prices. The renewable energy levy is a severe handicap for the competitiveness of German enterprises. In view of the ever-increasing electricity costs, this form of financing must be reconsidered.

Mobility for billions

The desire and demand for flexible, economic forms of public and private mobility in a world in which many regions are faced with a rapidly growing and increasingly urban population calls for new approaches. Mobility providers have been undergoing a genuine innovation boom for many years. In all corners of the world, teams are at work researching and trying out new drive systems, better vehicles, intermodality, new transport concepts, new urban concepts, to name but a few examples. New business models are emerging for cars in particular. The integration of information and communications services in the mobility sector also opens up numerous new opportunities, and the services related to mobility are already very broad. The automation of mobility in many areas will also open up new technological opportunities. The "automated driving" of cars is only the most visible expression of this range of possibilities.

It is only gradually becoming clear that the infrastructure will have to be adapted too. This will not just encompass the traditional provision of transport routes by the state or private project financiers but also include the supply of the respective transport carriers with novel drive and fuel sources (electricity, hydrogen, gas). It is evident that the lead markets for these new technologies will require a significant degree of coordinated action among the service and infrastructure providers and a review of the regulation of these new forms of value added, and that organisational issues will have to be resolved.

Medical progress

The rapid progress in medicine with many new treatments and data analysis for lifestyle improvements will lead to changes in the lifestyles of billions of people leading to new business models in medicine, pharmaceuticals and healthcare. The latest advances in the analysis of DNA, in stem cell and tissue technology, the growing areas of application for medical sensors and measuring instruments and many other developments indicate that the preventative dimension of healthcare will open up large-scale opportunities for the private sector.

Thesis 6: Germany's energy industry is undergoing a major transformation. Substantial investments are needed in energy generation and distribution. Germany has been an expensive location for some time now and this is causing problems for energy-intensive businesses. The course set forth by policymakers will determine whether the energy objectives can be met and what the consequences will be for the country's international competitiveness.

Switch to renewables opens up opportunities but also entails problems

The major economic sector of electricity and heat generation is, as we all know, also experiencing fundamental change. The energy sector and particularly nuclear power has been the cause of more controversies than almost any other sector in the last five decades. And there is almost no other individual factor that has such a massive impact on the production costs of the manufacturing sector than supply security and German energy costs. Germany has also been pursuing a very challenging course in its economic policy for over fifteen years now, bent on systematically shifting the production mix for electricity and heat towards renewables over a period of almost fifty years. Regulations on carbon gas emissions in the European Emissions Trading System and, for those industries and fields that are not covered by this system, German and European framework legislation also play a central role. The charted move towards renewables by changing the production mix in the electricity industry and the parameters for emissions trading are causing many uncertainties for the operators and leading to unscheduled write-offs in their capital stock. Over the last few years, the market capitalisation of energy utilities has suffered considerably in many other countries as well as in Germany.

While Germany's energy policy will certainly continue to cause high transformation costs in the energy system up to 2030 and beyond, it is by its very nature also opening up space for new business models and technologies. Estimates put the necessary investments in the next fifteen years alone at between 280 billion euros and 310 billion euros, a large part of which will be needed by 2020 (see Expert Commission Report "Strengthening Investment in Germany" 2015: 48 and the sources given there). Investment activity in this capital-intensive sector has been very high for years now (24–26 billion euros p.a. between 2008 and 2013), and is set to rise even higher.

High-cost location curbs investment

It is beyond the scope of this dossier to go into the complexities of an imperfectly balanced energy policy mix on a national level under the legal framework of the European internal market and of a climate policy that is European in key areas. It suffices to note that the high electricity prices in Germany (in some years more than double those in the US) is bound to incentivise at least some energy-intensive industries to relocate their production to other countries in the medium term. This incentive can only be countered by having very differentiated regulations. Finding a balance between overarching climate and energy targets on the one hand, and the objectives of value creation in industry and industry-related services on the other, was already a top-priority issue in the last policy cycle in Brussels preceding the European Parliament elections, but still remains unresolved and unmitigated and included on the agenda of the current policy cycle of EU institutions.

Energy efficiency presents another opportunity to improve global competitiveness

The field of energy efficiency is similar in that it harbours technological and commercial opportunities that have long been identified. However, there has not been the targeted management of making the necessary investments because the amortisation periods are too long and incentives are low even though the investments will be lucrative in the long term. Furthermore, the government has taken too long to set the course in some fields in the past few years and consequently the overall energy efficiency will only increase at a very slow pace. There are numerous opportunities in this field, too. And here also there is a risk of excessive regulation.

Thesis 7: Public opinion on industrial value added has become mixed and complex in these times of rapid technological change. Industrial value added meanwhile risks losing broad acceptance among the population and this must be discussed and addressed transparently and democratically.

The pluralisation, differentiation and moralisation of political opinions and interests has also left its marks on Germany's industry and industrial policymakers. In many contexts, economic value creation and the infrastructure this requires is not viewed with the recognition that it merits among the public.

National economies are subject to extensive political review

This changing attitude has certainly not been caused by changing political and social preferences primarily but rather by new priorities attached to very different objectives, which in turn have produced the dominant influences in shaping political opinion for a good thirty years. However, not all preferences have changed fundamentally. Good, secure jobs and income for the population continue to be important political objectives with widespread support in most countries. Monetary stability is now an accepted objective of the government in a large number of countries. Not many people are opposed to growth and prosperity if this can be achieved hand in hand with protecting the environment, sustainable public finances, a permanent provision of social security against the major risks of life (ageing, poverty, unemployment, health problems, long-term care) and with investments to expand the knowledge of the country's population. Protecting the environment and the climate has certainly become a higher priority here in Germany than it was fifty years ago, but that is completely normal. Japan also adjusted its objectives over forty years ago when it became difficult to breathe in Tokyo. China is currently facing the pressing tasks of removing particulate matter from the air in its big cities and cleaning up and protecting the severely damaged environment. All in all, however, the people in Germany and in other countries must continue to support, directly or indirectly, growth and welfare.

The spectrum of social criticism levelled at industrial value added and the infrastructure this requires is very broad and is emanating from the media, the population and parts of the political and social elites. And yet we need a widespread acceptance of the transport and telecommunications infrastructure – all the ports, railways, roads, airports and the corresponding vehicles, the flight masts, data centres and internet hubs – that a strong industrial society requires in Germany and in the whole European economic area. Efficient processes would not be possible without this infrastructure. On the other hand, it is natural that not all of the infrastructure serving industry or all the production and research facilities will be unreservedly popular despite the jobs created by them. Many industries are facing manifold problems in relation to acceptance.

The international dimension of acceptance

Problems with acceptance do not stop at the borders. Sales of many of these industrial products and their related services raise a whole spectrum of political issues concerning the condition of the rest of the world. In the last few years this has been reflected not only in a return of almost late-Victorian standards in the world economy (Posen 2013), but also in world politics, in which the regulations, institutions and power balances of the long hegemonial post-war period are giving way to a new and complex constellation of old and new world powers with a myriad of conflicting and cooperative relations prevailing among them. Our economic relations with many countries are thus subject to continual political review and to becoming politicised.

To put it differently: The industrial country of Germany must, in each of the economic dimensions of its activities – from the purchase of a coffee bean in Latin America or Africa to the necessary infrastructure and means of transport, the investments in value added at home, up to the sale of a technically complex machine or environmental protection plant to Asian customers – combat a wide range of problems concerning acceptance in society and in the media.

It has not been possible to find a long-term resolution to these perceived or real problems, or to come up with a procedure or a political solution for them, or to turn these critical views into a new consensus among the elites, as discussions come up time and again in different problem contexts. A large proportion of economic activity in Germany is viewed critically precisely because of the internationalisation of economic operations. Although Germany is not alone in experiencing this phenomenon, it is subjected to it with unusual severity, as everything in its national discourses is questioned with typical German thoroughness.

Thesis 8: Economic activity is trending increasingly towards the management of entire value chains and the provision of completely new bundles of goods and services. Key drivers of these new products are the intelligent use of data and knowledge.

The goods and services that are nowadays regarded as essential components of consumer lifestyle may not be the same as those twenty years ago. While living and eating are still important to all, there is a greater demand today for entertainment and information services, and for education, childcare and health services. Costs for mobility, living and daily needs (food, clothes) still make up the lion's share of most workers' monthly expenditures, but new interactive services are featuring more prominently in the lives of a growing number of people. This change is also reflected in the markets. Not least in the fact that the top performers in consumer services on the global stock markets, in terms of market capitalisation, are Californian and South Korean social media, telecommunications and internet corporations, while the traditional industrial enterprises of the Karlsruhe tradition (or the MITS of this world) are currently performing less well.

New markets and new consumers

The value added of companies in almost all countries reflects these shifts in the structure of demand. German industry and industry-related services are gradually adapting to the structural change affecting the markets and consumer preferences. German enterprises have so far primarily felt only the indirect effects of this phenomenon due to their specialisation in capital goods and some consumer durables. The biggest changes have so far been seen in a range of consumer-related services (media, retail, tourism). Changes are also emerging in some other services with new internet-based “smart services” (financial services, education, residential property, energy supply). Popular buzzwords are new mobile payment systems, MOCCs, smart homes and intelligent power grid systems.

Industry is largely still testing out new territory in the transformation of production and distribution driven by the new technologies. In the US, cooperation between universities, venture capitalists and private sector research institutes is close, especially in the last few years in information technology. A lively debate has emerged here whether the big data and analysis capacities in information technology can also lead to a data-based approach in industrial, IT-supported value creation (Locke and Wellhausen 2014, Berger 2014). China, in contrast, has experienced a rapid rise in knowledge-intensive value creation in recent times. South Korea is a leader in the commercialisation of new products and services in many areas.

Data or services – what's ahead?

What these trends all have in common is that, in many fields, there is no longer a clear division between where the internet-based interaction between producers and customers starts and where the sale of the final product and integrated service ends. Many traditional service providers and industrial enterprises need to manage their value chains themselves and restructure the positioning of their business. Intangible assets in their different dimensions are likely to become more and more important, both in terms of value creation through knowledge assets including protected intellectual property (Rollwagen 2012) and the organisational capital with which the company connects its customers, suppliers and workers.

Thesis 9: There are weaknesses in Germany's innovation culture. These need to be improved through a series of economic policy reforms and the mobilisation of venture capital. German businesses and entrepreneurs will have to compensate for the deficits of Germany as a business location in the medium-term by cooperating with European partners and continuing to engage in global operations.

Traditional strength lies in research and development

Like every other country, the innovation culture in Germany has both strengths and weaknesses (Hofmann 2003, EFI 2015). Germany has above average levels of research and development (input and output indicators). There are still a large number of scientists and researchers in the country registering a considerable number of patents and registered designs, public and private expenditure in research and development are high, and industry itself is at the forefront of research and development in Europe. Cooperation between research institutes (also large research institutes and more application-oriented institutions), universities and the private sector has been one of the country's strengths for the past hundred years and more.

Weaknesses in disruptive innovations, start-ups and venture financing

Germany also has traditional weaknesses regarding the regulatory environment, the infrastructure and the political open-mindedness towards radically new products and services. Germany's businesses are more known for incremental improvements in their products, services and process innovations than for disruptive innovations, completely new patterns of value creation and the rapid upscaling of new ideas to global levels. Successful, new high-growth start-ups are therefore the absolute exception. Large, privately financed universities that conduct the highest level of research and teaching and are funded with a high volume of private funds are few and far between in Germany. The country is hereby squandering its potential to tie the greatest minds in research to German universities on internationally competitive terms and conditions.

A weakness of the German culture of private enterprise is also that it lacks a strong profile for business start-ups. New enterprises take a long time to become integrated into the value chain. Technology-oriented start-ups tend to originate as spin-offs of large corporations or corporate venture capital rather than from the large-scale investment of venture capital from institutional funders, young entrepreneurs and business angels.

Capital market financing is the exception in Germany, only found among large corporations and the really big family businesses. A culture of trial and error and viewing failing as the common run of things in start-ups has only just begun in small sectors such as biotech and online companies. This is very different then from the founding years of the German empire, but this culture has not been expressed throughout the entire post-war period.

The structural deficits in the German start-up landscape and the German financial system can be mitigated to encourage the foundation of private enterprises in general through a wide range of public investment banks and programmes. However, the frequent cases in industrial fields of application with relatively capital-intensive research and production processes and correspondingly large financing requirements clearly show the market failure in institutional investment and venture capital. The battery of problems is well known and understood in Germany but has not yet been tackled with a long-term approach (EFI 2015, Expert Commission Report "Strengthening Investment in Germany" 2015). This is basically the case for almost all member states of the European Union. An approach at EU level would be appropriate and the foundation to this could be laid in the course of setting up the Capital Markets Union and the Investment Plan of the European Commission. In the short term, German large-scale innovation financing will remain excessively dependent on Silicon Valley (see e.g. Keese 2014). There are an estimated 50,000 plus Germans working in Silicon Valley, many of which are prospective entrepreneurs.

Thesis 10: Germany's industrial development and innovation capacity can only be secured through the development of system leadership. Well-defined legal and regulatory parameters, forward-thinking investments by the state and market participants into infrastructure, and discerning consumers are the usual ingredients of lead markets. There are substantial opportunities opening up in a range of technology fields that should be exploited with vigour.

In the last few years the parameters of several markets have been reset. New fields of value creation have emerged that cut across different sectors and industries. Examples here are the development of social media and fracking in the US, battery technology in South Korea and China, and electronic equipment from the People's Republic of China. Germany has not been a big trendsetter in the last decade but has built on its traditional strengths. There are indications that Germany has a good chance of securing a greater role in the system leadership of complex new applications by combining industrial production with related services.

Opportunities for system leadership in mobility

Mobility is also set to undergo fundamental change in the next fifteen years. Germany will certainly become the largest European laboratory for experiments in the innovation of transport and traffic management. In the last few years Germany has started to remedy the deficits in its transportation infrastructure by increasing public and private investments. These investments are still primarily going into the conventional modes and routes of transport, focus mainly on maintenance and only integrate the possibilities offered by digital technology for traffic management, "user-pays" systems and automated driving to a minimal extent. In view of German innovative strength, particularly that of the country's automotive industry, it would be expedient to consistently support the system leadership of Germany in the further high-technology developments in mobility and turn this into an internationally competitive advantage. There are some indications that the high system requirements of traffic management in Germany enabled by digitisation could lead to a systematic solution by 2030. But this will take place without any hint of Californian spontaneity.

While individual mobility and rail-bound transport stand to benefit from the waves of innovation in individual transport, shipping and aviation face global competition and have to cope with the disadvantages of Germany as a business location. Ports and airports are increasingly having to compete with non-European locations. Aviation companies also have to cope with a whole row of unfavourable German and European regulations that put them at a disadvantage in this strategically very competitive global market with a high level of state participation and subsidies.

Industry 4.0 as a key paradigm

Many technology experts believe that connecting products and product processes to the internet will bring about completely unprecedented leaps and bounds in quality and productivity in industrial production and new business models. The technical side of this is already challenging and raises complex questions about system integration and communications. Critical for value creation here will be the rapid, secure and competent establishment of the legal parameters and the necessary infrastructure for telecommunications. Germany has the key prerequisites in this area with its strengths in mechanical engineering, electro-technology, process automation and system management. Germany has a strong information and technology industry built on many years of IT implementation and process automation in these fields. Sufficient research and development is also conducted in these fields in Germany. The determining factor for this sector to flourish will be whether policymakers can identify rapidly enough where action is needed and create the necessary environment.

Thesis 11: Germany will become even more deeply integrated into Europe and will want to improve the conditions for economic value creation through its international cooperation. In the past external pressure has often been enough to promote deeper European integration.

European integration and Europe's role in larger processes of international cooperation are worthy of special note. European integration has over time become such a natural part of our economic and political reality that there is often no public reflection on what has been integrated and why. Without going into the whole background of European integration as the answer to two terrible world wars, it is worth remembering that the many stages of integration between a simple cooperation between Germany and France and the creation of an economic and monetary union as a continued development of the single market each reflect a negation of alleged sovereignty, national independence and national policy space that would have been unimaginable at the time and are only now in retrospect discernible as small steps towards a bigger whole.

A similar move towards a system of joint governance has not taken place on the international level despite the efforts to expand the Group of Five (G5) to the G7 then to the G8 then back again to the G7, to create a Group

of Twenty (G20) during the financial crises, to strengthen the international economic organisations and expand their membership, and to consolidate security cooperation in communal institutions. Asia is today where Europe was in the early 1950s, with limited systems of balance-of-payments assistance, free trade, first steps towards liberalisation and first public investment banks. The US completed the move to a free trade zone twenty years ago but further steps towards economic and monetary integration are hard to imagine. Europe is the exception here.

Europe has the opportunity of representing a more united political front than any other world region and, with its demographic, cultural, linguistic, economic, geographical and political differences, can form a politically attractive, economically and socially successful political whole that practices a peaceful foreign policy.

Naturally, in the process of integrating nation states, this entity needs free trade, the single market, a minimum of uniformity on the labour market and in the social security systems, a common currency, an EU budget and possibly additional fiscal capacities to deal with shocks and adversities, consequently a bank, capital market and fiscal union, an energy union, a digital single market, a more uniform foreign policy and, as a matter of course, a deeper integration of political decision-making processes and their democratic and legal legitimisation (see Eichert 2015b).

Thesis 12: Deepening the European single market and orientating the EU towards industrial innovation are the central tasks of industrial policy. Several technology and market trends indicate that the breakthrough of modern production processes and their success on the market will only be possible within a harmonious European-wide framework.

The legal regulatory framework for German industry is by and large laid down by European framework legislation in combination with additional national regulations. The industrial policy approaches and the consequences for the EU accordingly play a large role in key policy areas. Although the European Union has sought to address this issue for a few years now and has developed and pursued the beginnings of a strategy for industrial policy, there is still much work to be done in the horizontal integration of different policy areas, especially in the face of dwindling resources (energy, raw materials), great technological change in value creation structures and ever increasing international competition, if we are to see a renaissance of industrial value added following the crisis of 2008–09. A real breakthrough towards a proper industrial policy has, in our opinion, not yet been achieved (see also Business Europe 2014). Weaknesses in the legal regulatory framework and in the European-wide infrastructure for transport, energy and data, and other aspects are important here.

Single market policy is strategic industrial policy

The deeper integration of the market for goods, services and public procurement still offers significant welfare gains. The creation of a digital single market in particular, also for the industrial sector, is an important precondition for developing a competitive information and communications infrastructure, for enabling standard setting for the industrial internet (the internet of things) and for generating the necessary returns to scale on the product markets. The current structural transformation in which many final products are evolving into integrated product and service bundles, often with new owner and user structures, will not be able to unfold without a real integration of the product markets across the traditional segments, policy areas and industries. The digital fragmentation of the European infrastructure has already put European industry at a competitive disadvantage to the US even though the scalability of new business ideas and products should really be better in the European single market than in the US. And Europe's businesses and users are also lagging behind lead countries such as the US and South Korea in the application of smart solutions and in the use of ICT, according to various OECD studies.

While it is hardly surprising that the pace of technological progress has slipped to below normal on account of the macroeconomic crisis that has hit many member states and put the brakes on investment activity (over-indebtedness, weak demand, etc.; see OECD 2015), there was already a discernible downtrend before the 2008–09 crisis. All these factors are pulling down productivity growth. Other industry-related and business-to-business service sectors are also not becoming European because of the regulatory divergence within the single market. Suppliers remain small and weak and do not trigger the welfare gains that would otherwise be possible. The European Commission has rightly identified the construction industry and various business-to-business service sectors as needing further integration. The economic recovery and the EU's investment package could serve to stimulate investment activity and promote technological progress and turn this trend around. Internal market policy in the EU is of crucial strategic importance for industrial policy and not just an exercise in nostalgia, harking back to the beginnings of the European Union phase and the failure to breathe meaning into the Treaties of Rome beyond the major push forward in 1992.

Energy and trade policy have a direct impact on industrial value added

The right industrial policy then needs to be supported by an energy, climate and raw materials policy that is focused on low-priced and smart inputs (raw materials and energy) and provides incentives for long-term investment activity in the efficient technologies that the markets need. Also required, of course, is a regulatory framework for technological developments that keeps pace with the market and will need to set new legal parameters, with an appropriate measure of cost and risk-oriented regulation and product market regulation aligned towards business growth. We also need to have a clear-eyed understanding of the structural change occurring in employment and the skills required of workers in these new markets. Foreign policy should also reflect the priorities of a growth and employment-oriented policy in its activities in the foreign, investment and strategic regulatory policy of the EU vis-à-vis big markets and raw materials exporters. This has tended to work better in the EU foreign policy than it has internally in attempts to balance out the conflicting targets in EU internal industrial policy.

Of course these conditions cannot all be produced through the national regulatory framework of Germany alone as this would run counter both to the interconnectedness of the economy and the political reality in the EU. This can only take place with concerted action at the EU level. And while this is accepted in principle by European policymakers, it must be given a stronger political basis and given the necessary priority, defended against many other policy areas, and, in view of the value creation in European alliances, pursued with targeted national action in the still nationally dominant policy areas of the labour market and the social security system, and with certain environmental and product regulations. It is therefore in its own interests for Germany to support and promote an integrated package of measures on the strategic internal market policy for industry and services under these guidelines.

Thesis 13: In 2030 Germany's prosperity will be generated in a more deeply integrated Europe in close cooperation with other specialised partners. Europeanisation will give many industries the opportunity for consolidation among companies, the emergence of efficient enterprises and the further improvement of consumer welfare.

Europe's national economies and economic cultures have very different competencies and traditions. European companies apply these complementary specialisations within the internal market, where it exists, to generate common prosperity. Germany is in a good position to become the driver of productivity, research and innovation in a Europe focused on welfare, competition, social equality and international openness. Germany indeed already holds this position and this is not really disputed – either economically or politically. Possibly controversial are the stabilisation tasks required by the monetary union or its approach to public finances. It is an undisputed fact that the internal market must be further developed in many industries and cross-cutting areas in order to promote new structures of value creation (Monti 2010; Mariniello, Sapir and Terzi 2015; Vetter 2013).

An engine alone is not enough to get a car up and running. Germany needs partners that invent innovative lamps, produce safe tyres, comfortable seats and crystal clear rear-view mirrors, intuitive operating concepts and terrific navigation systems, as well as great coffee for every passenger, plus partners that offer outstanding user friendliness and high-quality customer service on the road. And happily these types of partners are all available to German industry (which is often not quite as "German" as it appears) in Europe or the rest of the world. One could write volumes of praise on the international interconnectedness of the value creation processes of German industry and point out the interesting ways in which Eastern and Southern European parts suppliers are pushing the innovation envelope themselves and how IT service providers, electronics experts, financial service providers, logistic providers and researchers have built up value creation networks throughout Europe that often pool competencies – which are not only regionally close to each other but also spread across national borders – in a practical way to create new products and services. We could show how companies from other continents are integrating themselves into these processes, why some innovative solutions of German and European companies for design, research and production are nowadays located in South Korea or California and are integrated into the value chains. One could also fill volumes with complaints, and wonder whether the whole European industry will not succumb to the pressure of Asian cost and scale optimisers or the overpowering weight of US hardware and software producers in the digital age. One could also remain absolutely calm and trust that the pressure of competition in Europe will trigger the usual market reactions and policy packages, which will in turn unfold the innovation capacity of the economy and the readiness for social change, in an environment of lively democratic debate and robust entrepreneurial action.

Thesis 14: The shift in world economic power is an incentive for German policymakers – and German society at large – to focus on the country's own strengths and tackle its weaknesses.

German economic policy should be focused on what worked best in previous phases when the German or European economic model was at risk either by the overpowering US in the 1950s and 1960s or the "multinationals" of the last century or the overpowering newly industrialised countries of East Asia and the Japanese in the 1970s and 1980s. And this has consisted of further developing Germany's own strengths in a focused way and bringing these to bear in international competition through clever investment activity, a rebalancing of the social partnership, a favourable economic policy environment and courageous European integration. During these periods of comparable competitive pressure, European policymakers and companies managed, after some years of complaining, to restructure their value creation, tackle the economic challenges and set economic policy towards growth and employment. Interestingly, in each of the respective conflicts a strategic swerve away from the world economy was actually followed by deeper internationalisation, even where this was often not the explicit objective of policymakers or their actions. This is not least because of the very stable coalition of trade unions and employer associations that have helped support the policy of global economic integration, and a conflict culture with an inherent orientation towards productivity (Kreile 1978, Schmidt 2011).

Looking at the next fifteen years, it appears likely that Germany's hub industries will internationalise further and receive diverse impetus for knowledge-oriented value added for new products, process this impetus and inject it into German industry (IW 2015). Germany will have to open up some of its industry-related services in particular to further competition and make them more efficient. Many sub-segments are in need of consolidation processes, a better regulatory environment for the single market and national structural reforms (see the country reports of the OECD, the IMF and the European Commission).

Germany has two options. It can either leave these industries in their present condition and accept low productivity growth and buy-in services from other European countries and abroad, or put itself in a better position and improve its own structural weaknesses. It would definitely be in the overall economic interest of Germany to choose the latter path, even though some areas of the business sector that compete internationally should be able to circumvent Germany's shortcomings.

Thesis 15: Germany is poised for a further wave of structural reform through 2030. Much can be done to set the course for modern economic activity in this period. And it is likely that this will happen. We have absolutely no cause to despondently bury our head in the sand.

Long waves of reform typical for Germany

Germany tends to build up the courage to implement structural reform at least every fifteen to twenty years, which would mean another big wave of structural reform in the period leading up to 2030. The last one is more than ten years ago (2001–05) and comprised a substantial tax reform with a large-scale reform of pensions, an extensive reform of the labour market and the social security system, changes in corporate governance (takeover legislation and the break-up of large companies) and the liberalisation of product markets (reform of trades and other markets). The preceding reform phase is more than twenty-five years ago and tackled the tax system and the privatisation of large state-owned enterprises (1986–1990). The first big post-war reforms, though not much remembered today, were implemented by the first Grand Coalition from 1966–69 and constituted the most extensive reforms of all. The next wave of reform could take place as early as the next legislative period.

Structural improvements in the interim

While Germany has invested a lot in education, research and the better integration of foreigners since the last large wave of reform, it has invested too little in competitive markets, competitive services in weak segments, new arrangements between the social partners and start-up funding. At least investment levels in the physical transport infrastructure and investment activity budgeted by regional authorities have recently been increased.

The “debt brake” introduced in 2007 set down extensive fiscal regulations and has led to a substantial consolidation of public finances, although the lion’s share of visible consolidation owes more to the special effects of the financial crisis, interest effects, one-time effects of bank consolidation and other factors. The government has at least stuck to its spending guidelines for many years now.

New reforms needed

It is to be feared that Germany will take several years and spend too much political capital on reconciling how the various levels of the regional authorities stand on issues such as the slicing of the tax cake and the division of responsibilities across the different government units. Policymakers are working on new regulations that cover aspects of federal-state financial relations and address several key points (the expiry of the Solidarity Pact, restructuring regional economic promotion, securing financial resources for the Eastern states, stepping up the debt brake for the state governments in 2020, etc.). It remains to be seen whether this will give the regional authorities a new and sustainable financial order.

The pitcher goes often to the well, but...

Given the very consensus-oriented German political system, problems in economic policy could well mount up until the pressure makes action unavoidable. The point where this pressure culminates in the next wave of structural reform will certainly be reached, if not in the upcoming parliamentary term then certainly in the subsequent one.

Areas of possible reform include the tax system to ease the burden on business activity and labour. While Germany's corporate tax levels are in the mid-range on an international comparison, the complexity of the country's trade tax, inheritance tax and other business tax regulations is well known and lamented by many, including the European Commission, the OECD and other experts.

Other negative aspects in Germany are that the taxes and charges on basic labour are high, investment in physical public infrastructure and human capital is low and that the country is lagging behind the leading countries in putting in place a good regulatory environment for the digital economy. Germany is also one of the few OECD countries that does not have any tax incentives for research. We have already mentioned the disadvantages of the energy sector. While consensus is definitely forming in Germany on which areas are in need of reform, it does not yet extend to the exact shape of these reforms.

Thesis 16: Germany's international profile will undergo a clear transformation until 2030. The significance of foreign trade in goods will gradually decline as the international trade in services and international investment activity become more important.

Germany top performer in foreign trade

For many decades, Germany has been one of the strongest exporting and importing economies in the world, is already one of the large investors abroad and is also a major location for foreign investment in Europe. The impending shift towards a more knowledge-intensive economy will also change the physical structures of foreign trade. Germany has on the whole managed to retain its share of global goods exports over the last few decades. In contrast to Japan and the US, its share in world trade has not declined significantly in the last twenty years in parallel to the rise of China. Germany has run counter to the general trend in this respect. Germany has also become a major foreign trader in commercial services.

German FDI increasing all over the world

Over the last few decades, German industry has, first gradually and then with incredible momentum in the last ten years, built up a substantial capital stock abroad, investing particularly in the rapidly growing emerging countries. The high savings rate of its citizens and businesses and its robust fiscal position has turned Germany into a large net global creditor. The country's highly positive net foreign position may well trend downwards in the face of demographic change.

Germany's world shares will nonetheless decrease mid-term

The underlying trends in global economic development point towards a definite gradual decline in Germany's share in the world trade of goods and services and in its global direct investment stocks at home and abroad (for scenario analyses, see BDI and IW Consult 2015, OECD 2015a). The shifting balance of power in the global economy will trigger such a propulsive force that will make it almost impossible to avoid this downtrend. The transition to knowledge-intensive products and integrated services by hub industries will change Germany's foreign trading structures considerably. Ensuring that key parts of value creation remain in Germany is and will continue to be of critical importance. There are simply too many jobs that depend on the interconnected structures of the different industries and their collective competitiveness on a global scale.

Thesis 17: Germany's social partnership will have to gradually adapt to these new conditions. Industrial relations and the working world itself will play a critical role in the emergence of technological leadership.

Germany's current social constitution is an exception internationally. Germany requires its political parties to reach a high level of internal consensus, has extremely complicated federal monitoring systems and a high degree of delegation of public tasks to non-governmental organisations. In pursuing its "Third Way" policy between state and market (Schmidt 2011), Germany's "semi-sovereign state" (Katzenstein 1987), has, from its very beginning, continued the traditions stemming from the times of the German Empire and the Weimar Republic, in delegating key areas of social policy to social partners, churches, welfare organisations and other co-opted social players. This has resulted in a distinct way of dealing with the pressure of globalisation that is difficult to reproduce. German society has developed a broad spectrum of public, market-oriented responses to social risks that have to be regulated within the social partnership and civil society that could also be useful in dealing with future changes.

The new points of conflict do not primarily concern new or higher risks in life but rather the balancing act between the new options for autonomous work and the changed requirements of monitoring mechanisms. Flexibility in the individualised labour inputs must be newly balanced with the existing protection regime. This is unlikely to trigger a new wave of industrial disputes in Germany even though it occasionally looked like this was the case in 2015. A good balance will have to be found in the next few years between the new liberties and the desire for new regulations.

New forms of work call for innovative solutions

One of the strengths of Germany's social market economy and the cooperative social partner institutions of a whole range of European countries, is that the critical points of contention in the division of wages and profits are not battled out in fierce industrial disputes but rather in the search for good solutions. Over the last few decades, Germany has distinguished itself with its pragmatic, assertive and self-confident trade unions that consider not only the unit labour costs in the Chinese provinces but also the weal and woe of peace within the company and the pains involved in stepping up the job specifications for the core workforce. On the other hand, employers in Germany are involved to an unusually high degree in the self-regulation of social insurance systems, the financing of further training and in other social partnership tasks. A closely meshed network of mutual considerations has evolved over the last few decades in labour regulation that is binding on the majority of employees in Germany. It is to be expected that the next few years will see complex negotiation processes to adapt labour regulations to the newly emerging business models, training and requirements of the employing companies.

Collective bargaining policy may also be impacted

The changes taking place in industry and in society are not likely to dramatically change the institutions of social partnership themselves but will require both sides at the negotiation table to make concessions to adapt to the new situation. Traditional collective bargaining policy is not likely to get any easier under these new conditions, as it will require changes to the organisational structures of both sides, adjusting the legal parameters and jointly resolving the questions of the availability and the training of workers to fit the new requirements of the working world in the knowledge-intensive industry. Collective bargaining will, above all, have to become more elaborate and more multidimensional. Like several other smaller European countries, Germany has a long tradition of reaching consensus within the social partnership. It is to be expected that the approaches taken will differ substantially from the Anglo-Saxon and Asian methods. The critical question is whether Germany and the EU

will manage to assert their own ideas despite the high competitive pressure, and this will largely depend on whether Germany and the EU manage to attain technological and regulatory leadership in key areas.

Thesis 18: The multilateral orientation of Germany's regulatory framework jars against the neo-Victorian approach of the superpowers in pursuit of their individual interests. The economic potential of the regional and multilateral liberalisation of trade remains high but the political obstacles to successful trade agreements have increased.

Germany's multilateral orientation under pressure

The governments of the Federal Republic of Germany have all, without exception, supported multilateral and, in some areas, bilateral agreements and international economic organisations to give these regulations on world trade form and clout. The International Monetary Fund, the World Bank, regional development banks, and 129 investment protection agreements to make up for the absence of a multilateral agreement, are just a few expressions of Germany's multilateral orientation. In the present neo-Victorian state of world affairs with a small number of world powers, these institutions and regulations are coming under increasing pressure. Little progress in multilateral trade policy has been achieved since the start of the Doha Round. The multilateral trade regime is only developing at a slow pace, although progress has been made in individual areas with a package on trade concessions and information technology products.

The transition of many emerging countries into mature and democratic market economies is still under way and curbing their willingness to accept international regulations

The world economic order is facing an increasing number of new problems on account of the rising international competition from companies from divergent regulatory regimes. While not problematic for all aspects of bilateral economic exchange with these regions, the massive increase in the influence of the state in many emerging countries on overall economic activity and the continuing discrimination against foreign companies in many of these countries are set to thwart efforts to create a global playing field for some time to come given the neo-Victorian structures in world politics.

Progressive multilateral economic diplomacy facing many obstacles

Germany and similar-minded governments within Europe have succeeded, in the course of a huge economic, financial and integration crisis, to anchor the complex sets of regulations on intra-Community trade in its different facets in the European institutions and procedures but have not achieved any substantial progress on the regulation of their trade relations with other countries. Outside the European regulatory framework, the international regulatory policy of Germany is increasingly, in the WTO Doha Round, international climate policy and many other fields, coming up against the power political considerations and short-sighted interests of the big nations in the concert of powers, who are unwilling to take on leadership or bind themselves.

Transatlantic trade and investment partnership is a huge global economic opportunity

The transatlantic trade and investment partnership is a major strategic response to this analysis of our times. It is an opportunity to lay down transatlantic standards for the world economy, at least for the near future, and can set the stage for our interactions with the emerging Asian civilisations. It is urgently necessary that the central trade and investment policy issues, at the very least, are jointly regulated within the Atlantic region.

It is precisely in Germany, the country that stands to benefit most from such an agreement, that numerous internal political obstacles risk preventing the quantum leap into real integration from taking place, even in the much less problematic and highly promising transatlantic relationship. The trade and investment agreement and parallel efforts in other fields could otherwise serve to secure the position of the two still largest economic regions in the world as the leading regulation-setting powers up to 2030. This leading role will however probably be assumed by the US and its market power alone for large sections of the knowledge-intensive economy, and increasingly by China, which is already the world leader in terms of manufacturing value added. It is even more difficult to negotiate multilateral and extensive regulations on climate protection, financing, foreign trade and the energy sector with the upcoming superpowers or indeed any regulations on these issues that are not narrow and directly in line with their own interests.

In an ever more globalised world, divergent civil societies and social policy are increasingly causing political conflict over institutions and regulatory issues

Other countries that compete internationally with Germany have completely different social-cultural structures. How businesses from countries in regions that are organised in an entirely different way and with different civilisations (Katzenstein 2005, 2013) will compete and cooperate in future remains an open and exciting question, the outcome of which research cannot foresee with any reliability. Germany has a whole host of characteristics that made it, overall, highly congruent with the benevolent hegemonic order of the US for over four decades after the Second World War. Germany's political elite and Germany's population have been socialised with an orientation towards regulation-based communities with the different stages of the European framework leading up to the European Union, the regulation-based economic world of GATT, the World Trade Organisation, the IMF and other institutions, as well as the country's social and political model that is built towards achieving an internal balance of interests. This strongly Kant and Grotius-based model of civilisation has, with all its consequences on foreign policy, run into difficulties. Over the past fifteen years, the efforts of German policymakers have been frustrated repeatedly in dealings with other civilisations that are not so community, balance and integration-oriented, but whose priorities for development tend to follow a mercantile policy that is strongly influenced by the state.

China's reform process should facilitate convergence over the medium term

Some long-term trends may make interaction easier over time. In many respects, the Chinese economic system is approximating market economic processes and structures at home more closely than even many experts realise. The Chinese economy is already today affected to a much greater extent by market powers than by political intervention, although such intervention is still common in China generally as a fallback to hierarchical solutions and in politically selected industries. But the markets have quite consciously been allowed to prevail over Mao, in reference to the title of Nicolas Lardy's book *Markets Over Mao* (Lardy 2014; see also Lardy 2012, Pettis 2014, Schambaugh 2014). However, China is facing a difficult phase of macroeconomic stabilisation and structural reform in the next few years in the reorientation of its economic model. The political risks of

implementation are not to be underestimated, as indicated by the most recent turbulences on the financial markets (IMF 2015b, c).

Opportunities beckoning in other reform countries in Asia

Japan's moderate economic opening should also prove helpful. Under Prime Minister Abe, Japan has reformed internal structures that have until now been regarded as sacrosanct, including life-long employment and the control of managers through owners with stricter regulations on corporate governance (see Deutsch and Keichel 2015). South Korea's economy has also advanced, with much less government intervention than two decades ago, and is performing well in the competition for innovation and has garnered product leadership in key technology segments. India's recent wave of reform is very promising although the obstacles that stand between the country's integration into the world economy are particularly high.

The deepening of economic relations must take many forms

At the same time, the civilisations in the Chinese and other Far Eastern market economies such as Japan and South Korea have produced a very different environment from that of Rhineland capitalism. And this is even more true of the digital market economy in the United States, so there is plenty of fuel for conflicts. As the multilateral world trade regime is not in a position to address and regulate the many new fields that are arising and requiring regulation, the large economic regions will need to take action on a bilateral level. In view of these complex differences, it remains to be seen whether it will be possible for the EU to enter into modern trade and investment agreements with China, India, Japan and the individual ASEAN countries.

Thesis 19: The German economic model will have to face further surprises from markets, world powers, technologies and citizens. Germany's apparent internal stability over the last few years stands in stark contrast to the turbulent and increasingly chaotic external world. This trend will certainly have consequences for Germany.

Sometimes the unexpected happens

Germany has been taught an important lesson in the last twenty-five years. During this period, we have seen structures that we have regarded as permanent uprooted by radical change within the space of a few months. German reunification is a shining example here, but certainly not the only one. The dissolution of the Soviet Union, the change in course in India, the renewal of large parts of Africa, the Islamisation of politics in the Middle East, the militarisation and brutalisation of international terrorism, the distancing of Russia from the international community, the structural transformation of the Chinese economy, political change in general, the massive economic crises in the North Atlantic region, the wave of migration and many other phenomena have all not been anticipated, or not sufficiently, by experts or governments. It stands to reason that the next twenty-five years will bring just as many political surprises from the present superpowers, from market developments (Who foresaw the market capitalisation of the Californian IT companies ten years ago?) and from citizens of many of the world's countries.

Most surprising events in world politics are ultimately stabilising

Some of the trends described here have had an extremely stabilising effect on the economic development in Germany and on the German economic and social model. Although reunification did initially burden the unified country with stabilisation tasks, internationalisation with the reintegration of Eastern Europe and the momentum in the Far East have saved the "German model". The EMU has also stabilised the German model substantially in most years.

No such luck in the future

This combination of cost savings and new sales markets will not be seen again in the same way in the period leading up to 2030. The current conflicts in world politics cannot be easily contained by creating a better regulatory framework for security, welfare and environmental protection, because this regulatory framework itself cannot be diplomatically developed fast enough and alternative regulatory models are starting to assert themselves, particularly in Asia.

Risks of international interconnectedness coming to the forefront

Germany's economy and politics, and also its population, will have to get used to the fact that on the costs side no one will be able to help them again so quickly and to such an extent, and that the sales opportunities in emerging countries will grow further but will not skyrocket. Negative developments in large national economies caused by incredibly misguided decisions in the security policy of key countries, failure to take action in economic policy and/or market instabilities can extensively affect production and corporate balance sheets. The risks of internationalisation are just as high as the opportunities. The sources of future prosperity are rather to be found in the mobilisation of technical progress and the increase of productivity. Germany can prepare itself for the future by taking appropriate action in its labour market, migration and education policy, in the intelligent new alignment of industrial relations and by adopting a growth and welfare-oriented economic policy.

Germany needs a broad debate on political solutions to these difficulties

The adaptability of the German population is set to increase to a very high level on an international comparison in view of the already very high degree of internationalisation of German industry. This will also lead to an over-proportionate degree of democratic discourse. The vibrant German democracy with its large number of media and discussion-friendly parties and citizens is, perhaps on account of its long traditions in consensus culture, which in turn is the result of major religious and political divisions long ago, very well suited to effectuating an especially high level of political change.

A modern industrial policy for Germany and Europe must restore the sources of prosperity

A modern industrial policy will in future have to be developed into a value creation policy that rigorously addresses the whole process chain from innovation and invention to the purchase of materials, ideas and patents in the whole world up to the sales of high-end goods, services and design patterns to the whole world and takes account of Germany's comparative advantages and special institutional strengths. As explained above, these advantages have already been expressed in highly complex products, knowledge-intensive value creation and industry-related services on the market. By 2030, this understanding will either have been broadly acknowledged in politics, the economy and society, or Germany will be bewailing the crisis.

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