

MARTA ULBRYCH  
Kraków

## THE EVOLUTION OF THE GERMAN INDUSTRIAL POLICY IN THE CONTEXT OF CHALLENGES TO THE GLOBAL ECONOMY

### INTRODUCTION

The development of the global economy entails new structural phenomena which imply challenges for national economies and their industrial sector. The problem of counteracting internal and external negative conditions and the issue of adaptation to structural changes is consistently dealt with and analysed. Basically, two possible stimulants of transformations of industrial structures should be distinguished [Karpiński 2013, p. 16]. The first one is based on spontaneous processes in market mechanisms, while the other assumes active involvement of the state in the acceleration of these processes through the development and implementation of industrial policy. However, both solutions involve certain risks. In the first case, the problem primarily relates to the short-term perspective of the activities undertaken, which hinders the effective increase of investments that strengthen the innovative potential of enterprises. This is because market impulses and the resulting allocation of development resources usually take one-year profit into account. Consequently, changes occur slowly. In turn, the second solution can be effective, provided that an efficient state and its agencies exist. At this point, the essence of industrial policy should be explained and its concept should be defined. Generally, it can be assumed that it constitutes an element within the economic policy and consists of the conscious intervention of the state in market mechanisms of resource allocation, taking into account the presence of imperfections in the functioning of this mechanism. Discourse on the rationales and directions of the application of industrial policy has continued incessantly since the 1950s. Recent debate was caused by the consequences of the 2008 global crisis. The consequences of the crisis stressed the necessity for new sources of jobs and growth; thus policy-makers have already begun re-examining industry-related policy approaches, which reflect the changing nature of manufacturing [O'Sullivan et al. 2013, p. 1]. Therefore, a discussion on the challenges and opportunities for the need of industrial policy in today's economy is currently needed.

Due to the highly competitive position of German manufacturing in the global economy, this paper explores the evolution of industrial policy in the German economy since the end of World War II. To achieve this, the paper necessitates the pursuit

of three interrelated aims. The first identifies the concept of new industrial policy and the accompanying challenges and opportunities. The second focuses on the position of the German manufacturing sector in the global economy and the EU. The third studies the history and objectives of industrial policy in Germany. In this respect, the research will be performed primarily on the basis of the review of the literature and an analysis of statistical data of Eurostat and the United Nations Industrial Development Organisation (UNIDO) databases.

#### CHALLENGES AND OPPORTUNITIES OF NEW INDUSTRIAL POLICY

The main task of traditional industrial policy is to achieve more efficient operation of businesses, the definition of the Organisation for Economic Co-operation and Development (OECD) formulated in 1975 states that "Industrial policy is concerned with promoting industrial growth and efficiency" [Warwick 2013, p. 15]. A conventional approach to industrial policy emphasises two theoretical justifications for its application [Weiss 2011, p. 2]:

- Markets (particularly in developing countries) fail to produce a social optimum due to market failures.

- The manufacturing industry has a special role in the growth due to its greater scope for generating a high level of growth in productivity and positive spillovers.

The first justifies referring to so-called normative theories which imply that there are natural market failures in the market economy. These theories are tied with the economic function of the state to impact on the allocation of resources. The existence of public goods, natural monopolies, externalities and other factors (asymmetric information, lack of information) make free market forces fail in their allocation function. Consequently government intervention is required to correct the failures [Tanzi 2011, p. 3-4]. However, there are important practical difficulties, such as the risk of government failure, the risk of rent-seeking behaviour and the potential use of industrial policies for protectionist goals.

The second premise emphasises the commonly given arguments in favour of a strong manufacturing base, such as [Stöllinger et al. 2013, p. 4-10]: the manufacturing sector is a major source of innovation and due to this potential, the productivity growth in this sector is higher than in the rest of the economy. Moreover, the manufacturing sector is an important source of demand for many services. Manufactured products are highly tradable whereas this is only true for a subset of services.

Due to controversies surrounding the justification of the use of industrial policy, the views on it are changing, and the polemics relate to both the rationale for designing and implementing it as well as its methods and instruments. The traditional approach favoured selected branches and not the entire industry, taking into account horizontal objectives to a small extent. Expectations with regard to industrial policy related mainly to the need for the formulation of long-term programmes for certain industries and sectors of the economy. In the 1990s, pursuant to the neo-liberal view

on the need to keep state intervention in the economy to a minimum, the concept of industrial policy was however challenged. The need for its application was negated and temporary, selective interventions were replaced by the promotion of a horizontal approach aimed at an increase in the quality of framework conditions for conducting industrial activities. However recent developments in both the theory and practice of industrial policy suggest that it is possible to find a theoretical rationale for the government.

In recent decades we have observed new social, economic and technological phenomena in the global economy. These factors determine the possibilities and directions of development of industrial enterprises. The changing nature of manufacturing and services should also be taken into account when determining a policy framework. The most important processes occurring currently in the area of industrial production include [Ulbrich 2016, p. 154-155]:

- Technological progress
- Dematerialisation and servicisation
- Internationalisation and fragmentation
- Global value chains

The dynamic development and widespread use of technology modifies the scope of manufacturing capabilities of enterprises and changes their organisational structure. As a result, the automation of production, productivity growth and reduced involvement of humans in many phases of the production process is a common phenomenon.

Simultaneously, dematerialisation of production, i.e. the increasing use of intangible factors in relation to tangible factors is observed. Consequently, the decoupling of economic growth from the rate of natural resource consumption and the pollution production is observed. The second aspect of this phenomenon is the growth of the services sector, which leads to a relative reduction in the importance of industrial production. The relative decline in the manufacturing share of both value added and employment in the economic system is equal to deindustrialisation and it is strictly referred to as servicisation or tertiarisation (that is the increased share of the services sector). The other meaning of tertiarisation is the growing complexity of external, product-related services as an intangible element of output, which account for a rising share of total product value [Szalavetz 2003, p. 5].

The liberalisation of the movement of production factors in the global economy allows companies to internationalise their activities and the free choice of the location of investments. Thus, they optimise manufacturing processes and build their competitive advantage. A widespread trend in this area is the fragmentation of production, which means breaking down the previously integrated process into individual stages that may be located away from each other. Free movement of capital, migration and disparities in the level of socio-economic development of individual economies stimulate the delocalisation processes. These processes consist in the transfer of a part of production to countries with lower manufacturing costs.

The increased involvement of developing economies in the international division of labour determines the development of global value chains, i.e. a series of inter-related activities performed as part of the process of manufacturing the final product. From a global point of view, positive effects resulting from the optimal allocation of production factors can be distinguished. However, the distribution of benefits arising from the development of international production networks remains a controversial aspect of this process.

New development conditions force the countries to undertake permanent activity in the area of structural adjustments, which in turn implies challenges for economic policy, including industrial policy. Nowadays, hardly anyone still believes that state planning and public investments can be a driving force behind economic development. However, simultaneously, on a global scale, disappointment resulting from market-oriented reforms carried out in recent decades has been observed. Liberalisation and privatisation have not produced the intended results everywhere. The weakening of beliefs on both sides raises the need for a discussion on the policy programme which will be positioned reasonably and centrally between the two abovementioned extremes. Market forces and private resourcefulness would be decisive forces in this programme, but governments would have a strategic coordinating role in the production area by guaranteeing property rights, enforcement of contracts and macroeconomic stability [Rodrik, 2004, p. 2].

The need to conduct industrial policy has become apparent, however the question of what it will look like remains (i.e. how rather than why it is crucial). It is now widely accepted that industrial policy is instrumental in terms of technological upgrading and economic growth but greater flexibility in the practice of industrial policy is important. The horizontal approach and the creation of general conditions through appropriate macroeconomic policy instruments are still promoted but a growing number of followers have also adopted a selective approach which promotes some sectors ahead of others.

At the same time, it should be stressed that contemporary industrial policy refers not only to a narrowly defined strategy targeted at manufacturing but also to other policies. It is closely linked to the overall socio-economic policy and its content consists of actions undertaken in other areas (such as: trade, education, tax, labour, energy, environment, infrastructure, competition). Therefore, a very broad definition should be quoted, which corresponds to so-called "new" or "systemic" industrial policy. This policy should be based on new technologies, its goal is to support society's long-term targets and its spirit aims at securing framework conditions favourable to the improvement of industrial competitiveness. According to the literature, future oriented industrial policy in the globalised world should focus on the following elements [Aiginger 2014, p. 8-9]:

- Cooperation between the government and private sectors.
- Promotion of new activities, support for broad sectors, never firms.
- Creation of new comparative advantages to help developing countries to diversify and stimulate exports, not prevent imports.

- Governments should only intervene where they have long-term interest.
- Synergy between different kinds of economic policy and the spill over effect.
- Prevention of “lock-in” situations and of investments in old, dirty technologies.

Pursuing an active industrial policy, focused on investment and innovation, is also widely discussed in the EU. One of the seven initiatives in the Europe 2020 Strategy, “An Integrated Industrial Policy for the Globalisation Era”, emphasises the need to maintain and support a strong, diverse and low-carbon industrial base in order to stimulate economic growth and create jobs [COM (2010) 614]. The key importance of industry for the growth of the EU economy was subsequently highlighted in the reindustrialisation strategy adopted in 2012 entitled “A Stronger European Industry for Growth and Economic Recovery” [COM (2012) 582].

In successfully applying industrial policies, productive transformation has been presented by national leaders as essential to the future welfare of the country. Experiences in many countries show that industrial policy can work, but may also fail, depending on the political and institutional environment. Initiatives in this field need to be properly designed but also require a stable institutional framework and permanent mechanisms based on a combination of factors, such as the broad social legitimacy of the efforts, strong partnership among relevant social and political actors, stable and technically sound public organisations and instruments to ensure a stable financing [OECD 2013].

#### POSITION OF GERMAN MANUFACTURING IN THE GLOBAL ECONOMY AND THE EU

Germany is one of the most developed industrial countries in the world. Its position is primarily based on exports which are driven by manufacturing. In 2015, manufacturing value added accounted for 20.7% of German GDP, i.e. 7 percentage points more than in the EU-15 and nearly 5 percentage points more than the average for the world (table 1).

The growth rate of the value added of manufacturing in Germany also exceeded the average for the EU and the EU-15; however it was lower than in the rest of the world. Similar trends can be observed in the case of indicators of economic growth; in the analysed periods the German economy recorded better results than the EU average, however they fell far below the global average.

The analysis of the international position of Germany’s industrial production used the statistics of UNIDO. This agenda proposes a synthetic measure which assesses the industrial potential of a particular economy, i.e. the Competitive Industrial Performance (CIP) Index. The index consists of eight sub-indicators grouped along three dimensions of industrial competitiveness [UNIDO 2013, p. 6-8].

1. The first dimension relates to countries’ capacity to produce and export manufacturing and is captured by their manufacturing value added per capita (MVApc) and their manufactured exports per capita (MXpc).

2. The second dimension covers countries' level of technological advancement and upgrading. To proxy for this complex dimension, two composite sub-indicators have been constructed:

- industrialisation intensity, which is measured by the medium- and high-tech manufacturing value added share in total manufacturing value added – MHVAsh and manufacturing value added share in total GDP – MVAsh;
- export quality, obtained as a linear aggregation of medium and high-tech manufactured exports share in total manufactured exports – MHXsh and the manufactured exports share in total exports – MXsh;

3. The third dimension entails countries' impact on world manufacturing, both in terms of their value added share in world manufacturing value added – WMVA and in world manufacturing trade – WMT.

Each indicator is graded on a scale from 0 to 1 and the most recent data relate to 2013.

Table 1  
*International comparisons of German industrial performance*

Indicator	Year/Period	Germany	EU-15	EU	World
Gross Domestic Product (GDP) average annual real growth rate (in %)	2005-2010	-0.92	-1.42	-0.95	2.41
	2010-2015	1.87	0.60	0.88	2.86
Manufacturing Value Added average annual real growth rate (in %)	2005-2010	1.18	0.72	0.84	2.27
	2010-2015	1.03	0.59	0.67	2.49
Manufacturing Value Added as percentage of GDP at constant 2005 prices in USD	2005	19,78	13.54	13.83	15.78
	2015	20,72	13.67	14.09	16.06

Source: Based on: [UNIDO online].

When analysing the results of the CIP ranking contained in table 2, it should be stressed that Germany traditionally remains an undisputed leader. It has a high level of manufacturing value added of manufacturing per capita (USD 7655.8) and the manufactured exports per capita (USD 15504.5). In addition, given the statistics of trade measured by the value added, it turns out that the share of domestic value added content used in export production is nearly 70% [OECD-WTO online]. In addition, the German economy also has a high share (10.1%) of the global trade in manufacturing, greater than in the case of the American economy which is four times bigger. Out of the analysed countries, only Chinese products account for a greater share in international trade and they achieved a leading position as late as 2009. In the era of the knowledge-based economy, special focus should be placed on technological sophistication. The share of medium and high technology production in the manufacturing value added (59.9%) and exports (72.7%) in 2013 was greater or comparable to the indices of major competitors – namely Japan, Korea, USA and China.

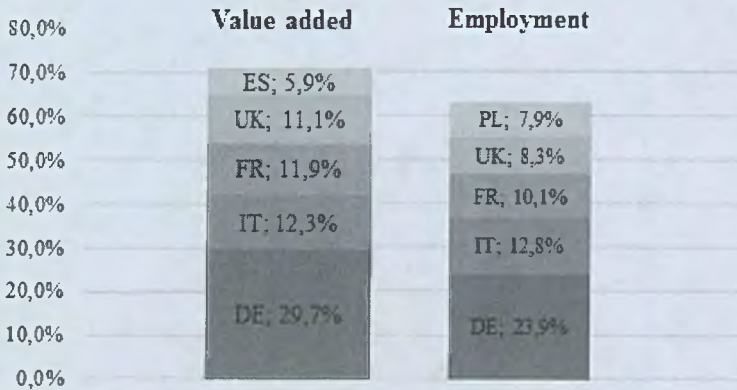
Table 2  
*The industrial competitiveness performance of Germany and selected countries*

2013	1990	Country	Index	MVApc (USD)	MX pc (USD)	MHVash (%)	MVA sh (%)	MIIX sh (%)	MX sh (%)	WMVA (%)	WMT (%)
1	1	Germany	0.576	7655.8	15504.2	59.9	21.0	72.7	87.9	7.0	10.1
2	2	Japan	0.466	7820.7	5163.5	54.9	21.0	78.1	91.8	11.0	5.2
3	17	Korea	0.442	7180.7	11043.4	63.1	29.0	72.4	97.2	3.9	4.3
4	3	USA	0.442	5464.5	3229.0	50.6	12.0	61.7	75.3	19.4	8.1
5	32	China	0.366	1142.6	1540.5	44.0	33.0	58.3	96.6	17.5	16.8

Source: Based on: [UNIDO 2015].

The German industrial sector plays an essential role in the EU, accounting for nearly 30% of the value added of European manufacturing and 24% of employment (figure 1). A favourable relationship of the value added to the level of employment also demonstrates the relatively high productivity of German manufacturing in relation to other countries included in figure 1.

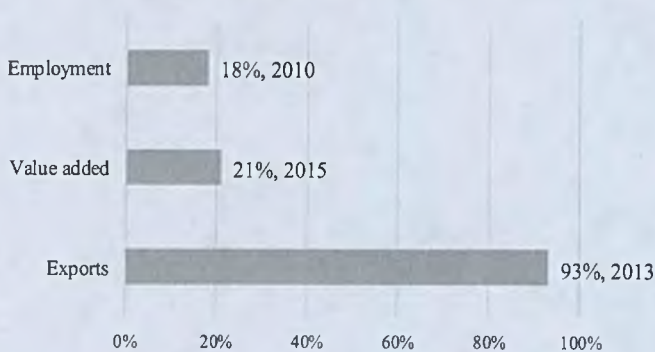
Figure 1  
Concentration of value added and employment in the EU in 2013  
(manufacturing as % of total economy)



Source: Based on: [Eurostat 2016, [naida\_10\_a10] and [nama\_nace06\_e]].

In addition, manufacturing is an important sector of the German economy, not only in terms of generating the gross value added but also in terms of employment. Sectors related to manufacturing employ 18% of the active employed population in Germany (figure 2). As already mentioned, German manufacturing focuses on the export of its products to international markets; more than 60% of German exports go to the EU,

Figure 2  
The importance of manufacturing for the German economy: key numbers  
(manufacturing as % of total economy)



Source: Based on: [Eurostat online, [nama\_nace06\_e] and UNIDO online].

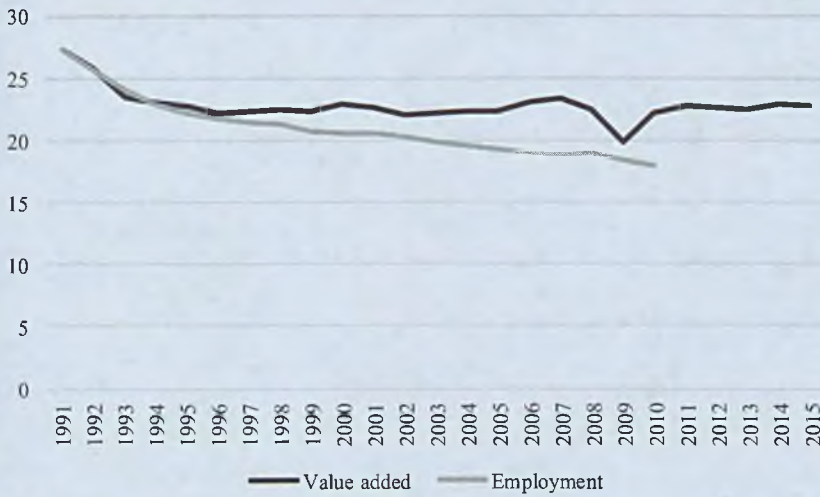


followed by the United States and China. Thus, manufacturing accounts for approximately 90% of exports.

There are several factors that drove Germany's success; above all, its specialised, high value-added exports – especially machinery and transport equipment. Then, Germany took advantage of offshore production and its proximity to the cheaper labour force in Central and Eastern Europe.

Figure 3

*Value added and employment in Germany (manufacturing as % of total economy)*



Source: Based on: [Eurostat online, [nama\_nacc06\_e] and [naida\_10\_a10]].

German industry, similarly to the majority of developed countries, is undergoing structural changes. This branch of the economy gives way to services and it is an objective phenomenon, resulting from the increase in productivity in the manufacturing sector. An analysis of the aggregated data in figure 3 confirms that while the German economy has experienced a systematic decrease in the share of employment in industry, the share of the value added of manufacturing has been in fact constant since the mid-1990s (with the exception of the economic collapse in 2009).

#### THE HISTORY AND OBJECTIVES OF INDUSTRIAL POLICY IN GERMANY THE DETERMINING FACTORS FOR THE GERMAN MANUFACTURING SECTOR

When studying the features that have boosted Germany's economy, a strengths and weaknesses analysis is useful (table 3).

The organisation of the manufacturing process in Germany is attractive from an international perspective through the coexistence of factors such as a diversified and competitive industrial base, modern and developed transport and technical infrastructure and a good level of capacity for innovation and environmental efficiency.

However, in some areas the weaknesses of the German economy are noticeable. An increasingly urgent issue is a skills shortage as a result of a population advancing in age. Furthermore, German industry bears high labour and energy costs. As regards manufacturing, the price of one hour worked in Germany averaged 38.70 euros in 2016. Here Germany ranked fourth among the EU countries [Federal Statistical Office, 2017]. Moreover climate protection is an important cost factor for companies operating in Germany due to the EU Emission Trading Scheme and other regulations governing climate policy.

Table 3  
*Basic characteristics of German manufacturing sector*

STRENGTHS	WEAKNESSES
<ul style="list-style-type: none"> <li>• European market leader in many branches and broad range of industry sectors</li> <li>• High level of productivity and product quality</li> <li>• Modern supply, transport and telecommunications infrastructure</li> <li>• Good capacity for innovation in industry</li> <li>• Pioneering role in environmental and climate technologies, efficient use of resources</li> </ul>	<ul style="list-style-type: none"> <li>• Relatively high labour costs</li> <li>• High dependency of raw material import</li> <li>• Relatively high energy prices compared to international counterparts</li> <li>• Ageing population in Germany</li> <li>• Threat of carbon leakage</li> </ul>

Source: Own study based on: [Federal Ministry of Economics and Technology 2010 and Federal Ministry of Economics and Technology 2016a].

Policy makers face urgent tasks of adopting the development strategy to match globalisation and technical progress. To maintain Germany's role as a manufacturing centre, the sector has to generate high value-added production with the maximum degree of vertical integration in the country. In this context, the reshoring concept has been debated as a potential source of renewed job creation in manufacturing, the sector which has been most exposed to offshoring activities. The term reshoring (backshoring) is defined as the relocation of all or parts of the production process to (or near) the country of origin of the parent company by a multinational enterprise [ILO, Research Department Briefing 2015].

In the Federal Republic of Germany, industrial policy has always been positioned within an area of noticeable tension: on the one hand, it had to abide by regulatory policies requiring complete integration into the federal governments; guiding principles of economic policy. On the other hand, it is noticeable that the practice of industrial policy was influenced by more pragmatic considerations regarding economic effectiveness, political appropriateness and social justice [Grüner 2014, p. 86]. A historical review exposes three major perspectives on industrial policy in Germany [Rubenson 1990, p. 11-12]:

- The scope and domain of government involvement.
- The special role for technology policy in ensuring long-term competitiveness.
- The use of industrial policy as a means of structuring the economy to ensure long-term competitiveness and achieve long-run social goals.

Despite the continuing debate about industrial policy, Germany traditionally has not announced a clearly defined industrial policy. Nevertheless, the instruments that support the progress and advancement of German industry can be identified (table 4). These tools have been systematically developed since the end of World War II.

After World War II, a framework for rebuilding the German economy was developed and it allowed for rapid reconstruction known as the economic miracle (*Wirtschaftswunder*). The era of rapid economic growth in the 1950s and 1960s elevated West Germany from the ashes of wartime devastation to a developed nation. The policy assumptions were based on the concept of an ordoliberalism-based social market economy (*sozialen Marktwirtschaft*) that was formulated by Ludwig Erhard. This project established the principles of private enterprises (medium-sized enterprises were a focal point), private ownership and competition as the basic drivers of the post-war economy. The role of the state was limited to a basic condition setting that would facilitate a competitive market. The government's publicised ideas for economic policy were determined by the basic assumption that all actions had to be integrated into the regulatory principles of the social-market economy.

Table 4

*Selected industrial policy tools characteristic of the post-war German economy*

Scope	Tools
Market conformism	<ul style="list-style-type: none"> <li>• Export-oriented medium-sized enterprises as a driving force of the economy</li> <li>• The decentralisation of the decision to grant financial support</li> <li>• Trade facilitation and export promotion</li> <li>• The tax system</li> <li>• Competition law and control of antitrust</li> </ul>
Institution structure	<ul style="list-style-type: none"> <li>• Modern technologies</li> <li>• Chamber and associations</li> <li>• Training programs and investment in human capital</li> </ul>

Source: Own study.

The formula of minimal government involvement was soon imposed by the necessity to rebuild the nation's infrastructure and the need to exploit foreign aid in a logical manner (The Marshall Plan funds). Tax policy was used as a means of directing investment into selective areas, such as building basic industries (coal, steel, energy, rail and water supply). Then, in 1965, competition law (*Wettbewerbsgesetz*) was altered to allow easier cooperation between firms and to facilitate mergers. The first post-war recession in 1966-1967 brought a new perspective on industrial policy and as a consequence key areas for development were identified and mid-range finance plans were introduced. Committees were established to coordinate the financial plans of the federal government and regional governments [Rubenson 1990, p. 6-8].

The oil crisis of the 1970s created structural problems for industrialised Germany and sparked the first intensive debate about industrial policy. The government intensi-

fied its help to industry in an offensive approach to overcoming problems (the emergence of federal research and technology policy). Since then, and particularly from 1990, industrial policy has increasingly focused on strengthening new industry sectors and enabling them to keep up with the global demand for innovation. Since that time, industrial policy infrastructure has relied heavily on decentralised institutions such as industry associations and local chambers of commerce. In Germany, a multitude of associations provide lobbying along with professional associations. Entrepreneurial groupings like The Federation of German Industries (BDI) or Association of German Chambers of Industry and Commerce (DIHK) are part of a permanent dialogue geared towards influencing government policy. Germany manufacturing companies have been also supported by highly organised institutional infrastructure stimulating the acceptance of German products abroad. Economic development agency of the Federal Republic of Germany - Germany Trade and Investment (GTAI) provide the knowledge base for planning and conducting business activities.

Institutions grounded in German ordoliberalism were also flexible during the last global crisis. For example, Gerhard Schröder's Agenda 2010 introduced reforms aimed at liberalizing the labour market but having regard to social security system. These major reforms increased the incentive to work and ensured greater manoeuvrability in the wages of lower-paid workers by restricting wage-replacement benefits paid by the state [Folkerts-Landau, Schneider 2016, p. 5].

The literature review indicates also that strong German economic performance is less a product of policy than a result of key institution and strategic investments in innovation, entrepreneurship and localised decision-making fields. D. B. Audretsch and E. E. Lehmann identify seven fundamental features of German economic strategy [Audretsch and Lehmann 2016]:

- Medium-sized companies (*Mittelstand*), the government promotes localised economic development while enabling firms to exceed internationally within well-defined niche markets (Schumacher's view that "small is beautiful").

- A dual education system of universities and skilled-labour apprenticeships educates employees for both knowledge-based industries and manufacturing ("poets and thinkers").

- Two opposed aspects of policies are noticeable in Germany: decentralised decision-making processes and governance exist with a global orientation ("roots and wings").

- Investments in transport, communication and other amenities improve not only the carriage of goods but also human and social capital in the form of networks among people ("infrastructure").

- Germany has proved remarkably flexible in maintaining traditional values and local culture but also adopting innovation ("laptops and lederhosen").

- The country has become a leading manufacturer by investing in research relevant to small and medium size companies and enhancing quality and productivity through adequate training systems and worker-friendly policies ("made in Germany").

- Germans feel very positive about their country due to the relatively high standard of living (“it’s good to be German”).

An analysis of these conditions for German economic success suggests that the supply side of an economy plays a crucial role in the era of globalisation. Currently, two aspects of the development of industrial production in Germany are particularly emphasised, namely energy transition and the digitalisation of economy.

#### ENERGIEWENDE: THE ENERGY TRANSITION

Considering the need for sustainable development, government actions in creating policies compatible with social objectives are clear and justified. The market fails to solve many of the environmental challenges, therefore, the concept of a green industrial policy has become more and more popular. One of the projects in this context is unfolding in Germany in terms of the transformation of the country’s energy system. The German government announced the transition in 2010 and it encompasses various targets aimed at allowing Germany to achieve a set of goals by 2050. These short- medium and long-term targets focus on a reduction in energy consumption, reductions in greenhouse gas emissions and rapid nuclear phase-out in favour of growth in the share of renewables in its energy mix. An additional motivation for the energy transition is the idea that increasing the use of renewables can strengthen Germany’s energy security. Under this plan, Germany aims to increase its share of renewables to 80% of the total energy supply by 2050. Additionally, the government’s target is that greenhouse emissions be 80-95% lower than they were in 1990 [Bundesministerium für Wirtschaft und Energie 2015].

In spite of Germany being perceived as a climate leader (it reduced its carbon emissions by 27.2 percent between 1990 and 2015), meeting its targets to cut emissions is unlikely, due to high levels of progress in the heating and transportation sectors [Jungjohann 2016, p. 51]. Moreover, the energy transition towards climate-friendly economic development is not without risk. Key problems include electricity price hikes, the development of large-scale energy storage capacities and massive competition from emerging markets’ manufacturers [Deutsches Institut für Entwicklungspolitik 2014].

#### INDUSTRIE 4.0: DIGITISATION OF THE ECONOMY

Germany has maintained its status as one of the most modern industrial nations in today’s circumstances, when the global economy stands on the cusp of the fourth industrial revolution linking physical production and network connectivity within the Internet of things. The government wants to utilise the potential of digitisation to strengthen Germany’s manufacturing base. *Industrie 4.0* is a central focus of the Federal Government’s Digital Agenda. This concept fits to a smart and flexible production process, which takes advantage of the potential of the digitalisation revolution in

order to boost prosperity and quality of life. This approach makes it possible to deliver tailored products to meet individual customer requirements at low costs. It integrates manufacturing with information and communication technology. The “smart factories” look like this: smart machines coordinate manufacturing processes by themselves, service robots cooperate with people on assembling the products, transport vehicles cover the logistics side on their own. *Industrie 4.0* defines the complete life cycle of a product: from concept, through manufacturing, exploitation, to recycling to optimise material flow [Federal Ministry of Economic Affairs and Energy online]. The cyber-physical systems (CPS) improve resource efficiency and enable more flexible models of work organisation. A special support tool for entrepreneurs in this area has been created – Platform *Industrie 4.0*. Around a third of businesses in Germany are currently involved in this program. The platform’s working groups, based on knowledge and practical experience, identify where action is needed and make recommendations for implementing suitable framework conditions. Moreover, businesses can inform themselves about the different topics and cope with them in a concrete way [Federal Ministry of Economic Affairs and Energy 2016b].

The government has taken the lead in *Industrie 4.0*, creating structure that connects representatives from trade associations and ministries to unions and academics. The first aim of this structure is to produce templates and publicise interesting examples. Its second aim is to convince two groups of the need for change: *Mittelstand* firms and the industrial trade unions [The Economist 2015].

## CONCLUSIONS

The dynamic nature of the transformation of economic systems – caused by the liberalisation of the movement of production factors, technological progress and the growing importance of developing economies – dictates new conditions for the organisation of manufacturing. The increased interest in industrial policy in the broader sense arises when the importance and complexity of global value chains grows and competition from emerging economies increases, even in respect of activities that have been traditionally considered the primary advantages of developed countries. The strategic objective of industrial policy is the sustainable development of industry, which is achieved as a result of the efficient use of resources and oriented at the creation of comparative advantages based on the increase of human capital creativity and innovation.

The experiences of the German economy demonstrate how to effectively shape the competitive capacity of national entities in a globalised economy. Germany’s manufacturing sector is a key factor in its macroeconomic performance and the leader of the Competitive Industrial Performance Index.

Due to ordoliberal traditions, industrial policy has never existed as an explicit field in Germany. However, the government has consistently taken actions to remain a globally competitive high-wage economy. Two recent initiatives are particularly

important: the long-term energy concept (*Energiewende*) and the digitisation of the economy (*Industrie 4.0*). In the first case, the political objectives emphasise the need to cope with climate change mitigation, a nuclear phase-out and the massive expansion of renewable energy. While in the second, the strategic objective is to take up a pioneering role in revolutionising the manufacturing sector of information technology. The *Industrie 4.0* idea describes the organisation of production processes based on technology and devices autonomously communicating along the value chain.

Summarising, the undeniable achievements of the German economy are due to industrial policy following more of a bottom-up approach and it is systematically distributed across various objectives and instruments of the main fields: innovation, sustainable development, medium-sized enterprises, training programs and public-private partnership.

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**Ph. D. Marta Ulbrych** – Cracow University of Economics, Faculty of Economics and International Relations, Department of International Economic Relations

**Dr Marta Ulbrych**, Katedra Międzynarodowych Stosunków Gospodarczych, Zakład Studiów Regionalnych, Uniwersytet Ekonomiczny w Krakowie (marta.ulbrych@uek.krakow.pl)

**Słowa kluczowe:** Niemcy, polityka przemysłowa, *Energiewende*, *Industrie 4.0*, produkcja przemysłowa

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#### ABSTRACT

*The manufacturing sector plays a much stronger role as a driver of growth and employment in Germany than in other countries. Therefore it seems appropriate to identify the essential features of German manufacturing and to analyse the evolution of industrial policy priorities in this country. In this respect, the research is performed primarily on the basis of the review of the literature and an analysis of statistical data.*