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The National and European Context of Industrial Development

Although there are an increasing number of experts, researchers, analysts, journalists and politicians addressing the decline and obsolescence of industry—in other words, deindustrialization—there are other voices which try to demonstrate the contrary: the need to recognise the economic, social and cultural importance of industry.

It is a matter of record that deindustrialisation—defined mainly as widespread and systematic disinvestment in basic production capacity (Bluestone and Harisson 1982, 6)—has been a subject for debate and study in most developed and developing countries, and that real life has offered an abundance of arguments to illustrate the applicability of this concept everywhere, including Romania (Ciutacu and Chivu 2015, 209–216).

In technical writings, industry has always been viewed as the key sector of economic development, and in many countries building industry was almost a centuries-long obsession for the ruling classes.

Industry was regarded as a *sine qua non* pillar for the enhancement, through processing, of the intrinsic value of natural resources, as a better means of capitalising on the knowledge and creative intelligence of human capital, and as an opportunity to further refine that knowledge.

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The arguments most often brought forth were the value added to products and the efficiency of production factors, including that of labour.

According to these arguments, the industry has benefited from major support from the state, whose effects—largely generally recognized—have also been the subject of discussions regarding their possible negative long-term impact.

As shown by Grabas and Nutzenadel (2013), the implementation of interventionist industrial policies in most European countries during the post-World War II years, which prevailed until the 1990s, favoured structural economic changes that supported high economic growth rates, but in many cases led to inefficient allocation of resources with a potential adverse effects in the longer run

And, last but not least, industry has always had not only important economic functions, contributing to the development of other economic activities, such as transport, infrastructure, constructions, education and scientific research, but has also performed the social function of creating jobs and providing earnings that made possible increased welfare and quality of life.

The history of industrialisation shows that the economic development of the various states of the world comprised several stages of evolution, from the Stone Age to the Bronze Age the Iron Age, culminating in our times in what we call the industrial revolution.

In fact, three such industrial revolutions have been identified historically, each of them triggered by a certain type of energy, and characterised by a succession of generations of technologies, running from labour-intensive technologies to technologies based on mechanics, electricity, electrical engineering, chemistry, biology and information.

Any industrial revolution is generally preceded and sparked off by scientific, technical and organisational progress. This is also true about the fourth industrial revolution, in progress now under our very eyes: it too requires the existence of three cultural, technological and organisational conditions.

The first industrial revolution started at the end of the eighteenth century; and the drivers were coal, metallurgy, textiles and the steam engine. The second industrial revolution was triggered by electricity, mechanics, crude oil, chemistry, the telegraph, the telephone and collective transport by steam locomotives and steamboats. The third industrial revolution was brought about by the discovery, in mid-twentieth century, of semiconductors and transistors; and its main foci were the development of electronics, telecommunications, information technology, audio-visual media, nuclear technologies, robotics, automation, space technologies and biotechnologies. Lastly, the forth industrial revolution, also known as industry 4.0, has caused a disruption of production processes due to adoption of the internet and data processing and other transmission and communication technologies, which allow new industries to offer their clients intelligent and personalised products with the aid of smart processing techniques.

Professor Klaus Schwab, Founder and Executive Chairman of the World Economic Forum, exploring the dramatic changes in the global environment caused by the new technologies, argues that the world is facing its fourth industrial revolution, but that it is essentially different from the three previous ones in terms of speed, scope and impact. The revolution which we are witnessing is moving at exponential speed, disrupting almost every industry worldwide; and the spread and depth of the changes it is bringing radically are transforming entire production systems, management and governance, with multiplied effects from emerging technology, such as, among others, robotics, self-driving cars, 3-D printing, nanotechnology, biotechnology, energy storage and genetic editing (Schwab 2015). Regarding global concerns about the difficulties of adapting to these changes and capturing their benefits, it is relevant in this context to mention that the central aim of the WEF Forum Annual Meeting 2016 was “Mastering the Fourth Industrial Revolution”.

In the long evolution of mankind, particularly in the past two centuries, the focus has been industrialisation, until, after 1990, the reverse concept—deindustrialisation—appeared. In the latest industrial revolution, industrialization and *deindustrialisation* as its corollary are occurring together, both as the result of new materials and of data processing and communication technologies.

We cannot ignore the fact that the foundation of industrial development in the twentieth century, mostly in its middle third, was the *production of metal in general, and of steel in particular*.

Steel production and metal-working have been the basis of the economic systems in the developed countries, and the decline of such systems results in restructuring, deindustrialisation and reindustrialisation by means of 4.0-generation technologies.

After 1950, the developed countries in Europe and North America embarked on what was called at the time the "30 glorious years" or the "Golden Age" (Grabas and Nutzenadel 2013). It was a time when big industrial ventures appeared (for example, the European Coal and Steel Community [ECSC], founded in 1952)—the so-called national champions, which provided jobs for large numbers of workers, whose pay became increasing better (Ciutacu and Chivu 2015, 209–216).

In addition to the workforce directly employed in these companies, this sector favoured the development upstream and downstream of the coal- and mineral-ore-mining industries, the production of energy, transport, construction, education and scientific research. Metal itself provided the raw material that boosted many other manufacturing branches of industry.

The statistics of the time reveal the widespread industrial development that occurred. To quote just a few examples from the European Union (EU) member states, the real index of industrial production during the period 1960–1990 grew 6.5 times in Portugal, 5.8 times in Spain, 4.9 times in Finland, 3.4 times in Austria, 3.1 times in Italy, 3 times in the Netherlands, 2.6 times in France and so on.

Compared to 1990, in 2016 industrial output increased, in real terms, in Spain by 1%, in Portugal by 6%, in France by 7%, in the Netherlands by 17%, in Finland by 74% and in Austria by 112% (output in Italy, in contrast, decreased by 9%).

As for the new EU member states in the Eastern Europe, in the same time frame—1960 till 1990—industrial output increased 10.3 times in Romania, 3.8 times in Poland and 3.2 times in Hungary, while in the period 1990–2016, the industrial output of Romania grew in real terms by 38%, in Poland by 274% and in Hungary by 154%.

Since that time, in general, the industrial sector has contributed less to the creation of the gross value added (GVA) in the economy.

The first signs of the decline of industry's contribution to the GVA occurred in the Organisation for Economic Cooperation and

Development (OECD) member states in the early 1980s. But the profile of this decline has seen significant variations from one country to another.

A stronger reflection in the reduction of the industry's share in total GVA can be seen in the following countries and periods: in Japan from 1993 in 1997, in Italy from 1992 in 1995 (with a new wave from 1997 to 1999), in the United States in 1991–1994 and after 1990 in Germany. The decline of industry in France was more pronounced between 1993 and 1998.

These developments are a result of public policies and corporate strategies, whose effectiveness has slowed down or accelerated this process (Chatillon 2011).

In 2016, industry, in the EU 28, contributed a share of 19.3% to the overall GVA, as compared with 23.3% in 1995. According to Eurostat data, this average derives from a low of 7.1% in Cyprus (12.6% in 1995), 7.2% in Luxemburg (14.9% in 1995) to a high of 38.9% in Ireland (26.2% in 1995) and 32.3% in Czech Republic (31.4% in 1995).

In 12 EU member states, industry contributed 10% to 19.9% to the GVA (10.6% in Malta, 13.0% in United Kingdom, 13.4% in Greece, 13.9% in France, 15.0% in Netherlands, 16.7% in Belgium and Latvia, 17.8% in Spain, 18.5% in Romania, 18.8% in Denmark, 19.3% in Italy and 19.9% in Sweden); in another 12 EU member states, the contribution of industry was in a range of 20–30% (Finland 20.2%, Estonia 20.7%, Croatia 21.3%, Austria 21.6%, Lithuania 22.1%, Bulgaria 23.8%, Germany 25.7%, Ireland 26.3%, Poland 26.8%, Hungary 27.0%, Slovakia 27.3% and Slovenia 27.6%).

Statistics show that steel production grew significantly in the period from 1960 to 1970 (with the exception of in the United Kingdom).

The rise in the price of crude oil after 1973 brought about major changes in this trend. Between 1990 and 2015, only in 5 of the 19 EU member countries considered for this analysis did, the steel output continued to grow: Austria, from 4.3 to 7.7 mil. tonnes, Finland from 2.9 to 4.0 mil. tonnes, the Netherlands from 5.4 to 7.0 mil. tonnes, Portugal from 0.7 to 2.1 mil. tonnes, and Spain from 12.9 to 14.8 mil. tonnes (Table 1.1).

In the New Member States (NMS), the drop of the steel output has sometimes been very steep: in Romania, for example, the steel production

Table 1.1 Steel production in some of the EU member states (mil. tonnes)

	1960	1970	1980	1990	2015	Maximum output	Year of max output
Austria	3.2	4.1	4.6	4.3	7.7	8.0	2013
Belgium	7.2	12.6	12.4	11.5	7.3	12.4	1980
Bulgaria	0.3	1.8	2.6	2.2	0.5	3.0	1987
Czech Rep. and Slovakia	6.8	11.5	14.9	14.9	9.8	15.4	1987
Denmark	0.3	0.5	0.7	0.6	…	0.8	2000
Finland	0.3	1.2	2.5	2.9	4.0	5.1	2006
France	17.3	23.8	23.2	19.0	15.0	23.2	1980
Germany	37.9	51	51.1	44.0	42.7	51.2	1980
Hungary	1.9	3.1	3.8	3.0	1.7	3.8	1984
Italy	8.2	17.3	26.5	25.5	22.0	31.6	2006
Luxembourg	4.1	5.5	4.6	3.6	2.1	4.6	1980
Netherlands	1.9	5	5.3	5.4	7.0	7.4	2007
Poland	6.7	11.8	19.5	13.6	9.2	19.5	1980
Portugal	…	…	0.7	0.7	2.0	2.1	2013
Spain	1.9	7.4	12.6	12.9	14.8	19.0	2007
Sweden	3.2	5.5	4.2	4.5	4.4	6.0	2004
Romania	**1.8**	**6.5**	**13.2**	**9.8**	**3.4**	**15.0**	**1987**
United Kingdom	24.7	28.3	11.3	17.8	10.9	28.3	1970

Source: *Steel Statistical Yearbook*, World Steel Association, Brussels, various editions, 1960–2015
Note: … = Not available data

plummeted from a maximum of approximately 15 mil. tonnes in 1987, to 9.8 mil. tonnes in 1990, and to 3.4 mil. tonnes in 2015; in Poland, the steel output shrank from 19.5 mil. tonnes in 1980 to 13.6 mil. tonnes in 1990 and to 9.2 mil. tonnes in 2015 *et cetera*.

According to the *Steel Statistical Yearbook*,[1] world steel production has grown steadily: from 129 mil. tonnes in 1950, to 594 mil. tonnes in 1970, 770.5 mil. tonnes in 1990 and to 1669.9 mil. tonnes in 2014, with a small decrease at 1620.4 mil. tonnes in 2015.

The growth of world steel production is, to a large extent, due to developments in China's industry. There steel production has risen from 47 mil. tonnes in 1985 to 95 mil. tonnes in 1995, 356 mil. tonnes in 2005 and 803.8 mil. tonnes in 2015.

The trade in scrap iron is the most telling proof of ongoing deindustrialisation. After a period of over 30 years of massive investment in the development of industrial platforms and infrastructures, equipment, machinery and equipment specific to "heavy industry", at a time of radical change, progress towards digitization of manufacturing processes and the widespread use of Information and Communication Technology (ICT) generated a rapid moral degradation of old investments and transformed entire generations of technologies into the equivalent of iron scrap.

While the steel industry reversed its growing trend after each of the two shock waves of oil prices hikes in 1973 and 1978, in most of the developed countries, and particularly in the EU member states, after 1990, the reduction in steel output (or its much slower growth) has been accompanied by a rise in the scrap-iron trade (Table 1.2).

In the years 1980–1989, in the EU 15, the trade in scrap iron accounted for 20% of overall steel production, while in the new member states (NMS), scrap iron accounted for only 1%. In the following 25 years (1990–2015), the share of scrap iron in the overall production of steel grew significantly. During the period 2010–2015 it accounted for 44.7%.

The volume of scrap iron trade in the EU 28 has fluctuated from 456 mil. tonnes in 1990–1999 to 701.8 mil. tonnes in 2000–2009 and to 462.7 mil. tonnes in 2010–2015; scrap iron's share of the total steel output followed a rising curve over the same time periods: 24.7% in 1990–1999, 36.7% in 2000–2009, and 45.4% in 2010–2015.

In the aggregate, the balance of the trade in scrap iron in the EU 15 followed a growing curve, from a deficit of some 29 mil. tonnes in 1980–1989 and 23 mil. tonnes in 2000–2009 to a surplus of 39.8 mil. tonnes in 2010–2015.

In the NMS, exports of scrap iron exceeded imports by 20.4 mil. tonnes in 1990–1999, by 52.7 mil. tonnes in 2000–2009 and by 41.6 mil. tonnes in 2010–2015.

As argued by Ciutacu and Chivu (Ciutacu and Chivu 2015, 209–215), in terms of sustainable development, exporting scrap iron is questionable, particularly when paralleled by imports of scrap iron. Importing and exporting the same item, which is facilitated by rules allowing free movement of goods and services, obviously is contrary to the principles of sustainable development, with regard to energy saving and greenhouse gases (GHG)-emission reduction, promoted by the EU 2020 Strategy. The simultaneous existence and encouragement of the manufacture of

Table 1.2 Manufacture of basic steel, and total trade in iron scrap, by time periods

	1990–1999		2000–2009		2010–2015	
	Output (mil. tonnes)	Scrap iron share in steel output (%)	Output (mil. tonnes)	Scrap iron share in steel output (%)	Output (mil. tonnes)	Scrap iron share in steel output (%)
EU 28	**1847.3**	**24.7**	**1914.6**	**36.7**	**1020.3**	**45.4**
Austria	46.1	19.7	65.6	34.5	45.7	**27.3**
Belgium—Luxembourg	139.3	32.3	131.6	74.7	58.7	**98.2**
Denmark	6.9	86.2	1.9	706.2	0.0	**...**
Finland	33.6	11.2	43.3	22.6	23.1	**16.7**
France	186.4	28.3	190.4	43.6	93.6	**54.9**
Germany	417.3	21.8	446.2	26.5	259.0	**32.1**
Greece	9.6	5**6.8**	19.6	62.8	7.9	**50.3**
Ireland	3.1	70.6	0.5	638	0.0	**...**
Italy	255.4	21.7	278	18	151.5	**21.3**
Netherlands	60	93.9	63.9	88.5	41.2	**90.3**
Portugal	8.2	16.8	13.4	60.4	11.6	**58.0**
Spain	133.8	35.6	170.9	37.5	88.8	**36.0**
Sweden	47.9	14.1	53	22.4	27.3	**35.7**
United Kingdom	172.1	20.3	132.4	47.4	63.6	**72.0**
EU 15	**1519.7**	**27.5**	**1610.8**	**38.2**	**872.1**	**44.7**
Bulgaria	19.6	5.7	18.3	40	3.9	**133.0**
Czech Rep.	72.7	10.1	64	23.5	31.6	**45.1**
Hungary	19.2	32.7	19.6	32.3	8.6	**77.8**
Latvia	2.77	44.2	5.8	59.3	2.2	**240.9**
Poland	107.7	6	93.2	15.9	50.9	**25.6**
Romania	**63.6**	**4.1**	**53.4**	**36**	**19.9**	**54.4**
Slovenia	4.1	105.7	5.5	80.8	3.7	**151.1**
Slovakia	38	7.7	43.9	11.9	27.0	**16.6**
New Member States (NMS)	**327.6**	**11.8**	**303.8**	**28.6**	**148.3**	**49.4**

Source: Authors' own compilation based on data from *Steel Statistical Yearbook*, World Steel Association, Brussels, various editions, 1990–2015
Note: ... = Not available data

basic steel and exports of iron scrap are generated by a systemic inertia. Therefore, this issue requires a broader debate on whether such practices can be substantiated from economic and social perspectives, whether they contradict the principles of sustainable development or whether they are likely to trigger a surge of deindustrialisation.

Until 1989, Romania produced more than 14 mil. tonnes of steel, with some less significant imports of iron scrap. In 2010, with domestic steel production reduced to 3.7 mil. tonnes, Romania exported over 2.5 mil. tonnes of iron scrap.

The statistics for the year 1980 recorded a scrap-iron trade amounting to 53.3 mil. tonnes, and in 2015, world trade volume had reached 167.8 mil. tonnes.

If we start from the assumption that, in the future, China will evolve in the same pattern of the developed countries, the questions to be posed would be where China would be exporting and what countries would import China's scrap iron, considering the fact that China's steel production was 804 mil. tonnes in 2015, which accounted for 50% of all steel global production?

Leaving aside these disturbing implications, which experts and the media often choose to ignore, we cannot help but observe that the advocates of the theory of industrial decline have found arguments in relevant data and statistical information regarding macroeconomic indicators. Most quoted among these are the gross value added, the contribution of industry to the formation of the gross domestic product (GDP) and the curve of the number of workers in the industry.

At global level, according to the development theory, in the case of the old industrialized countries, manufacturing industry diminished its contribution to the creation of the global gross value added.[2]

The data used to support this theory demonstrate that in the time span—1991–2014—the decreasing contribution of old industrialised territories is only relative, but in nominal terms, the value added generated by the manufacturing industry increased in 2014, up from 1991, by 1087 bn. USD in Western Europe and by 1126 bn. USD in North America (Table 1.3).

According to World Bank (WB) data, in 2015, the value added in industry, expressed in billions of USD, totaled 4529 in China, 3327 in

Table 1.3 Contribution of territories to the world added value in the manufacturing industry (%)

	1991	2014
European Union	32	21
North America	24	19
Japan	19	7
Emerging countries	21	53
Total (bn. USD)	4717	6577

Source: Authors' own compilation based on World Bank Data

USA (2014), 1225 in Japan (2014), 923 in Germany, 563 in India, 495 in United Kingdom, 476 in South Korea, 422 in France, 402 in Russia, 385 in Italy, 349 in Mexico and 346 in Brazil. In the same year, the *value added in Romania's industry was 55 bn. USD*.

The relative decline of the manufacturing industry is also reflected in its share of the GDP: In 1991 and 2014, industry generated 16%, and, respectively, 12% of the GDP in the United States, 21% and 16% in the EU, 21% and 15% in Italy, 20% and 16% in Sweden, 17% and 11% in France, 27% and 23% in Germany and 17% and 10% in the United Kingdom. In Romania, the contribution of the manufacturing sector to the GDP was 34% in 1991 and 24% in 2014.

During the same period, we can notice a rise in this share from 15% to 17% in India; in 2013, in China, industry accounted for 30% of the GDP.

Another indicator used as an argument to demonstrate the downward trend in industry is the curve of the number of jobs. In France, for example, in the last 30 years, the industry has lost 2 million jobs, i.e., about one-third of its total employment (Chatillon 2011, 11). In only the last ten years, 500,000–600,000 jobs were eliminated in French industry; whole territories have been devitalized, especially the old mono-industrial regions.

Since 1980 until 2007, the number of jobs in the industrial sector of France dropped by an average of 71,000 jobs/year (17,000 jobs as a consequence of outsourcing, 21,000 jobs as an effect of labour productivity, 9000 by competition), and, with effect from the year 2000, records show an average annual loss of 65,000 jobs (42,000 due to an increasing labour productivity, 3000 due to outsourcing and so on).[3]

Based on a well-documented analysis of the decline in manufacturing employment in Denmark during the period 1994–2007, some authors have demonstrated that it represents not just a story of displaced industries and failing firms, but that deindustrialization involved a transition from manufacturing companies to those engaged in services or more service-linked activities, which raises major questions regarding economic policy (Bernard, Smeets and Warzynski 2017, 31).

Distinguishing three types of manufacturing companies (switchers, stayers and exits), this analysis conclude that the workers separated from either exiting firms or from stayer, have relatively bad short-term labour-market outcomes (lower wages and more likely to be unemployed), but for workers separated from switchers, the long-term prospects are relatively good (Bernard, Smeets and Warzynski 2017, 33).

The traditional strength of industry has been disturbed by the advent the digital technologies, the environmental constraints, global competition, and by the changes in the consumers' behavioural patterns, prompted by increasingly aggressive advertising policies.

An economy that owes its architecture to the first three industrial revolutions is now being gradually ousted, at a growingly faster pace, by the 4.0 generation of industry; the information technology has opened the path to the fourth industrial revolution, creating new configurations between the secondary and tertiary sectors, and leading to the emergence of the new industrial order.[4]

The convergence of the internet, nano- and biotechnologies; robotics/cobotics (collaboration between humans and collaborative robots); the creation of the cyber physical systems (CPS) for data processing, communication and control; and the emergence of cloud computing (remote processing and storage of data) make it possible to use module-structured industrial facilities, which renders them mobile and adjustable, thereby changing radically the traditional image of the factories and industrial parks of a not too distant past. Industry has stepped into an era of smart processing and development.

Industrial companies are now reshaping their functional schemes, the supply and sales lines, as well as the entire economic model, as an effect of the emergence of the international value chains born of a consensual deregulation that requires a new industrial and corporate culture, where the human factor is expected to play an ever greater role.

Despite its dynamic advantage effects, information and communication technology (ICT) is not the only sector where innovation is fast and abundant; other economic sectors are equally important, and seem, at a perfunctory glance, to have lost some of the interest initially vested in them due to the cyclonic changes brought about by ICT (such as the nanomaterials, composites, injection techniques, new forms of energy and so on).

There are also voices claiming that the relocation of manufacturing processes leaves industrial parks deserted and destroys skills, weakens the middle class, and cleaves an ever deeper divide between highly paid positions and low-competence jobs (concentrated especially in travelling services and the big distribution chains).

New theories have arisen about how states must respond to these new challenges posed by growing tensions between post-industrial labour markets and industrial welfare states (Häusermann and Palier 2008, 559–586). The challenges that they face regarding new employment policies are can summed up as follows: massive unemployment that began in the early 1970s; difficulties in entering the labour market for newcomers; the expansion of atypical/precarious forms of work; increasing income inequality and feminisation of the labour market.

But if these are developments caused by market demands, the question that arises is whether education should be remodelled to respond to such requirements.

The services produced, also called out-of-factory goods, are, most of the time, consumed on the spot, and therefore rarely exported; or if they are, it is as part of exported industrial ware, which, also indirectly, spares them from competition; part of the services belongs to the intermediate consumption for industry (in 2011, consumed services accounted for 39% of the European value added to the export of manufactured goods to non-European countries).

In general, industry is the sector where 80% of all innovations happen, and 75% of Europe's exports; a quarter of the purchasing transactions in industry are for services; 80% of the manufacturing costs arise from how a product was envisaged in its design stage; in 2010, 80% of the in-house spending for research and development in France was concentrated in industry, and only 18% was in services.

In most of the developed countries, industry is the main source of monetary externalities and *knowledge*; research is a pillar of sustainable development; industrial ventures can cope with competition thanks to research, which is a source of new knowledge, of new products, of new manufacturing technologies, at a low cost and yet with the possibility to ensure the diversity and quality of goods, which, in turn, translates into productivity and better living standards.

In 2013, in France for example, industrial ventures spent 24.1 bn. euro for research, distributed as follows: 3.95 bn. euro in car manufacturing, 3.5 bn. euro in spacecraft industry, 3.1 bn. euro in pharmaceuticals, 1.8 bn. euro in the chemical industry, 1.6 bn. euro in the manufacture of measuring apparatuses, 1 bn. euro each on the manufacture of telecommunication, electrical and other machinery and equipment. The total number of researchers in France grew from 100,000 in 1985 to 266,000 in 2013.

In the same reference year, 2013, Romania spent 558 mil. for all of its research activity (0.4% of the GDP), compared to 79.7 bn. euro in Germany, 47.5 bn. euro in France, 34 bn. euro in the United Kingdom, 21 bn. euro in Italy, 14.4 bn. euro in Sweden, 13 bn. euro in Spain, 9.6 bn. euro in Austria and Belgium, 7.8 bn. euro in Denmark, 6.7 bn. euro in Finland, 3.4 bn. euro in Poland, 3 bn. euro in the Czech Republic, 935 mil. euro in Slovenia *et cetera*.

Industrial decomposition in Romania rendered useless dozens of institutes for research and technological development and forced tens of thousands of researchers to resort to petty business schemes for survival, such as selling second-hand clothing or dealing in scrap iron, among others.

It is very unlikely that reindustrialisation by way of innovation and smart processing, or, in general terms, the competitive development of industry, would be possible without investment in research and development.

But small and medium companies cannot afford to invest in research and development, which is why the only sources of money for industrial innovation are the public budget, and the European funds.

The new products resulting from research and development will generate growth and competitiveness in other sectors, so as computers (for example, boosted productivity, helped the diversification and celerity of banking services, brought radical changes in the health system, and in the production of pharmaceuticals *et cetera*).

Gradually, the loss of property over the raw materials and natural resources has been exacerbated by the loss of intellectual property. The deindustrialisation of Romania has meant not only the physical disappearance of more than 1000 industrial platforms and of the physical possession thereof; it has meant the disappearance of drawings, schemes, blueprints and all the technical knowledge and know-how related to the goods and products that the Romanian industry used to manufacture, and which formed *an enormous wealth of intellectual property, now lost*, because it wasn't even considered as an asset in the negotiation of the privatisation agreements.

The view of the German Government is that industry is the economic and social engine of Europe, and Gary P. Pisano and Willy C. Shih (Harvard) explained, in 2009, why America needs" a manufacturing renaissance", if it seeks prosperity (Pisano and Shih 2012).

The purpose of industry is not to create companies that are highly priced on the stock exchange, to bring quick money into the pockets of a few shareholders; sadly, however, many companies make more and faster money by means of financial speculation than by production proper.

Such a money-centred, short-term vision prefers to sacrifice profitable operations if investment therein fails to fetch super-financial gains; this thinking is detrimental to capital assets, which are one of the pillars of economic development, and a fundamental component of investments and intermediate consumption in any economy.

A new type of accounting has been proposed which cuts the value chain into separate items, so that low-paid jobs that cannot be outsourced are deleted; very often, in industry, the logical connection between the upstream and downstream jobs, which is indispensable for the integration as early as the design phase of a product features that require the consistency between all the links in the chain—manufacturing, logistic, sales, post-sales—is all but gone.

One is at risk of failing to see that advanced automation, though capable of provide high performance, may, if not properly integrated with design, generate losses. On the average, 80% of the manufacturing cost arises from how the product is designed.

The new goals—centred directly to profit—make managers from industry to ignore sometimes the medium and long-term perspectives; more attention is paid to decrease variable costs (salaries and operation costs), to the detriment of fixed costs (which are also an expression of the quality of management).

An analysis of downsizing announcement, drawing on 714 large, publicly held US firms, between 1981–2006, shows that pressure from institutional investors and the new decision context encouraged firms to downsize more frequently, due to the strong link between the rise of shareholder value and the recent prevalence of downsizing. Under these circumstances, shareholder-value-oriented managers are using downsizing as a strategy to manage shareholder value and to signal to investors their commitment to increasing value (Jung 2015). Building on resource-dependence theory and demonstrating these firm-level processes that have led to the rise of downsizing as a shareholder-value strategy, Jung (2015) has pursued the sociological research on growing job insecurity and income inequality over the past three decades.

Organisation and cultural factors may cause costs to rise by 30% when a product is made in segments, by different manufacturers. (Toyota's product quality does not derive from the number of robots used in the manufacturing process, but from the management of their human resources, where people are not treated as mere robots).

Information and communication technology provides an advantage for those companies that have modelled their internal organisation to fit the requirements of the new technologies and that have the necessary culture, governance, vision and collaborative attitude between their subsystems and corresponding job chart, because results are never linear.

The decisive factors for the future are not necessarily technical or financial, they are mostly immaterial in nature—strategies, innovation and adequate anticipation necessary to make an industrial venture viable and competitive.

Competitiveness factors and indicators cannot be developed and applied globally for an entire industry or for all territories. There are big differences among sectors, branches, products and territories; therefore the effort must be made to adjust to them specifically.

From the regional policy perspective, as highlighted by Meliciani and Savona (2015, 387–416), it is extremely important to have the ability to build on regions' existing specialisation, ensuring technological rejuvenation of traditional sectors and moving towards knowledge-based sectors. Under these circumstances, an appropriate mix of innovation and industrial policy might favour the revamping of old manufacturing and rural areas, which would entail an increasing demand for knowledge-based services and an upgrading of the sectoral specialisation, enhancing knowledge spillovers and innovation.

There is a dedicated literature which analyses the intensity of competitiveness factors and indicators by groups of industries, branches and subbranches which can serve as useful reference. A good example are the contributions to the *Manufacturing the Future* (Global McKinsey Institute 2012) (Tables 1.4 and 1.5).

A quick glance at the drivers behind the industrial strategies of various states reveals what they have in common: a move towards industry 4.0, through renewal of the means of production and development of technologies based on ICT, robotics, automation and vocational training.

For several decades—the past three, to be more exact—global economic organisations and institutions, including the EU, have viewed industrial policies as a way to distort market trends as a barrier against the efficient allocation of resources in a market economy, which is why the state's top-to-bottom (vertical) interventions (through subsidies, state shareholding, customs revenues or public markets) have been replaced by horizontal measures (putting in place favourable conditions for innovation and company formation).

Surprisingly, the European Commission (EC), in 2010 and 2012, the World Bank (WB) in 2013 and the OECD in 2013 radically changed their position on these topics.

The EC reviewed its stance with regard to the place of industry in the economy, and to public intervention, stressing that a highly competitive manufacturing sector can provide the resources and many potential

Table 1.4 Manufacturing factor intensity level, by groups of industries

Group of industries	Industrial sub-branches/branches	Intensity of research and develop ment (%)	Intensity of labour	Intensity of capital (%)	Intensity of energy (%)	Intensity of trade (%)	Density of value
Industries generating global innovation for local markets (34% of GVA in the manufacturing industry worldwide, 2010)	Chemical products	High	Low	High	Medium-high	Medium-high	Medium-low
	Motor vehicles, trailers, and-trailers	Medium-high	Low	Medium-low	Medium-low	Medium-high	Medium-high
	Other means of transport	High	Medium-high	Low	Low	Medium-high	Medium-high
	Electric machinery	Medium-high	Medium-low	Low	Medium-low	Medium-high	Medium-high
	Machines, machinery and equipment	Medium-high	Medium-low	Low	Medium-low	Medium-high	Medium-high
Regional manufacturing industries (28%)	Rubber and plastics	Medium-high	Medium-high	Medium-low	Medium-high	Medium-low	Medium-high
	Metal structures and metal products	Low	High	Low	Medium-high	Low	Medium-low
	Food, beverages, tobacco	Medium-low	High	High	Medium-high	Low	Low
	Publishing and printing	Medium-low	Medium-high	Medium-low	Medium-low	Low	Medium-low

(*continued*)

Table 1.4 (continued)

Group of industries	Industrial sub-branches/branches	Intensity of research and develop ment (%)	Intensity of labour	Intensity of capital (%)	Intensity of energy (%)	Intensity of trade (%)	Density of value
Energy- and Resource-intensive industries (22%)	Products of wood	Low	High	Medium-high	High	Low	Low
	Oil refining, coking coal, and nuclear industries	Low	Low	High	High	Medium-low	Low
	Paper and pulp	Medium-low	Medium-high	Medium-high	High	Medium-low	Low
	Other, non-metallic, mineral products	Medium-high	Medium-high	Medium-high	High	Low	Low
	Metallurgical products	Low	Low	High	High	Medium-low	Medium-low
Innovative global industries and technologies (9%)	Computers and office machinery	High	Medium-low	High	Low	High	High
	Semiconduc-tors and electronics	High	Low	Medium-high	Low	High	High
	Medical, optical, and high-precision apparatuses	High	Medium-low	Medium-high	Low	High	High

(*continued*)

Table 1.4 (continued)

Group of industries	Industrial sub-branches/branches	Intensity of research and development (%)	Intensity of labour	Intensity of capital (%)	Intensity of energy (%)	Intensity of trade (%)	Density of value
Labour-intensive industries (7%)	Textiles, footwear and leather goods	Medium-low	High	Low	Medium-high	High	Medium-high
	Furniture, jewellery, toys, etc.	Medium-low	High	Medium-low	Low	High	Medium-high

Source: Based on *Manufacturing the Future*, Global McKinsey Institute, SUA, 2012
Note: Intensity of research and development = Research and development spending/Gross value added × 100 (USA, 2007); Intensity of labour = Work hours per 1000 USD gross value added (EU 15, 2007); Intensity of capital = Gross operating surplus/Gross value added × 100 (world average 2006–2010); Intensity of energy = Cost of purchase of fuels and electric power/Gross value added × 100 (USA, 2010); Intensity of trade = Exports/Gross production × 100 (world average 2006–2010); Density of value = Worth of shipped goods/quantity of shipped ware (USD in thousands/tonne, USA, 2007)

Table 1.5 Manufacturing factor intensity, by groups of industries

Group of industries	Industrial sub-branches/branches	Intensity of research and development (%)	Intensity of labour	Intensity of capital (%)	Intensity of energy (%)	Intensity of trade (%)	Density of value
Industries generating global innovation for local markets (34% of GVA in the manufacturing industry worldwide, 2010)	Chemical products	25	10	50	5	42	1
	Motor vehicles, trailers and semi-trailers	16	14	32	2	39	8
	Other means of transport	25	19	29	1	42	8
	Electrical machines	6	17	30	2	46	7
	Machines, machinery and equipment	8	18	32	2	48	8
Regional manufacturing industries (28%)	Rubber and plastics	3	21	33	5	21	3
	Metal structures and metal products	1	23	28	3	14	3
	Food, beverages, tobacco	2	23	40	4	15	1
	Publishing and printing	2	19	33	3	4	3
Resource-and energy-intensive industries (22%)	Wood products	1	31	35	7	13	0.5
	Refining of crude oil, coal coking, nuclear industries	1	6	56	10	21	0.4
	Pulp and paper	2	18	37	10	24	1
	Other, non-metallic, mineral products	3	20	39	11	14	0.1
	Metal products	1	14	41	14	26	1

(*continued*)

Table 1.5 (continued)

Group of industries	Industrial sub-branches/branches	Intensity of research and development (%)	Intensity of labour	Intensity of capital (%)	Intensity of energy (%)	Intensity of trade (%)	Density of value
Innovative global industries and technologies (9%)	Computers and office equipment	25	15	41	1	91	72
	Semi-conductors and electronic equipment	33	15	38	1	60	
	Medical, optical, and precision apparatuses	35	17	40	1	57	
Labour-intensive industries (7%)	Textiles, footwear, and leather products	2	35	31	5	50	5
	Furniture, jewellery, toys, etc..	2	30	33	1	69	4

Source: Base on *Manufacturing the future*, Global McKinsey Institute, 2012

Note: Intensity of research and development = Research and development spending/Gross value added × 100 (USA, 2007); Intensity of labour = Work hours per 1000 US Dollars gross value added (EU 15, 2007); Intensity of capital = Gross operating surplus/Gross value added × 100 (world average 2006–2010); Intensity of energy = Cost of purchase of fuels and electric power/Gross value added × 100 (SUA, 2010); Intensity of trade = Exports/Gross production × 100 (world average 2006–2010); Density of value = Worth of shipped goods/Quantity of shipped ware (USD in thousands/tonne, USA 2007) solutions to the societal challenges that EU is facing, such as climate change, the health of the ageing population and the development of a healthy, safe and secure society.[5] This EU key document speaks of merging vertical and horizontal policies into a uniform approach to sectors like aerospace engineering, environmental goods and services, health, security and energy-intensive sectors with high exposure to international competition. In 2012, the EC clearly spelled out its interest in advanced technologies for bio-industry, construction, use of environment-friendly materials and smart development and vehicles.

The concept of "new industrial policy and innovation in enterprises" proposed by the WB is intended not only to create a favourable environment (horizontal policy), or to render support to certain industrial sectors (vertical policy), but also to encourage restructuring and dynamic technological advance.

Another dimension of this new policy is a straightforward approach to the elements of political economy involved in public interventions in industry. This new approach is designed to replace the traditional opposition between horizontal and vertical through corrections of various types of "coordination and market failures", by designing modes of action by the public authorities in consideration of the principles of political economy.

The *first coordination failure* is the correlation between public and private research, between universities and enterprises or between the large corporations and the small enterprises. Some experts claim that cluster policies can address the coordination issue between corporate research activities.

The *second market failure* is private companies' inability to valorise, on the market, the externalities of research, because analysts claim that from a social perspective, private companies do not integrate externalities in their economic calculus.

The *third market failure* regards trans-border mergers and acquisitions: some hold that the market is not always able to distinguish between socially desirable and socially non-desirable international transactions.

Another market failure is that access to finance, particularly in the case of small and medium enterprises (SMEs), and intermediate-sized enterprises, is closely connected to the fact that everybody is interested in drawing benefits from the existing innovative potential rather than investing in new research projects, which are viewed more like a complement to, rather than a substitute for, public involvement.

And, finally, related to value chains, new challenges have brought about the fragmentation of the production chain for the manufacture of certain products[6]; this causes changes in revenue formation, growth and the very nature of competition between countries; it generates a closer interdependence and a stronger need for cooperation, which, in turn, render the governance of world trade more and more complex.

For a variety of reasons, we are witnessing a process of *relocalisation and desegmentation* of the value chains (growing salaries and the need for qualified labour in emerging countries, higher transportation costs, volatile foreign exchange rates, political risk, difficulties in ensuring quality control, protection of intellectual property and the decline or stagnation of the price of energy at world level). Regarding this trend, Patrick Artus (2014) warned that countries that lose their production apparatus are at risk of becoming economies based on domestic services, with a low living standard.

Notes

1. *Steel Statistical Yearbook*, World Steel Association, various editions, 1960–2015.
2. *L'avenir de l'industrie*, in Problemes economiques, France, No. 3137/August 2016, p. 5.
3. *Problemes economiques*, France, No. 3137/August 2016, p. 6.
4. See also (Szirmai 2011) and (Szirmai et al. 2013).
5. Communications from the Commission to the European Parliament, the Council, the European Economic and Social Council, and the Committee of the Regions, *An Integrated Industrial Policy for the Globalisation Era. Putting Competitiveness and Sustainability at Centre Stage* and *A Stronger European Industry for Growth and Economic Recovery*, COM (2010) 614 final and COM (2012) 582 final, p. 4.
6. *Problemes economiques*, France, No. 3137/2016, p. 33.

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