

Introduction

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The beginning of the twenty-first century is turning out to be full of disruptions and challenges for economies and societies. Climate change, world population growth, migratory pressures, are pressing challenges; the financial crisis has had a dramatic effect and many economies have had difficulties in recovering their pre-crisis development level.

Meanwhile, innovation and technological changes are accelerating, in various fields including genomics, nanotechnologies, information and communication technologies (ICTs) and big data, robotics and artificial intelligence, new materials, and others. ICTs, with the Internet of Things (IoT), the Cloud, big data, are allowing hyper-connection of people and objects and digitisation of production processes. The change induced is so disruptive that there is quite wide consensus that we are experiencing an industrial revolution, the fourth one. New means of production and new products are appearing and will continue doing so, changing individuals' life in important aspects, namely economic, social and cultural.

Globalisation has continued not so much in terms of volumes of goods and services traded, but in terms of volumes of data globally traded and exchanged. This 'digital globalisation' is having important socio-economic impact on countries and territories, through its effects on industries.

Many companies are investing in the new technologies to develop new processes and new products. Regarding the former, 'smart manufacturing' is diffusing, characterised by factories organised as systems of machines and robots, that are connected together and with the products, but also with the consumer who can send requests on product characteristics to the system, which adapts in real time to produce it. This new production system allows both large economies of scale and high economies of scope, so that it has been called 'mass customisation' (Bianchi and Labory, 2018a).

New market intermediaries have also emerged, namely online platforms that are expanding their businesses to all sorts of goods and services. Amazon is a primary player, which has become a global marketplace selling goods to people all over the world, except China where specific

national platforms prevail. In 2000, a tiny fraction of the world population used the Internet, while almost half did so in 2015; most people use the Internet to access information on goods and services, and most use online marketplaces.

As argued by Bianchi and Labory (2018a), online platforms have had important implications for firms existing in industries, primarily by putting pressure on prices. Consumers can confront prices more easily and also get more information on products. In addition, small firms have been able to enter markets by selling their products on platforms and getting a share of the market of established firms. For instance, Yoox is a business created by an Italian entrepreneur in 2000, selling luxury clothing online; Uber has disrupted the taxi industry; Airbnb is challenging hotels; and online ticket booking is disrupting established physical travel and cultural ticket agencies. These companies were created very recently: Uber in 2009 and Airbnb in 2012.

The main advantage of online platforms is their ability to match users of the different sides by means of personal and business data they collect, exploiting economies of scope in large data sets. Thanks to these big data analytics and the development of algorithms, these companies can target ads, which are their main revenue source, but also suggest products according to preferences.

As a consequence, companies have to adopt new business models, creating their own platforms in order to directly interact with consumers, or using other platforms such as Amazon. The online market makes it easier for small companies to access the global market, since they can interact with consumers all over the world with an online platform; but it also makes them more vulnerable to the big platforms, which have the resources to accumulate and analyse the big data that small businesses do not develop so easily.

Big data are the strategic assets of companies: in the online community they collect data on consumers, on their preferences, past choices and purchases, which become even richer if these data can be matched with data on other choices made by these consumers, in their travels, leisure activities, purchase of other products. The companies that collect such rich sets of big data, such as Google or Amazon – namely, pure platform businesses – have large market power, and have become key market intermediaries, selling an ever-increasing range of products on their online platform.

As outlined by Brun et al. in Chapter 2 of this book, companies become ‘light’: the key asset is not the physical capital but the data, the big data that can be exchanged, accumulated and analysed.

In other words, market competition is changing. Products are more varied, more differentiated, and the marketplace is global and primarily digital, although physical shops have not disappeared.

Global value chains (GVCs) also transform (Bianchi and Labory, 2018a, 2018b). Existing GVCs reshape, taking advantage of the new technologies to reorganise production of existing products or launching new ones. One tendency that seems to be emerging is reshoring: many companies that have invested in smart manufacturing have reshored production in their home country or in advanced countries. When factories are organised as networks of machines and robots, less labour is needed, and the labour which is hired in the factory is highly skilled, able to identify and solve problems in the machines and robots, and reprogramme them when necessary. Smart manufacturing requires territories where highly skilled labour is available and where infrastructure is sufficiently developed, particularly connection infrastructure. New GVCs are also emerging as a result of the development of new products and processes generated from innovation and technological change.

Besides reshoring, another trend in production reorganisation that can be outlined is company focus on high phases of the production process, namely pre- and post-manufacturing. Manufacturing is increasingly performed by robots in smart factories, that can be located anywhere, provided there is access to energy, high-capacity Internet and materials. The key assets for a firm become its knowledge base, its technologies, its experiences, together with its capacity to identify market trends and consumers' tastes, and its capacity to innovate, to renew products and services.

However, beyond global trends it is still too early to outline systematic tendencies and evolution, or characteristics that would be valid for all firms across sectors. More research is needed on how production is transforming in the various sectors. This is important to provide answers to another important question which has been debated recently: the impact of the fourth industrial revolution on skills and jobs.

A characteristic that has been repeatedly mentioned regarding this fourth industrial revolution is its speed: smartphones appeared about a decade ago, yet they now represent a global product that almost all human beings on the planet own. Billions of people are connected through this product, exchanging data, getting information, and buying other products and services, since this product has become both a new market intermediary (buying goods through the various apps), a means of payment (no need to have a credit card in your pocket if it is registered on the smartphone), and a repository of all individual information (such as name, age, tastes and preferences, contacts, and so on).

The transformations implied by the industrial revolution are complex and deep. Structural change is multidimensional. It means adoption of new technologies, new production systems, which imply new skills in the labour force. Hence the adaptability of the labour force – namely, its

capability to learn new skills – is an essential factor for structural changes. New knowledge and competencies may be required, implying the need for vocational training and also adaptation of the education system so that young people might get the preparation for new types of jobs. New sectors might emerge, implying the reform of institutions that provide new regulations (product standards, protection of intellectual property rights, contract law, and so on). Structural changes generally require institutional changes. This process might create systemic failures, in that institutions and productive sectors change at different speeds. One particular problem is the large amount of time needed to adapt skills provided in the educational systems. The latter might be changed, but it takes a generation to take full effect: only pupils having performed their whole schooling in the new system will have full preparation for the new skills. In addition, teachers have to be trained to be able to transmit new knowledge and skills to their students.

Structural changes arising in specific industries might have effects on other industries (due to complementarities) and on the whole economic system. Industrial policy must therefore be based on an analysis of productive processes, but also on analyses of the interactions between different productive processes. Favouring structural changes in one sector may have positive or negative impacts on other sectors; it may also impact upon the labour market, changing the skill required in the labour force, as well as wages. The analysis of trajectories of structural change must therefore be performed to choose specific trajectories and a mix of measures to favour the evolution of the economy towards these trajectories. Industrial policy has always been implemented in times of important structural changes for industries. Governments at various levels are concerned that the industries in the territory will be able to adapt, as well as develop in new ways.

So many questions are raised: can some trends be outlined in productive transformations? Are services more important than manufacturing? How should action be articulated at national and regional, but also supranational levels?

This book originates from a conference organized by the Emilia-Romagna Region of Italy in October 2017, aiming at reflecting on these crucial matters by creating a network of academics, economists from international organization, institutional and business stakeholders, as well as representatives of the civil society.

The book is not aimed at a review of industrial policy. The literature is now wide and there is consensus that it is useful and that it aims at favouring structural changes in industries (Rodrik, 2004, 2008; Chang, 1994, 2010; O'Sullivan et al., 2013; Bianchi and Labory, 2011, 2018a; Bailey et

al., 2015; Noman and Stiglitz, 2016). The above-mentioned changes are structural and require industrial policy: the institutional framework has to adapt (think, for instance, of the new regulation needed for artificial intelligence, particularly for traffic with self-driving cars, but also for new medical treatments based on nanorobots introduced into the body to directly cure infected cells), and innovation, education and social policies respectively have to provide appropriate infrastructure and favour the development of adequate capabilities.

Bianchi and Labory (2018a, 2018b) analyse what industrial policy is needed today. They argue that in order to favour structural changes one has to look at the mechanisms of productive transformation. Structural changes imply developing new productive capabilities, which are necessary to reshape global value chains and favour the emergence of new ones. For this purpose, coordinated action is needed in the multilevel governance process: actions at regional, national and supranational levels must be coordinated and coherently implemented. They also argue that action at regional level is particularly important in order to prepare for the industrial revolution.

In this context, this book aims at realising a reflection on market trends, structural changes, and how much industrial policy currently implemented in countries really promotes structural changes and orientates industrial development towards specific and preferred paths.

The conference was intended as the first in a series of reflections on these very complex issues. It started from an analysis of the state of the art, hence industrial policies at national level, highlighting the different approaches and implemented actions. An analysis of current market trends – namely, globalisation and the disruptive impact of the fourth industrial revolution – was performed to outline the new issues that are raised in terms of industrial policy in this context. Finally, the conference concluded by outlining the role of territories. Briefly, territories have a role to play in mobilising tangible and intangible resources to build the capabilities necessary to make them hubs in the digital and globalised world. There are many examples of effective regional industrial policies, implemented coherently in a multi-level governance framework, which have contributed to making the regional territory attractive to businesses and oriented towards favourable industrial development paths. The Emilia-Romagna region is one case illustrated in Bianchi and Labory (2018a, 2018b). Innovation and high-tech is important, but industrial development concerns all sectors, so that even lagging regions can define and implement industrial policy that are appropriate to their local conditions. This is very important to induce a balanced industrial development and growth, which should be a primary aim of policy, as shown by current events such as Brexit and the rise of

populism in many areas, as outlined by Michael Piore and David Skinner in the concluding Chapter 9 of this book. The chapter regards the United States of America (US), but its analysis applies to any place.

The book is organised as follows. In Chapter 1, Jostein Hauge and Ha-Joon Chang discuss the importance of manufacturing in economic development. They examine the various arguments that have been put forward for and against, and they show that it is indeed essential, and industrialisation remains a necessary phase of development. More precisely, the authors conclude that while both the potential for contribution to productivity growth and the tradability of services have increased, manufacturing remains the backbone of productivity growth and economic development. Economic development has hardly ever happened without industrialisation; manufacturing has a larger multiplier effect in the economy than services; the falling share of the manufacturing sector in gross domestic product (GDP) in many countries is somewhat of an illusion; manufactured goods remain far more tradable than services; and the supposed risk of automation of manufacturing jobs in developing countries is mostly hype without evidence.

Chapter 2 by Lukas Brun, Gary Gereffi and James Zhan analyses recent evolutionary trends in GVCs, with a particular focus on the implications of the adoption of the new technologies of the fourth industrial revolution (Industry 4.0). They argue that recent dynamics in GVCs include: rationalisation, in that lead firms have tended to reduce the number of suppliers; regionalisation, namely a concentration of production in broad regions, mainly North America, Europe and Asia; and resiliency and digitisation, which means the use of advanced data analytical tools and physical technologies to improve the digital connectivity and technological capabilities of supply chains. The authors outline three major effects of Industry 4.0 on GVCs and derive three possible scenarios of future evolution according to whether digital multinational organisations (MNEs) will develop in a complementary manner to existing firms (complementary scenario), will disrupt existing firms (displacement scenario), or whether existing firms will be able to adapt and develop alongside digital MNEs (adaptation scenario).

Chapter 3 by Keun Lee and Jongho Lee examines to what extent are countries prepared for the fourth industrial revolution, by looking at several dimensions of their National Innovation Systems (NISs). The focus is on five countries, namely South Korea, Germany, France, Italy and the United Kingdom (UK). Using patent data in the last decade, the authors compare five indicators: originality, cycle time of technologies, knowledge localisation, technological diversification, and inventor-level concentration of innovation activities. They conclude that the UK and Germany

appear to be well prepared for the fourth industrial revolution, France has medium preparation, Italy exhibits low preparation, and the Korean NIS has good indicators but is still low in terms of originality.

These first chapters in Part I provide useful insights on the productive transformations occurring as a result of digital globalisation, namely the fourth industrial revolution, as well as its policy implications. Industrial policy aims at favouring structural changes in industries, so it is the main policy that has to be mobilised in order to favour the transition. As shown by Bianchi and Labory (2018a, 2018b), industrial policy in times of deep structural transformation such as an industrial revolution has to be designed and implemented jointly and coherently with other policies, particularly education and training, social and labour, infrastructure, trade, antitrust and regulation policies.

Part II of the book therefore looks at the lessons that can be drawn from past experiences of national industrial policies. To begin with, Chapter 4 by Marco Di Tommaso, Mattia Tassinari and Andrea Ferrarinni looks at the US industrial policy in the long run. The authors show that the US government has continuously promoted structural changes in its industries, through various means and actions that are analysed in the chapter.

In Chapter 5, Marco Di Tommaso, Chiara Pollio, Elisa Barbieri and Lauretta Rubini examine and show the essential role of industrial policy in the industrialisation process of China. An interesting focus of the chapter is on the ‘specialized towns’ programme, which reflects attention of the Chinese government to places, since it has favoured the agglomeration of industrial activities in some Chinese provinces. The programme has been successful in spurring industrial development in these areas; however, it has produced uneven development in the country, since other areas have been left behind.

In fact, Bianchi and Labory (2018a) outline that the risk of uneven development is generally high in times of industrial revolution. Previous industrial revolutions, from the first to the third, have tended to favour some places or regions at the expense of others. Consequently, unless governments intervened to rebalance development, disparities were created. The evidence of Industry 4.0 is that this risk also exists nowadays, implying a role for regional industrial policy (Bianchi and Labory, 2018b).

Chapter 6 by Jorge Máttar looks at industrial policy in Latin America and the Caribbean. He shows that past industrial policies have not been effective, because they missed actions to prepare industries to structural changes. For instance, many countries based their development on exports of raw materials and encountered problems when their prices fell. Industrial policy favouring upgrading – and particularly, in this case, the transformation of raw materials – could have helped to mitigate the

negative effects of price reductions. Jorge Máttar therefore argues that the fourth industrial revolution could be taken as an occasion to adopt appropriate industrial policies, namely policies aimed at preparing the national industrial systems for the deep structural changes taking place and expected to take place in the future. The author delineates some principles and elements that these industrial policies should adopt. He stresses in particular the necessity for participative governance processes, where governments and stakeholders dialogue and interact in order to identify possible development paths and choose actions in favour of the chosen path.

Chapter 7 by Clemente Ruiz Durán shows the complexity of the challenges of today's global society and argues that industrial policy has a role to play in resolving these challenges. One particular issue which is outlined is that current structural changes require institutional adaptation, which is usually a slow process, while technologies and businesses change fast.

These chapters highlight that industrial development is an engine of social and cultural development. Industrial revolutions have profound impacts not only on economic, but also on social and cultural life. Industrial adaptation and industrial policy therefore have to take these socio-cultural implications into account in order to ensure an even development of the territory. The last two chapters of the book, in Part III, outline the risks of uneven development and the necessity of this comprehensive view in which the design and implementation of industrial policy should be considered.

Marco Bellandi, Lisa de Propris and Enrica Santini highlight in Chapter 8 that industrial policy has to pay attention to local specificities, and has to be comprehensive in the sense of taking all dimensions of development (not only economic, but also social) into account. This is important especially for the adaptation of small and medium-sized enterprise (SME) systems. They therefore delineate place-based industrial policies at the intersection between technological change and territories.

In Chapter 9, Michael Piore and David Skinner show that the risks of uneven development are reflected in the boom of reactionary populism in the US; due, according to the authors, to the implementation of wrong policies. The chapter argues that past policy paradigms such as the 'Washington consensus' or the 'Silicon Valley consensus' have failed, mainly because the structural adjustment processes vary across territories and countries, with different speeds and different characteristics. Each territory should design coherent policies favouring structural changes in an inclusive manner, starting from a dialogue with stakeholders. In particular, the authors stress the importance of the dialogue between businesses and schools so that appropriate skills are trained in workers.

More generally, they argue that the Keynesian paradigm should be referred to today; not to implement it straight away, but as a reference for a reflection on what type of policies are desirable today. This, they say, 'seems particularly important at the current moment, which in so many ways resembles the inter-war period where public policy was caught by surprise, unprepared and ill-equipped to respond to the political reaction against globalization'.

A political economy approach to industry analysis and industrial policy design and implementation thus seems highly relevant in these times of deep structural transformations (Bianchi and Labory, 2018c). There is indeed a real risk of not having the right tools for a full understanding of the changes in social and political relations that structure economic actions. We need to gain an understanding of complex social phenomena, using all the tools of interdisciplinary dialogue at our disposal, in order to avoid the reactions against globalization turning into a wave of anti-democratic closed-mindedness.

This book therefore aims at contributing to this need for a better comprehension of the ongoing structural transformations, by highlighting their structuring elements, namely innovation, territory, people's rights and institutions. The democratic development of our world will depend on how these elements are balanced in the near future.

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