Preface

Manufacturing is the mainstay of many modern economies, capable of generating social, economic and environmental benefits, as well as helping overcome the great challenges of our times. From a broader point of view, the availability of advanced expertise, industrial culture, image, brands and reputation, availability of resources for innovation and research, and the right conditions to attract talent are all elements that can seal a country's success.

Over the last three years, it has become even more apparent that—based on the characteristics and availability of resources (such as skills, manufacturing plants and raw materials)—each country needs to develop a strategy to ensure a strong industrial sector, focusing on processes, sectors and applications that embody the uniqueness of the region's characteristics, with a view to achieving excellence in strategic areas of specialization.

Italy, more than most, has a unique heritage in terms of tradition, culture, skills, image, design and technologies, which represent the optimal environment for a manufacturing sector that produces high-added-value products and services exported worldwide.

The only conceivable engine for driving continuous evolution in a country is a research and innovation plan accompanied by a training plan designed to refocus the set of skills within the national industrial fabric in line with European policy objectives. A multi-year research plan must leverage the qualities of Italy's available production resources and must be aligned with research challenges and international trends in the manufacturing field.

The pandemic has put all companies and economies through the wringer, and no analysis of historical data is complete without also looking at current economic data, which nonetheless makes coming up with any forecast for the future much more difficult and calls for great caution in a context that is still very much evolving and marked by a great deal of uncertainty.

On the one hand, it is necessary to avoid the risk of being influenced by the latest trends that the shifting current scenario can easily overturn; on the other, it is necessary to define pathways that take into account challenges and the opportunities they bring for an overhaul of Italian manufacturing.

The Cluster's strategy is based on the fact that the development and application of scientific research outcomes is recognized as one of the most effective levers for improving competitiveness and creating products and processes that are more efficient and sustainable and, more generally speaking, better able to meet people's needs.

In addition, this has a considerable impact on society as it can help improve the quality of life of its citizens and the competitiveness of the system as a whole, tackling social challenges, such as sustainability, product customization and development of human resources.

A process of this kind is complex and involves various components and different roles, taking into consideration different points of view, interests and needs. Over the last 15 years, models capable of supporting an innovation process of this kind have been discussed at length and analysed at a scientific, industrial and political level with the goal of finding more effective ones. Today, one of the most widely adopted models of innovation is the so-called triple helix model.

According to this model, the growth of a country, capable of considering the needs and characteristics of the society and industrial system, can be achieved through proactive collaboration between research, business and government. On one side, the objective of the research activities is the development of innovation that can be applied to different contexts. On the other side, it is the task of businesses to ensure they are profitable, competitive and offer value for money.

Institutions must provide a regulatory framework supporting effective collaboration, assisting them during the initial phase from research to innovation through to actual industrialization, as they often prove unfeasible where they rely on market forces alone. Moreover, a virtuous system should be based on social and economic improvement, which researchers and companies should factor into the technological development models, possibly also backed by government bodies.

In this context, there is no denying the paramount importance of the Cluster's role: it becomes a facilitator of research and innovation networking processes, acting as a soft-governance body to bring together the needs of all these actors through processes designed to help define appropriate policies to support and stimulate research and innovation, and their implementation, with the aid of strategic documents such as the roadmap.

Therefore, with its ultimate goal of defining the new roadmap for research and innovation for the Italian manufacturing industry, this book groups the work of more than 200 people involved with different sessions of brainstorming, focus groups, expert elicitation and content analysis.

The first chapter "Defining a Collaborative Framework for Roadmapping Activities" proposes a collaborative framework and methodology that can be used for supporting roadmapping activities involving large groups of actors representing different interests.

The second chapter "Analysis of the Italian Manufacturing Sector" proposes an insight into the context of the Italian manufacturing sector, comparing it with other countries in Europe and across the globe, also offering a focused look at the sector's

response to the pandemic crisis, and with a focus on the machine tools sector and on system competitiveness.

This is followed by the chapter "The Role of Industrial Policies: A Comparative Analysis" with the analysis of the reference documents that are orienting industrial policy at the European, national and regional levels to study how these decisional levels can interact in terms of content and synergies of objectives.

The following chapter ("Building Scenarios for the Future of Manufacturing"), referring to a number of important environmental, social and technological trends, offers a number of reference scenarios that are emerging for having a significant impact on the manufacturing sector in terms of changes in production models along the time horizon from short to long term and that can be used to identify the strategic lines.

Chapters "Strategic Action Line LI1: Personalised Production"–"Strategic Action Line LI7: Digital Platforms, Modelling, AI, Cybersecurity" expand on the content in terms of strategic action lines each covering a specific macro-area and identification of related research and innovation priorities.

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