China's Industrial Policy Plan
Made in China 2025

An analysis of motives, implementation and effectiveness of China's industrial policy plan Made in China 2025

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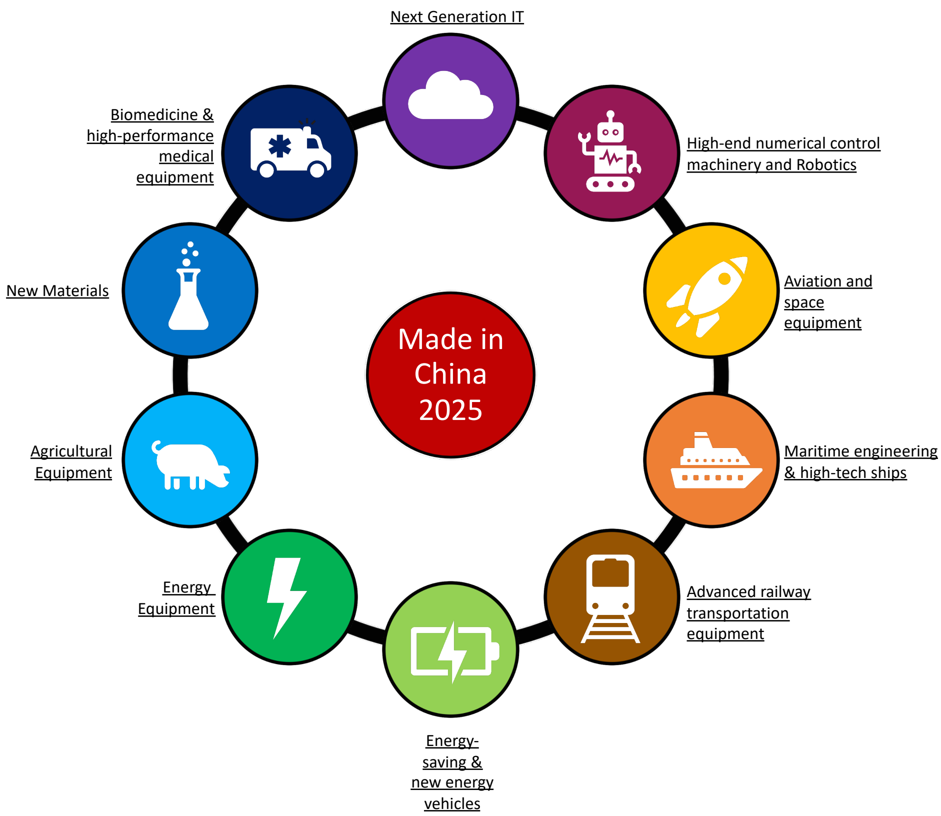

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I. Abstract

This thesis investigates China's industrial policy (IP) plan *Made in China 2025* (MIC2025). Through a disciplined interpretive case study of MIC2025, it explores the industries, actors, objectives and targets of the plan, the key factors that have led to the emergence of the plan and the IP-instruments employed in its implementation. A multiple case-study of three industries covered under MIC2025, shows how the plan is implemented at the industry-level and what outcomes can be observed across these industries between 2015 and 2019. As its theoretical framework, the thesis employs the debate about IP and the role of the state in structural transformation.

The thesis has five main conclusions: Firstly, it is concluded that MIC2025 follow a top-down policy approach to make China a technological superpower by focusing on ten key industries. Bottom-up dynamics, however, remain weak, resulting in a limited coordination between central and local government. Secondly, it is concluded that several domestic, regional and global factors have led to the emergence of MIC2025 including (i) a surge in Asian IP plans, (ii) a high dependency on imports, (iii) the middle-income trap, (iv) the fourth industrial revolution, (v) regional and global competition, and (vi) China's position in global value chains. Thirdly, the thesis finds that the debate on MIC2025 within China is multifaceted with differing views on the degree to which the state should engage in IP. Fourthly, the thesis finds that MIC2025 combines a range of highly diverse horizontal and vertical IP-instruments in its implementation, and that especially government-guided funds, SOE's and large state-owned banks are important actors of the plan. The industry-level multiple case-study reveals that some overlap exists between the policy instruments applied across industries, while others are industry-specific. Finally, the outcomes observed across the three industries are to some extent in line with the objectives set under MIC2025 as of 2019, but the overall efficacy and success of MIC2025 remains to be seen.

At a more general level, the thesis contributes to the understanding of how IP is made in emerging economies, and what characterises such policies. MIC2025 exemplify the increasing complexity found in IP-making today and underscores the increasing role of global value chains and the fourth industrial revolution on IP formulation in emerging economies today.

Keywords: Made in China 2025, MIC2025, industrial policy, global value chains, the fourth industrialisation

II. List of figures

III. List of Tables

IV. List of Abbreviations

AQSIQ	General Administration of Quality Supervision, Inspection and Quarantine
CAE	Chinese Academy of Engineering
CATR	China Academy of Telecommunication Research
CNCA	Certification and Accreditation Administration of the People's Republic of China
CPC	China’s Communist Party
CSMLSG	China Strong Manufacturing Leading Small Group
EU	European Union
EUCCC	European Chamber of Commerce in China
FDI	Foreign Direct Investment
IP	Industrial Policy
IR4	The Fourth Industrial Revolution
ILC	Industrially-Lagging Countries
JV	Joint Venture
MIC2025	Made in China 2025
MIIT	Ministry of Industry and Information Technology of the People’s Republic of China
MNE	Multinational Enterprise
MOFCOM	The Ministry of Commerce of the People’s Republic of China
MOF	Ministry of Finance of the People’s Republic of China
MOST	Ministry of Commerce of the People’s Republic of China
NIC	Newly Industrialized Country
NDRC	National Development and Reform Commission
Roadmap15	Key Technology Area Roadmap 2015 Edition
Roadmap17	Key Technology Area Roadmap 2017 Edition
R&D	Research and Development
SAC	Standardization Administration of China
SOE	State-owned enterprise
SME	Small and Medium-sized Enterprise

“没有强大的制造业, 就没有国家和民族的强盛”

(State Council, 2015)[1]

1 Introduction

Industrial policy (IP) has never been a more interesting field of study than it is today. With the tectonic shift in economic and political power from West to East largely driven by state-led economies in Asia, IP is back on the academic and political agenda. While the main objective from the state’s perspective is to generate economic growth and prosperity, the theoretical and political discussion has emphasized how state interventionism and market forces should be balanced to reach an economic structure that most effectively supports the economy’s strategic objectives (Naudé, 2010). This debate has been characterized by disagreements on industrial policies merits, contents and applications (Naudé, 2010).

Large government-led efforts such as top-down approaches have a mixed record of success, and there is no blueprint or universal best-practice of IP. Supporters of IP often refer to the success of the ‘four tigers’ (Hong Kong, Singapore, South Korea and Taiwan) and the impressive economic progress these economies experienced due to strong state-involvement during the period from 1950 to 1980 (Amsden, 1989; Chang, 2002; Johnson, 1982; Wade, 2012). Opponents of IP, on the other hand, has often referred to the case of failed policies in Sub-Saharan Africa (Pack, 1993) and Latin America (Peres & Primi, 2009) during the 1960s and 1970s or ascribed the success of e.g. Japan to liberal markets and competitive pressures rather than government intervention (see e.g. Porter, Takeuchi, & Sakakibara, 2000). The stark contrast between the successes and failures of industrial policies constitutes a good example of the importance of context and content of IP-making as argued by scholars such as Rodrik (2008) and Naudé (2010). It is this debate that is the theoretical framework for the thesis, through which I intend to investigate China’s IP plan *Made in China 2025* (MIC2025).

MIC2025 was first announced by Premier Li Keqiang during the annual work report presentation at China’s ‘two sessions’ – the Chinese People’s Political Consultative Congress and the National People’s Congress – in March 2015 (Li, 2015). The plan aims to make China a global technological superpower by 2049, by supporting and developing China’s domestic high-tech industries and

[1] China’s State Council: “*Without a strong manufacturing industry, there will be no national prosperity*”. This quote is taken from the opening paragraph of the ‘Made in China 2025’ plan and underscores the importance attached to the plan by the Chinese leadership (State Council, 2015).

increasing China's competitiveness in ten key industries. It is currently the main state-led IP plan, and its strategic importance is underscored by party- and state leader Xi Jinping who has announced it as one of his signature projects along with the *Belt and Road Initiative*[2] and the *China Dream*[3] (Zenglein & Holzmann, 2019). In the West, MIC2025 has quickly become a thorny issue and has been criticised at large by officials in the US (e.g. vice president Mike Pence) and the European Union (EU) as a conduit for China to use government funds to gain competitive advantages, while flouting global trading rules. The EU Chamber of Commerce in China (EUCCC) has called for 'competitive neutrality', and the unfair competition of China's state-owned enterprises (SOE)'s and the need for privatization and reform is again high on the agenda (Wang & Behsudi, 2019).

At the root of the scepticism and uncertainty about MIC2025, lies the fact that it is a relatively new initiative that is still inadequately understood. While it has been followed closely by politicians, think tanks and international organisations, not much scholarly attention has been devoted to the topic. This is obvious when comparing the accumulated number of scholarly articles on *Scopus*[4] mentioning MIC2025 with the number of newspaper articles mentioning it: In the period between July 2014 and July 2019, there was a total of 2,975 official news-articles mentioning MIC2025 (Chen, 2019). In comparison, only 114 entries appear by a key-word search of "Made in China 2025" and "China Manufacturing 2025" in the corresponding period on *Scopus*. The majority of these studies are within the subject area of engineering (45%) and computer science (25%), with business (12%) and social science (10%) only accounting for a small percentage of the total.[5] Through a comprehensive screening of the abstracts of the 114 studies, it is only the following nine English-language articles and book chapters that deals specifically with MIC2025 from a social science or political science perspective: (Qi, 2018); (Sun & Jiang, 2017); (Sendler, 2017); (Lüthje, 2019); (Kenderdine, 2017);

[2] The *Belt and Road Initiative* (BRI) is China's vision of revitalising the historic 'Silk Road' which was the major trade route between China and Europe for centuries. It plans to connect Eurasia through a land-borne (yidai 一带) and a maritime (一路) trade route and is mainly focusing on infrastructure and .

[3] The China Dream or The Chinese Dream (中国梦) is Xi Jinping's plan to rejuvenate the Chinese nation and reclaim national pride.

[4] Scopus is the world largest abstract and citation database of peer-reviewed literature. It contains more than 20,500 titles from over 5,000 international publishers (Elsevier, 2019).

[5] Calculated as a fraction of the total number of articles: Engineering: 51/114 = 0.447; Computer Science: 28/114 = 0.245; Business: 14/114= 0.122; Social Science: 11/114 = 0.964. The numbers are rounded to the nearest whole number.

(S. X. Liu, 2016); (K. Liu, 2018); (Müller & Voigt, 2018); (Huimin et al., 2018).[6] The business and social science perspective on MIC2025 is essentially missing in scholarly articles.

Research institutions in both the EU and U.S., mainly focus on the challenges MIC2025 poses to the international competitive environment. The most comprehensive of such reports to date, is the report by Berlin-based policy-oriented think tank Mercator Institute for China Studies (see Zenglein & Holzmann, 2019), which mainly focus on how the EU should respond to MIC2025 by providing policy recommendations to European, and especially German, governments and business. The same is the case for the European Commission (2019) report released earlier this year, the European Chamber of Commerce in China (2017) report, and the U.S. Chamber of Commerce (2017) report. Other reports have focused on the challenges posed to certain industries of strategic importance (see Rubio, 2017) as well as the challenges MIC2025 poses to the comparative advantages of specific countries/regions (see OECD, 2019). Little discussion in the reports, if any, is devoted to the larger questions of *why* and *how* China is using MIC2025 as a strategic policy tool to increase its global competitiveness, as well as the motives and factors leading to MIC2025.

It is these observations and the related research gap that underscores the motivation to dig deeper into the *why* and *how* of MIC2025. While other policy plans are important too, MIC2025 is particularly relevant and deserves scholars and policy-makers full attention, as it may have the most wide-ranging implications for the trajectory of China's future IP. Understanding the reasons and motives behind MIC2025 may provide a more balanced view on why MIC2025 has emerged, and case-studies on industries may indicate how it is implemented and what has been achieved thus far. I have therefore specifically chosen to investigate this by asking the research question presented below.

[6] Based on a key-word search ("Made in China 2025") on Scopus between July 2014 and November 2019.

1.1 Research Question

What is MIC2025, and what are some of the key factors that led to the emergence of MIC2025? Why is it necessary for China to pursue MIC2025 from a Western (external) and Chinese (internal) perspective, how is MIC2025 implemented, and to what extent can we conclude on the efficacy of MIC2025 between 2015 and 2019?

The answer to the research question will be tied to the debate about the merits of IP and its implications for industrial modernisation. In a larger perspective, it may give us an indication about whether China's approach can offer a different model of success where state-capitalism is the main driver of innovation and economic growth. It is the goal of the thesis to provide a comprehensive understanding of MIC2025 and illuminate the complexity that surrounds IP-making today.

Studying MIC2025 is important, since the plan affects more than just economic development in China. The successful implementation of MIC2025 is expected to have long-term implications for economic growth and development in China but will also have an impact on how the fourth industrialisation and the global race for technological innovation plays out and how global value chains (GVCs) will be organized in the future. As already seen with the ongoing trade war between China and US, it also has the potential to impact international trade and ultimately international security politics. Understanding what the plan seeks to accomplish and its consequences for international trade, will be important knowledge for policymakers and IP scholars and experts. With China being the architect of the plan, everyone interested in international political economy, area studies and economic development should likewise be eager to understand this plan in more detail.

In order to thoroughly answer the principal research question, a number of subordinate questions will need to be addressed. The thesis is therefore organized around five questions which structures the analytical sections: These five subordinate questions are described in detail in the following paragraph.

1) What is MIC2025, what is its key contents and who are its key actors?

To answer this question, the national plan as well as the roadmap released by the State Council is investigated. The purpose is to give a thorough picture of what MIC2025 is seeking to achieve, and how it is structured in terms of objectives, industries, scale, actors and functions. Similarities and differences between MIC2025 and former IP plans initiated by the CCP will also be examined. Finally, I will review the most important adjustments and changes to MIC2025 since its inauguration in May 2015 up until December 2019.

2) What are some of the key factors that led to the emergence of MIC2025?

This question tries to analyse the key factors that led to the emergence of MIC2025. It does not seek to provide an exhaustive list of factors, but rather to assess the *key* factors and what role these factors had on the emergence of MIC2025. Focussing on the most important factors allows a more thorough and detailed assessment of the identified factors. To analyse this, the section investigates the economic, political and trade environment that existed in China prior to the implementation of MIC2025.

3) Why is it necessary for China to initiate MIC2025 from a Western (external) and Chinese (internal) perspective?

This section investigates why China has chosen to pursue MIC2025 and compares the arguments for and against this. It is examined why China need this policy, and the arguments for and against this are discussed. The internal debate in China provides the emic perspective to a debate largely dominated by Western research communities and media and gives a glimpse into the multifaceted debate taking place in China on MIC2025.

4) How is China implementing MIC2025 and through what IP-instruments?

This section looks into which IP-instruments China is using and how they are using them. The list of IP-instruments as outlined in section 3.4 is used to conduct a multiple case-study on three of the ten key industries of MIC2025. It looks at both horizontal and vertical IP-instruments and compares similarities and differences between the industries.

5) How effective has MIC2025 been since its inauguration in 2015 until 2019?

This section looks into how far China has come in reaching its objectives and targets of MIC2025 for the case-studies of the three industries. Comparing the 2015 and 2019 realized industry measures with the 2020 goals, the section seeks to evaluate how far China has come in reaching their goals as of today, as well as what the future prospects looks like.

The five questions follow the structure as outlined in the model below:

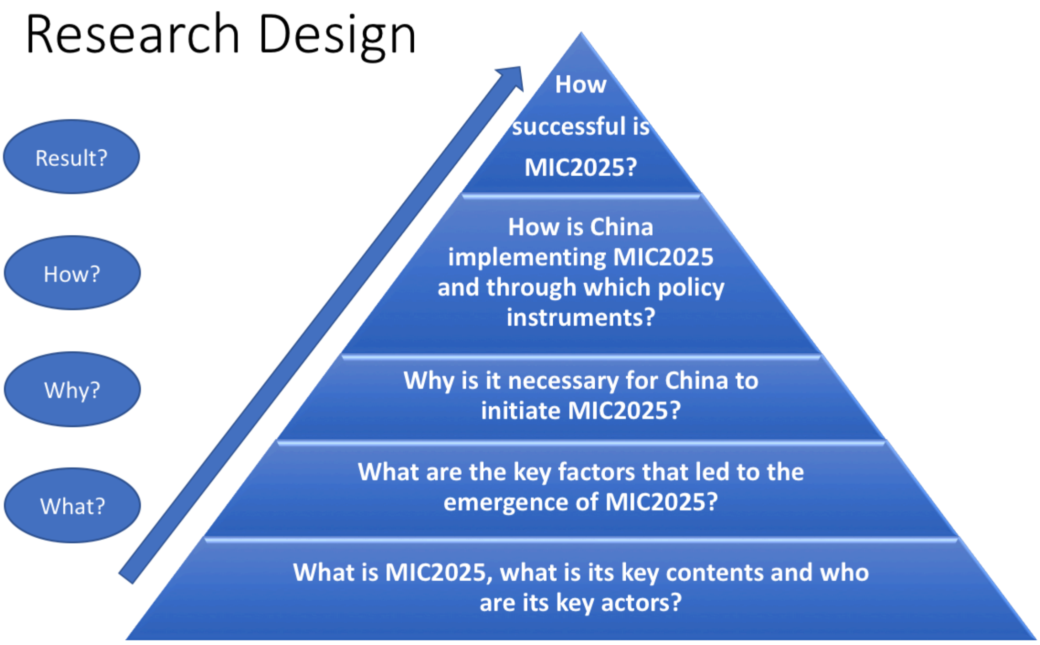

Figure 1: Research Design

1.2 Delimitation

Defining a reasonable scope is the precursor for a successful research design. This thesis focuses specifically on MIC2025. While MIC2025 is the main state-led IP plan, it only constitutes one element of a much larger and highly complex network of industrial innovation policies (Zenglein & Holzmann, 2019, p. 32). Different policy plans are targeted towards different strategic areas, that besides addressing manufacturing (MIC2025), also include plans on digitalisation (*The Internet Plus Strategy*), going global (*The Belt and Road Initiative*), and smartification (*The Next Generation Artificial Intelligence Development Plan*) (Zenglein & Holzmann, 2019, p. 32). This thesis only tangentially touches upon these plans and only to the degree it is relevant to MIC2025. The arguments for choosing MIC2025 as the subject of the study and why it deserves our fullest attention has been outlined in section 1.1.

In terms of data, the thesis takes a qualitative approach to the study. This approach gives the necessary situational understanding of what MIC2025 is, which factors that have driven its emergence, how and why it is needed and how it is implemented. The thesis seeks to provide a deeper understanding of MIC2025 which is achieved only through qualitative research. While it is recognized that a quantitative study could give valuable insights into for instance FDI investments into Europe and their connection to MIC2025, this would require a completely different analytical outset, relying on regression-models, econometrics and data analytics significantly more. Also, such a study has already been partly pursued by e.g. (Zenglein & Holzmann, 2019, p. 13), who finds that 58% of the value of Chinese FDI into Europe in 2018, could be attributed to core industries under MIC2025. What is missing, is still the *why* and *how* of MIC2025. Therefore, the quantitative approach to IP, which is largely concerned with investment policy, taxation, financing and FDI policies of the state, is only addressed to the degree it is relevant to MIC2025.

In section 4.2 on the factors, it is not the attempt of the thesis to provide an exhaustive list of factors that have led to the emergence of MIC2025. Rather, the desire is to carefully assess and choose the most important factors, in order to conduct a thorough and detailed assessment of these factors. This is in line with the case-study approach, where depth is preferred over quantity. A thorough mapping of all factors is therefore left for future studies to pursue. Neither are the identified factors weighted, while it is recognized that the factors certainly differ in their effect on China's motivation to pursue MIC2025. The identification of factors is supposed to give a comprehensive picture of what has driven the emergence of MIC2025, rather than the degree of influence those factors have had on its emergence.

The reader will be reminded of such delimitations throughout the thesis when deemed appropriate.

1.3 The structure of the thesis

The thesis is structured in the following way: Chapter two establishes the foundation for the thesis, by addressing philosophy of science, methodology, and research design. Chapter three is a literature review of IP, both at a general level and in relation to Asia and China specifically – it investigates IP in a historical perspective, the case for and against IP, and looks at how IP is changing today. Chapter four is the analytical section and constitutes the main part of the paper. It initially introduces the background information of the case, MIC2025, and then addresses the five subordinate research questions one by one (see 1.1 for the questions). The fifth chapter is a discussion of the findings in chapter four. Ultimately, the sixth chapter addresses the implications of the findings for future research before concluding the thesis.

2 Methodology

Imperative for any academic study is the constant deliberation of methodology prior to and during the study undertaken. Before endeavouring on answering the research question, this section will therefore discuss the methodology for this study. This is done by explaining the philosophy of science, elaborating on the research design and the *disciplined interpretive case study* approach, and discussing data access and reliability and finally accounting for the importance of Chinese language sources.

2.1 Philosophy of Science

Political scientists often focus on policies but neglect outcomes, whereas economists focus on the outcomes, but neglect the policies regulatory or institutional structures (Brandt & Rawski, 2019, p. 2). Therefore, this research project seeks to combine studies in China studies with studies in political science and economics and incorporate methods and concepts from both. The study is based on a critical realist approach. In critical realism, reality is seen as having an objective existence, which cannot be fully understood or theoretically explained. That is, reality exists without our knowledge of it (Bhaskar, 2010, p. 49). Critical realism distinguishes between the real world, the actual events created by the real world, and the empirical events which are what we can actually observe, capture and record about the world (Easton, 2010, p. 128). To understand and create knowledge on this objective existence that surround us, researchers depend on theories, even if these theories are 'fallible' (Danermark, Ekström, & Karlsson, 2019, p. 15). In order to generate such knowledge, critical realists use the concept of "abstraction", to discuss the isolated areas of the larger reality, i.e. a concrete object, to find more specific knowledge about this object. Abstraction must be based on something concrete and cannot rely solely on theory. Critical realism is thus neither based on abstraction (theory) or the concrete (empirical observation) but must include both perspectives. Critical realists use causal analysis to explain why things have happened the way they did. Causal analysis seeks to understand how the different mechanisms have led to the observed occurrence of the "concrete object".

In terms of economic schools of thought, I am, in line with Chang (2002) and Nolan (2001), of the believe that while neoclassical economics can provide useful tools to explain and analyse problems within a given structure, it is not adequate in understanding the institutions, technologies, politics and ideas that are important to define how that structure evolve over time (Chang, 2002). This unorthodox view of economic development has become increasingly influential over the last decades, though neoclassical economics and neoliberal ideals remains significant in the West (Wade, 2019, p. 23). IP in China, for instance, has drawn heavy inspiration from non-mainstream economic theory, after studying the empirical IP cases of Japan and the 'four tigers' (Nolan, 2001).

2.2 Research Design – The Case Study Approach

The research design should be structured in a way so that it is possible to answer a delineated research question. For this analysis, I have chosen MIC2025, as my empirical subject of analysis. Specifically, I am interested in *why* and *how* China is implementing MIC2025. Therefore, a *disciplined interpretive case study* approach has been chosen as the appropriate method for this study. This method allows the researcher to deep dive into the specificities of a case, which can provide more valuable insights and give a more holistic picture of the case then quantitative approaches would. This requires a deep dive into the motivations for and discussions around engaging in IP, and therefore the case study is particularly well-suited (Yin, 2003). What a case-study can offer, is its ability to understand a phenomena in depth and comprehensively (Easton, 2010, p. 120). The iterative research process of a case-study allows the researcher to disentangle complex factors and relationships though only in a small number of instances (Easton, 2010, p. 120). Secondly, one of the main qualities of the case study, is that it is possible for the researcher to report more information about the case than a statistical study covering the same case (Odell, 2001, p. 171). Critical realists often use case-studies as an important part of their research strategy. While all individual cases are generally viewed to be unique, the cases do have certain similar underlying causes for their outcomes, and it is thus possible to generalize about specific aspects of a theory and possibly to further develop this theory (Easton, 2010, p. 127). The key constraint of the case study, however, is its low statistical representativeness (Easton, 2010, p. 120).

This thesis mainly deploys a deductive and explanatory method, since the research strategy has been designed specifically to assess and evaluate the case of MIC2025 against the already existing theoretical frameworks of IP. It takes its starting point in the part of IP theory that argue that nearly all developing countries has used some form of IP in their quests to undergo structural transformation. The theory explains why developing countries should engage in IP, but the arguments for this needs to be compared with the arguments for pursuing MIC2025 and what happens in reality, to see if the theory is suited to explain the why of MIC2025. The IP theory further states that the implementation of IP in general follows a specific set of policy instruments, as outlined in section 3.5. To what degree China follows these instruments is investigated in section 4.3. The sections describing MIC2025 and the industries are to a large extent descriptive, whereas the sections on why and how follow a more explanatory and exploratory approach. The research onion proposed by (Saunders, Mark Lewis, P Thornhill, 2008) is an easy way to visualize the research design described above. The model outlines different aspects of a study's research design, including research philosophy, approach, strategy, choice of methods, time horizon and data collection & analysis. Below the original research onion has been adapted to fit the research design for this study:

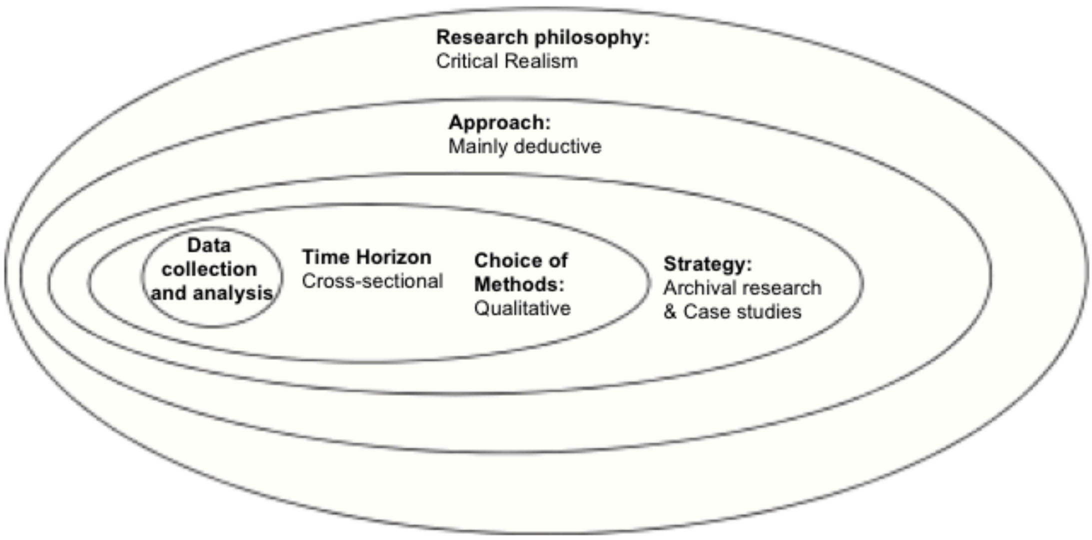

Figure 2: The Research Onion[7]

Qualitative interviews are often necessary to validate or obtain information in China but have not been conducted for this study for two reasons. Firstly, the duration of the project makes negotiating

[7] (Adapted by author from: (Saunders, Mark Lewis, P Thornhill, 2008))

and gaining access to high-level officials and policymakers highly unlikely. The timeframe of the project also makes it difficult to travel to China and arrange the relevant meetings, even if setting up such meetings were possible. Secondly, the limitation in terms of financing restricts longer stays in China, which would be needed to establish relationships with relevant stakeholders. Therefore, desktop research of English secondary sources and Chinese primary and secondary sources has been chosen as the preferred method for the thesis. It is however acknowledged that semi-structured interviews with high-level official's inside the CPC working on MIC2025, would give valuable insights into the why and how of MIC2025.

Since desktop research and archival methods are the main ways to obtain data for this study, it is important to address this methodologically. Archival data are found in many places, and includes as diverse data as books, magazines, internet sources, educational data, historical records and so on (Vogt, Gardner, & Haeffele, 2012, p. 88). In this thesis I mainly use primary and secondary sources obtained through webpages, libraries and databases. It is of utmost importance that the researcher takes the time to understand who collected the data and how it was collected as the compiler who generated the sources has made decisions on what to include and interpretation has been built into the collections (Vogt et al., 2012, p. 87). Nonetheless, archival methods are extremely valuable due to the enormous amounts of information and data accessible through such research. To deep dive into MIC2025, archival methods and desktop research has been deemed appropriate for this study.

2.3 Data reliability and statistical data from China

Scholars working on China are often questioned on the reliability of accessible data and statistical material from China. While it is important to maintain a critical attitude to the statistical data obtained from China, it is, however, what is available and is used by virtually all scholars working on China (Kjeld Erik Brødsgaard, 2019, p. 22). In this thesis, Chinese statistical material is used as the best data available, and in line with Grünberg, I view the official data as "*a good indicator of real trends and actual conditions*" (Grünberg, 2018, p. 20).

Since this thesis is largely based on text-based desk studies, it is important to address data access. While Chinese statistical data and government material such as laws, regulations, public speeches and Party-documents have become increasingly available over the last decade, there are still many barriers to access of primary data in China (Grünberg, 2018, p. 19). CPC decisions and internal documents are particularly hard to gain access to, due to their status as internal (*neibu* 内部) or classified (Kjeld Erik Brødsgaard, 2019, p. 22). Since CPC regulation surpass state-level regulation, these decisions and regulations have far-reaching implications for how the administrative regulation is formulated and implemented and functions as normative guidelines that the state administration should adhere to (Grünberg, 2018, p. 20). The inaccessibility makes research on such documents very complicated, and forces researchers to apply a suboptimal approach, which means resorting to abductive reasoning. In abductive reasoning *a* is inferred as an explanation of *b*, but it is not possible to positively verify it. Therefore abductive reasoning, as Grünberg notices, requires the researcher to try to constantly verify textual data and conclusions, and to test those conclusions "*against statements and information obtained from various sources*" (Grünberg, 2018, p. 20). Therefore, I have to the degree possible, cross-checked facts obtained from Chinese sources and the conclusions I have drawn, with other sources on MIC2025.

The analysis undertaken in this study is based on both primary and secondary sources. I have used statistical economic data from the National Bureau of Statistics (*zhongguo tongji nianjian* 中国统计年鉴), policy documents published by the State Council and the Ministry of Industry and Information Technology (MIIT), industry association publications and ministerial documents such as those published by MIIT, MOST, and Ministry of Finance (MOF). The two most important documents for the analysis of MIC2025 has been the official MIC2025 plan (see State Council, 2015), as well as the 296-pages *Key Area Technology Roadmap 2017-edition* (Roadmap17) which currently is only available in Chinese (see NMSAC, 2018).

Speeches from high-level officials (found through desktop research and academic databases) have been important in giving insights to the internal debate on MIC2025. In addition to this, the scholarly articles database, Asiaportal, available through the Copenhagen Business School credentials, has been essential as it gives access to multiple databases on Chinese academic and scholarly work. The *Wanfang Data* (*wanfang shuju* 万方数据) is one of the most comprehensive Chinese databases, compiled by the Institute of Scientific & Technological Information of China under the Chinese Ministry of Science & Technology (MOST), from the 1950s until today. It includes digital resources such as journals, dissertations, conference proceedings, patents, standards, Chinese companies, etc. and is especially rich in research within the social sciences. Equally important has been the National Social Sciences Database (*guojia zhexue shehui kexue xueshu qikan shujuku* 国家哲学社会科学学

术期刊数据库), compiled by the Chinese Academy of Social Sciences, with access to more than 9 million full-text articles from 1921 until present. Finally, the China National Knowledge Infrastructure (*zhongguo zhiwang* 中国知网, CNKI) compiled by Tsinghua University together with different PRC ministries, has allowed me to access nearly all Chinese academic journals. Through these databases and academic journals, it has been possible to get access to some of the most prominent and influential scholars working on MIC2025 and get a glimpse into the Chinese discourse on the topic.

2.4 Language

Certainly, the language needs to be addressed when working on China. I have, where possible, strived to conduct the research based on original Chinese language sources (speeches, CPC documents, legislation etc.) to avoid language barriers and concomitant misunderstandings. I have therefore strived to compare English and Chinese sources when possible. Secondary literature such as Chinese scholarly work has added important insights into the Chinese discourse around MIC2025 and IP, and also added an emic perspective to a debate that has been largely dominated by Western research communities and media. The Chinese sources has been crucial to the understanding of the different concepts related to IP and MIC2025, how policies are viewed, and for what reasons. Such considerations are important to get a holistic picture of the actual motivations and interests that have driven the emergence of MIC2025 and to understand why and how it is being implemented.

3 Literature review

For societies to attain high and sustainable levels of per-capita income, they have to undergo some type of structural reform (Naudé, 2010, p. 1). This proposition is a robust evidence-based and empirically tested insight, and according to the theory, it requires producing new goods with new technologies, and relocating the resources from traditional activities into these new activities (Rodrik, 2008). As Rodrik notes "*development is fundamentally about structural change*" (2008, p. 4). Structural change requires a transformation from relying on low-productivity activities (agriculture) towards higher-productivity activities (manufacturing and services) (Naudé, 2010, p. 1). Besides having a positive effect on per-capita income levels, structural change also helps create a more balanced economy, which means that the economy is less exposed to external shocks.

The empirical evidence clearly underlines this. High-income countries all have a relatively large share of their GDP coming from the secondary and tertiary sectors. Undertaking this structural change is known as *industrialisation* or *industrial and technological upgrading* (Naudé, 2010, p. 2). According to (Szirmai, 2012) industrialisation should be seen as "*a single global process of structural change, in which individual countries follow different paths depending on their initial conditions and moment of their entry into the race"* (Szirmai, 2012, p. 407). Industrialisation is seen as core to economic development and has generated discussion about the nature of technological progress and innovation, manufacturing's role in development, clustering and urbanisation (Naudé, 2010, p. 2).

The debate on IP has been centred around how developing countries can most effectively develop competitive industrial sectors that enhance domestic productive capabilities and international competitiveness (UNCTAD, 2018b, p. 134). At the heart of the debate is what the role of the government should be in development and how government can help fast-tracking structural change. While the main objective from the state's perspective is to generate economic growth and prosperity, the theoretical and political discussion has emphasized how state interventionism and market forces should be balanced to reach an economic structure that most effectively supports the economy's strategic objectives. Industrially lagging countries (ILC) have the potential of leapfrogging by adopting technologies and experiences from countries that already went through this structural change. How governments undertake this, can be understood by analysing their IP's (Naudé, 2010, p. 2).

The debate on IP has been characterized by disagreements on industrial policies merits, contents and applications (Naudé, 2010). A good way to understand how IP theory has developed, is Naudé's classification of IP into 'old' issues and 'new' issues. The 'old' issues of IP which are mainly concerned with controversies over industrial development have been overtaken by 'new' issues that address (i) the fact that the majority of industrialised countries (e.g. US, UK, Germany) *de facto* have engaged in IP which stands in stark contrast to their position as homes of liberal economic policy (Chang, 2002) and (ii) the *how* and *content* of IP (Naudé, 2010, p. 2). The challenges that new and emerging global trends such as financial crises, climate change and the fourth industrialisation (Industry 4.0) pose to the world calls for a reassessment of IP. To date, this has been largely neglected in the literature and the future debate will therefore have to be concerned with the "*new challenges and trends influencing the content of IP*" (Naudé, 2010, p. 3).

3.1 Defining Industrial Policy (IP)

Defining IP is difficult. Multiple understandings are tied to the concept and no consensus about the definition exists, except for a general acceptation that it is a guide to government intervention. Many define IP as the strategy of 'picking winners', in line with the definition by Pack, who sees it as: "*actions designed to target specific sectors to increase their productivity and their relative importance within the manufacturing sector*" (Pack, 1993, p. 48). The argument behind this definition, is that a country has the potential to 'defy' its comparative advantage, and instead support its 'latent' comparative advantage – that is, develop industries in which no prior comparative advantage existed. This logic is also found as early as with the German economist, Friedric List (1789-1846), who is generally quoted as the father of the 'infant industry protection' argument (Chang, 2002, p. 3). Even today, List's seminal theories on supporting selective infant industries for ILC's to climb the ladder are still relevant in theoretical discussions. Policy instruments such as quotas and import tariffs are common types of such intervention and the experience of the 'four tigers', has shown that this type of selective IP can work both economically and politically (Lall, 2004, p. 75).

Others define IP not as a selective policy tool, but rather as a comprehensive way of supporting the entire structure of the economy, and thereby promoting the competitiveness of the entire manufacturing industry (Lall, 2004, p. 78). This kind of 'functional' policy approach usually encompasses the entire supply-side of the economy rather than just a specific sector (Naudé, 2010, p. 3). Others, such as Rodrik (2008), argues for the necessity of dialogue between state and private sector so as to overcome the market failures and information gap that hinders economic development. Rodrik challenges the general economic perspective, that takes the informational asymmetry between state and private sector as given, and argues that through strategic collaboration and coordination this asymmetry can be overcome with the beneficiary being society as a whole (Rodrik, 2008, pp. 26–27). In Rodrik's view, IP is seen not as a list of policy instruments, but as a 'process of discovery' where state and private sector works together. Rodrik draws inspiration from Chalmers Johnson's (1982) concept of the 'developmental state' and Peter Evans (1995) concept of 'embedded autonomy' to argue that the capacity for the state to design and implement industrial policies requires both autonomy and embeddedness with the private sector (Evans, 1995, p. 12). Schmitz (2007) instead see the role of IP as a tool to influence the decisions of entrepreneurs, and overcome market and technology gaps.

This thesis apply the definition by (Naudé, 2010). In line with Rodrik (2008), Naudé argues that the goal of IP should be to support structural transformation, and that the process and experimentation side of IP needs to be emphasized more. Naudé therefore defines IP as "*the process whereby governments aim to deliberately affect the structural characteristics of their economies"* (Naudé, 2010, p. 2). Naudé concludes that the future debate will be structured around two threads: The *how* rather than the *why* of IP, and the new challenges and trends influencing the content of IP (Naude, 2010).

3.2 IP in a historical perspective

3.2.1 The Western countries

In *Kicking Away the Ladder,* Ha-Joon Chang shows how the majority of countries that are classified as industrialized countries today, used industrial policies when they themselves were developing. Chang, whose methodology is largely inspired by the German economist Friedric List, takes a historical approach to the study of economic development and argues for why developing countries need to implement industrial policies in a world where developed economies often advocate for policies prescribed by the Washington Consensus: the principles of liberalization, free markets and privatization advocated by institutions such as IMF, the U.S Treasury and the World Bank. By analysing industrial, trade and technology policies used by a range of countries that already went through industrialisation, Chang shows that the policies these economies applied were close to opposite of what the orthodoxy at the time suggested (Chang, 2002, p. 1). Since Chang's study, there has been a growing consensus and acknowledgement of his findings in the literature. For instance, Rodrik too notices that most governments today in reality carry out industrial policies even if they call it something else (such as 'export facilitation', 'promotion of foreign investment', 'free-trade zones', etc.) (Rodrik, 2008, p. 2). Worth quoting is Chang's analysis of how England used industrial policies during the industrial revolution in the 18th century:

> "(…) Britain's technological lead (…) had been achieved 'behind high and long-lasting tariff barriers. It is also important to note that the overall liberalization of the British economy that occurred during the mid-nineteenth century, of which trade liberalization was just a part, was a highly controlled affair overseen by the state, and not achieved through a laissez-faire approach" (Chang, 2002, p. 24)

The industrialisation in the UK is important to IP because, as the quote above illustrates, this industrialisation was not just a consequence of the operation of free markets (Naudé, 2010, p. 4). It was not until the mid-nineteenth century, that UK began to reduce such policies, by which time their technological capabilities were far supreme (Chang, 2002, p. 22). Following the industrial revolution, countries like France, Germany and USA also started implementing industrial policies and by the end of the 1970s, most of the Western European states had nationalized significant proportions of their industries (Naudé, 2010, p. 5). Especially worthy of our attention – due to its often-proclaimed position as 'free-trade America' and the mother of the 'Washington Consensus' – is the US. US' impressive growth in the 19th century was not due to the workings of *laissez-faire* capitalism, but rather due to a strong emphasize on protectionist policies, as explained by Chang:

> "(…) throughout the nineteenth century and up to the 1920s, the USA was the fastest growing economy in the world, despite being the most protectionist during almost all of this period." (Chang, 2002, p. 30)

From 1820 to 1930 U.S. tariffs on imported manufacturers never went below 25% with the majority being far higher than that (Nolan, 2001, p. 8). More recently, US has also enacted several measures that can be described as IP and measures to support its recovery following the financial crisis of 2008. For instance, it is worth noting that Tesla, the most successful electric vehicle producer in the U.S., received a loan of $451.8 billion by the U.S. Department of Energy's Advanced Technology Vehicle Manufacturing program in 2010 (Rubio, 2017, p. 33). While Tesla was able to repay the loan in 2013 and ahead of schedule, the loan was crucial to its success (Rubio, 2017, p. 33). Another example is the U.S. Small Business Administration established in 1953, a government agency tasked with enhancing competition in the marketplace for small U.S businesses (Schrank & Whitford, 2009, p. 11). It provides government-sponsored funding, loan guarantees, contractual programmes, and runs several programmes to service small new businesses (Schrank & Whitford, 2009, p. 11). One of its programmes is the Small Business Investment Company Programme, which provides private equity firms with licences to make equity and debt investments in promising firms. The Small Business Investment Company program has been crucial in securing early funding to companies such as Apple, Intel, Amgen, FedEx and Tesla (Rubio, 2017, p. 75; Schrank & Whitford, 2009, p. 11). Through the build of strong and powerful firms by the use of protectionist measures, U.S. and Britain became "*converts to free trade and the global level playing field*" (Nolan, 2001, p. 8). They thereby promoted the likelihood of their now large and powerful firms to freely enter the markets of less developed economies, where markets were still weak and business structures immature (Nolan, 2001, p. 8).

3.2.2 The Asian economies

There has long been an ideological debate about what caused the economic miracle of Japan and the 'four tigers' in the post-war period (Chang, 2002, p. 49). It is however generally accepted, that the rapid growth was due to activist industrial policies, trade policies and technology policies (Chang, 2002, p. 49). The following section looks at how these economies used IP from the 19th century up until the 1980s, largely based on the findings of (Chang, 2002) and (Nolan, 2001).

Japan:

Following the Second World war, Japan experienced an unrivalled GDP growth of 8 per cent annually between 1950 and 1973 (Chang, 2002, p. 49). In this period, Japan followed a catch-up process that was very different from that advocated by mainstream economic theory at the time. It was under the close indirect support of the state, that the giant Japanese firms, that are the key to Japan's success today, developed their competitive advantages (Nolan, 2001). The Japanese government was focused on creating oligopolistic competition, and the Ministry of International Trade and Industry (MITI) played an important role in facilitating this (Nolan, 2001, p. 9). MITI encouraged mergers of the leading firms into *keiretsu(s)* – a oligopolistic organisation of each industry by conglomerates (Johnson, 1982, pp. 11–12). By implementing strict import controls, large indigenous firms were able to develop quickly, and the government oversaw this procedure. Especially important to the success of the companies, was the Japanese governments awareness that it needed to avoid creating a monopoly, and therefore the state closely monitored the market shares and prevented investments so large that they could destabilize the market (Nolan, 2001, p. 9). The government then used international market shares as performance goals to keep track of the international competitiveness of the firms (Nolan, 2001, p. 9). The cross-shareholding features of the *keiretsu* was an extremely efficient method to allow Japanese companies to grow at high speeds and almost all large companies were members of a *keiretsu*. The *keiretsu* had stakes of around 2 per cent in every firm in the group, which meant that between 30-90 per cent of a firm was owned by other members of the group (Nolan, 2001, p. 10). Through this 'removal of ownership control', the Japanese could focus on long-term goals and discard the performance measures of short-term profitability that was often found in US and UK at the time (Nolan, 2001, p. 10). Share price increase became less important, while market domination became imperative. There was rarely any M&A's due to the perception by the managers that engaging in M&A's was equal to surrendering to the enemies (Nolan, 2001, p. 10). The few M&A's that took place often meant that the managers lost their jobs, and therefore it was important for the managers to build alliances with their employees (Nolan, 2001, p. 10). This resulted in long-term programmes where employees were offered job-security, in exchange for wage increases (Nolan, 2001, p. 10). The economy and the firms massively benefitted from this developmental role of the state and the *keiretsu* structure. In 1993, Japan had increased its number of firms listed on the Fortune 500 list to 135 – a more than fourfold increase compared to the 31 they had in 1962 (Nolan, 2001, p. 10). As Johnson (1982, p. 305) concludes in his seminal study on the Japanese Miracle, the success of Japan was not due to its culture or national character, but rather due to the states priorities and the ability of the bureaucracy to design and implement industrial policies. While the state was not consistent in achieving its priorities throughout the period, the consistent and continual focus on economic development meant that Japan accumulated learning and adaptation which it leveraged to accelerate development in the latter half of its industrialisation period from the 1950s onwards. According to Johnson, any state that seeks to achieve similar economic transformation and development, must first of all be a developmental state (Johnson, 1982, p. 306).

The 'four tigers':

In line with Japan, the role of the state and the importance of large firms was very important in the successful development of the 'four tigers' (Nolan, 2001, p. 11). Except for Hong Kong, pervasive state intervention and control was apparent in almost all segments of the economy and active industrial policies were found in both Taiwan, Korea and Singapore (Nolan, 2001, p. 11). These policies went far beyond influencing the business environment. In Korea and Taiwan, the states were important in the construction of large-scale businesses by operating the upstream and heavy industries where private investment did not have the incentive to invest initially. In Hong Kong and Singapore, the state had an important role in e.g. developing human capital and invested heavily in sectors such as education, health and housing (Nolan, 2001, p. 11). Large firms played an important role in all of these economies' development. While Hong Kong and Singapore largely followed a free trade regime, mainly due to the small size of their economies, both Korea and Taiwan heavily relied on trade policies in their catch-up strategies (Nolan, 2001, p. 11). They implemented high tariff barriers, as well as non-tariff barriers to protect their economies, and in Korea this remained the case all the way up until the 1990s (Nolan, 2001, p. 11). For a more elaborate description of the IP of the 'four tigers' see 8.3.

3.2.3 China

After the 1970s, China was largely inspired by the developments in Europe and the U.S. during their 'catch-up' process, and even more so from its close neighbours, Japan and the 'four tigers' (Nolan, 2001, p. 15). The Chinese leadership hoped to emulate the successes of Japan and the 'four tigers' and through state-support create large competitive corporations (Nolan, 2001, p. 15). By the early 1990's a key slogan to economic reform was "grasp the large and relax control of the small" (*zhua da fang xiao* 抓大放小) (Nolan, 2001, p. 16). The desire to rely on and build large competitive corporations, stemmed from a comprehensive study by the Chinese leadership of the industrial structure of advanced capitalism (Nolan, 2001, p. 16). In 1998, Wu Bangguo, who was Vice Premier under Premier Zhu Rongji at the time, stated that large enterprises were crucial to China gaining a powerful position in the international economic order (Nolan, 2001, p. 16). He argued that this was most obviously seen by America having large companies such as General Motors, Boeing and Du Pont, Korea having the *chaebols* and Japan having the six large *keiretsus*. Similarly, China needed to nurture their large enterprises. In the 1990's, a 'national team' of 120 enterprise groups was selected by the State Council (Nolan, 2001, p. 17). The enterprises were chosen in sectors deemed of "strategic importance", and included electronics, iron and steel, coal mining, automobiles, electricity generation, machinery, chemicals, transport, aerospace, pharmaceuticals and construction materials (Nolan, 2001, p. 17). These enterprises benefitted from heavy protection. For instance, import tariffs on vehicles stood at 80-100 percent in the late 1990s (Nolan, 2001, p. 18). Non-tariff barriers were numerous and various and included technology transfer stipulations, requirements to source from Chinese component suppliers and that foreign firms were excluded routinely from accessing domestic distribution channels (Nolan, 2001, p. 18). Joint ventures were often a prerequisite for entering the country, and the Chinese domestic partner company was often chosen by the Chinese bureaucracy (Nolan, 2001, pp. 18–19). In addition to this, the companies received substantial and preferential state-financing through China's 'big four' state-owned commercial banks (the Bank of China, the Industrial and Commercial Bank of China, the China Construction Bank, and the Agricultural Bank of China) (Nolan, 2001, p. 19). In addition to financing, the banks established professional branches in the large enterprises, providing advice and easier access to capital (Nolan, 2001, p. 19). The enterprise groups thus had favourable conditions for becoming internationally competitive. The far majority of the enterprise groups were leaders in their respective industries, and in 1997 they accounted for more than 30 percent of total output value of the whole large and medium scale enterprise sector, and for more than 50 percent of profits in the entire state-owned sector (Nolan, 2001, p. 20). In 2003, a new round of reforms was implemented at central level (K. E. Brødsgaard, 2017, p. 41). This included the establishment of the State-Owned Asset Supervisory and Administration Commission (SASAC) (K. E. Brødsgaard, 2017, p. 41). The SASAC was tasked with exercising authority over China's largest SOE's on behalf of the State Council, to ensure alignment of business interests and national interests (K. E. Brødsgaard, 2017, p. 41). While large private companies such as Alibaba and Tencent today has become household names in China, it is still the big SOE's and state-owned banks that through drivers behind China's IP plans, through which China mobilizes funding and support for the targeted industries through its model of state capitalism.

Today, China's development model to some extent still follow the blueprint of Japan and the 'four tigers' (Zenglein & Holzmann, 2019, p. 9). It seeks to break through the ceiling of labour-intensive and low-tech manufacturing, that are often restricting growth for emerging economies (Zenglein & Holzmann, 2019, p. 9). This model is characterized by selective industrial policies that target specific strategic sectors, and driven by a strong government that aligns national targets with the targets of private companies as well as SOE's (Zenglein & Holzmann, 2019, p. 9). As in the case of the 'four tigers', China aims to move a considerable share of their exports to higher value-added and advanced parts of the value chain. MIC2025 is supposed to be the new IP plan driving this change.

3.3 The debates in IP

The debate about IP is rooted in one of the oldest and most basic discussions within political economy and modern political analysis. It is concerned with how free trade and mercantilism, socialism and capitalism, public sector and private sector should be weighted to support structural transformation (Johnson, 1982, p. vii). This debate has oscillated between economists who view market failures as the bigger threat, and economist who sees government failures as the key concern. At the risk of oversimplifying this debate, we find on the one side free-market liberals, neoclassical economists and neoliberalist, and on the other side heterodox, non-mainstream and institutional economists. As noticed by Rodrik, both sides claim truth, but the problem is that there is still no 'knock-out evidence' to support their claims, mainly due to the complex nature of IP which makes inference of causality difficult (Wade, 2018, p. 524). In this section I discuss some of the arguments for and against engaging in IP.

3.3.1 The case and arguments for IP

A number of studies have been conducted that underscores IP's important role as an effective tool for government intervention, including Johnson (1982), Amsden (1989), Chang (2002), Nolan (2001, 2004), Rodrik (2008), and Wade (2012, 2018). The theoretical case for IP emerges as the need to (1) correct market failures and (2) overcome coordination failures (Naudé, 2010, p. 13).

Correcting market failures

The economic argument for engaging in IP relates to the concept of market failure (MF). If markets were perfect, resource allocation would take place in the most optimal and efficient way possible, and intervention would therefore not be necessary (Lall, 2004, p. 76). Some examples of market failure include imperfect competition, public goods and externalities (Lall, 2004, p. 76). There are five areas where intervention may be needed to avoid market failures:

- **MF in exports:** Exports have positive spill-overs to the domestic economy, however, due to the sunk cost faced by firms entering export markets, and the possibility of gaining the information through spill-over effects from earlier entrants, most firms will not initially pursue exports, making government intervention necessary. Government's should subsidize exports and assist firms in foreign market research (often done in SEZ's or EPZ's) (Naudé, 2010, pp. 13–14).
- **MF in FDI:** FDI is important as it has positive knowledge spill over effects for local firms and is necessary when entrepreneurial capacity is lacking (Lall, 2004). Government should encourage this through tax-breaks, provision of infrastructure, relocation allowances and other business services for foreign firms. Today, investment promotion agencies is also a common way of attracting FDI (Rodrik, 2004).
- **MF in manufacturing sector:** The manufacturing sector can create positive externalities through its linkages with the rest of the economy, technology diffusion and dynamic economies of scale (Naudé, 2010, p. 14). As learning-by-doing is a prerequisite for becoming proficient in manufacturing, countries without a considerable manufacturing sector, should support the growth of a such (Naudé, 2010, p. 15). This is also the main argument behind

infant industry protection (or import substitution industrialisation) implemented to shift imported goods to domestically produced ones.

- **MF due to information asymmetry:** Market failures is a consequence of information asymmetries, which can lead to failure in capital markets and restrict capital accessibility for firms (Naudé, 2010, p. 15). To overcome this, governments need to create venture capital funds or development banks to ensure lending opportunities for firms (Naudé, 2010, p. 15).
- **MF in entrepreneurial entry:** Hausmann and Rodrik (2003) states that entrepreneurs in developing countries may be unwilling to engage in entrepreneurship, as this would give competitors information about the 'latent comparative advantage' of the country, while the cost would have to be paid by the first-mover (Hausmann & Rodrik, 2003). IP can thus be a process of 'self-discovery' about a country's latent comparative advantage, and government should support SME and start-ups innovation e.g. by providing subsidized credit (Naudé, 2010, p. 16).

Deliberately creating market failures

- The complete removal of market failure will constrain a country to only focus on its current comparative advantage (Naudé, 2010, p. 16). IP, as a form of minor market distortion can then be used as a way to avoid a larger market failure by defying current comparative advantage and focus on the 'latent' one (J. Lin & Chang, 2009). Focusing on a country's comparative advantage may lead to static efficiencies, but not growth efficiencies.

Overcoming coordination failures

- Coordination failure takes place when the initial investment by private companies are hard to incentivize, because the risk-averse, profit-optimizing firm lack resources or capital to undertake the investment. Therefore, governments should incentivize such investments through IP and facilitate the creation of a competitive environment, to overcome coordination failures. Overcoming coordination failures is particularly important in technology that leads to increased productivity but often require high initial fixed costs. Examples include assembly lines and electricity. Accordingly, a coordinated (government-led) effort is needed to develop these complementary assets (Altenburg, 2009, pp. 30–31). Rodrik argues that coordination measures are specific to industries, but that coordination can be achieved without large financial outlays, by unlocking private sector investment through communication, persuasion and guarantees (Rodrik, 2004, pp. 13–14).

3.3.2 The case and arguments against IP

"market forces, not government decisions, should determine economic outcomes"

(Porter et al., 2000, p. 2)

The key argument against IP, is that any market failure correction would lead to a government failure larger than the market failure it seeks to correct. The arguments against IP can be divided into (1) information constraints, (2) rent-seeking and corruption, (3) (missing) empirical evidence.

- **Information constraints:** Governments lack the capabilities to decide which sectors have a 'latent comparative advantage' and therefore cannot 'pick winners' (Brandt & Rawski, 2019, p. 5). Institutional capabilities of governments determine their capacity to overcome informational constraints, and therefore context is important. Since the development of institutions is endogenous and correlated with a country's development level, it is often the case that the countries that need structural transformation the most do not have the capacities to implement it (Naudé, 2010, p. 19).
- **Rent-seeking and corruption**: The second argument is that IP is an 'invitation to rent-seeking and corruption', also known as political capture. Mutually beneficial relationships between business leaders and government officials lead to crony-capitalism, where industries are not chosen based on merits, but based on connections and rent-seeking, with well-connected insiders receiving subsidies and protection (Brandt & Rawski, 2008, p. 5).
- **Lack of empirical evidence:** The third argument is, that the empirical (econometric) evidence underpinning the case for IP is at best very mixed. It is very difficult to measure the actual effectiveness of IP, and according to Rodrik, it is difficult to see how studies based on statistical evidence can ever reach a convincing conclusion, due to measurement errors and omitted variable bias. The role of 'counterfactuals' further complicates causality, as it is not possible to estimate what *would have* happened, in case IP was not used during e.g. the Japanese miracle or the 'four tigers' (Naudé, 2010, p. 21).

3.4 IP-Instruments

There are a number of different IP-instruments that states can employ as part of their IP's and the use of selective IP by the Asian countries in the twentieth century is a well-researched topic. Among some of the cases analysed in the literature are Japan's 'Miracle' (Johnson, 1982; Porter et al., 2000), the ’four tigers’ (Amsden, 1989; Evans, 1995) and finally China (Amsden, 1989; Nolan, 2001, 2014b). Many similarities can be found between these economies IP’s and Chang (2002) argues that they have all used somewhat similar IP-instruments with the most important being (1) export promotion, (2) attraction of FDI, (3) macroeconomic policies to boost savings and selective provision of credit to firms, (4) extensive education and skills formation programmes; (5) creation of venture capital funds, and (6) the coordination of complementary investments (Chang, 2009). Policy instruments related to industrial policies are many and somewhat hard to entangle from their larger context. Often these instruments are not specifically implemented as IP-instruments, but also target other underlying issues in the economy. By investigating the different debates in IP, and the instruments used in different periods and contexts, Naudé (2010) classifies IP-instruments into seven domains. The seven domains are 1) economic signals and incentives, 2) scientific and technological innovation, 3) learning and improving technological capabilities, 4) selective industry support, 5) selection mechanisms, 6) distribution of information and 7) improving productivity of firms and entrepreneurs (Naudé, 2010, p. 8). For each of these seven domains the state can either take a regulatory role, a production role, a consumer role or a financing role. The figure below shows the relationship between inputs, outcomes and levels of coordination for the seven domains (Naudé, 2010, p. 8).

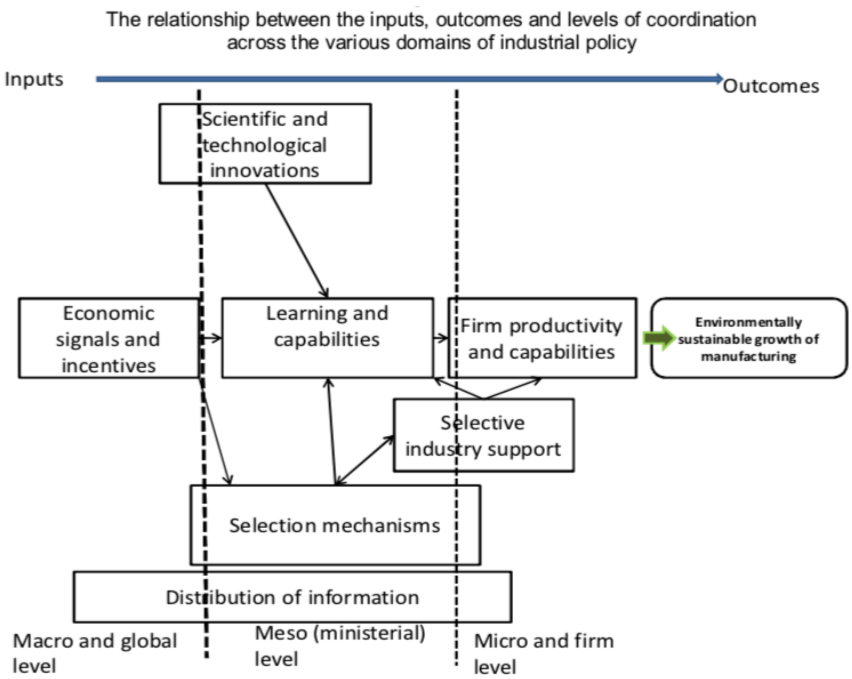

Figure 3: Overview of IP domains according to Naudé[8]

[8] (Naudé, 2010, p. 9)

The economic signals and incentives is mainly the responsibility of national governments as well as international role players (Naudé, 2010, p. 9). These instruments include price regulations, monetary policy, exchange rate policy and tax breaks, and is a more horizontal or 'functional' form of IP (Naudé, 2010, p. 9). In general, moving from macro and global level to micro and firm level, the IP-instruments often become less market-based (Naudé, 2010, p. 9). As the model outlines, the majority of IP-instruments are clustered around the meso (or ministerial) level. The ministries play an important role in domains such as selection mechanisms, learning and capabilities, and scientific and technological innovation (Naudé, 2010, p. 9). Cooperation between national and local governments is therefore crucial to the success of the IP, since many of the instruments operate at the meso level, across sectors and industries (Naudé, 2010, p. 9). Selective industry support mechanisms and capacity building for firms tend to operate at the micro and firm level and requires extensive local coordination. Underpinning all of the three levels is the distribution of information, since the formulation and implementation of a successful IP and catch-up process is a learning process, which requires strong coordination and communication between the different levels (Naudé, 2010, p. 9). Based on the findings by Naudé, I have created a framework for the seven domains and their related policy instruments, which will be operationalized in the analysis to evaluate how MIC2025 deploys IP-instruments. The framework is available in appendix 8.1.

3.5 IP today

For decades, the 'rules of the game' has been set by the Bretton Woods Institutions, the World Trade Organisation (WTO) and major donors of funding such as the International Monetary Fund (IMF) (Lall, 2004, p. 76). These liberal economic views have dominated the debate for decades and has been important in shaping the strong disbelieve in IP during the 1980s and 1990s (UNCTAD, 2018b, p. 134). Today, however, nearly any nation that wants to become a leader and upgrade its economy to a modern, industrial society, will in some way or another engage in IP. IP-making has shifted away from the heavy-handed focus on protecting industries towards a focus on more "*agile, interactive, inclusive, flexible and integrative*" policies, that are more responsive to matters such as sustainable and environmentally friendly economic development (UNCTAD, 2018b, p. 126). The pamphlet of instruments used has likewise increased significantly from the original focus on infant industry protection to a more complex and varied pamphlet of policy instruments (UNCTAD, 2018b, p. 126). This include IP-instruments targeted at improving entrepreneurship, innovation, clusters and linkages, enterprise development, finance and social policies (UNCTAD, 2018b, p. 126). The UNCTAD World Investment Report, provides a good overview of how IP-instruments have changed since the 1970's until today (UNCTAD, 2018b, p. 130):

			Modern industrial policies	
	Until the 1970s	**1980s–1990s**	**2000s and ongoing**	**Recent/emerging themes**
Key features/ themes	• Industrialization and structural transformation	• Stabilization, liberalization, laissez faire	• Knowledge economy • GVCs	• NIR • Sustainable development
Policy goals	• Creating markets, diversification	• Market-led modernization	• Specialization and increased productivity	• Modern industrial ecosystem development
Key elements	• Import substitution • Infant industry protection • Sector development • Gradual and selective opening to competition	• Limited government involvement • More horizontal policies • FDI opening • Exposure to competition	• Targeted strategies in open economies • Enabling business environment • Digital development (IT) and ICT diffusion • Participation in global production networks • FDI promotion combined with protection of strategic industries • SME support • Skills development	• Technical capabilities development • Innovation in production (OT) • Learning economy • SDG sector development • Public-private knowledge/ tech development institutions • Acquisition of foreign technology • Entrepreneurship development

Figure 4: Evolution in IP and new themes according to UNCTAD[9]

IP's today include both horizontal policies that target the operational conditions across several industries, and vertical policies that specifically target selected industries (UNCTAD, 2018b, p. 126). In particular, two things have been driving the change in IP-formulation. The first is the increasing importance of industrialisation 4.0 and the second is the role of GVCs. These two key themes are explored in detail below.

3.5.1 Industrialisation 4.0

Technological progress and innovation have always been an important part of IP, but increasingly so today. At the core of IP-making today, is the desire to lead the fourth industrialisation, and emerging markets have been investing heavily in areas related to this (Jungbluth & Coka, 2019). Emerging markets have grown rapidly within this field, and especially China is at the forefront of areas such as autonomous driving, smart cities and facial recognition (Zenglein & Holzmann, 2019, p. 25). In China,

[9] *Source: (UNCTAD, 2018b, p. 130)*

MIC2025 is too formed under the broader state-narrative of developing a technologically strong superpower, with a package of policy programs to support this transformation (UNCTAD, 2018b, p. 136).

In 2016, Klaus Schwab stated that the implementation of digital technologies across all industries will not only change the modes of production, consumption and service provision, but also the way people live, work and relate to each other (Schwab, 2016, pp. 9-13). This new technology-driven paradigm has resulted in many economies focusing on its competitiveness and capabilities in advanced technology (UNCTAD, 2018b, p. 130). Modern industrial policies today have a high focus on digital development and information and communication technologies in firms, with the main driver for this being productivity gains (UNCTAD, 2018b, p. 131). New digital technologies, 3D printing, internet of things and advanced (industrial) robotics are increasingly included in IP plans, due to their ability to upgrade manufacturing supply chains (UNCTAD, 2018b, p. 131). Especially important are General Purpose Technologies (GPT´s). GPT's are instrumental technologies in the upgrading and progression of an economy, usually at the national or global level (Jovanovic & Rousseau, 2005, p. 1185). Some prior examples of GPT´s include the invention of the steam engine (first industrial revolution), electricity (second industrial revolution) and information technology (third industrial revolution) (Jovanovic & Rousseau, 2005, p. 1185). The first industrial revolution was driven by mechanical production driven by water and steam power, the second industrial revolution by electricity and the adoption of assembly lines and third industrial revolution the use of electronics and IT to create automation (EUCCC, 2017, p. 6).

Today, the technologies covered under GPT´s are e.g. artificial intelligence and industrial robotics. The fourth industrial revolution seeks to utilize big data and cloud computing and digitisation of manufacturing to optimize entire industrial value chains operated by human and robot in a synergetic relationship (EUCCC, 2017, p. 6). As we shall see, these are all areas in which China is heavily investing. Today, many companies in China still operate according to the Industry 2.0 model, but China is, however, well-positioned to adopt Industrialisation 4.0 to at least some level (EUCCC, 2017, p. 10). China's large internet companies such as Baidu, Alibaba and Tencent have strong capabilities in big data and digitisation which are crucial to Industrialisation 4.0 (EUCCC, 2017, p. 10).

3.5.2 Global value chains

The global fragmentation of manufacturing processes over the last decades has changed global commerce considerably. Today, around 80 percent of all global trade flows through global value chains GVC's, and is mainly led by multinational corporations (Wade, 2019, p. 24). GVC's has become a key driver of IP, with especially developing countries seeking to enter higher levels of value-added goods and services (UNCTAD, 2018b, p. 130). In 1992 Stan Shi developed the smiling curve to describe how value is added along the value chain (Ye, Meng, & Wei, 2015, p. 3). Plotting the value chain from beginning to end on the X-axis and added value on the Y-axis, the curve that emerges resembles a smile, as seen in figure 3 (Ye et al., 2015, p. 3). At the beginning of the process R&D, branding and design represent high value-added activities. In the middle is manufacturing and assembly as well as highly standardized services with low to middle value-added. In the end distribution, marketing and sales/services is again high value-added (Ye et al., 2015, p. 3).

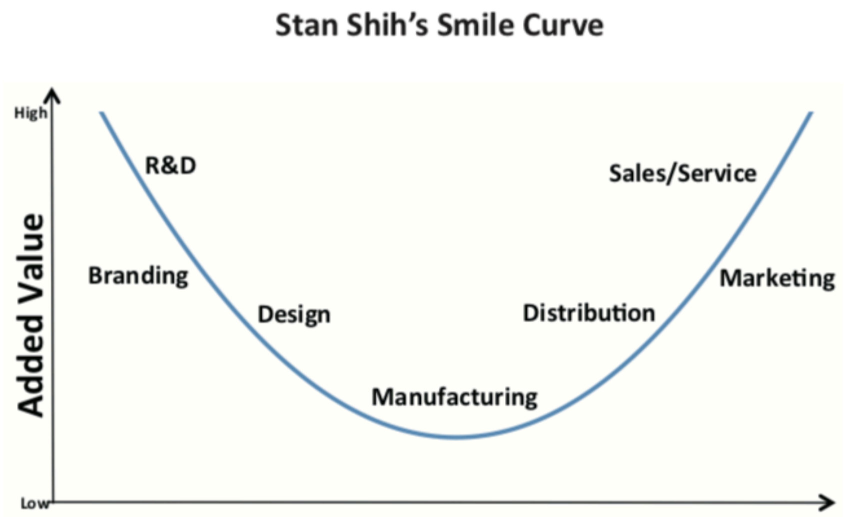

Figure 5: The smiling curve[10]

4 The Case: *Made in China 2025*

4.1 What is MIC2025, its key contents and actors?

This section will address the first subordinate research question: *(1) What is MIC2025, its key contents and actors?*

[10] *Adapted from* (EUCCC, 2017, p. 3)

4.1.1 Introducing MIC2025

MIC2025 is a comprehensive strategic plan published in May 2015 by the Chinese State Council, aiming to upgrade the Chinese economy by promoting and supporting innovation and technological advancement. The plan outlines 10 key industries, in which China aims to become a technological leader. Functioning as a roadmap for innovation and sustainable development, the plan outlines ten key industries, in which China wants to create globally competitive companies.

The initial design and preparation of MIC2025 was led by the MIIT and more than 20 government ministries including NDRC, MOF and MOST (Tse & Wu, 2018). It was first publicly mentioned by Premier Li Keqiang during the annual work report presentation at China's 'two sessions' (the Chinese People's Political Consultative Congress and the National People's Congress) in March 2015. In 2015 the State Council released the final plan, which set the strategic priorities (战略任务) and the supporting mechanisms （战略支撑）of MIC2025 until the end of 2025 (State Council, 2015).

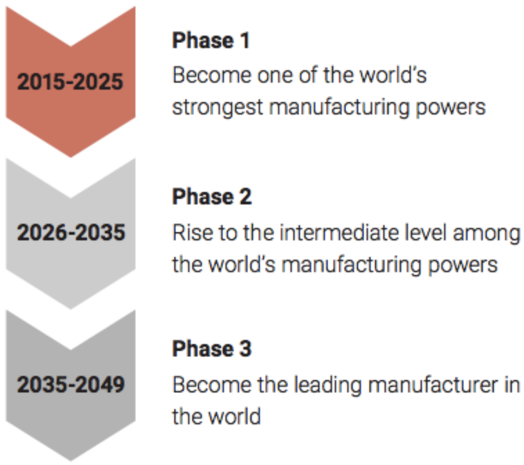

Figure 6: The three phases of MIC2025

The plan consists of three phases (see Figure 6)[11] which outlines strategic objectives (战略目标) that has to be met by the end of each phase. By 2025, China should be a major manufacturing power, by 2035 a global manufacturing power, and by 2049 the leading manufacturing superpower in the world (Zenglein & Holzmann, 2019, p. 20). The year of 2049 is specifically chosen, as it is the 100th anniversary for the founding of the People's Republic of China, by which China should have transitioned from a large to a powerful manufacturing sector (*you da bian qiang*, 由大变强）. These strategic objectives aim to turn China from a low-value added export-based economy to an advanced manufacturer of high-tech and high-value added products. It seeks to strengthen China's domestic innovation capacity, reduce its reliance on foreign technologies and take China to the forefront of

[11] Adapted from (Tse & Wu, 2018)

Industrialisation 4.0 while moving higher up in global value chains (GVC) (European Commission, 2019, p. 9).

MIC2025 is often compared to Germany's 'Industry 4.0', and is often claimed to draw heavy inspiration from it (see e.g. Kennedy, 2015). While some similarities do exist, MIC2025 is, however, a much more comprehensive plan in terms of both scale and scope. Germany's Industry 4.0 adopted in 2013 targets technological advancement as its core issue. It is specifically addressing intelligent manufacturing and how to use Internet of Things to allow a more optimized use of information technology in production. It is primarily focused on facilitating the process of technological development and innovation, through establishing strong institutions, protecting intellectual property rights, supporting R&D at universities, and ensuring SME's have a voice (EUCCC, 2017, p. 6). MIC2025, on the other hand is concerned with restructuring the entire Chinese industry. Advancement in production technology as a driver of competitiveness is but one of the instruments used in MIC2025 (EUCCC, 2017, p. 7). In terms of financing, the Action Plan proposed by the German government in Germany's Industry 4.0 only allocates around EUR 200 million to the initiative, with industries committing to chip in another EUR 2.5 billion (EUCCC, 2017, p. 7). Compared to MIC2025, these figures are only a drop in the ocean. In 2016, the China Development Bank alone pledged to contribute at least 300 billion CNY to be invested in MIC2025 over the period of the 13th five-year plan from 2016-2020, even though funds pledges often do not necessarily equal those deployed (Economic Daily, 2016). An estimated 1,600 government-guided funds (*zhengfu yindao zijin* 政府引导资金) endowed with hundreds of billions of dollars have been set up to make investments in companies and industries related to MIC2025 (T. Huang, 2019). Financial tools, tax incentives, SME financing and direct funding are just some of the ways in which CCP uses its economic power to support MIC2025 (Zenglein & Holzmann, 2019, p. 44).

Smart-manufacturing and technological innovation are some of the key areas in which investment is directed, due to its importance in improving efficiency and productivity of manufacturing. Green growth, sustainable development and circular economy are also key aspects of the plan, with investments in energy-efficient vehicles and electric vehicle batteries driving this change. But the plan goes further than industries, and also targets the institutional structures and framework conditions that needs to be upgraded to increase efficiency (European Commission, 2019, p. 15). This means providing public funding for major projects, and upgrading major industries, as well as providing policy support through improved legislation, regulation and investment guidelines.

The first of the four basic principles in MIC2025 states that MIC2025 should be market-led but government-guided (*shichang zhudao, zhengfu yindao* 市场主导、政府引导) (State Council, 2015). It is stated that the market should have a decisive role in resource allocation and is underscored as important to upgrade quality and efficiency and improve the framework conditions set by the state. As we shall see, however, MIC2025 is highly government driven.

In 2015, the National Manufacturing Strategy Advisory Committee (NMSAC)[12] released the first edition of their '2015-edition Key Area Technology Roadmap' (Roadmap15).[13] Roadmap15 was later updated with a 2017-edition (Roadmap17)[14] released in February 2018 (Zenglein & Holzmann, 2019, p. 32). The document was drafted by more than 400 industry experts and provides a comprehensive description of how and when the objectives and targets should be met. The 2017-version is a 296-pages document, meticulously explaining every aspect of how to reach the set targets (such as market shares, sales, global positions etc.) (NMSAC, 2018). Besides the specific targets and objectives set out in the roadmap, MIC2025 also sets targets for the number of patents needed per 100 million CNY in revenue, as well as how and when to develop specific quality brands (Zenglein & Holzmann, 2019, p. 20). While the objectives outlined in the roadmap are mainly aspirational from a Chinese viewpoint, local governments often pick up on these policies, and the related local intervention can lead to overcapacity as seen in other sectors such as solar panels.

4.1.2 What is MIC2025s key contents?

According to Miao Wei, Minister of MIIT, the key contents and composition of MIC2025 is most easily comprehended and remembered by the mnemonic "one-two-three-four-five-five-ten". It covers the overarching goal, phases, guiding principles, projects and industries of MIC2025. These are outlined in the table below:

M A	**一**	**One** refers to the one goal, which is to bring China from a large manufacturing country to a powerful manufacturing country by 2049（*you da bian qiang*, 由大变强）(MIIT, 2015).

[12] *Zhongguo zhizao qiangguo jianshe zhanlüe zixun weiyuanhui* 中国制造强国建设战略咨询委员会.

[13] *Zhongguo zhizao 2025 zhongdian lingyu jishu luxiantu 2015 nianban* "中国制造 2025"重点领域技术路线图 2015 年版 (NMSAC, 2015)

[14] *Zhongguo zhizao 2025 zhongdian lingyu jishu chuangxin lüpishu - jishu luxiantu 2017 nianban* "中国制造 2025"重点领域技术创新绿皮书 – 技术路线图 2017 年版 (NMSAC, 2018)

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5</td><td>二</td><td>Two refers to the integration of informatization and industrialisation to lead and drive the development of the entire manufacturing industry.</td></tr>
<tr><td>三</td><td>Three refers to the three phases as outlined above in figure 1. By 2025, China should be a major manufacturing power, by 2035 a global manufacturing power, and by 2049 the leading manufacturing superpower in the world.</td></tr>
<tr><td>四</td><td>Four refers to the four basic principles underlying MIC2025, being that MIC2025 should be i) market-led but government-guided[15], ii) both short-term and long-term focused[16] iii) achieve comprehensive advancement and key breakthroughs[17] and iv) support indigenous development and win-win cooperation.[18]</td></tr>
<tr><td>五</td><td>The first five refers to the five guiding principles of MIC2025, being “innovation-driven, quality first, green development, structural optimization and talent at the core”.[19]</td></tr>
<tr><td>五</td><td>The second five refers to the five major projects that MIC2025 should implement. These are (1) the project to establish manufacturing innovation centres (2016-2020), (2) the strong industry foundations project, (3) the green manufacturing project (4) the smart manufacturing project and (5) the high-end equipment innovation project.[20] Implementation guidelines has been developed for all of these five projects, see e.g. (Zenglein & Holzmann, 2019, p. 68).</td></tr>
<tr><td>十</td><td>Ten refers to the 10 key industries of MIC2025. These are (1) Next-generation information technology; (2) High-end numerical control machinery and robotics (3) Aerospace and aviation equipment; (4) Maritime engineering equipment and high-tech maritime vessel manufacturing; (5) Advanced rail equipment; (6) Energy-saving vehicles and new energy vehicles; (7) Electrical equipment; (8) Agricultural machinery and equipment (9) New materials; (10) Biomedicine and high-performance medical devices (European Commission, 2019, p. 9).</td></tr>
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Table 1: Mnemonics of MIC2025

The 10 key industries:

MIC2025 specifically addresses ten key industries in which China desires to become a world leader by 2049 (State Council, 2015). China views these industries as strategic emerging industries that will

[15] *shichang zhudao, zhengfu yindao* 市场主导、政府引导
[16] *ji lizu dangqian, you zhaoyan changyuan* 既立足当前，又着眼长远
[17] *quanmian tuijin, zhongdian tupo* 全面推进、重点突破
[18] *zizhu fazhan he hezuo gongying* 自主发展和合作共赢
[19] Translated from: *chuangxin qudong*、*zhiliang weixian*、*lüse fazhan*、*jiegou youhua he rencai weiben* 创新驱动、质量为先、绿色发展、结构优化和人才为本 (MIIT, 2015).
[20] Translated from: 制造业创新中心的建设工程；第二个就是强化基础的工程，我们叫强基工程；第三个是智能制造工程；第四个是绿色制造工程；第五个是高端装备创新工程（MIIT, 2015).

help the state to become a producer of high value-added products and move up global value chains. In the following section, each of the industries will be briefly introduced, and the most important success criteria (such as global and domestic market shares etc.) will be outlined. The industries are important to understand, as they are the backbone of MIC2025, and thus have a high priority for China and Chinese IP. In section 4.4.2 I analyse in detail the IP-instruments implemented and outcomes observed across three of the ten key industries outlined below: 4.4.2.1 next generation information technology; 4.4.2.2 high-end numerical control machinery and robotics; 4.4.2.3 Energy-saving vehicles and new energy vehicles. Therefore, these industries are only briefly described in the following.

(1) Next-generation information technology

Next generation IT has been important to China since the Strategic Emerging Industries plan (SEI) of 2010, and remains fundamental to China's IP (Rubio, 2017, p. 35). It is seen as critical to advancing China's position within global value chains, and is underscored multiple times in the MIC2025 plan: *"The deep integration of next generation information technology with manufacturing is triggering far-reaching industrial transformation, forming new modes of production, industrial forms, business models and economic growth points (...) The industrial transformation and innovative development of China's manufacturing sector ushers in major opportunities."*[21] State-supported companies seeking to turn such opportunities into reality include ZTE, Huawei, Alibaba and Tencent and the trajectory of other industries such as industrial robotics or aerospace follow from its development. (Rubio, 2017, p. 36). 'Enabling' or 'core' technologies, such as e.g. semiconductors, are crucial to a number of advanced products and China sees semiconductors as the Achilles heel of China's digital economy. China has tried to reduce its dependency on semiconductors as early as in the 8th five-year plan (1991-5) without any significant success (Brandt & Rawski, 2019, p. 267). Currently, China is highly dependent on foreign imports of IC chips, with less than 10% of its supply being domestic in 2017 (Rubio, 2017, p. 36). The production of IC chips is particularly difficult to master – compared to designing and testing of IC – due to the highly specialized equipment required for producing. Currently, China has none of the major equipment companies and it is one of the reasons why the National IC Industry Investment Fund has been established (Rubio, 2017, p. 36). American

[21] Translated from: "新一代信息技术与制造业深度融合，正在引发影响深远的产业变革，形成新的生产方式，产业形态、商业模式和经济增长点（. . . ）我国制造业转型升级、创新发展迎来重大机遇" (State Council, 2015, p. 1).

technology companies, however, still retain their positions as industry leaders, but are increasingly challenged by China (Rubio, 2017, p. 35). For the specific targets see 8.2 Objectives and targets of MIC2025.

(2) High-end numerical control machinery and robotics

Industrial robots have become increasingly important to China. Labour-saving technologies are specifically important due to China's changing demographics and the shrinking labour force. In 2018, Boston Consulting Group found 'shortage of labour' to be the main driver of robot automation in companies (Rose et al., 2018). In China, there is heavy investment in the production and adaptation of robots and industrial robots are seen as critical to economic development (Rubio, 2017, p. 51). Unlike many of the other industries, neither MIC2025 nor Roadmap17 set export targets for robotics in foreign markets, but focus primarily on China's domestic markets (NMSAC, 2018, p. 57). This industry will be further elaborated in the case studies in section 4.4.2.2. on page 75.

(3) Aerospace and aviation equipment

China's middle class has grown, and the demand for services like air travel has largely increased. However, China is still lacking behind major companies in aerospace equipment (Boeing and Airbus) and therefore, the development of indigenous passenger aircraft has a high priority in MIC2025 (Rubio, 2017, p. 25). In 2017, the biggest export from U.S to China was civilian aircraft, with a total value of USD 16.3 billion (Rubio, 2017, p. 25). The aerospace industry is thus immensely important to the U.S, which is why the increased investments by China has been a key concern to the U.S. This is mainly because the aerospace industry is at the highest end of the value chain, in terms of value and scale required for production and therefore highly important to the U.S. (Rubio, 2017, p. 25). MIC2025 sets a target of China's aerospace industry to account for 20% of the global market share by 2025 (NMSAC, 2015). To spearhead this, China has established the Commercial Aircraft Cooperation of China (COMAC), which together with China's largest aircraft manufacturer, Aviation Industry Corporation of China (AVIC), are investing heavily in realizing the 2025 market share goals (Rubio, 2017, p. 26).

(4) Maritime engineering equipment and high-tech maritime vessel manufacturing

Significant resources are devoted to the construction of a commercial shipbuilding industry. Government support includes IP-instruments such as subsidies, export financing, and joint venture requirements (Rubio, 2017, p. 44). This has been largely detrimental to e.g. the U.S. industry, which was once the largest industry of commercial shipbuilding, but now supplies below one percent of the global market (Rubio, 2017, p. 44). The ocean-based economy is, however, nothing new from a Chinese perspective. In 2003, the State Council issued the "*Outline of the National Ocean Economy Development Plan*" which underscored the importance of maritime upgrading, and MIC2025 now continues this path. MIC2025 highlights shipbuilding, maritime resource extraction and various other maritime industries as the key priorities and stresses the need to manufacture advanced maritime equipment and high-technology ships (State Council, 2015). (Rubio, 2017, p. 44). The increasing integration of civil-military cooperation, means that China now can focus more on creating higher value commercial ships, such as autonomous vessels, since the government no longer to the same degree transfer superior resources to the military shipbuilding (Rubio, 2017, p. 45). With China's proven abilities to build large quantities of low-cost ships and vessels, MIC2025 now aims for higher-value production.

(5) Advanced rail equipment

Railway is important in building up China's domestic infrastructure, and increasingly so due to its importance to the BRI initiative. It is estimated that 83 percent of all rail products in the world today are either operated or are from the state-owned enterprise Chinese Railroad Rolling Stock Corporation which is the biggest rolling stock manufacturer in the world (Rubio, 2017, p. 40). These companies are expanding across the world, especially due to the significant amounts of resources being poured into the state-owned companies by the government. The company reported revenues of 37 billion USD in 2015, compared to a total of 22 billion USD for the entire U.S. railcar industry (Rubio, 2017, p. 40). The roadmap sets goals for China to control 30 percent of the global market for rail transit equipment by 2020, and 45 percent by 2030 (Rubio, 2017, p. 40). China already has the longest high-speed rail network, which with its more than 30,000 kilometres of operational track in the beginning of 2019, account for over two-thirds of the total high-speed rail in the world (Mitchell & Liu, 2018).

(6) Energy-saving vehicles and new energy vehicles

In 2017, the passenger car sales in China reached 24.72 million, which is by far the biggest market in the world, representing 31.3 percent of global market sales[22] (Statista Research Department, 2019e). China's top players in the domestic market, however, is still largely dominated by foreign companies such as Volkswagen, Honda, Hyundai and Toyota (Statista, 2017). Now China seems to have found a way to combat this trend by focussing on NEV's through government support. China's strong focus on NEV's is among others motivated by the fact that China can leverage the NEV's to reduce its reliance on foreign oil and the challenges it faces with air pollution (Rubio, 2017, p. 31). It will also cut its reliance on foreign automakers such as the U.S., where automobiles currently is the second-largest finished goods export to China (Rubio, 2017, p. 31). Roadmap17 defines NEV's as referring to both hybrids (plug-in hybrid electric vehicles, PHEV) and fully electric cars (battery electric vehicles, BEV), however, there seems to be a clear preference for developing the fully electric cars, which accounted for 78 percent of the total NEV sales in 2018[23] (Statista Research Department, 2019b). Roadmap17 also sets specific and detailed goals for the NEV industry, as well as strategic support and guarantee' measures. Several of the NEV objectives has also been updated in Roadmap17. By 2020, Chinese companies should account for more than 80 percent of the domestic market sales in China (compared to 70 percent in Roadmap15) and increase volume sales to minimum two million pr. year (compared to one million in Roadmap15) (NMSAC, 2018, p. 156). The goals and objectives are summarized in: Objectives and targets of MIC2025 and analysed in the case-study in section 4.4.2.1.

(7) Electrical equipment

China is the world's largest energy consumer (World Energy Council, 2019, p. 104). In 2017, China consumed 4490 million tons of Standard Coal Equivalents [24], of which 60.4 percent came from coal, 18.8 percent from crude oil, 7.0 percent from natural gas, and 13.8 percent from primary electricity and other energy (National Bureau of Statistics, 2018b). Today China's vast population and its rapid industrialization requires an abundance of energy, and China desires to make the bulk of this energy come from renewable energy sources rather than the coal, oil and gas as seen above. In addition to

[22] Calculated as the fraction of the total market in 2017: 24.72 million/79 million = 31.291% (Statista Research Department, 2019e).

[23] Calculated as: 984,000/1,255,000 = 0.7840 (Statista Research Department, 2019b)

[24] Tons of Standard Coal Equivalent (SCE) is a measure used by China's National Bureau of Statistics to represent energy generated by burning one metric ton of coal. One ton of SCE equal 29.31 GJ (at low heat) and 31.52 GJ (at high heat) (Business Dictionary, 2019).

this, China's dependence on import of oil from politically-unstable countries at times, poses a security threat to China, and green energy development has become important to shift away from this reliance (Rubio, 2017, p. 56). Electrical equipment and renewable energy is therefore chosen as one of the critical sectors covered under MIC2025. Roadmap17 also targets several energy sources needed to bring China away from its heavy reliance on coal towards more sustainable energy sources, such as renewables, nuclear energy and carbon-based fuels (Rubio, 2017, p. 56). State-financing, subsidies and different government policy instruments are important drivers of China's' nuclear energy and its nuclear energy exports. In its solar energy industry, China has been the subject of extensive international criticism due to its use of industrial policies to subsidize Chinese solar panel manufacturers, causing prices in Europe and the U.S. to drop as much as 80 percent between 2013-2018 (Rubio, 2017, p. 57).

(8) Agricultural machinery and equipment

Food security is a key concern for China. While accounting for one-fifth of the world's population, China only has one-tenth of the world's farmland. Changing demographics has changed populations food habits, and food supply is a key concern for policy-makers in China (Rubio, 2017, p. 63). Agricultural modernization is a key concern, as underscored by China's Vice Minister of science and technology, Xu Nanping: "*Agricultural modernisation should be attached with a pair of science and technology wings.*"[25] The policy instruments used include significant state support such as subsidies and research and development funding (Rubio, 2017, p. 63). While China is the largest producer of agricultural equipment, the bulk of this is still found in the low-technology category (Rubio, 2017, p. 63). Roadmap17 therefore sets goals for China to attain a 90 percent self-sufficiency and having developed at least some internationally recognized brands by 2025 (Rubio, 2017, p. 63). Foreign technology and technical expertise are important drivers of getting the know-how and expertise needed to go from low-end to high-technology goods (Rubio, 2017, p. 64). China therefore sets joint-venture requirements for foreign firms, and give them certain benefits, such as subsidies if they manufacture their goods inside China (Rubio, 2017, p. 64). Through the Belt and Road initiative China also tries to create and expand the market for its high-value agricultural products and in 2016 China's outward FDI in agriculture amounted to 3.29 billion USD, a 17-fold increase from the 190 million USD in 2006 (Rubio, 2017, p. 65). The transformation of the agricultural sector, however, face certain institutional and technological barriers. Especially the small size of the Chinese farms

[25] Translated from: "给农业现代化插上科技的翅膀" (Lei, 2019).

makes it difficult to modernize the industry, as the dispersed farms are less adaptive to large capital goods and new adaptive technologies (Rubio, 2017, p. 65).

(9) New materials

New Materials are the building blocks of nearly all the industries covered under MIC2025, and essential constituents of China's technological ambitions. New materials have applications such as faster charging times for electric vehicle batteries, 3D printing, medical devices and microelectronics (European Commission, 2018, p. 21). However, China's foundational technologies, such as semiconductors, new materials and basic research are still weak, which is why it has obtained a central position in MIC2025 (Rubio, 2017, p. 59). The specific goals set out for new materials in Roadmap17 are relatively vague, stating that China by 2020 should "*reach effective control over the entire scale of the foundational material industry*"[26] and "*achieve self-sufficiency of advanced basic materials"*[27] (NMSAC, 2018, p. 234). Naturally endowed with rare earth elements, China is currently producing approximately 90 percent of the total supply (Rubio, 2017, p. 59). These elements are critical as inputs to catalysts (chemical processing, petroleum refining etc.) metallurgy (hybrid vehicles, computers, steel additives etc.), magnets (satellite electronics, clean energy etc.) and many other highly advanced technologies (Rubio, 2017, p. 59). To keep these critical elements within the country, China has imposed export taxes of 15-25 percent on rare earth elements, which has caused international prices to rise drastically. China's domestic industry has gained a large competitive advantage in terms of cost, and have a substantial advantage over foreign firms (Rubio, 2017, p. 60). In addition to this, the policies attract foreign firms, to compete in China where the rare earth elements are easily available at lower costs (Rubio, 2017, p. 60).

(10) Biomedicine and high-performance medical devices

Like with other industries covered under MIC2025, China aims to increase its position in the biomedicine and high-performance medical devices value chain. Today, 80 percent of the active pharmaceutical ingredients in the U.S. comes from overseas countries, primarily China and India (Rubio, 2017, p. 47). In 2016, China was the second largest drug market by consumption, with the industry reaching sales volumes of 2.9 trillion RMB[28] (NMSAC, 2018). Innovating new drugs,

[26] Translated from: "基础材料产业总体规模得到有效控制" (NMSAC, 2018, p. 234)
[27] Translated from: "先进基础材料总体实现自给"
[28] Approximately 446 billion USD.

increasing the quality of products and reaching self-sufficiency are some of the goals of the industry (Rubio, 2017, p. 47). In the low-to-medium priced segment, China occupies close to 80% market share, whereas the foreign companies such as Philips, Roche and Medtronic clearly dominate the high value-added segments. The National Medical Products Administration has undertaken several reforms to address challenges that plagued its industry, such as streamlining approval processes, and raising production standards (Rubio, 2017, p. 48). Such reforms have increasingly attracted foreign pharmaceutical companies (Rubio, 2017, p. 48). While foreign firms may have short-term success in the market due to these newly implemented regulations, it is clear that the ultimate goal for China, as outlined in the roadmap, is to support its domestic industry (NMSAC, 2018, p. 271). It seeks to reach the same position in the high value-added end of the value chain, as the one it currently occupies in the lower end of the value-chain (Rubio, 2017, p. 48).

4.1.3 Who are the key actors?

MIC2025 involves a large number of various ministerial and supporting actors that undertake different responsibilities and contributions in relation to the plan. At the top, the State Council, which is the chief administrative authority of the PRC, overseas everything and acts as a coordinating organisation. The different actors and their interlinkages are most easily comprehended by organizing their relationships as seen in the model below:

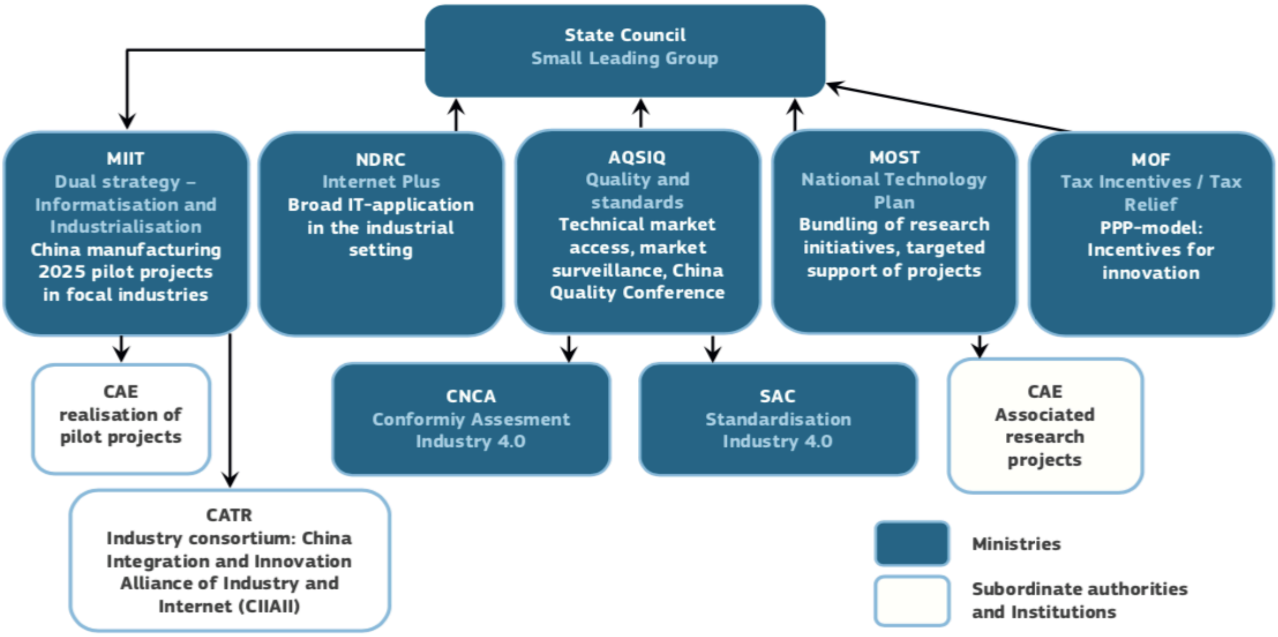


Figure 7: Chinese actors in the context of MIC2025[29]

The inter-ministerial China Strong Manufacturing Leading Small Group (CSMLSG) is the main coordinating mechanism that guides the implementation of MIC2025 under the State Council.[30] It is currently headed by vice premier, Ma Kai, who serves as chair of the CSMLSG (EUCCC, 2017, p. 15). Designated as vice chair is the minister of MIIT, Miao Wei, together with five other ministerial-level officials, including vice minister of finance Liu Yikun and deputy director of NDRC, Lin Nianxiu. The MIIT is responsible for the implementation of MIC2025 under the guidance of the CSMLSG and a co-releasing institution of all of the eleven national-level supplementary documents published on MIC2025 (Zenglein & Holzmann, 2019, p. 68). These include two special action plans, five project implementation guidelines (see 4.1.2), and four development guidelines for specific industries (IT, new materials, pharmaceutical and talent development) (Zenglein & Holzmann, 2019, p. 68). For the five project implementation guidelines, especially the NDRC plays an important role, together with the MOST, the MOF and the CAE (EUCCC, 2017, p. 8). The NDRC is also the main actor of the ‘Internet Plus' strategy, which is closely linked to MIC2025. The Chinese Academy for Engineering functions as a strong management and consultative body, which provides strategic

[29] Adapted by author from *(European Commission, 2019, p. 14)*
[30] Leading Small Groups (LSG's) are decision-making units within the CPC, which have gained in number and influence under Xi Jinping. The LSG's are tasked with planning and coordination . Xi himself is heading 9 of such groups, an unprecedented centralization of

advice and is also targeted with associated research projects, the demonstration centres and the realisation of pilot projects (European Commission, 2019, p. 15). The MOF is responsible for tax incentives and tax relief. At the expert level, the China Centre for Information Industry Development, and the National Expert Commission for Constructing a Manufacturing Superpower provides important inputs to the CSMLSG (Wübbeke, Meissner, Zenglein, Ives, & Conrad, 2016, p. 18). Policy-industry interaction takes place through alliances and federations. These include for instance alliances such as the Smart Manufacturing Industry Alliance and the Alliance for the Promotion of the Digitisation of Industry, as well as federations such as China Machinery Industry Federation (Wübbeke et al., 2016, p. 18).

The MOFCOM, while not listed in the model, is also an essential actor to MIC2025. MOFCOM is one of the key actors in developing the domestic market in China, and regulates China's integration into the wold economy (Heilmann, 2016, p. 78). Together with the NDRC, MOFCOM also formulates China's national "investment catalogues"[31]. Historically, these catalogues have specified the industrial sectors and technology fields where investment was either encouraged (such as the high-tech sector), restricted (such as requiring joint ventures in the automobile industry to facilitate technology transfer) or prohibited (such as sensitive industries like education, media or military) (Heilmann, 2016, p. 79). However, on July 30, 2019, the NDRC and MOFCOM jointly issued two "negative lists" and one "encouraged catalogue". The two negative lists are the *Special Administrative Measures on Access to Foreign Investment (2019 edition)* and the *Free Trade Zone Special Administrative Measures on Access to Foreign Investment (2019 edition).* The restricted and prohibited sectors originally covered by the investment catalogue, are now covered by these negative lists. MOFCOM is an important organisation in regulating the environment for foreign investors as well as domestic actors, and together with the NDRC it forms the champions of national industry and technology policy (Heilmann, 2016, p. 79).

There is thus a strong, political leadership behind both the drafting and implementation of MIC2025 and together these commissions and ministries form the regulatory backbone of MIC2025. Interestingly, however, certain actors are absent from the drafting and execution of MIC2025 and MIC2025 lacks both vertical and horizontal integration with actors. Vertically, the top-down approach of MIC2025 stands in sharp contrast to the enterprise-driven and bottom-up strategies

[31] The catalogues full name is: The Catalogue of Industries for Guiding Foreign Investment (*waishang touzi chanye zhidao mulu* 外商投资产业指导目录)

pursued in Germany and the U.S (Wübbeke et al., 2016, p. 17). The main issue for MIC2025 is not the lack of market orientation or over-reliance on SOE's, but rather that bottom-up dynamics remain weak, which results in limited coordination between industrial policies at central and local level. While local governments play an important role in financing MIC2025, mainly through providing research and training facilities and subsidies for infrastructure and building, there is hardly no coordination of the development of value chains between and within the emerging new industrial clusters (Lüthje, 2019, p. 205). Horizontal integration is also limited, and MIC2025 lacks integration with broader societal actors in terms of social politics, urban politics and environmental politics (Lüthje, 2019, p. 205). The Ministry of Education, the All-China Federation of Trade Unions, and the Ministry of Labour and Social Security, have been largely absent from the drafting and execution of MIC2025 (Lüthje, 2019, p. 205). Workforce development, changes in labour and social security has been institutionally excluded from MIC2025 and a number of policy questions still remains unaddressed, such as how to reform vocational training, wage and incentive systems as well as labour laws (Lüthje, 2019, p. 205). There are thus clear inefficiencies that need to addressed and overcome for MIC2025 to succeed on a larger scale, but as an overarching plan, it remains a forceful catalyst for industrial upgrading (Zenglein & Holzmann, 2019, p. 21).

4.1.4 How is MIC2025 different from other Chinese IP plans?

When China announced its first IP-program in the late 1980s, it was largely considered as emulating the industrial policies of the 'four tigers' (Hong Kong, Singapore, South Korea, Taiwan). Since then, IP-programs has increased substantially in numbers and has together with the opening-up reforms been important in driving the tremendous progress China has experienced over the last 40 years (Heilmann & Shih, 2013, p. 3). The World Bank (2019) estimates that China has lifted more than 850 million people out of poverty since Deng Xiaoping initiated market reforms in 1978, and GDP has seen growth levels around nine percent a year (World Bank, 2019). During the Hu-Wen administration (in office 2003-2013) the main IP-plan was the 'Medium- and Long-Term Plan on the Development of Science & Technology' (Kennedy, 2015). The 15-year plan (2006-2020) was entirely focused on advanced technologies, and the key concept of the plan was 'indigenous innovation' (*zizhu chuangxin* 自主创新) (Kennedy, 2015). In 2010, the plan was replaced by the 'Strategic Emerging Industries' plan, which focused on developing leading-edge technologies through R&D investments from state and industry sources, accumulating intellectual property and letting foreign companies gain access to the Chinese market in exchange for transferring technology.

The plan was jointly developed by the NDRC and the MOST with inputs from MIIT and other ministries. Its most important targets included that SEI-industries should account for 8 percent of the economy in 2015 and for 15 percent in 2020 (Kennedy, 2015).

<table>
<tr><th>Strategic Emerging Industries</th><th>Made in China 2025</th><th>13th Five-year Plan</th></tr>
<tr><td>biotechnology</td><td>biopharmaceutical and high-end medical equipment</td><td>gene industrialisation</td></tr>
<tr><td>energy saving equipment</td><td>energy equipment and technology</td><td>green energy and nuclear power</td></tr>
<tr><td>next generation information technology</td><td>integrated circuits and new generation IT</td><td>integrated circuitry</td></tr>
<tr><td>new materials</td><td>new and advanced materials</td><td>advanced equipment and new materials</td></tr>
<tr><td>new energy vehicles</td><td>new energy vehicles</td><td rowspan="6">advanced manufacturing</td></tr>
<tr><td rowspan="5">advanced manufacturing</td><td>advanced rail and equipment</td></tr>
<tr><td>agricultural machinery and technology</td></tr>
<tr><td>aviation and aerospace equipment</td></tr>
<tr><td>advanced marine equipment and high-tech vessels</td></tr>
<tr><td>advanced manufacturing control equipment and robotics</td></tr>
<tr><td>high technology services</td><td></td><td></td></tr>
<tr><td>digital creative industries</td><td></td><td></td></tr>
</table>

Table 2: Comparison of recent Chinese IP plans[32]

MIC2025 differs from such policy plans in multiple aspects. First, MIC2025 focus on the entire manufacturing process, and is not confined to only targeting innovation (Kennedy, 2015). Secondly, MIC2025 is not only focusing on advanced industries, but also traditional and more modern services (Kennedy, 2015). Thirdly, the role of the market is more prominent than in earlier policy plans such as the SEI, with MIC2025 stating multiple times that MIC2025 should be "market-led but government-guided" (Kennedy, 2015). It attaches high importance to private entrepreneurship and market mechanisms (Zenglein & Holzmann, 2019, p. 30). Fourthly, the detailed and specific goals set out in MIC2025 and the Roadmap17 is unusual for Chinese IP plans, and are in many aspects similar to the structure found in the five-year plans, though MIC2025 is supposed to run over a much longer period (Kennedy, 2015). The market share goals for 2020, 2025 and 2030 laid out in the Roadmap17 are exceptionally detailed and differs greatly from other IP plans which tend to be highly aggregated and general in their formulations (Zenglein & Holzmann, 2019, p. 21).

[32] Adapted by author from *(Kenderdine, 2017, p. 328)*

MIC2025 builds on decades of IP-making in China (Wübbeke et al., 2016, p. 3). While the plan is not radically new, it differs from other policies and strategies developed by the Chinese government, due to its critical and realistic reflections on the challenges that China faces, both in terms of the composition of its current industries and in terms of its capacities to make MIC2025 a reality (European Commission, 2019, p. 14). This includes shortcomings in efficiency, the quality of the industrial structure, its innovation capacity and its degree of digitalisation (European Commission, 2019, p. 14). Therefore, MIC2025 also have a longer perspective than what is usually seen in the 5-year or 15-year plans announced by CCP (European Commission, 2019, p. 14).

4.1.5 MIC2025 today: Recent adjustments and changes

Since MIC2025 was introduced in 2015, a number of revisions and readjustments has been made to the plan, and the plan is constantly being revised to cope with emerging challenges (Zenglein & Holzmann, 2019, p. 9). Successes and impediments in policy design and implementation over the last four years, has inspired the readjustment of MIC2025. By the end of 2018, more than 445 authoritative documents on how to implement MIC2025 have been issued by the Chinese government (Zenglein & Holzmann, 2019, p. 9). China's local governments are active in translating the national guidelines into local directives.

The most important of these adjustments include Roadmap17, which with its release in February 2018 readjusted many of the ambitious market share targets already set out in Roadmap15 in 2015 (NMSAC, 2018). For instance, new energy vehicle domestic market shares were readjusted from reaching 80 percent by 2025 in Roadmap15, to reaching 90 percent by 2025 in Roadmap17 (NMSAC, 2018). Many equally ambitious readjustments have taken place in the new roadmap. Roadmap17 especially stresses the importance of new materials (see 4.1.2, industry 10), and manufacturing equipment that are important to 'smartification', which is seen as essential to further upgrade the ten industries (Zenglein & Holzmann, 2019, p. 33).

Another interesting development is China's change in rhetoric regarding MIC2025. Zhong Wei, professor at Beijing Normal University, has argued that China should tone down its use of MIC2025, as to avoid the critical international speculations about China's ambitions (Leng & Zheng, 2018). A quantitative study looking at Chinese and U.S. official media articles in relation to MIC2025, found that MIC2025 basically disappeared from official news media as a direct response to the US-China trade war (Chen, 2019). While it is difficult to infer correlation from such events, it seems peculiar that MIC2025 was suspended so abruptly following escalation in the US-China trade war after March 2018 (Chen, 2019). The study underscored the CPC's use of national media as a political tool. In the picture below the grey dots represent Chinese news media articles, and the green/marble/blue dots represent U.S news articles.

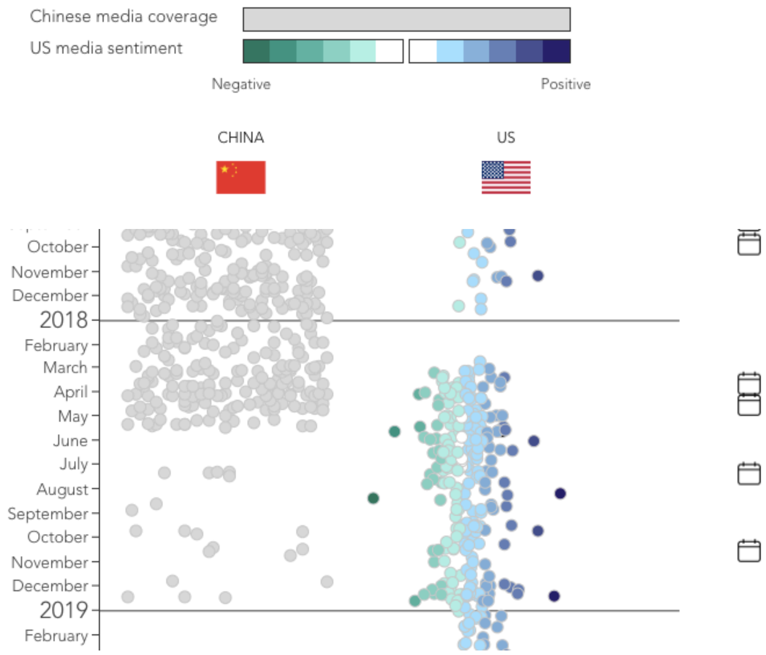


Figure 8: China's vs US' media coverage of MIC2025 between Oct 2017 and Feb 2019[33]

The fact that MIC2025 is facing heavy external pressure from the West, has shaped the way MIC2025 is depicted and talked about (Zenglein & Holzmann, 2019, p. 29). Key words to MIC2025 such as "MIC2025" (*zhongguo zhizao* 2025 中国制造 2025) and "self-sufficiency rate" (*zizhulü* 自主率) has largely disappeared from official rhetoric, and have been replaced by less intrusive words such as "core technology" (*hexin jishu* 核心技术) and "indigenous innovation" (*zizhu chaungxin* 自主创新) (Chen, 2019). The mention of MIC2025, which have been a consistent theme in Li Keqiang's government reports since its inauguration in 2015, was likewise not mentioned in Li Keqiang's Government Work Report in March 2019 at the Second Session of the 13th National People's Congress (Zenglein & Holzmann, 2019, p. 30). In contrast to this, the 'Internet Plus' strategy, which

[33] *Adapted by author from: (Chen, 2019)*

was only mentioned sporadically in earlier work reports, had an important place in the report, and was mentioned seven times in the 2019 report (Li, 2019).

According to Taiwan's Central News Agency, a document, purportedly issued by the Chinese central authorities, was even circulated on the social media platform Sina Weibo in June 2018 (Fang, 2018). The document instructed the internet users on how to address the US-China trade war, and stated specifically that: "*'Made in China 2025' should not be used; otherwise, punishment will be dealt*" (Fang, 2018).

While the rhetoric has changed, most analysts (European Commission, 2019; Zenglein & Holzmann, 2019) believe that this is a strategic choice, and that the ambition to catch-up with Western industrialized countries through MIC2025 remains. It seems that much of the discussion about MIC2025 is now increasingly taking place in other forums, without the mention of MIC2025. An important indication of this, is that the NMSAC hosted the yearly 'National Expert Forum for the Establishment of a Strong Manufacturing Country' on October 15, 2019 in Ningbo (NMSAC, 2019). The forum is recognized as an important platform for discussion on high-quality development of China's manufacturing industry and has earlier had key-note speeches by officials highly involved in MIC2025 such as Ma Kai, Chairman of the CSMLSG. At this year's forum, key speakers included Zhou Ji, Director of the Strategic Consulting Committee for the Establishment of a Strong Manufacturing Country, and He Yingkun, Deputy Director of the Planning Department of the MIIT (NMSAC, 2019). He Yingkun read a speech prepared by Wang Zhijun, Deputy Minister of MIIT, which among others addressed the need for smartification of traditional industries, the importance of entrepreneurs in driving innovation, and the need to overcome institutional obstacles to technological advancement (NMSAC, 2019). These are all themes that used to be linked to MIC2025, but this time around, there was no mention of it. The wording may have changed, but the ambition remains the same.

4.1.6 Sub-conclusion (1)

This section addressed the first subordinate research question: (1) *What is MIC2025, its key contents and actors?* It found that MIC2025 is a comprehensive IP-plan, which focus on 10 key industries, in which China aims to become a technological leader. The plan has three phases and set objectives and goals for 2025, 2035 and 2049, the year by which China should reach global leadership in technological innovation. The plan differs from prior Chinese IP plans in both scope (focusing on the whole manufacturing process) and scale (CDB alone has pledged 300 billion RMB[34], and more than 1,600 government-guided funds has been established). MIC2025 involves a large number of various ministerial and supporting actors, the most important being the CSMLSG, the CAE, the MIIT, and the NDRC. However, bottom-up dynamics remain weak. Today, it seems MIC2025 has entered a 'stealth mode' phase, where the official rhetoric around the plan has changed. However, it seems that such discussion has moved to other fora, and the ambition to pursue MIC2025 remains.

4.2 What are some of the key factors that led to the emergence of MIC2025?

This section will address the second subordinate research question: *(2) What are some of the key factors that led to the emergence of MIC2025?*

Over the last decade since the financial crisis in 2008, at least 84 countries have issued explicit policy frameworks for industrial development or IP statements (UNCTAD, 2018b, p. 128). The use of industrial policies are applied by countries at different levels of development and technological upgrading and for different reasons (UNCTAD, 2018b, p. 128). The use of industrial policies has also emerged as a response to a multitude of contemporary challenges faced by both developed and developing countries (UNCTAD, 2018b, p. 128). These include among others creating jobs, avoiding unemployment, reducing poverty, participating in global value chains, participating in the fourth industrial revolution, meeting the UN sustainable development goals, promoting efficient and clean energy and increasing their role in global governance (UNCTAD, 2018b, p. 128). The development of advanced manufacturing has become a priority for both emerging and mature markets (UNCTAD, 2018b, p. 129). In this section I look at some of the factors that have led to the emergence of MIC2025.

4.2.1 Defining the factor criteria:

This thesis defines a factor as a phenomenon which exists independent of the MIC2025, but which has specific relevance to the emergence of MIC2025. In this case, relevant factors are defined based on the following three criteria:

[34] Approximately 46.15 billion USD

i) Scholars and researchers describe the phenomenon to have a significant impact on the emergence of MIC2025.
ii) The emergence of MIC2025 has an impact on or is considered as highly likely to have an impact on the phenomenon itself.
iii) There is a consensus among said scholars and researchers about the phenomenon.

Identifying factors is the first step towards a thorough analysis of each factor. Through examination of primary and secondary sources, reports and policy documents, my research suggests that the identified factors have had considerable influence in driving the emergence of MIC2025. I argue that the factors identified can be classified as either domestic, regional or global. For example, 'getting rich before getting old' is classified as a domestic factor, as it is the domestic demographic changes that are driving this factor to emerge. MIC2025 is then viewed by the government as a tool to propel China into higher productivity levels and overcome long-term labour shortage. On the other hand, increased regional and global competition is viewed as respectively regional and global factors, as it is mainly the pressures from the foreign companies that drives China's desire to increase domestic companies market shares. MIC2025 is then believed to address the factors. Several other factors have been identified but has not been included as they did not meet the factor criteria. In the following, I will analyse some of the domestic, regional and global factors that have led to the emergence of MIC2025. For a complete summary of the identified factors and how MIC2025 seeks to tackle these factors see section 4.2.5.

4.2.2 Domestic factors

[Moving away from] the image as the 'worlds factory':

China is still the world's largest producer of goods. In 2015, when MIC2025 was introduced, China produced half of the world's steel, 80 percent of the world's computers, 90 percent of the world's mobile phones, and 60% of the world's colour TV's (EUCCC, 2017, p. 3). When taking a closer look at China's production in many of these industries, they are still mainly in the low-value added and energy intensive category (EUCCC, 2017, p. 3). In addition, they are often polluting, which has become a source for great social discontent in recent years (EUCCC, 2017, p. 3). By upgrading its industrial base, China aims to enter the middle and high value-added segments and become a technological superpower. It thus seeks to follow in the footsteps of what Japan and the 'four tigers' has achieved before, and MIC2025 is the main industrial plan to make this a reality (EUCCC, 2017, p. 3).

[Escaping] the middle-income trap

The World Bank has developed the concept of the 'middle-income trap', which outlines the problems developing countries face when they are squeezed between poorer countries, which have cheaper labour, and richer countries, which have higher efficiencies and productivities due to advanced technologies. A study done by the World Bank, found that of the 101 countries which in 1960 was classified within the 'middle-income' range, only thirteen of those countries had made it into the 'high-income' range in 2008 (Wade, 2019, p. 21). Among those thirteen were Japan, South Korea and Taiwan that were able to escape the middle-income trap, by 'climbing' various technological pinnacles by the help of the state, as outlined in section 3.2.2. As China reached its Lewis-turning point (shrinking labour supply and rising wages) in the mid-2000's it became evident that the current growth-model was no longer sustainable. The CPC therefore initiated initiatives to change its economy from a primarily export-driven economy to a more domestically consumer-driven economy. China's GDP per capita, which reached 9,776.4 USD in December 2018, is now close to 10,000 USD, which is how the World Bank defines middle-income status (CEIC, 2019). China has referred to its concerns regarding the middle income trap in its 13th five-year plan (2016-2020), where it is stated that China "*should improve the quality and efficiency of development*" and "*constantly open up new realms for development*" to avoid the middle income trap (State Council, 2016b)[35]. While the policy plans enacted to support this change are numerous, MIC2025 is the most comprehensive in both scope and scale.

[Combating] demographic changes

China's demographic dividend, which refers to the proportion of the labour force to the non-working population, is declining and is expected to decline further in the years to come. This is mainly due to the demographic changes in China's population structure, which in part stems from the decrease in children born under the 'One Child Policy', effective from 1978 to 2015. In 2018, China had an

[35] Translated from: "提高发展质量和效益(…)不断开拓发展新境界"(State Council, 2016b)

eligible workforce – defined by the National Bureau of Statistics as those aged 15-59 years old – of 897,290,000 people (National Bureau of Statistics, 2018a). In 2017 this number was 901,990,000 and in 2016 it was 907,470,000 (National Bureau of Statistics, 2016, 2017). From 2013 to 2018 China's eligible workforce has consistently declined from 919,540,000 to 897,290,000, a decline of 22,250,000 million (National Bureau of Statistics, 2013, 2018a). A shrinking workforce negatively impacts many of the other challenges China faces and with the declining economic growth, the CPC has realized the need to rely on more innovation and technology driven growth, which the contraction in working-age population complicates (EUCCC, 2017, p. 4).

MIC2025 seeks to address this especially through the increasing domestic application of industrial robotics (see section 4.1.2, industry 2) and the upgrading of China's hospital equipment and medical devices (see section 4.1.2, industry 10).

[Reducing] reliance on foreign suppliers

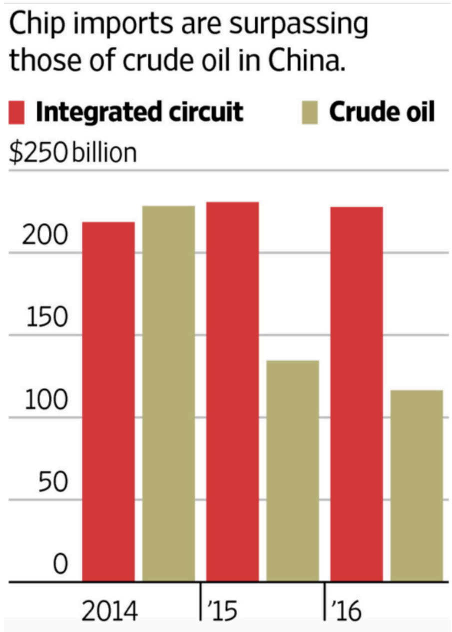


Figure 9: China's imports of microchips vs. crude oil

Chinese reliance on foreign goods is a bottleneck to its progress in key industries. Many of these industries are central to leading the technological race and the fourth industrialisation. Taking semiconductors as an example, the crux of the matter is not the money – in 2016 China spent 227 billion USD on chips (see Figure 9) even over crude oil – but rather it is the fact that semiconductors are urgently needed to support China's development in industries identified as central to its structural transformation. Semiconductors are important inputs to phones, telecoms gear, computers and a range of other products which in 2016 accounted for nearly a third of China's total exports. And semiconductors are still subject to restrictions from Western countries. Miao Wei, Minister of MIIT, has underscored why the strategic aspects are of higher priority than the monetary value: "*In addition to the money (we spend), what is even more critical, is that in order to develop, we urgently need high-end integrated circuits, but some of its components are still subject to restrictions on our exports from some Western countries"*[36] (MIIT, 2015). On a company level, this include for instance the Chinese telecommunications equipment company

[36] Translated from: "除了花钱，更关键的就是，高端的集成电路，是我们发展很急需的，但是它的一些装备，还受到了一些西方国家对我们出口的限制" (MIIT, 2015)

Huawei. Through an executive order signed by Donald Trump in May 2019, American technology companies were banned from dealing with Huawei (Fernandes, 2019). The order banned "*any acquisition, importation, transfer, installation, dealing in, or use of any information and communications technology or service*" without receiving a special approval (Fernandes, 2019).

The same goes for other important industries such as new materials, and key components for advanced machinery (Zenglein & Holzmann, 2019, p. 13). It illustrates how dependent China is on foreign technologies, and how easily such access and supply can be thwarted. To address this, China seeks to secure its supply by creating strong domestic companies through MIC2025. Investments in R&D is a key driver of this, and in 2018 China spent 300 billion USD on R&D, corresponding to 2.2 percent of its GDP. They thereby surpassed that of EU, which stood at 2.1 percent of GDP in 2018 (Zenglein & Holzmann, 2019, p. 11). In addition to this, China has assigned different regions with specific aspects of tech development, in the hope that clustering will lead to spill-over effects and drive competitiveness and operational efficiency (Zenglein & Holzmann, 2019, p. 11). As of June 2018, it is estimated that China has committed at least 150 billion USD as part of MIC2025 to build up its semiconductor industry (White, 2018).

[Gaining] legitimacy through economic prosperity

Economic growth and prosperity is one of the main sources of regime legitimacy in China (Chu, 2019). When challenged with issues ranging from pollution and food crises to debt and trade issues, the CPC has been able to showcase its extremely powerful economic might, as a reassurance that the economy is moving in the right direction. The estimations that more than 800 million people have been lifted out of poverty since initiating market reforms in 1978, is often used by the CPC as evidence of their mandate (World Bank, 2019). Sustained growth and control are therefore top priorities for the party, and together with the Belt and Road initiative, MIC2025 is expected to be a key driver of this growth. MIC2025 therefore entails both an economic and industrial focus, but also a political one, as necessary for the CPC's continued legitimacy.

[Tackle] decreasing demand

Demand in China is slowing and Chinese factories struggle with decreasing demand. Chinese imports from the world fell five percent through September 2019 (Balding, 2019). This is due to multiple interlinked factors, such as the declining growth rate, the prioritization of domestic goods even when those goods are more expensive than foreign, and the lack of dollar liquidity which all restricts China's ability to engage in international trade (Balding, 2019). It remains to be seen whether this is a temporary or structural phenomenon. With an excessively indebted economy, slowing growth and demographic changes, it seems difficult for China to return to the pre-2015 expansion of the economy (Balding, 2019). Reducing unemployment and stimulating growth are important measures to this.

4.2.3 Regional factors

[Avoiding] Increased regional competition

Labour cost in China is rising. In 2002, China's manufacturing labour costs were approximately 0.6 USD per hour. In 2019, that number stood at 5.78 USD per hour. Vietnam had a labour cost of 3 USD per hour, and India a labour cost of 2.5 USD per hour (Statista, 2019). The Annual Reshoring Report prepared by A.T. Kearney finds that in the last five years, manufacturers have been diversifying away from China, and have relocated their production to other low-cost economies, especially Vietnam. This trend is depicted in the graph below (Gott, Van den Bossche, Levering, & Castano, 2019, p. 4).

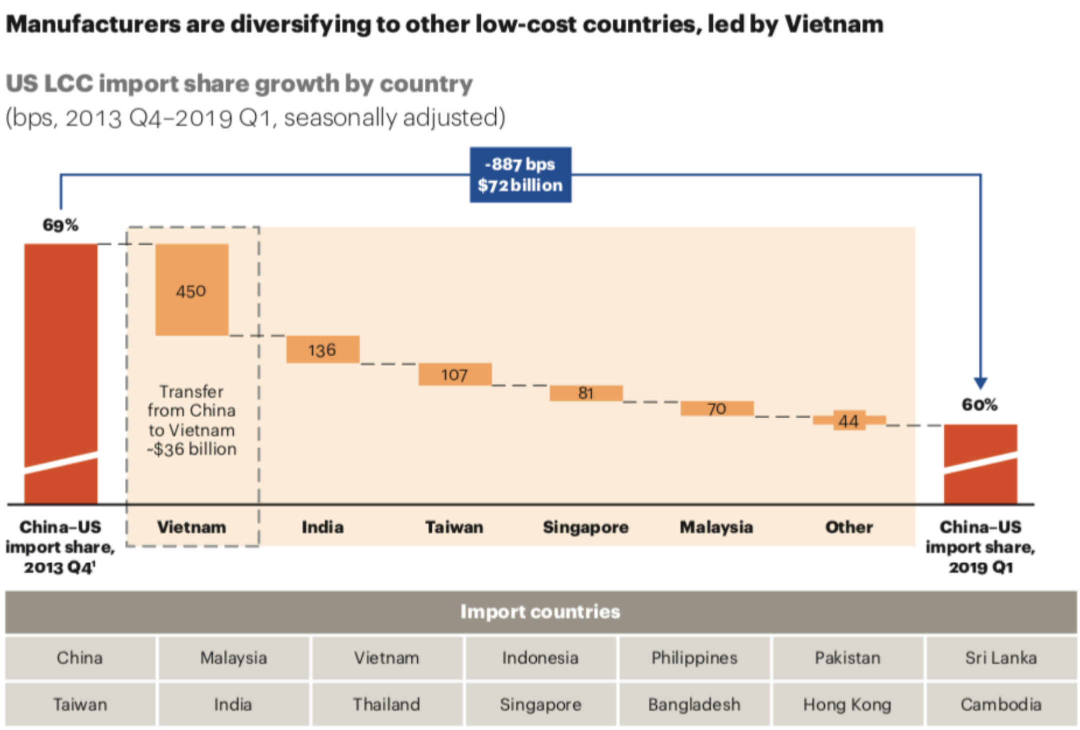


Figure 10: Manufacturers diversifying to other low-cost countries, led by Vietnam[37]

[37] Adapted by author from (Gott et al., 2019, p. 5)

Between Q4 2013 and Q1 2019, China's share of Asian economies imports to the US declined from 69% to 60% (Gott et al., 2019, p. 5). That corresponds to a loss of 72 billion USD in import value, with more than half of it being captured by Vietnam. The ongoing trade war between China and U.S. has further accelerated this trend, with companies diversifying and establishing manufacturing facilities in new locations. This includes companies such as Intel, Li & Fung, LG electronics and most recently Samsung, which closed its last smartphone manufacturing plant in Huizhou in Guangdong by the end of September 2019. (Yang, Bradshaw, & Jung, 2019). MIC2025 tries to address this, by putting "talent at the core" (*rencai wei ben* 人才为本) which companies such as Apple highly values, such as seen by CEO Tim Cook statement that: "*The number one reason why we like to be in China is the people. China has extraordinary skills*" (Yang et al., 2019).

[Handling] a surge in Asian IP plans:

In addition to the increased competition in Asia, other Asian economies are also implementing IP-plans. India launched its "Make in India" in 2014, Vietnam its "Industrial Development Strategy, Vision Toward 2035" in 2014, Thailand its "Thailand 4.0" in 2015 and Japan its "Industrial Value Chain Initiative" in 2015 (Desatova, 2018). Japan, which used automotive and electronic industries as drivers of its strong export performance, has focused on measures to diversify and strengthen its manufacturing resilience (UNCTAD, 2018b, p. 137). Vietnam's IP-plan on the other hand, has focused on industries of early development, that are important to national employment (UNCTAD, 2018b, p. 137). In line with MIC2025, the developing Asian economies employ horizontal competitiveness-enhancing policies combined with strategic industry development plans (UNCTAD, 2018b, p. 137). The ASEAN has also become a strong competitor of China in attracting FDI. Between 2016 and 2017, ASEAN experienced a growth of eleven percent in inwards FDI, while China only experienced a two percent growth over the same period (UNCTAD, 2018a, 2019). By selectively improving their business environment for foreign companies, such as allowing more lenient joint venture requirements and improving market access, China seeks to attract more high-value technology companies, which the CPC considers as particularly important to improving their industrial base (Zenglein & Holzmann, 2019, p. 50).

4.2.4 Global factors

[Avoiding] Increased global competition

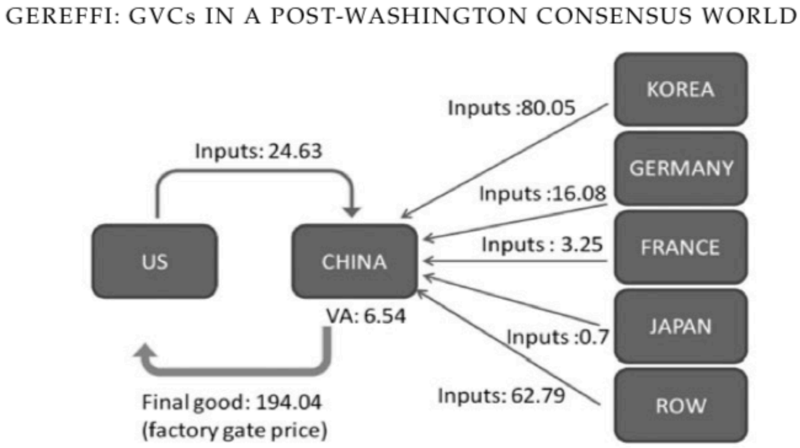
Just as China faces regional pressure from the ASEAN countries, it also faces pressures from the advanced industrialised countries. As stated by a MIIT official, China is being "pressured from both sides" (China Daily, 2015). Industrialised high-income countries have more advanced technology, and with the fourth industrialisation being heavily pursued by these countries, it is highly likely that new and advanced manufacturing technologies will drive down production costs and increase competitiveness of those countries. This may in turn result in reshoring of companies and their manufacturing activities, dragging firms, operations and jobs away from China (EUCCC, 2017, p. 5). A number of high-income countries including the U.S, Germany and Japan have also formulated strategies to support and develop their own manufacturing and technology industries (EUCCC, 2017, p. 5). For instance, Industry 4.0 which is Germany's plan to upgrade the industrial base through technological advancement is specifically addressing intelligent manufacturing and the use of IT in production.

[Addressing] the innovation gap and [leading] Industrialisation 4.0

China knows that Industrialisation 4.0 is important. China was in large a latecomer to the former industrial revolutions, but this time, as illuminated by Xi Jinping, China will not miss the boat: "*Innovation is the primary force guiding development. Unlike the previous industrial revolutions, the fourth industrial revolution is unfolding at an exponential rather than linear pace. We need to relentlessly pursue innovation*." (Xi Jinping, 2017). Reform and innovation are central objectives in the 13th five-year plan (Nolan, 2018, p. 1). Today, spending on R&D is critical for the development of competitive companies and high-technology industries (Nolan, 2018, p. 1). At the national level, China's government R&D expenditure has been rising. However, at the firm level, R&D spending is still highly concentrated in a small number of firms from high-income countries (Nolan, 2018, p. 1). At the enterprise level, China has a low R&D intensity level, corresponding to between 33-50 percent of that of advanced industrialised countries (EUCCC, 2017, p. 4). There is a minimal contribution to R&D activities from small- and medium sized enterprises, which face challenges in accessing capital from China's state-led banks, which often favour the big SOE's (EUCCC, 2017, p. 4). This weak innovation capacity leads to less competitive SME's with a shorter life span (EUCCC, 2017, p. 4). The companies that are capable of enduring despite such complications often do not face the necessary competition to develop and ascend into the high-end of the value chain, which results in stagnation at the SME level (EUCCC, 2017, p. 5). The European Chamber of Commerce in China, estimates that this ‘trend’ results in a structural overcapacity, with too many SME’s competing on the basis of price, while sacrificing quality (EUCCC, 2017, p. 5). China therefore desires to create strong domestic companies with high market shares, as outlined in the targets of MIC2025 and Roadmap17 (as outlined in section 8.2).

[Climbing up] Global Value Chains

The majority of China’s activities are still found in the manufacturing and assembly category, (EUCCC, 2017, p. 3). In 2014, one third of China’s imports went to export-processing zones, which accounted for nearly half of the country’s exports (Gereffi, 2014, p. 20). China has very successfully established broad manufacturing clusters at regional-level, such as the FDI-driven clusters in Guangdong, or the clusters in Zhejiang focusing on single products (Gereffi, 2014, p. 20). However, China does not create or capture much of the value it generates. With the increase in types of intermediate goods in global supply chains, there exists now a high discrepancy between where goods are produced, and where the value is attributed (Gereffi, 2014, p. 20). This can be shown by looking at China’s downstream and upstream segments in its supply chain. When analysing the upstream segment of China’s technology foundation, it becomes clear that China is heavily dependent on imports from foreign countries when it comes to semiconductors, machinery goods, and a range of other ‘core’ technologies and products. Gereffi (Gereffi, 2014) has used the example of the iPhone to show how China is positioned in the GVC’s. The full value of an iPhone is 169.41 USD, but only one tenth or less of the actual value is generated in China. The value-added in China mainly corresponds to the value of the labour used to assemble the iPhone, as well as a few of the components. However, the most important components for the phone are not Chinese. The processor for the phone comes from Taiwan, the memories and screens are supplied by Korea and so on (Gereffi, 2014, pp. 20–21)



US trade balance with	CHINA	KOREA	GERMANY	FRANCE	JAPAN	ROW	WORLD
Gross	-169.41	0	0	0	0	0	-169.41
Value added	-6.54	-80.05	-16.08	-3.25	-0.7	-62.79	-169.41

Figure 11: US bilateral trade balance with China for one unit of Iphone4 (USD)[38]

While it may look like China has a trade surplus of 169.41 USD, the reality is that China only extracts (or capture) 6.54 USD of that value. China would thus be much better off, if the value-added generated in the country approached the full value of its iPhone export to the U.S.

The further downstream on the supply chain we move, the more innovative China appears. For instance, China has become very successful at making consumer goods and offers various innovative retail experiences. This is exemplified by companies such as Alibaba-owned Hema, which offers innovative online-to-offline shopping models and social retail experiences to its customers. China is also the only country besides the U.S. that has been capable of building large internet companies such as Tencent and Alibaba, which rank in the global top ten of the world's largest internet companies by revenue (Statista Research Department, 2019d). A study done by the European Commission, found that in the years between 2000-2014, China's share in global value-added in manufacturing GVC's increased from 6 percent to 14 percent, while the EU's share dropped from 27 percent to 16 percent in the same period (European Commission, 2019, p. 19). While the EU report found that 55% of this growth stemmed from demand factors, the remaining 45% could be attributed to China's gain in competitiveness (European Commission, 2019, p. 19). Especially in the medium-high tech sectors (electrical, machinery, motor vehicles, transport etc.), and high-tech sectors (computer, electronic,

[38] Adapted by author from: (Gereffi, 2014, p. 21).

etc.) has China experienced strong growth (European Commission, 2019, p. 19). This is at large in line with the priorities of MIC2025 which targets these sectors extensively. The need to reduce the reliance on foreign components and capture more value by increasing domestic competitiveness is a key objective of MIC2025.

4.2.5 Sub-conclusion (2)

This section addressed the second research question: *What are some of the key factors that led to the emergence of MIC2025*? By analysing China's economic, demographic and trade environment, domestic, regional and global factors were identified. These factors have been described in detail in the above section. The table below provides a summary of the identified key factors, a description of the factor, how MIC2025 seeks to respond to the factor, and which industries were deemed as most relevant to address the factor.

Table 3: Overview of the key factors that led to the emergence of MIC2025

Key factors	Description of the factor	How is MIC2025 responding to the factor?	Industries specifically relevant to address the factor
Domestic factors	//	//	//////////////////////////////
[Moving away from] the image as the 'worlds factory'	China is still the world's largest producer of goods, but mostly in low to middle value-added goods. China wants to move away from being the 'worlds factory'.	By focusing on high-tech sectors and promoting domestic industries, MIC2025 seeks to bring Chinese production from low to high value-added.	*All ten industries*
[Escaping] the middle-income trap	World Bank and China itself estimate that China may be trapped in the middle-income trap: The point where rising wages erodes a countries comparative advantage.	MIC2025 is believed to be the driver of such change.	*(1) Next generation information technology; (2) High-end numerical control machinery and robotics*
[Responding to] demographic changes	China's demographics are against them. The eligible workforce declined by 22,250,000 million between 2013 and 2018 and is still in a downward trend.	MIC2025 is believed to raise the productivity of the sectors, meaning that less people will need to be employed to carry out the same work.	*(2) High-end numerical control machinery and robotics; (10) Biomedicine and high-performance medical devices.*
[Reducing] reliance on foreign suppliers	China relies heavily on other countries in industries which are important to its technological ambitions and structural transformation such as e.g. semiconductors.	China seeks to become self-sufficient, which is underscored in the several mentions to self-sufficiency rates, domestic market shares etc.	*(1) Next Generation information technology; (2) High-end numerical control machinery and robotics; (9) New materials; (6) Energy-saving vehicles and new energy vehicles*
[Gaining] legitimacy through economic prosperity	Economic growth is essential to CPC legitimacy. With slowing growth, China is seeking to change to a more consumer-driven economy.	MIC2025 is essential to sustain/improve growth, by driving domestic consumption and demand.	*All industries*
Regional factors	//	//	//////////////////////////////
[Avoiding] increased regional competition	Between Q4 2013 and Q1 2019, China's share of Asian economies imports to the US declined from 69% to 60% (Gott et al., 2019, p. 5). That corresponds to a loss of 72 billion USD in import value, more than half of it being captured by Vietnam. Companies like Intel, Li & Fung, LG electronics and most recently Samsung, are relocating.	China tries to retain companies through improved market access policies. MIC2025 puts 'talent at the core' and seeks to improve vocational education to increase China's share of GDP attributed to secondary and tertiary sectors creating a more balanced and less exposed economy.	*All industries*
[Handling] a surge in Asian IP plans:	IP-plans are surging in Asia. India, Vietnam, Thailand and Japan all have IP plans as of 2014/2015. China needed a plan too.	China's MIC2025 plan employs horizontal competitiveness-enhancing policies combined with strategic industry development plans, to bring China ahead of both regional and global competitors.	*All industries*
Global factors	//	//	//////////////////////////////
[Avoiding] increased global competition	Industrialised high-income countries have more advanced technology than China and new and advanced manufacturing technologies as part of Industry 4.0 may drive down production costs and increase competitiveness of those countries.	MIC2025 seeks to bring China to the same (or higher) levels of industrialisation and position in advanced technology.	*All industries; (2) High-end numerical control machinery and robotics; (9) New materials*
[Addressing] the innovation gap and [leading] Industrialisation 4.0	For 1500 years, China was at the forefront of global innovation. However, China was in large a latecomer to the former industrial revolutions (first, second and third). This time, China knows that Industry 4.0 is important and will not miss the boat.	Creating strong domestic companies with high market shares, are important targets in MIC2025 and Roadmap17. State-support and intervention should drive this in a world where R&D investments by the corporate sector is consolidated in high-income countries.	*(1) Next Generation information technology*
[Climbing up] Global Value Chains	China does not create or capture much of the value it generates in GVC's. This is exemplified by the example of the iPhone by (Gereffi, 2014, pp. 20–21).	MIC2025 targets medium-high tech and high-tech sectors extensively. The need to reduce the reliance on foreign components and create and capture more value by increasing domestic competitiveness is a key objective of MIC2025.	*All industries*

4.3 Why is it necessary for China to initiate MIC2025?

This section will address the third subordinate research question: *(3) Why is it necessary for China to initiate MIC2025 and what are the arguments for and against MIC2025 in both the external (Western) and internal (Chinese) debate?*

The analysis in this section is divided into two sections, as listed in the table below:

Section 1: Arguments for and against MIC2025 in the Western debate	***Section 2: Arguments for and against MIC2025 in the Chinese debate***

4.3.1 Arguments for and against MIC2025 in the Western debate

As mentioned in the introduction, few academic studies have addressed MIC2025 academically as of today. Therefore, the arguments for and against MIC2025 in the following to a large extent builds on the arguments for and against IP in China.

As noted by Peter Nolan, China has been leading the world in innovation for at least 1500 years (Nolan, 2018, p. 253). China was more technologically advanced than Europe until at least the European Renaissance, and much earlier than Europe, China developed gunpowder, the compass, paper and printing (Nolan, 2018, p. 251). Even the key components of the steam engine, considered as the most important innovation of the British Industrial Revolution, possibly found its way to Europe from China (Nolan, 2018, p. 252). The state contributed largely to the development of all of these technologies and inventions, but in most industries (such as e.g. metallurgy, mining, and textiles) it was China's profit-seeking artisans and entrepreneurs who were driving the technical progress in pre-modern China (Nolan, 2018, p. 251). The foundation for China's success, was its symbiotic relationship between market and state. China thought in a very pragmatic way about, how to both stimulate and control the market. When this was done most successfully, it involved the combination of the philosophical foundation of Confucianism and the idea of 'duty' and morality with pragmatic, non-ideological state actions, that thought to overcome 'market failures' (Nolan, 2018, p. 252). While the system had flaws, such as when the principles were not adhered to, or bureaucrats and rulers were corrupt, the coherence and benefit of the system was extremely important to China's success in innovation in those years (Nolan, 2018, p. 253). It managed to combine "*the 'invisible hand' of market* *competition with the 'visible hand' of pragmatic, non-ideological government intervention in the market where necessary*" (Nolan, 2018, p. 253).

In 1800 the British industrial revolution transformed the world, and since then global innovation has been dominated by a small number of firms, the majority stemming from the high-income countries (Nolan, 2018, p. 253). China thus lost its position as the 'leader of innovation' to the UK and later the US. Since the 1980's, the role of the corporate sector's share of R&D investments has increased significantly, from 52 percent in 1981 to 65 percent in 2008 (Nolan, 2018, p. 253). The European Commission publishes a yearly report on the top 2500 companies in R&D spending in the world (See: European Commission, 2018). In 2017/2018 these companies spend a total of 736.4 billion EUR on R&D, accounting for approximately 90% of the global total business-funded R&D (European Commission, 2018, p. 5). The R&D spending by the G2500 companies is highly concentrated. In 2018, the R&D expenditure for the top 10 companies accounted for 15 percent of total R&D spending, the top 50 companies for 40 percent, top 100 companies for 53 percent and top 500 companies for 81 percent (European Commission, 2018, p. 26). An important topic to the debate on why China needs MIC2025, is the discussion on the role of artificial intelligence. Artificial intelligence is one of the key areas of the *Next-generation information technology* industry included under MIC2025 and today, the leader in modern technologies have the potential to reshape the global balance of power – both politically, economically and militarily (Sheehan, 2019). It underpins many of the industries assumed to drive the fourth industrialisation, such as industrial robotics, internet of things and quantum computing (Sheehan, 2019). AI is incredibly difficult to measure on its own, due to its myriad of applications and industries where it is used, and it is thus difficult to answer the question of "who leads in AI" globally (Sheehan, 2019). However, when studying the top 500 companies in G2500, the core of global innovation, the advanced economies still dominate the information technology industries with increasing amounts of capital. China's share of those companies only accounted for 5.9 percent of G2500 R&D spending in 2014/2015 (Nolan, 2018). This was less than the combined share of Switzerland, Sweden and Netherlands which accounted for 8.4 percent (Nolan, 2018, p. 254). According to Nolan, this has been driven by the global big business revolution, which has consolidated global R&D in a small group of firms from high-income countries. It is therefore very difficult for smaller companies in developing countries to 'catch up' without state support. These arguments largely follows the arguments outlined in the theory section by (Chang, 2002), and builds on the arguments that that developed countries 'kick away the ladder' for developing countries, in order to retain their place at the top of the pyramid (Chang, 2002, p. 8). Rather, developing countries should be allowed to adopt policies according to their economic, social, political and cultural conditions to create trade and investment opportunities for all countries in the long run (Chang, 2002, p. 141). In sharp contrast to Nolan and Chang, Porter (2000) argues against this, and while his study focuses on Japan, it addresses more general IP questions regarding the role of the state (Porter et al., 2000). Porter investigates why Japan was so successful during its industrialisation and concludes that the 'Japanese Miracle' was not due to well-implemented IP policies, but rather due to the competitiveness created in a few industries. In clear contrast to Johnson (1982), he argues that the state largely failed to create the framework conditions for economic prosperity, but rather the heavy involvement was detrimental to Japan's development: *"by raising taxes, failing to stimulate domestic demand, and clinging to their policy of export-led growth for too long, Japanese bureaucrats mismanaged macroeconomic policy"* (Porter et al., 2000, p. 2). Porter argues that the main problem is that the government mistrusts competition and therefore justify intervention, with detrimental consequences for both productivity and prosperity of the nation (Porter et al., 2000, p. 3). His underlying justification is mainly based on free market liberal ideas where competition between profit-optimizing individuals is seen as the most well-fare enhancing driver of economic growth. Mainly positive, but somewhat in-between these viewpoints, Wade argues that the need for the developmental state is still there, but IP should only be used in some cases (Wade, 2018, p. 521). Wade argues that the increasing role of financialization, global value chains and an increasing intellectual property monopoly, makes it necessary for *certain* countries to strategically support industries through IP. The most recent studies on MIC2025 undertaken in the West seems to emphasize more with the views of Porter than the others. These include the EUCCC (2017) report, the European Commission (2019) report and the MERICS (Zenglein & Holzmann, 2019) report. The key arguments for and against MIC2025/IP have been summarized in the table below:

Table 4: Summary of the proponents and opponents of MIC2025 in Western literature

Three major proponents of MIC2025/IP in Western literature	**Three opponents of MIC2025/IP in Western literature**
Peter Nolan (Nolan, 2001, 2014a, 2018) *Key opinion:* The global big business revolution has consolidated global R&D. It is very difficult for smaller companies in developing countries to 'enter the game' without state support i.e. IP is necessary for China.	**Michael Porter** (Porter et al., 2000) *Key opinion:* "*government mistrusts competition and therefore is prone to intervene in the economy in ways that harm the nation's productivity and prosperity*" (Porter et al., 2000, p. 3)
Ha-Joon Chang (Chang, 2002)	**EU Chamber of Commerce in China** (EUCCC, 2017)

Key opinion: Industrialized countries used IP when they themselves were developing. China needs IP to become industrialized	*Key opinion*: China should avoid government intervention and go towards ‘competitive neutrality’, lessen forced technology transfer open market access, and become member of the plurilateral Agreement on Government Procurement of WTO.
Robert Wade: *Key opinion:* Financialization, global value chains and the increasing intellectual property monopoly makes it necessary for *certain* countries to strategically support small number of industries at a time.	**MERICS** *Key opinion:* The EU has been to ‘naive’ in dealing with China, and a ‘exemplary willing partner’ of Chinese FDI into Europe, which has been detrimental to EU’s competitiveness. China’s IP policies restrict ‘reciprocity’ in EU-China investment relations, and post-entry companies face unequal enforcement of laws.

4.3.2 Arguments for and against MIC2025 in the Chinese debate

> *“One important reason why China fell into backwardness and took beatings in the modern era is that the previous industrial revolutions slipped through our fingers, leaving us with weak technology and a weak state. To realize the great rejuvenation of the Chinese nationhood that is the Chinese Dream, we must make genuine use of science and technology, this revolutionary force and lever of power in the highest sense.”* (State Council, 2016a)[39]

A debate among Chinese scholars is taking place around the role of the state in China’s industrial policies. This debate, has focused on tensions between proponents of free-market forces on the one side, and proponents of state-led approaches on the other side (Zenglein & Holzmann, 2019, p. 43). The conservative economic nationalists seems to be sceptical of the increase in what they see as ‘too-radical’ reforms, while the more reform-driven officials press for an increase in the role of the market (Zenglein & Holzmann, 2019, p. 43). In the following I look at some of the proponents and opponents of MIC2025 internally in China. Based on the discussion I classify what I call the three major proponents and the three major opponents of MIC2025 in Chinese scholarly and official circles.

The political and economic motivations for undertaking MIC2025 has been summarized by many high-level officials worth noting, but possibly most powerfully by Xi Jinping during a speech at the

[39] See also (Cheng, Jia, Li, & Li, 2019, p. 78) for a discussion on the importance of this quote.

17th conference of the Chinese Academy of Sciences and the 12th Conference of the Chinese Academy of Engineering in June 2014, where he stated that:

> "*The foundation of China's scientific and technological innovation is still not firm, indigenous innovation and especially originality is still not strong, and the pattern of key areas and core technologies being controlled by others fundamentally haven't changed.*(Xi, 2014)"[40]

Especially the need for indigenous innovation took up an important part of the speech, with Xi Jinping stating that China had no other choice then to pursue the "road of indigenous innovation."[41] Xi concluded that improved coordination between government, academia and industry was needed for this transition to take place successfully. Another prominent voice who have underscored the importance of MIC2025 is Premier Li Keqiang. Through multiple visits at provinces, industry clusters and SOE's, he has, in line with CPC, explained how MIC2025 seeks to propel China to new levels of industrialisation, and underscored the need for innovation-driven development. At his meeting with the German chancellor Merkel in 2015, he stated that China and Germany should "*join hands to advance the strategic alignment of "Made in China 2025" and "German Industry 4.0*""(Zhang, 2015). As outlined above, the policies, however, seems to be more in conflict than support of each other.

On the academic level, one of the key debates in relation to MIC2025, took place in November 2016, when former chief economist at the World Bank, Justin Yifu Lin, and professor of economics at Peking University, Zhang Weiying engaged in a three-hour debate at Peking university (J. Y. Lin & Zhang, 2016). The debate revolved around the need for IP and the role of the state in industrial upgrading. The debate was broadcasted on national television and watched by over one million people. Prior to the debate, Zhang Weiying had written an article published on Peking University's official website, in which he criticised the "China Model" (*zhongguo moshi* 中国模式), stating that it led to increased concerns from the West about China (J. Y. Lin & Zhang, 2016). Interestingly, his view are in direct conflict with the official party-line, with Xi Jinping having referred to it as China's "model for other countries to emulate" (see e.g. this article Wildau, 2018) Throughout the debate, Zhang why

[40] Translated from: "我国科技创新基础还不牢，自主创新特别是原创力还不强，关键领域核心技术受制于人的格局没有从根本上改变。只有把核心技术掌握在自己手中，才能真正掌握竞争和发展的主动权，才能从根本上保障国家经济安全、国防安全和其他安全" (Xi, 2014).

[41] Translated from: 我们没有别的选择，非走自主创新道路不可 (Xi, 2014)。

he opposes industrial policy and why externalities and coordination failures does not constitute a legitimate reason to engage in IP (J. Y. Lin & Zhang, 2016).[42] Zhang stresses how Lin's assumptions about market failures are not evidence based, and the two especially agreed about the degree to which neoclassical economics was important tool to (J. Y. Lin & Zhang, 2016)[43]. Lin on the other hand largely followed the arguments of Ha-Joon Chang, whom he also referred to multiple times in the debate (J. Y. Lin & Zhang, 2016). The debate even got personal, when Zhang started criticising Lin personally, leading to Lin answering: "It is unfair, you don't criticize my theory, but instead you add my name" (J. Y. Lin & Zhang, 2016).[44] The role of the state, the role of R&D financing and the role of the SOE's in structural transformation took up large parts of the discussion as well as the need to 'defy' one's current comparative advantage and focus on the 'latent' comparative advantage. A key issue in the debate seemed to relate to how the two professors defined IP at the outset. On the one side, Lin to a large degree talked about the larger, horizontal form of IP, which addresses education, basic research and the need for IP to overcome market failures, while Zhang to a larger degree addressed the micro-level and firm level of IP (J. Y. Lin & Zhang, 2016).

While most Chinese scholars are in favour of MIC2025, there have been some interesting outliers. Most notably, Lou Jiwei, former minister of finance from 2013-2016, has stated that MIC2025 is "a waste of taxpayers' money" and "a lot of talking, but very little was done" (Lo, 2019). Interestingly, this has been against the official policy at the time. The statement by Lou Jiwei could indicate a debate, that may be taking place within the CPC, while not being in public. Finally, a prominent voice against MIC2025 has been Huang Qifan, former mayor of Chongqing. Huang argues that China should no longer rely on large sums of investments, exports or consumption, but should instead focus on better and more stable development.[45] Huang Qifan has been one of the main proponents of a 'tariff-free China', arguing that China should pursue a policy of "zero tariffs, zero subsidies, and zero non-tariff barriers" (*ling guanshui, ling bilei, ling butie* 零关税、零壁垒、零补贴) (Q. Huang, 2019a).

[42] Translated from: 第二点，我为什么反对产业政策；第三点，外部性和协调失灵不构成产业政策的正当性理由；(J. Y. Lin & Zhang, 2016).
[43] Translated from: ”不能把自己从新古典经济学的桎梏中解放出来” (J. Y. Lin & Zhang, 2016).
[44] Translated from: ”不批评我的理论，但是把我的名字加上去是不公平的” (J. Y. Lin & Zhang, 2016).
[45] Translated from: ”主要就是不靠高额的投资拉动、出口拉动、消费拉动，而是更好的、稳稳当当的持续的发展” (Q. Huang, 2019b)

Table 5: Summary of the proponents and opponents of MIC2025 in Chinese literature

Three major proponents of MIC2025/IP in Chinese literature	**Three major opponents of MIC2025/IP in Chinese literature**
Justin Yifu Lin *Key opinion:* All former developing countries used IP policies, and MIC2025 is a	**Zhang Weiying** *Key opinion:* IP does not work, and the 'China Model' scares other Western powers, detrimental to China's rise.
Xi Jinping *Key opinion*: China needs to strengthen its industrial base, and IP is the best way to do so.	**Lou Jiwei** *Key opinion:* MIC2025 is a "*waste of taxpayers' money*" and
Li Keqiang Key opinion: China should utilize MIC2025 to become a technological superpower and should rely on China's talent.	**Huang Qifan** *Key opinion:* former mayor of Chongqing, promoting the "*zero tariffs, zero subsidies, and zero non-tariff barriers*". MIC2025 is not futile.

4.3.3 Sub-conclusion (3)

By investigating the Western and Chinese debate about MIC2025 and IP in general, I have shown that a multifaceted debate exists on why China need MIC2025. The difference in the debate is the degree to which opinions are expressed. In the West, the debate is largely dominated by news media and think tank's that are critical of the policy, and arguments that China would be better off without the policy. In China, on the other hand, it mainly takes the form of positive statements about MIC2025, which rarely deviates from the party line. However, the major Chinese opponents identified, may indicate something about the debate taking place in China. It is clear that there is not a consensus in China's scholarly circles on the merits of MIC2025 and IP in general, such as seen with the debate on IP in the West too.

4.4 How is China implementing MIC2025 and through what IP-instruments?

4.4.1 Overview

China's IP-instruments are highly diverse, ranging from very general, horizontal measures that target entrepreneurship and university enrolment, to vertical efforts that focus on channelling resources to priority industries, or help firms adopt specific technologies (Brandt & Rawski, 2019, p. 2). Before diving into the specificities of these instruments, I initially look at some of the larger strategies China is using in its implementation of MIC2025.

The implementation of MIC2025 takes place at both national and local level, and follows the “1+N” framework, which is often applied by the State Council. In this framework, there is one (“1”) leading document which sets the trajectory of the overarching strategy, and a number of supplementary documents that specify how the policy will be rolled out (“N”) (Zenglein & Holzmann, 2019, p. 29). MIC2025 follows this framework, with the MIC2025 plan at the top, and the eleven supplementary documents (the two special action guidelines, the five project implementation guidelines and the four development guidelines) below.

By the end of 2018, there were more than 445 authoritative documents issued about MIC2025. But these documents also span far beyond MIC2025, and forms a network of intertwined and mutually reinforcing policies and plans, that seek to make China a strong manufacturing superpower (Zenglein & Holzmann, 2019, p. 30). They include the *Belt and Road initiative*, the *Internet Plus* strategy and the *Next Generation Artificial Intelligence Development Plan*. These plans and measures are also closely related with China’s ambitious goals to become a leading country in standard-setting, which is underscored by the consultative work to create the action plan ‘China Standards 2035’ (*zhongguo biaozhun 2035* 中国标准 2035) (Zenglein & Holzmann, 2019, p. 30).

Provinces and municipalities have released their own implementation plans for MIC2025 and the further down the administrative level one go, the more specific the efforts and targets become (Zenglein & Holzmann, 2019, p. 31). For instance, MERICS did a study on the implementation of MIC2025 in China’s Zhejiang province, which showed that at the county-level city (Yuyao) only four of the ten industries were addressed. At the city-level (Ningbo) six industries were included, whereas the province-level (Zhejiang) addressed all ten industries (Zenglein & Holzmann, 2019, p. 31). Such plans allow local governments to both steer regional development and to show Beijing that they are devoted to the successful implementation of MIC2025. Central funding is crucial to the local governments which often compete on funding, and is a key driver of local governments ambitions to implement MIC2025 in line with national priorities (Zenglein & Holzmann, 2019, p. 31). A key concern here, is that this will lead to overcapacities, as seen in other industries such as the solar industry. The government therefore seeks to coordinate MIC2025 centrally, in order to make sure that the comparative advantages of each province/region is used in the most favourable and efficient way (Zenglein & Holzmann, 2019, p. 36).

The national government has also outlined the key tasks that local governments should adhere to. In 2018, the key foci include: 1) developing new financing mechanisms for IP, 2) support establishment of MIC2025 National Demonstration Zones, 3) the establishment of world-class industry clusters, 4) innovations in basic general technologies, 5) establishment of manufacturing innovation centres, 6) fiscal support mechanisms, 7) creating more opportunities for foreign investors (Zenglein & Holzmann, 2019, p. 33). In 2018, the MIIT also released an 'opinion' on the need for establishing key laboratories, with a plan to set up more than 700 of such laboratories by 2025 (Zenglein & Holzmann, 2019, p. 33).

4.4.2 Case Studies on implementation

The above section presented some of the more general ways in which China is implementing MIC2025. In this section I look into the specific IP-instruments that are implemented across three of the ten key industries outlined in MIC2025: 4.4.2.1 Next generation information technology; 0 High-end numerical control machinery and robotics; 4.4.2.3 Energy-saving vehicles and new energy vehicles.

4.4.2.1 Next-generation information technology

The technology companies that operate within the next generation information technology, receive various forms of government support and China combines both private and public funds to support the industry (Rubio, 2017, p. 35). According to the 2019 budget report by the MOF, the government will "*give full play to the leveraging role of government funds in guiding capital and resources toward key areas of strategic importance*" (Ministry of Finance, 2019). For instance, in 2014 the State Council issued the "*Guidelines to Promote the Development of the National Integrated Circuit Industry*" (State Council, 2014). Under this initiative, the National Integrated Circuit Industry Investment Fund (called the 'Big Fund') was established. The fund raised 138.72 billion RMB[46] in its initial round of funding and another 200 billion RMB[47] in its second round (T. Huang, 2019). The fund's largest shareholders are the MOF (36%) and several SOE's including China Development Bank Capital Corporation (22%), China Tobacco (11%), and China Mobile (5%) (T. Huang, 2019). The fund invests in promising semiconductor companies often together with other local government-

[46] Approximately 20.03 billion USD
[47] Approximately 28.88 billion USD

guided funds and private venture capital funds (T. Huang, 2019). The Chinese government also funds and encourages FDI in chip technology companies and China has been heavily engaged in acquiring semiconductor firms in Europe and the U.S. (Bazavan, 2018).

Semiconductors is still mainly the privilege of U.S. companies (Sheehan, 2019). China has felt this with their domestic companies such as Huawei and ZTE, who has been cut off from U.S. semiconductor supplies, highly detrimental to their businesses (Sheehan, 2019). China is therefore highly investing in semiconductors, and top Chinese universities such as Tsinghua has begun producing noticeable research on e.g. new hybrid chips (Sheehan, 2019). China's ministries are also involved in the improvement of the next-generation IT industry. MOST has prioritized IC chips as one of the 13 'transformative' technology projects that need to be met by 2021 (Bazavan, 2018). In November 2017, MOST has named Baidu, Alibaba Group, Tencent Holdings and iFlyTek to be 'champions' of artificial intelligence. Each of these companies has been assigned to lead an AI-related industry: Baidu with self-driving cars, Alibaba with smart cities, Tencent with computer optics, and iFlyTek with medical diagnostics and voice intelligence (Bazavan, 2018). In addition to preferential finance and FDI policies, China offers unbeatable salaries and favourable policies like employer-paid private school for children of employees who choose to work at Chinese semiconductor companies (Ihara, 2019). Taiwan has been concerned that this leads to a brain drain of one of their core competencies, with as many as 3,000 chip engineers (nearly 10% of Taiwan's 40,000 semiconductor design engineers) allocating to China following the favourable policies (Ihara, 2019). While this trend has existed for some years, it has become increasingly accelerated under MIC2025. Roadmap17 has stated that China by 2020 is expected to reach a domestic market share of domestically produced high-performance computers and servers of 60%. Interestingly, in December 2019, a CPC directive ordered state offices to replace foreign PC's and software with domestically produced technology (Yang & Liu, 2019). How strict the CPC's definition of domestically produced PC's and software is remains to be seen. For instance, Lenovo, the Chinese-owned computer company, gets its computer processor chips produced by Intel and its hard drives produced by Samsung (Yang & Liu, 2019). The central government is also seeking to establish advanced industry clusters in high-tech industries, especially those of Next Generation IT, which have taken up a large share of the industrial development focus (Zenglein & Holzmann, 2019, p. 36).

4.4.2.2 High-end numerical control machinery and robotics

Roadmap17 states that companies that contribute to the development, lead the innovation and reach targets in industrial robotics will be rewarded according to their contributions (NMSAC, 2018, p. 57). What rewarded means however, is unclear. There seems however to be a problem with rent-seeking industrial robotics companies, that only seek to receive government subsidies, without making a profit. Investments in industrial robotics are rising on a provincial level too. Guangdong province has announced plans to invest 65.5 billion USD in emerging industries including robotics in 2020. This also covers the opening of a 430,000 square foot factory in Foshan, with an estimated annual production of 10,000 robots (Rubio, 2017, p. 52). Midea Group, a Chinese electrical appliance manufacturer, is currently planning construction of a 8.6 million square foot industrial estate, with an estimated annual production capacity of 75,000 industrial robots by 2024 (Rubio, 2017, p. 53). The German robotics company, Kuka, which was bought by the Chinese robot producer Midea Group in 2016, exemplifies well the Chinese intention to engage in outwards FDI to support its domestic industries and support knowledge spill overs. However, the robotics industry also entail a high danger for glutting in subsidies or overcapacity (Wübbeke et al., 2016, p. 48). It is also estimated, that if government subsidies were removed, a number of the companies currently operating in industrial robotics would go bankrupt or not be profitable (Wübbeke et al., 2016, p. 48). These companies are thus being 'kept alive' through government policies, and do not align with the 'live and let die principle'.

4.4.2.3 Energy-saving vehicles and new energy vehicles

In NEV's, Chinese government likewise has an important role to play. The IP-instruments targets not only the cars themselves, but also batteries and other key components needed for the success of the industry. As the NEV industry is very capital-intensive and companies need a high R&D intensity to develop and innovate new products, it requires large injections of financing, which most small companies lack. The government is therefore highly important as a financer. Both manufacturers and producers have received subsidies in an effort to create an initial demand for the NEV industry in China, with subsidies accounting for as much as 100,000 RMB[48] (Clover, 2017). The instruments employed by the government includes restricting the number of traditional car license plates to be issued in major cities, tax breaks for companies, and favourable infrastructure policies. Starting in 2019, China now requires traditional car-makers to meet quotas for battery-powered cars which have pushed traditional car-makers to enter the NEV industry to meet policy targets (European

[48] Approximately 15,000 USD

Commission, 2019, p. 96). The Chinese government has also used government procurement policy to stimulate demand. The Chinese government required that 50 & of public vehicles purchases should be NEVs in February 2016. Chinese government procure up to 42% of NEV's. In addition to this Roadmap17 has set goals to Increase support for research of critical core technologies, and support creation of NEV technology innovation alliance. R&D funding been important part of NEV funding, together with the implementation of "pilot demonstration projects", "pilot cities" and "national demonstration zones" (NDZ's). These are seen as key drivers to introduce new technology into the Chinese economy. Since 2015, more than 4000 projects have been officially announced, and a total of 31 pilot cities have been established (Zenglein & Holzmann, 2019, pp. 34–35). Especially NDZ's are important, because they constitute the best-practices for integrating MIC2025 into the local environment (Zenglein & Holzmann, 2019, p. 34). This learning-process is highly important to the NEV-industry.

4.4.3 Sub-conclusion (4)

In the analysis of the IP-instruments I found that MIC2025 combines both vertical and horizontal IP-instruments across the three industries. I have found that MIC2025 deploys policy instruments such as tax breaks, subsidies (for both manufacturers and buyers), R&D funding, R&D subsidies, government procurement policies, provision of infrastructure, among some of their instruments. These policies often seek to stimulate demand or encourage consumption. The instruments have been summarized in appendix 8.2.

4.5 How effective has MIC2025 been since its inauguration in 2015 until 2019?

4.5.1 Overview

Prior to any assessment of the effectiveness/success of MIC2025, it should be acknowledged that we are still early on in the implementation of MIC2025, and therefore definitive and generalizable conclusions about the effectiveness of MIC2025 are difficult. Further complicating the process of assessing MIC2025, is the nature of the objectives and policies of MIC2025. The objectives tend to fluctuate between being exceedingly detailed and highly aggregated (Zenglein & Holzmann, 2019, p. 21). This means that the progress assessments will vary significantly depending on what parameters and individual industries are included in the assessment (Zenglein & Holzmann, 2019, p. 21). This does not mean, however, that it is impossible to analyse certain effects in specific industries. Now, four and a half years since MIC2025 was introduced, analysing changes in key objectives related to MIC2025 on an industry-level may be able to give indications about the larger effectiveness of MIC2025. As seen in section 4.3, many of the industries are targeted with similar IP-instruments and face similar challenges. Therefore, a deep dive into three of the industries, will also give a glimpse into the larger picture of the potential effectiveness of MIC2025. To conclude something about MIC2025 on a larger scale, the industries have to be comparable and representative of MIC2025 as a whole. Therefore, the data is to the largest degree possible dealing with the same years, and the same measurements (e.g. 'market shares', 'production capacity', 'number players domestically or internationally' etc.) across the three industries. In the following, I analyse statistical evidence, which is mainly based on reports from Chinese industry associations and consultancies. Data access have been very restricted especially on domestic measures, and therefore some measures are missing.

4.5.2 Case studies on outcomes

4.5.2.1 Next-generation information technology

The development of a domestic semiconductor industry and information technology are key areas in MIC2025. In 2015, China accounted for just 4% of global semiconductor production, while U.S accounted for nearly 50% (Bazavan, 2018). The question is now whether China is on the road to a stronger semiconductor industry or if the attempts to upscale remain futile. The following tables show the goals and objectives as outlined by Roadmap17, as well as China's position in these measures in 2015 and 2019. Goals such as "*create a safe and reliable IC industry with advanced technology by 2020*" has been excluded from the analysis as I have chosen to focus on the quantitative measures:

Table 6: Targets and actual outcomes for next-generation information technology

Horizontal: Year, goals and targets **Vertical:** Indicator	**2015 Actual**	**2019* Actual *or most recent data**	**2020 goal (as of Roadmap17)**	**2025 goal as of Roadmap17**
Domestic production of integrated circuits of the domestic consumption	12.7%	15%	40%	70%
Yearly IC industry sales growth	19.7%	**2018:** 20%	20%	-
Domestic production of mobile terminals	-	-	Domestic market share: 75% International market share: 35%	-

Domestic production of mobile terminal chips	-	-	Domestic market share: 35% International market share: 25%	-
Domestically produced high-performance computers and servers	-	-	Domestic market share: 60% International market share: 15%	-
Domestically produced basic software market share	-	-	Domestic market share: 50% International market share: 20%	-
Domestic production of mobile telecommunication system equipment	-	-	Domestic market share: 75% International market share: 30%	-
China's share of total global semiconductor sales	42%	48%	-	-

Note on data: Data collected based on (Statista, 2018).

There are a few interesting things to notice from the above data. First, there are clear indications of some sort of industrial development taking place. While China may be unlikely to fulfil its target of having a 70% self-sufficiency rate in IC any time soon, the domestic production of IC is still expected to rise, and China's companies share of both domestic and international consumption will most likely rise too. If China's other industries covered under MIC2025 also see considerable growth, they may be able to absorb some of the semiconductors and thus avoid oversupply as seen in other industries.

4.5.2.2 High-end numerical control machinery and robotics

As seen during the analysis of IP-instruments, industrial robotics receive more political support than many other manufacturing technologies in China (Wübbeke et al., 2016, p. 43). In 2014, China's annual shipments of multipurpose industrial robots stood at 57,096 units. By 2017, it had reached 137,920 units – more than doubling over three years (Statista Research Department, 2019c). In terms of robotic units installed, China was the largest installer in 2017, with a total of 138,000 installations, threefold the 46,000 installed in Japan which was the second largest that year (Rubio, 2017, p. 52). While China's growth is impressive, it still lacks behind developed countries on robots-per-worker, where e.g. South Korea (710 per 10,000) and Japan (308 per 10,000) are ahead compared to China's 97 per 10,000 as of 2017.

Table 7: Targets and actual outcomes for high-end numerical control machinery and robotics

Horizontal: Year, goals and targets **Vertical:** Indicator	**2015 Actual**	**Actual 2019 (or most recent data)**	**2020 goal (as of Roadmap 17)**	**2025 goal as of Roadmap17**
▪ High-end computerized numerical control machine tools	-	-	70%	80%

and basic manufacturing equipment % of the domestic market				
▪ Spindles, screws, rails, and other medium- to high-grade component capability % of domestic market share.	-	-	50%	80%
▪ Indigenous brands of industrial robots % market share for the domestic market (NMSAC, 2018, p. 57).	-	-	50%	70%
▪ Domestically produced critical components % of the domestic market (NMSAC, 2018, p. 57).	-	-	50%	70%
▪ Product MTBF	-	-	80,000 hours	Reach international levels
▪ Companies with yearly production above 10,000 units	-	-	2-3 companies	1-2 companies in world top 5
Industrial robotics industry clusters.	-	-	5-8 clusters	-
Production volume of industrial robots (in units)	*33,000*	*147,000*	-	-

Note on data: Sales volume data from: (Statista Research Department, 2019b; Till Bunsen et al., 2019); fuel cell cars data from: (Till Bunsen et al., 2019, p. 34); fuel consumption data from: (Columbia University, 2019).

4.5.2.3 Energy-saving vehicles and new energy vehicles

New energy vehicles (NEV) has grown rapidly under the wings of MIC2025. In 2018, annual sales volume of the NEV's reached 1.255 million, compared to 331,092 in 2015 corresponding to a CAGR of 55.9 percent[49] (Statista Research Department, 2019b). According to the Global Energy Vehicle Outlook 2019, China's stock of 2.3 million electric cars accounts for nearly half of the total electric cars in the world, with the U.S accounting for less than half of China's stock (1.1 million) (Till Bunsen et al., 2019). In addition to the NEV industry, China has been powering up its battery industry for global competition. In 2017 seven out of the global top ten battery manufacturers were Chinese (Holzmann, 2018). Among the biggest are CATL, with a global share of 19% and BYD with a global market share of 17% (Holzmann, 2018). I have compiled the most important (of the accessible) indicators in the table below:

[49] Calculated as: (1,255,000/331,092)^(1/3)-1 = 0,559 (Statista Research Department, 2019b)

Table 8: Targets and actual outcomes for energy-saving vehicles and new energy vehicles

Horizontal: Year, goals and targets **Vertical:** Indicator	**2015 Actual**	**Actual 2019 (or most recent data)**	**2020 goal (as of Roadmap17)**	**2025 goal as of Roadmap17**
Sales volumes in units of NEV	0.331 million	**2018:** 1.25 million	2 million	3 million
Number of popular car types that enter into the top 10 of global sales	-	**2018:** (of Plug-in electric vehicles):	Have 'popular models' with sales ranking in global top 10	Have two carmakers' volumes in the global top 10
Average fuel consumption of passenger-use vehicles	2015: 7L/100 km	**2018:** 5.8L/100 km	5L/100 km	4L/100 km
MTBF vehicle mileage	-	-	20,000 km	-
Increase production volume of fuel cell cars	**Stock:** 560 units	-	1000 units	-

Note on data: Sales volume data from: (Statista Research Department, 2019b; Till Bunsen et al., 2019); Fuel cell cars data from: (Till Bunsen et al., 2019, p. 34); Fuel consumption data from: (Columbia University, 2019). Other data from:

Interestingly, there seems to be a discrepancy between the quantitative goals set by the government, and the principle to led the "market lead, and the government guide" (*shichang zhudao, zhengfu yindao* 市场主导、政府引导) as stated in MIC2025 (State Council, 2015). Roadmap15 initially stated that the goal of 2020 should be to have sales volumes of NEV's at 1 million, however this was updated to 2 million in Roadmap17. If the original goal of 1 million were still valid, they would have exceeded it by 250,000 a year in advance. In 2018, China had four out of the top ten models of global plug-in electric vehicles. While Tesla's Model 3 by far were the biggest (with 145,850 units sold), the Chinese Chinese automobile manufacturer BYD's models such as BYD Qin PHEV (with 47,450 units sold) and BYD e5 (with 46,500 units sold) were all found in the top ten (Statista Research Department, 2019a).

It is estimated that China's NEV industry will reach 1.67 million by 2019. However, the NEV sales has been slowing in recent months. According to the China Association of Automobile Manufacturers, the NEV sales saw a decline of 34.2 percent in September 2019 compared to September 2018 (China Association of Automobile Manufacturers, 2019). This was the third consecutive month of decreases in sales year-on-year (Shepherd, 2019). Strong policy support in the form of subsidies has sparked production of cheap, low-quality electric cars, but the government is now cutting subsidies, in an attempt to raise the quality of the cars (Shepherd, 2019). In 2017, the subsidies amounted to 22bn

RMB[50] according to MIIT data, with China's BYD receiving 3.6bn of those (Shepherd, 2019). It is estimated that between 2009-2017, cumulative government support for the NEV industry reached 58.8bn USD (Rubio, 2017, p. 31). The government hopes that cutting subsidies will force consolidation in the market, and lead to enhanced technical capabilities and optimal pricing strategies of the firms (Shepherd, 2019). According to IP theory, for infant industry protection to be justified, the industry should be able to sustain itself *after* government support is removed. The question then remains whether the heavy government support will lead to oversupply, or whether the NEV industry can survive when subsidies are removed, especially when consumer demand is slowing, as a consequence of decelerating GDP growth.

4.5.3 Sub-conclusion (5)

China's IP plans, such as MIC2025 are not irrelevant. While the targets and objectives are not necessarily met, the plans constitute an extremely important mobilising factor for capital and resources, which is mainly achieved through state-banks and government-guided funds. However, the fact that the objectives such as increased domestic market share and sales records have been met or even exceeded, does not necessarily equal increased capabilities in technological advancement or innovation. It seems that there is an inherent discrepancy between MIC2025 and Roadmap17's quantitative goals and MIC2025's principle of putting 'quality first'.

5 Future Research and perspective

While this thesis has provided detailed insights into China's motivation for and implementation of MIC2025, as well as its effectiveness across the three industries, it has also opened up for a number of related questions. For instance, this thesis has only to some extent dealt with the geopolitical implications in terms of MIC2025's potential to spill into other areas such as international relations and security politics. While think tanks and news media are heavily engaged in such debate, evidence-based academic studies are still scarce. The whole FDI perspective of MIC2025, has only to some extent been described, and opens up for questions such as why and how China engage in outwards FDI, not only on a value basis, but also on a strategic, company-level. What happens to the ownership structure, and how mixed-ownership reforms (SOE-private integration) will influence companies and competitiveness are key related questions that are still seldomly studied.

[50] Approximately 3.38 billion USD.

Furthermore, future research would be able to support and elaborate on related findings of this thesis, by conducting interviews with officials involved in the policymaking of MIC2025. This opens up for a number of questions, such as what the relationship between policy formulation at state-level, and the policy implementation at local level looks like, and may give further insights into the challenges and opportunities of MIC2025. One way of organizing such a research project, could be to develop a typology of how local MIC2025-policies are implemented across provinces and compare those to the state-level (national) plans.

6 Conclusion

This thesis has investigated China's industrial policy (IP) plan *Made in China 2025* (MIC2025). Through a disciplined interpretive case study of MIC2025, it has explored the industries, actors, objectives and targets of the plan, the key factors that have led to the emergence of the plan and the IP instruments employed in its implementation. A multiple case-study of three of the ten key industries covered under MIC2025, has been conducted to give insights into how the plan is implemented at the industry-level and the outcomes observed across the three industries between 2015 and 2019. This approach was taken to answer the principal research question for this study:

What is MIC2025, and what are some of the key factors that led to the emergence of MIC2025? Why is it necessary for China to pursue MIC2025 from a Western (external) and Chinese (internal) perspective, how is MIC2025 implemented, and to what extent can we conclude on the efficacy of MIC2025 between 2015 and 2019?

To answer the principal research question, the thesis structured the analytical sections around five sub-ordinate research questions.

The first sub-ordinate question asked: *(1) What is MIC2025, its key contents and actors*? Here it was concluded that MIC2025 is a comprehensive IP plan, which focus on 10 key industries, in which China aims to become a technological leader. The plan has three phases and set objectives and goals for 2025, 2035 and 2049, the year by which China should reach global leadership in technological innovation. The plan differs from prior Chinese IP plans in both scope (focusing on the whole manufacturing process) and scale (CDB alone has pledged 300 billion RMB[51], and more than 1,600 government-guided funds with an estimated 3 trillion RMB[52] has been established). MIC2025 involves a large number of various ministerial and supporting actors, the most important being the CSMLSG, the CAE, the MIIT, and the NDRC (see IV for abbreviations). However, bottom-up dynamics remain weak. Today, it seems MIC2025 has entered a 'stealth mode' phase, where the official rhetoric around the plan has changed. However, it seems that such discussion has diverted to other fora, and the ambition to pursue MIC2025 remains.

The second sub-ordinate question asked: *What are some of the key factors that led to the emergence of MIC2025*? Through analysing China's economic, demographic and trade environment, domestic, regional and global factors were identified. The key domestic factors were identified to include (i) moving away from the image as the 'worlds factory', (ii) escaping the middle-income trap, (iii) demographic changes, (iv) reducing reliance on foreign suppliers and (v) gaining legitimacy through sustained economic growth. The key regional factors were identified to include (vi) increased regional competition and (vii) a surge in Asian IP plans. The key global factors were identified to include (viii) a high dependency on imports, (ix) the fourth industrial revolution, (x) global competition and (xi) China's position in global value chains. The list of the identified factors were summarized in a table (see section 4.2.5) listed by the identified key factors, a description of the factor, how MIC2025 seeks to respond to the factor, and which industries were deemed as most relevant to address the factor.

The third sub-ordinate question asked: *Why is it necessary for China to initiate MIC2025 from a Western (external) and Chinese (internal) perspective?* By investigating the debates in China's scholarly circles (especially the debate between Justin Yifu Lin and Zhang Weiying), I have shown that the debate in China, which from an outside perspective may seem homogeneous and aligned on pursuing MIC2025, is in fact highly diverse with differing views on the degree to which the state should engage in IP. The main arguments revolved around the need to 'defy' one's current comparative advantage and focus on the 'latent' comparative advantage. While this debate has been important, China is still at large a planned economy with tremendous power coming from the CPC, and officials are expected to adhere to the 'party-line'. The prospect of such debates leading to noteworthy changes in policy is thus limited.

[51] Approximately 46.1 billions USD.
[52] Approximately 461.5 billion USD.

The fourth sub-ordinate question asked: *How is China implementing MIC2025, and through what IP-instruments?* Here I conducted a multiple case-study on three of the ten key industries covered under MIC2025, namely next-generation IT; high-end numerical and control machinery and robotics; energy-saving vehicles and new energy vehicles. It was found that MIC2025 combines a range of highly diverse horizontal and vertical IP-instruments in its implementation, and that especially government-guided funds, SOE's and large state-owned banks are important actors of the plan. It also revealed that some overlap exists between the policy instruments applied across industries, while others are industry specific.

The fifth sub-ordinate question asked: *How effective has MIC2025 been since its inauguration in 2015 until 2019?* Here it was concluded that the nature of MIC2025 and Roadmap17 makes it very difficult to reach anything conclusive about the effectiveness or efficacy of MIC2025. However, it was found that the outcomes observed across the three industries to a high degree are in line with (or even exceed) the objectives and targets set under MIC2025 as of 2019. In line with the theory on IP, omitted variables may further complicate inference of causality. It therefore still remains to be seen how effective MIC2025 will be in the future.

At a more general level, the thesis has contributed to the understanding of how IP is made in emerging economies, and what characterises such policies. MIC2025 has exemplified the increasing complexity found in IP-making today and underscores the increasing role of global value chains and the fourth industrial revolution on IP-formulation in emerging economies today.

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8 Appendices

8.1 Overview of the IP-instruments based on (Naudé, 2010)

Economic Signals and Incentives

- Intellectual Property
- Price regulations
- Exchange rate policy (e.g. undervaluation)
- Monetary (interest rate) policy
- Countercyclical fiscal policy
- Tax breaks

Scientific and technological innovation

- Scientific policies
- High-tech lead projects
- Funding of university research
- Establishment of research centers
- R&D subsidies and or tax credits

Learning and Improving technological capabilities

- Education and training policies
- Foresight exercises (to identify national research priorities)
- Labor training subsidies and/or tax breaks.
- Skills formation and upgrading schemes
- International educational and research collaboration
- Incentives for foreign direct investment

Selective Industry Support

- Impose tariffs and/or quotas
- Provide export subsidies/credit/support
- Establish special economic zones
- Use of state-owned enterprises/privatization
- Create public utilities providing inputs (e.g., electricity)
- Directed finance/subsidies
- Provide public guarantees
- Direct state procurement policy

Selection mechanism

- Entry and exit regulations for firms 'Live and let die' principle (political will to end support to failing firms)
- Introduce anti-trust and competition policy
- Support national trading companies
- Preferential access to finance
- Long-term development finance

Distribution of information

- Collective action mechanisms
- Promotion of standards
- Use of consultative forums
- Use of business chambers
- Encouraging firm cooperation/firm linkages
- Marketing of export industries
- Dissemination of successful experiences

Improving productivity of firms and entrepreneurs

- Providing or subsidizing management training
- Firm (SME) monitoring and assistance
- Infrastructure, funding and management for incubators and cluster formation
- Promotion of public-private partnerships
- Location marketing and enhancement Upgrading of economic infrastructure
- Creation of venture capital funds

8.2 Objectives and targets of MIC2025

Objectives and targets of MIC2025 based on the summary of Roadmap15 done by U.S. Chamber of Commerce (2017, pp. 65–80). Compiled and updated by author based on own translation according to the new goals set out in Roadmap17 (NMSAC, 2018).

Industry	2020 goals	2025 goals, unless stated "2030"	Strategic support and guarantee
Next-generation information technology	▪ Minimize the gap between Chinese IC industry and international levels. ▪ Reach yearly IC industry sales growth of 20% ▪ 16/14nm IC chips to reach scale production ▪ Create a safe and reliable IC industry with advanced technology. ▪ Domestic production (not including Taiwanese companies) of mobile telecommunication system equipment, mobile terminals, mobile terminal chips to reach 75%, 75%, and 35%, respectively, of the domestic market, international market share is expected to be 35%, 25%, and 15% respectively. ▪ Domestic production of routers and switches is expected to reach 20% international market share. ▪ International market share for domestically produced high-performance computers and servers will reach 30%, and the domestic market share will reach 60%. ▪ Domestically produced basic software to reach 50% market share	▪ 2030: IC industry chain to reach advanced international levels. ▪ Domestic production of mobile telecommunication system equipment, mobile terminals, mobile terminal chips to reach 80%, 80%, and 40%, respectively, of the domestic market ▪ Domestic production of mobile telecommunication system equipment, mobile terminals, mobile terminal chips international market share is expected to be 40%, 45%, and 20% respectively. ▪ Domestic production of optical communication equipment expected to reach 60% market share. ▪ International market share for domestically produced high-performance computers and servers will reach 40%, and the domestic market share will reach 80%. ▪ Domestically made high-end servers will exceed 50% of the domestic market ▪ Use of domestically produced branded servers for CPUs reach above 30% of the domestic market ▪ "Internet Plus" smart industrial cloud has usage rates exceeding 60% market share in major industries.	▪ Expand the scale of the National IC Industry Investment Fund ▪ Strengthen policy and resource coordination ▪ Encourage strong companies to lead setting international standards. ▪ Establish national testing and a standards certification system for operating systems and industrial software. ▪ Encourage strong companies to lead setting international standards. ▪ Establish national testing and a standards certification system for operating systems and industrial software. ▪ Establish a national laboratory for core informational equipment for smart manufacturing.
High-end numerical control machinery and robotics	▪ High-end computerized numerical control machine tools and basic manufacturing equipment to exceed 70% of the domestic market ▪ Computerized numerical control system standard and intelligence to reach 60% and 10% of the domestic market share, respectively ▪ Spindles, screws, rails, and other medium- to	▪ High-end computerized numerical control machine tools and basic manufacturing equipment to exceed 80% of the domestic market ▪ Computerized numerical control system standard and intelligence to reach 80% and 30% of the domestic market share, respectively, ▪ Spindles, screws, rails, and other medium- to high-	▪ Create national innovation centres for advanced industrial design and CNC machine tools. ▪ Prepare a plan for robotics that supports and promotes the indigenous innovation

	high-grade component capability to reach 50% of domestic market share. ▪ Indigenous brands of industrial robots to reach 50% market share for the domestic market (NMSAC, 2018, p. 57). ▪ Domestically produced critical components to reach 50% of the domestic market (NMSAC, 2018, p. 57). ▪ Product MTBF to reach 80,000 hours ▪ Develop 2-3 companies with yearly production above 10,000 units ▪ Create 5-8 robotics industry clusters.	grade component capability to reach 80% of domestic market share. ▪ Indigenous industrial robotic brands to reach over 70% market share domestically (NMSAC, 2018, p. 57). ▪ Domestically produced core components to reach 70% market share domestically (NMSAC, 2018, p. 57). ▪ Main technical indicators for products to reach foreign levels, and MTBF to reach internationally advanced levels ▪ have 1-2 companies enter the top 5 companies.	capabilities of robotics and establishes indigenous brands. ▪ Companies that help lead, contribute breakthroughs, or reach targets will be rewarded. ▪ Innovation and testing centres will also be created to promote certification of reliable and safe robots.
Aerospace and aviation equipment	▪ Operating revenues for the civil aircraft industry will exceed RMB 100 billion; ▪ Complete development, production, and delivery of 150-seat single-aisle main-line aircraft; ▪ Main-line aircraft delivery should be above 5% of the total domestic market, ▪ Turboprop branch-line airplane delivery should be 5-10% of the total international market, ▪ General airplane and helicopter delivery to reach 20% and 10% of the international market. ▪ Complete a CJ-1000A model; ▪ Complete a 1,000kgf level turbofan and a 1,000kW level turbofan demonstration and development model; ▪ Establish a long-term, stable, high-quality, and trustworthy aviation material and component supporting system and complete industrial chain. ▪ reach a self- sufficient rate of over 60% for special information applications and form a more perfected satellite application industry chain. ▪	▪ Operating revenues for the civil aircraft industry will exceed RMB 200 billion; ▪ Complete development, production, and delivery of 280-seat double-aisle main-line aircraft; ▪ Main-line aircraft delivery should be above 10% of the total domestic market, ▪ Turboprop branch-line airplane delivery should be 10-20% of the total international market, ▪ General airplane and helicopter delivery to reach 40% and 15% of the international market. ▪ Commercial service of the CJ-1000A; ▪ Complete airworthiness certification for the 1,000kgf level turbofan, the 1,000kW level turbofan, and other major products; ▪ complete model development of the 5,000kW level turboprop. ▪ Achieve the first indigenously developed advanced large-scale civil turbofan for domestic commercial service ▪ Achieve 30% market share domestically for regional aircraft airborne products; ▪ General aircraft airborne products to have 50% market share ▪ Realize self-sufficiency of aircraft material and components.	▪ Formulate an airplane development plan and accompanying policies to increase the promotion of domestic production of the airplane industry. ▪ Carry out special supportive policies for domestic production of special equipment R&D. ▪ Promote the development of indigenously innovated aviation engines. ▪ Establish a national laboratory for airborne equipment and systems. ▪

Maritime engineering equipment and high-tech maritime vessel manufacturing	▪ Indigenous design and construction of maritime construction equipment and high-tech ships to reach 35% and 40% of the international market, respectively; ▪ marine construction equipment and high-tech ship critical system and equipment to reach 40% and 60%, respectively, self-supporting rate; ▪ Form the R&D base for domestic offshore oil exploration equipment technology; ▪ Basically, achieve self-supporting ability for core equipment for marine engineering below-water equipment as well as for 500 meter below-water production systems and specialized system production and testing capability	▪ Have more than 5 internally recognized manufacturing companies, and some areas be international leaders in design and manufacturing; ▪ Indigenous research, design, and construction of main marine construction equipment and high-tech ships to reach 40% and 50% domestic market share, respectively; ▪ Self-supporting rate for core systems and equipment to reach 50% and 80%, respectively; ▪ Realize complete self- supporting ability for core equipment for marine engineering above water equipment as well as for 1,500 meter below-water production systems and specialized system production and testing capability, ▪ Have production capability for extraction equipment for marine mineral resources and national gas hydrate, wave/tidal energy and other marine renewable resource development equipment	▪ Speed up the construction of indigenous innovation capabilities for deep ocean construction equipment.
Advanced rail equipment	▪ Research capabilities for rail transportation equipment and leading products to reach internally advanced levels, ▪ Industry sales to exceed RMB 650 billion, ▪ Overseas business to account for over 30% of total sales, and the service industry to account for over 15% ▪ Major products to enter the EU, U.S., and other developed markets.	▪ China is to form a complete rail transportation equipment manufacturing industry, possessing an innovation system that has continuous innovation, ▪ In main areas promotes smart manufacturing, main products reaching internationally advanced levels ▪ Overseas business to account for 40% and the service industry to account for over 20%, ▪ Leading revisions to international standards, ▪ Construct an internationally leading modern rail transport equipment industry system, and accounting for the high-end global industry chain.	
Energy-saving vehicles and new energy vehicles	▪ By 2020, form market-driven, enterprise-focused and research-based energy-efficient vehicle manufacturing system. ▪ Indigenous products should reach 40% of the market; ▪ Fuel consumption standards for new commercial-use vehicles should be close to advanced	▪ Form new independent and controllable energy-efficient vehicle industrial chain, ▪ Indigenous products to reach 50% of the market; ▪ Fuel consumption standards for commercial- use vehicles to reach advanced international standards, ▪ Domestically produced key parts should surpass 80% of the market;	▪ Increase support for research of critical core technologies, ▪ Support creation of NEV technology innovation alliance, ▪ Set up a common technology platform for industry.

	international standards, ▪ Domestically produced key parts should surpass 70% of the market; ▪ Average fuel consumption of passenger-use vehicles should be better than 5L/100km, ▪ Domestically produced key parts should surpass 50% of the market; ▪ Have popular car types and popular car companies ▪ 5 enterprises with sales of energy-efficient vehicles in the top 10. ▪ Indigenous products pp100 quality standard is equal to that of joint venture branded products. ▪ Indigenous NEV annual production should exceed 1 million units (2 million according to Roadmap17) ▪ Have more than 70% of the market; ▪ produce popular car types that enter into the top 10 of global sales, ▪ NEV passenger vehicles exports should achieve economies of scale, ▪ MTBF vehicle mileage to reach 20,000 km; ▪ Power battery, motor, and other critical system should be at advanced international levels and should have 80% of the Chinese market.	▪ Average fuel consumption of passenger-use vehicles should be better than 4L/100km, ▪ Domestically produced key parts should surpass 60% of the market; ▪ 3 enterprises with sales of energy-efficient vehicles in the top 5, ▪ Indigenous key products to reach 60% or the market, have energy-efficient commercial vehicles that have internationally advanced levels. ▪ 3 million annual production of NEVs on par with advanced international standards (NMSAC, 2018). ▪ Indigenous NEVs to reach over 90% of the market; ▪ Product technology standards should be on par with global standards, ▪ Have 2 NEV enterprises that are in top 10 of global sales of first- class car companies, ▪ Foreign sales should be 10% of total sales;	▪ Increase infrastructure for battery charging stations and hydrogen refuelling stations. ▪ Create cooperative development mechanism for NEV and smart car, smart grid, smart cities infrastructure, as well as coordinated development mechanism for critical parts and materials. ▪ Establishment of a national smart car common technology research institute and innovation centre ▪ Perfect the legal and regulatory system related to smart cars.
Electrical equipment	▪ Advanced power equipment industry scale to reach 100 million kW annually, ▪ Overall technical levels to reach internationally advanced levels, enter into ranks of global leaders. ▪ Domestically produced power equipment to reach 90% of the domestic market, and the proportion of exports to reach 30% of annual production. ▪ Power transmission output value to reach RMB 2.2 billion; ▪ Domestically produced key parts to reach 80% or	▪ Create 3 global enterprises with capital, scale, technology, quality, brand advantages, and core competiveness. ▪ Have indigenous IP for new energy and renewable energy equipment and energy storage devices to have over 80% of the market. ▪ Power transmission output value reach RMB 3 billion; ▪ Create a China-led international standard system for ultra-high voltage power transmission complete equipment; ▪ Domestic production of key parts reaches 90% or	

	more of the domestic market; ▪ Power transmission complete equipment export proportion over 20%; ▪ Ultra-high voltage power transmission technology is a global leader, enter into ranks of global powerhouses.	more of the domestic market; ▪ Power transmission complete equipment export proportion over 25%; ▪ Product reliability and technological specifications to reach international advanced levels.	
Agricultural machinery and equipment	▪ Agricultural machinery industry total output value to reach RMB 600 billion, ▪ Domestic production of agricultural machinery products to reach over 90% of the market, ▪ Large- scale tractors with over 200 horsepower, cotton picker machines, and other high-end products are about 30% of market. ▪ Industrialize variable application technology, effective use of fertilizer and pesticide reaches 40%. ▪ Control core parts manufacturing and reliable key technologies, ▪ MTBF for tractors and combine harvesters increased to 250 hours and 60 hours respectively.	▪ A full range of agricultural equipment for the production of bulk grain and strategic economic crops, a clear increase in agricultural equipment information collection ▪ Intelligent decision-making, and precision work, and create a plan for the informatization of agricultural production. ▪ Agricultural machinery industry total output value reaches RMB 800 billion, ▪ Domestic production of agricultural machinery products to reach over 95% of the market, ▪ Large-scale tractors with over 200 horsepower, cotton picker machines, and other high-end products are about 60% of market. ▪ Smart seeding and fertilizing, plant protection, harvesting machinery, effective use of fertilizer and pesticide reaches more 50%. ▪ Comprehensively grasp core equipment manufacturing and machine reliability of key technologies, ▪ MTBF for tractors and combine harvesters increased to 350 hours and 100 hours respectively.	
New materials	▪ Reach effective control over the entire scale of the basic material industry, ▪ See initial results from adjustment to the industry structure, ▪ Achieve self-sufficiency of advanced basic materials and form some export capability. ▪ Achieve industrialization and application demonstration for over 30 kinds of critical strategic materials.	▪ Industry structure is noticeably adjusted, ▪ Adjustment to basic material products achieves upgrades and replacements ▪ Have over 90% of the domestic market. ▪ Basically, solve the problem of restrictions on strategic materials for important areas of high-end manufacturing, ▪ Critical strategic materials have over 85% of domestic market.	

	▪ Effectively resolve urgent needs in next generation information technology, high-end equipment manufacturing, and other strategic emerging industries, ▪ Critical strategic materials exceed 70% of domestic market; ▪ Begin to create joint upstream and downstream innovation of strategic new materials, ▪ Accumulate a number of cutting-edge core technology patents, ▪ Some products achieve scale production, ▪ Achieve application demonstration in key areas.	▪ Some products enter into global supply system, key varieties fill the domestic void, achieve an indigenous IP system. ▪ Achieve effective layout of cutting-edge materials technology, standards and patents; ▪ Cutting-edge materials achieve important breakthrough and achieves applications of scale, some areas achieve global leading standards.	
Biomedicine and high-performance medical devices	▪ Promote a large number of enterprises to achieve drug quality standards and systems that are in line with international standards, ▪ At least 100 pharmaceutical enterprises obtain U.S., EU, Japanese, World Health Organization authentication and achieve product export; ▪ According to international drug standards, develop and promote 10-20 chemical drugs and high-end drugs, ▪ 3-5 new traditional Chinese medicines, ▪ 3-5 new biotech drugs complete drug registration in Europe, U.S. and other developed nations, ▪ Speed up the development of internationalization of domestically produced drugs. ▪ Before 2020 when international patents for blockbuster drugs expire, achieve over 90% generic production. ▪ Achieve breakthroughs for 10-15 important core and critical technologies; begin to establish national drug innovation system and innovation team. ▪ Annual manufacturing scale of high-performance medical devices reaches 600 billion; ▪ County-level hospitals domestically produced mid- and high-level medical equipment reach a	▪ By 2025, basically achieve drug quality standards and systems that are in line with international standards; ▪ Develop chemical drugs, traditional Chinese medicine, biotech drugs focused on 10 major diseases, ▪ Achieve industrialization of 20-30 innovative new drugs; ▪ 5-10 drugs with indigenous property rights receive U.S. Food and Drug Administration or EU authentication, and enter the international market; ▪ Construct, improve, and support the national drug innovation system for external services, form of high-level innovation team with an international perspective, ▪ Promote China's drug internationalization development strategy. ▪ Annual manufacturing scale of high-end medical device reaches 1.2 trillion; ▪ County-level hospitals domestically produced mid- and high-level medical equipment reach a 70% rate; ▪ Domestic production of core parts reaches 80% of the domestic market; ▪ Build 10 or more platforms and joint innovation centres for construction of scientific and	

	50% rate; ▪ Domestic production of core high-end medical device parts reaches 60% of the domestic market; ▪ Build 5 or more platforms and joint innovation centres for construction of scientific and technological achievements; ▪ Form 20 demonstration and application bases; ▪ Form 3 or more internationally recognized brands.	technological achievements; ▪ Form 6 province-level industrial clusters with output value of hundreds of billions of RMB; ▪ Form 30 demonstration and application bases; ▪ In all major product areas form 5 or more internationally recognized brands.	

8.3 IP's of the 'four tigers':

Taiwan	In the 1950s and 1960s, the IP of the Taiwanese government mainly focused on the labour-intensive light industries (Nolan, 2001, p. 12). In that period, import-substitution and export promotion were the main policy instruments adopted. In the 1970s the government turned to more heavy industry, such as steel, oil refining, shipbuilding and electricity generation (Nolan, 2001, p. 12). The government extensively operated vital upstream industries and through the use of different IP-instruments such as import controls, tariffs, local content requirements, entry requirements, and concessional credit schemes, the government was constantly pushing and assisting the private sector into further technological advancement (Nolan, 2001, p. 12). Already by the 1980s, 75 percent of Taiwan's exports were made of high and mid-tech products, and more than half were technology-intensive products (Nolan, 2001, p. 12). Following that, the government's policies shifted towards more indirect support, and subsequent widespread privatization. But even then, the government was still highly involved in further advancing into higher value-added activities (Nolan, 2001, p. 12). For instance, it established the Hsinchu Science Park and provided tax benefits for investments in high-technology industries and by the mid 1980s, the park accounted for 60% of total R&D expenditure in Taiwan (Nolan, 2001, p. 12). Taiwan relied on a combination of SME's and large scale enterprises which in a 'cluster-like' industrial structure resulted in high operational efficiencies (Nolan, 2001, p. 12). Taiwan's large-scale firms (defined as firms with more than 500 employees) accounted for 58 percent of manufacturing value-added in 1970 and in 1979 the top 100 firms in Taiwan made up 44 percent of the total private manufacturing assets (Nolan, 2001, p. 12). In 2001, Taiwan had 26 of the top 100 firms in the Asia-Pacific region excluding Japan, ranked by market capitalization (Nolan, 2001, p. 12).
South Korea	In 1961 South Korea were one of the poorest countries in the world (Witt & Redding, 2014, p. 217) . Around a generation later, in 1996, it attained OECD membership and had reached high-income country GDP per capita levels (Witt & Redding, 2014, p. 217). The South Korean developmental state and the role of big businesses were central to the catch-up process in South Korea (Nolan, 2001, p.

	13). Like the importance of *keiretsus* to Japan, South Korea relied heavily on *chaebols*, a large family-owned business conglomerate (Nolan, 2001, p. 13). The state supported the *chaebols* with preferential low interest credit loans from the state-owned banking system, and protected the domestic market through import substitution (Nolan, 2001, p. 13). Like in Japan, large oligopolistic firms played an important role, and the state made sure that collusion was avoided by only providing subsidies after strict performance goals were met (Nolan, 2001, p. 13). Infant industry protection was heavily practiced to nurture the domestic firms and avoid, and long-term support was provided until the firms had become internationally competitive, which also made it possible for the firms to make long-term investment plans (Nolan, 2001, p. 13). After the businesses had become firmly established domestically, the state required success and market share increases in export markets as a condition for continual support and subsidies (Nolan, 2001, p. 13). This both earned foreign currency to South Korea, and exposed the businesses to international competition, pushing them to constantly improve products (Witt & Redding, 2014, p. 217). During the industrialisation period the South Korean state was responsible for initiating every major industrial diversification in the 1960s and 1970s, as well as pushing for heavy machinery and chemicals by the late 1970s (Nolan, 2001, p. 13). The chaebols were core to the economic development experienced by South Korea from 1960-1980 (Nolan, 2001, p. 14). Having 35 of the top 200 largest industrial enterprises in developing countries in 1985, South Korea had a central position in international competition (Nolan, 2001, p. 14). Today, South Korea is a highly advanced, technology-driven economy which has the largest share of robots per worker in the world – 631 robots per 10,000 workers in 2018 according to the International Federation of Robotics – and with household company names such as Samsung, Hyundai and LG Electronics (International Federation of Robotics, 2018).
Singapore	After becoming independent in 1965, Singapore began to implement export-oriented developmental state policies largely similar to those of Taiwan and South Korea (Witt & Redding, 2014, p. 193). The government in Singapore was sceptical of the abilities of entrepreneurs to build up internationally competitive firms and it therefore focused heavily on attracting investment from corporations by applying

	a foreign capital-dependent development strategy (Nolan, 2001, p. 14). The government selected foreign companies that were technologically advanced and had long-term investment ambitions (Nolan, 2001, p. 14). While foreign capital was important, Singapore also focused on developing a strong group of indigenous, large firms (Nolan, 2001, p. 14).
Hong Kong	For neoclassical economists, Hong Kong is the ideal-type of an economy which was able to develop through free market competition and small competitive firms (Nolan, 2001, p. 14). Due to numerous favourable conditions such as an optimal location, a strong entrepreneurial tradition, and benefits from trade and investment in mainland China, Hong Kong was able to develop powerful domestic firms (Nolan, 2001, p. 14). In 2000, Hong Kong was home to seven of the fifteen largest companies in the Asia-Pacific region excluding Japan (Nolan, 2001, p. 14). Even in Hong Kong, large firms had an important role to play in the country's economic development, even though the neoclassical view often attaches low priority to this fact (Nolan, 2001, p. 15).

8.4 Abstract in Danish:

Dette speciale undersøger Kinas industripolitiske (IP) plan Made in China 2025 (MIC2025). Gennem et disciplineret case-studie af MIC2025 undersøger jeg planens industrier, aktører, mål, de nøglefaktorer, der har ført til tilblivelsen af planen og de IP-instrumenter, der anvendes i dens implementering. Et multiple case-studie af tre industrier, der er omfattet af MIC2025, viser, hvordan planen implementeres på industry-niveau, og hvilke resultater der kan observeres på tværs af disse industrier mellem 2015 og 2019. Som sin teoretiske ramme beskæftiger specialet sig emd med IP og statens rolle i strukturel transformation.

Specialet har fem hovedkonklusioner: For det første konkluderes det, at MIC2025 følger en oppe-fra-og-ned tilgang i målet om at gøre Kina til en teknologisk supermagt ved at fokusere på ti nøgleindustrier. Nede-fra-og-op dynamikken er imidlertid svag, hvilket resulterer i en begrænset koordinering mellem central- og lokalregering. For det andet konkluderes det, at flere indenrigs, regionale og globale faktorer har ført til tilblivelsen af MIC2025, herunder (i) en stigning i asiatiske IP-planer, (ii) en stor afhængighed af import, (iii) middle-income trap, (iv) den fjerde industrielle revolution, (v) regional og global konkurrence, og (vi) Kinas position i globale værdikæder. For det tredje finder specialet, at debatten om MIC2025 i Kina er mange facetteret med forskellige synspunkter på, i hvilken grad staten skal engagere sig i IP. For det fjerde finder afhandlingen, at MIC2025 kombinerer en række meget forskellige vandrette og lodrette IP-instrumenter i dens implementering, og at især statslige styrede fonde, SOE'er og store statsejede banker er vigtige aktører i planen. Multiple case-studierne af de tre industrier viser et vist overlap mellem de anvendte politiske instrumenter på tværs af industrierne, mens andre er industri-specifikke. Endelig er resultaterne, der er observeret på tværs af de tre sektorer, i nogen grad i overensstemmelse med målsætningerne, der er sat under MIC2025 fra og med 2019, men den egentlige effektivitet samt succes af MIC2025 er stadig uklar.

På det mere generelle plan, bidrager specialet til forståelsen af, hvordan IP skabes i ’emerging economies’, og hvad der kendetegner sådanne politikker. MIC2025 illustrerer den stigende kompleksitet der findes i IP-formulering i dag, og understreger den stigende rolle af globale værdikæder og den fjerde industrielle revolution i IP-formulering i nye økonomier i dag.
Nøgleord: Made in China 2025, MIC2025, industripolitik, globale værdikæder, den fjerde industrielle revolution.