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Public Policy and Intangibles: A Conceptualisation and Critical Appraisal

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Executive Summary

The meaning of intangibles

Intangibles assets have long been an important component of the world-wide economic systems. Intangible assets comprise non-physical and non-financial resources of the firm that yield long-term benefits. These include ideas, knowledge, aesthetic content, software, relationships, brands, organizational structures, culture and innovations. Intangible assets increasingly account for the major share of firm total value. Estimates by Corrado et al. (2018) suggest that in the period 2000-2013, compounded annual average rates of growth of investments in intangibles has been greater than that of investments in tangibles in key 18 countries belonging to the European Union and the US. These growth rates represent a fundamental change in how value is created in most developed economies. Firms increasingly owe their value not only to the greater sophistication and higher productivity of their production systems, but also to product and process innovations, and to assets such as brands, reputation, quality, and trained personnel (Teece, 2015).

The purpose of this report

Thus far, this change is not reflected in policy making, which is still geared primarily towards supporting the growth of tangible assets. One of the important objectives of the GLOBALINTO project is to examine and promote the role of public policy in the growth of intangibles. As a preliminary step, this report presents a systematic literature review to investigate the significance of policy, regulatory, and framework conditions for the generation and growth of intangible assets. It discusses the rationale and challenges for policy intervention, reviews current policy

practice and highlights areas that need further policy development as well as further academic research for its support.

The peculiar duality of intangibles and tensions arising from it

Any consideration of policy support for the build-up and use of intangibles has to take into account the *dual nature of intangibles*. On the one hand, firms see acquisition and control of intangible assets as essential to gaining competitive advantage. On the other hand, from a systemic point of view, individual ownership of intangible assets can limit the sharing and exchange of intangibles that is indispensable for growth and innovation for the economy as a whole. This duality in the nature of intangibles therefore leads to our categorising of intangibles as *firm-specific* intangibles and *intangibles that form intangibles commons at the level of the industry and economy*. These categories of intangibles differ in the mechanisms through which the intangibles generate and grow, and hence point to different rationales for policy intervention.

Although the growth of firm-specific intangibles is sometimes at the expense of intangibles commons, and vice versa, dynamically, they are interdependent: Over the medium and long-term the growth of one facilitates the growth of the other. When developing frameworks to positively manage this interdependence, the literature suggests that policy makers needs to take into account the following tensions:

- a) Appropriation vs. competition,
- b) Appropriation vs. innovation.
- c) Growth of intangibles vs. safety nets
- d) System-wide vs firm-specific investment in skills development as the core condition for developing intangibles

- e) Investment by large and established firms providing the necessary critical mass of intangible assets vs. investment by small and young firms sustaining collective provision of intangibles.

Any policy intervention needs to consider the trade-offs and tensions within and between the policies while developing a framework for policies for intangibles.

The need for policy intervention

Why should the state intervene in the development and use of intangibles in the first place? The review of the theoretical and empirical economic literature demonstrates the negative consequence associated with the tensions arising from the dual nature of intangibles as well as *market and system failures* that lead to systematic underinvestment in intangibles which in turn calls for policies. Firms may underinvest because intangibles are hard to protect from competitors, often because the benefits that flow from owning the intangibles can only be partially appropriated, or quite frequently because the costs of protecting intangibles from competition or maximizing appropriation are prohibitive. Policies are also needed to encourage the formation and growth of intangible commons. Intangibles commons depend for their growth on positive network externalities, interoperability (e.g. through norms and standards), flows across economies, and investment in public infrastructures that builds up capabilities.

The current role of policy

The main finding of the report is that there is no coherent policy or institutional framework for the development and deployment of intangibles as a category per se. While there are numerous individual policy instruments and a variety of institutions responsible for supporting the build-up and use of intangibles, an overarching institutional and policy approach is missing. The duality

of intangibles is thus reflected in a fragmented policy approach - dealing with individual intangibles for selected target groups on the one hand and with the provision of intangibles as intangibles commons on the other hand. This neglects the tensions inherent in the provision of intangibles, and largely ignores the interdependencies between types of intangibles and actor groups.

At present, the most common and elaborate area of policy support are innovation capabilities and outputs of firms. Support for research, development and innovation (RDI) is highly differentiated, whereby the role of public investment decreases with the degree of appropriation of the benefits of RDI investments. Further, to increase the benefit of investment in intangibles for the economy in total, there is an abundance of policies to support interactions and networking. As for policies to support RDI and knowledge related interaction, effects on firm and system level are broadly evaluated and rather well understood.

Alongside the investment in RDI, there is a diversity of policies and institutional frameworks to protect intellectual property. However, their effectiveness and interplay is not well understood. Here, the lack of a holistic approach to understand the tension between appropriation and intangibles commons is an obvious shortcoming of national and transnational economic systems.

The investment in capability build up and training is less clearly defined, the demarcation between private investments of - in particular large - firms and public investment is unclear, new ventures are at a disadvantage, and effects of different training frameworks not fully understood.

Finally, as with investments in tangible assets, the investment in intangibles relies on future markets that allow return on investment of those investments. While there are policies to support the creation of markets that result from investment in intangibles, most directly through

public procurement schemes. However, the roll out of public policies that support the buildup of intangibles for future markets is limited still.

Further development of adequate policies and institutions

Our review results in a number of recommendations for policy and further analysis.

- 1) As for policy, the major recommendations concern the need for a new institutional approach for a holistic support for intangibles. New institutions, policy coordination mechanisms and policy portfolios are needed in order to better reflect inherent tensions, increase the overall investment in intangibles for large and small actors alike and to increase the overall societal benefit arising from intangibles.
- 2) While there is an elaborated portfolio of RDI support measures for individual firms and public sector research organisations as well as for RDI interactions across innovation systems, there is less systemic support for other components of intangibles, in particular support relating to broader flexible dynamic capabilities across all organisational functions in the economy and policies directly tackling inter-operability and market creation (standards and norm setting).
- 3) Since there are significant differences between tangible and intangible assets, the institutional framework underpinning the policies for growth as well as the political and administrative organisations implementing those policies have to change to accommodate the different characteristics of intangible assets. Moreover, policy makers also have to develop new measurements and knowledge bases to design, implement and monitor the new policy framework.

Need for further analysis

The literature review has shown important gaps in our knowledge as regards the role of intangibles in the economy and therefore the role policies play - and should play - to support them. This report offers three major avenues for further research. One relates to the development of intangibles under the different regimes of competition, cooperation, and coopetition. The second relates to the specific policy instruments for the growth of intangibles, the impact of bundling instruments in policy mixes and the changes required to the instruments for different categories of intangibles. Finally, rigorous research needs to support the development of measurement schemes of intangibles in order to support policy making.

TABLE OF CONTENTS

EXECUTIVE SUMMARY.....	i
1 INTRODUCTION.....	1
2 SCOPE AND METHODS.....	7
3 DEFINITIONS, DIMENSIONS AND CHARACTERISTICS: RATIONALE FOR POLICIES FOR INTANGIBLES.....	13
3.1 INTANGIBLES: DEFINITIONS	13
3.2 DIMENSIONS OF INTANGIBLES	15
3.3 CHARACTERISTICS OF INTANGIBLES	16
3.4 WHY POLICIES FOR INTANGIBLES?.....	20
3.4.1 <i>Market Failures due to Characteristics of Intangibles.....</i>	<i>20</i>
3.4.2 <i>System failures and intangibles</i>	<i>26</i>
3.4.3 <i>Non-market factors and policies for intangibles.....</i>	<i>27</i>
4 THE POLICY DILEMMA: INTANGIBLE OWNERSHIP VS INTANGIBLES AS PUBLIC GOOD.....	29
5 THE NATURE AND DEVELOPMENT OF FIRM-SPECIFIC INTANGIBLES - AND THE ROLE OF POLICY	32
5.1 CHANNELS FOR DEVELOPMENT OF FIRM-SPECIFIC INTANGIBLES.....	32
5.1.1 <i>Entrepreneurial Skills</i>	<i>32</i>
5.1.2 <i>Managerial skills and capabilities.....</i>	<i>34</i>
5.1.3 <i>Research, Development and Innovation.....</i>	<i>35</i>
5.1.4 <i>Innovation skills and systems.....</i>	<i>37</i>
5.1.5 <i>Organisational processes, routines, systems, and structures.....</i>	<i>40</i>
5.1.6 <i>Firm specific training and development.....</i>	<i>42</i>
5.1.7 <i>Alliances, partnerships, and joint ventures.....</i>	<i>44</i>
5.1.8 <i>International trade and FDI.....</i>	<i>46</i>
5.2 ROLE OF PUBLIC POLICY IN DEVELOPMENT OF FIRM-SPECIFIC INTANGIBLES – A SUMMARY	46

TABLE OF CONTENTS

6 THE NATURE AND DEVELOPMENT OF INTANGIBLES COMMONS- AND THE ROLE OF	
POLICY	49
6.1 INTRODUCTION.....	49
6.2 CHANNELS FOR DEVELOPMENT OF INTANGIBLES COMMONS.....	51
6.2.1 <i>Public investment in research, education and training:</i>	51
6.2.2 <i>Open innovation</i>	52
6.2.3 <i>Creativity through new ventures</i>	54
6.2.4 <i>Spillovers</i>	57
6.2.5 <i>Demand from lead users</i>	58
6.2.6 <i>Supply chains as originators and transmission belts for intangibles commons</i>	60
6.2.7 <i>Clusters</i>	61
6.3 ROLE OF PUBLIC POLICY IN DEVELOPMENT OF INTANGIBLES COMMONS – A SUMMARY	63
7 POLICY CHALLENGES, TENSIONS AND TRADE-OFFS.....	66
7.1 SIGNIFICANCE OF ACCOUNTING STANDARDS FOR POLICY-MAKING	66
7.2 TENSIONS BETWEEN POLICIES ENCOURAGING APPROPRIATION AND INCREASING COMPETITIVENESS	68
7.3 TENSIONS BETWEEN POLICIES ENCOURAGING APPROPRIATION AND INCREASING INNOVATION	69
7.4 TENSIONS BETWEEN POLICIES ENCOURAGING GROWTH OF INTANGIBLES AND SAFETY NETS	70
7.5 FIRM VS. PUBLIC INVESTMENTS IN TRAINING	70
7.6 LARGE AND/OR MATURE FIRMS VS NEW VENTURES AND SMALL FIRMS	72
8 INSTITUTIONS FOR INTANGIBLES AND INTANGIBLES FOR INSTITUTIONS.....	74
8.1 INSTITUTIONS FOR INTANGIBLES	74
8.2 INTANGIBLES FOR INSTITUTIONS	78
9 POLICY AND KNOWLEDGE GAPS	80
9.1 MAJOR POLICY GAPS.....	80
9.2 KNOWLEDGE GAPS ON INTANGIBLES.....	82

TABLE OF CONTENTS

9.3	KNOWLEDGE GAPS ON POLICIES FOR INTANGIBLES	84
10	CONCLUSION	87
	REFERENCES.....	90
	APPENDIX A: CASE STUDIES.....	103
A.1	INTANGIBLES COMMONS FOR CREATIVE PROPERTY: CASE OF THE BRITISH FILM INDUSTRY	103
A.2	POLICY MIX AND ROLE OF NON-GOVERNMENTAL ORGANISATIONS: THE CASE OF NESTA.....	105
A.3	POLICY FOR INTANGIBLES AND THE ROLE OF TRADE BODIES: THE CASE OF SEMATECH.....	107
A.4	INTANGIBLES FOR INSTITUTIONS: CASE OF EBRD	109

LIST OF TABLES

Table 1a: Public policy and growth of intangibles: Illustrative examples of policy interventions for computerised information and innovative property components of intangibles	8
Table 1b: Public policy and growth of intangibles: Illustrative examples of policy interventions for economic competencies components of intangibles	9

LIST OF FIGURES

Figure 1: Pathways to develop the intangibles commons	50
Figure 2: Policy and development of the intangibles commons: Case of the British Film Industry	105
Figure 3: Role of non-government actors in policy and development of the intangibles commons	106
Figure 4a: Timeline for the creation of SEMATECH.....	107
Figure 4b: Key milestones in the life of SEMATECH	108
Figure 5: EBRD: Institutionalising delivering of advisory services.....	110

1 Introduction

Intangibles assets have long been an important component of the world-wide economic systems. Intangible assets comprise non-physical and non-financial resources of the firm that yield long-term benefits. These include ideas, knowledge, aesthetic content, software, relationships, brands, organizational structures, culture and innovations. Intangible assets increasingly account for the major share of firm total value. For example, according to a Reuters' news report, the sale of 6000 patents owned by Nortel Networks contributed more than all the other asset sales combined as Nortel wound down its operations after bankruptcy. Estimates by Corrado et al., (2018) suggest that in the period 2000-2013, compounded annual average rates of growth of investments in intangibles has been greater than that of investments in tangibles in key 18 countries belonging to the European Union and the US. These growth rates represent a fundamental change in how value is created in most developed economies. Thus far, this change is not reflected in policy making, which is still geared primarily towards supporting the growth of tangible assets. This report seeks to address this imbalance by examining policies for intangibles, reviewing current practices, and highlighting areas that need further policy development.

At the start, it is worth noting that intangible and tangible assets are complementary and interact across the enterprise (Leitner, 2005; Patel, Guedes, Soares, & da Conceição Gonçalves, 2018). The interaction affects systems and personnel across the enterprise. As production systems, whether manufacturing or services (Alamgir, 2019), increasingly integrate tangible assets such as machinery and intangible assets such as software, they also require recruitment and training of skilled personnel to control the production processes. A simple example can illustrate this transformational change. Volar Plastic, Finland is a supplier of heat moulded plastic elements for the tractor and forestry machine industry. Its multirobot cell contains robots

for cutting the plastic using various techniques, and an additional robot to transport and feed material to the robot cutting plastic. The functioning of these robots is controlled by ABB's offline software. The use of the software allows the operator to make on the fly changes to the functioning of the robots. The output has increased from 15 plastic parts per hour to 150. The use of the latest RobotStudio software has decreased the downtime required for changing the configuration when new parts have to be produced. In order to operate the advanced machinery, the operator has to obtain a Robotmaster diploma from ABB. Over time, Volar Plastic has achieved higher productivity by cultivating synergies between the tangible and intangible components of the production system¹.

Firms increasingly owe their value not only to the greater sophistication and higher productivity of their production systems, but also to product and process innovations, and to assets such as brands, reputation, quality, and trained personnel (Teece, 2015). For example, in the merger proposal of Celegne with Bristol-Meyers Squibb, the various intangible assets of Celegne, including intellectual property rights, and the firm brand equity were valued at 80.5 times the value of plant and machinery. In mergers and acquisitions (M&A) preliminary assessment analysts have found that brand equity can range from 1.16% to 49.7% of the total firm value (Bahadir, Bharadwaj & Srivastava, 2008).

There is an inherent duality in the characteristics of intangibles. On the one hand, intangibles can increase output and firm growth rate (Andersson & Saiz, 2018; Corrado, Hulten & Sichel, 2009; Marrano, Haskel & Wallis, 2009), underpin the competitive advantage of the firm (Teece, 2015; Villalonga, 2004), as well as provide for productivity and productivity growth

¹ <https://new.abb.com/products/robotics/case-studies/volar-plastic-finland>

at the macroeconomic level (Riley & Robinson, 2011). Because intangibles are non-rivalrous and generate increasing returns to scale, they also give rise to network effects that drives market share through feedback loops resulting in increased use by consumers, and technology lock-in due to standards and patents. By the same token, network effects also give rise to externalities that manifest in more suppliers joining the network and providing complementary products (Liebowitz & Margolis, 1994; Lev, 2001).

On the other hand, investing in the wrong intangibles can result in persistent losses for firms (Eggers, 2012). These losses arise because it is difficult to determine a residual value for intangibles and hence, intangibles that are loss making are difficult to trade (Andrews & de Serres, 2012; Lev, 2001) - unlike tangible assets, which can be sold for scrap value of materials, even if the asset is found to be unproductive. Due to the partial excludability characteristic of intangibles, they may be hard to protect from imitation (Teece, 1998), can be subject to fast follower effects (Eisenmann, Parker & Alstyne, 2011), and may not allow firms to appropriate rents due to changing environmental, technological, or organizational factors (Spithoven & Terilink, 2015; Wang & Chen, 2010; Kumar, 2010). In short, investing and relying on intangibles involve risks such as sunk costs, obsolescence of technology, and restricted risk-sharing opportunities. This duality leads to an unequal distribution of profits across firms, with only a few firms earning most of the profits (Gorzig & Gornig, 2013). Hence, the distribution of returns on intangibles is right skewed with a long tail.

The costs of investing in intangibles gives rise to negative externalities. Smaller firms usually lack the requisite resources needed to invest intangibles, and find it more difficult to borrow against what are highly uncertain future returns when compared to larger firms. Lack of adequate resources also means that they may also find it more difficult to litigate ownership of

intangible assets. On an aggregate level, this can result in under-investment in intangibles by the private sector; mainly because the investments by the leading firms do not compensate for the declining investments by laggards (Gutiérrez and Philippon, 2017; Morikawa, 2015). Under-investment in intangibles can also result when larger firms prefer to gain control on intangibles by acquisitions of smaller firms rather than investing directly in intangibles (Crouzet & Eberly, 2019). Under-investment can also result from focusing on extracting maximum rents from existing intellectual property rather than investing in further innovations. Such rent seeking can lead to more investment in legal services such as those provided by patent lawyers, but do not add to the productive capacity of the economy (Haskel & Westlake, 2018).

A second set of failures are at a systemic level. The existing policy, institutional, regulatory and financial incentive framework is mainly geared towards tangible assets and the build-up of new knowledge and technology (mainly through R&D). Other forms of intangibles necessitate complementary or different systemic conditions. Moreover, those conditions must be flexibly adaptable to the increasingly rapid developments of intangibles.

In sum, the various market and system failures we observe based on the characteristics of intangibles lead to an underinvestment and under-exploitation of intangibles. This is at the core of a multi-faceted justification for policy interventions to build up and utilise intangibles in firms and across the economy and public sector in the new economy of intangibles. Analysis of investments data and labour market regulations by Haskel & Westlake (2018) indicate that less stringent regulations in product and labour markets encourages investments in intangibles. Their analysis also shows a correlation between intangible investments by the private sector and public sector co-investment. Moreover, data from Corrado et al., (2018) and Goodridge, Haskel &

Wallis (2013) suggest that investment in intangibles grew at a slower rate after the financial crash in 2007-2008.

Policy measures are important not only to manage the externalities but also ensure that intangibles contribute to growth and productivity. A key component of the GLOBALINTO project is to explore and increase the role of policy for the mobilisation of intangibles. This project aims to not only to assess productivity potential of intangibles but also to decompose the explanatory factors of intangibles in a way that offer tools for policies to foster innovation and future growth. As a first step, this project seeks to conduct a structured and systematic literature review that probes the role of policy, regulatory and fiscal framework conditions for the generation and development of intangible assets. This report surveys academic and practitioner literature to develop a framework for the policy interventions that stimulate not only firm level investments, but also their societal impact. Through this report, we aim to highlight the tensions and trade-offs inherent in policy-making for intangibles that make it complex to implement but vital for the future growth of the firm and the economy as a whole.

In the first and second chapters, we discuss the scope of the study and the methods used to conduct the literature survey. In chapter three, we present the overview of the literature on intangibles with particular attention to definitions, dimensions and characteristics. Based on this literature survey, we explore market failures associated with intangibles in general, specific dimensions of intangibles in particular, and the rationale they provide for public policy. Chapter four explores the first theme related to the control and ownership of intangibles. It introduces the major differences between firm-specific intangibles and the intangibles commons. Chapters five and six detail the variations in policies for firm-specific intangibles and the intangibles commons, and the associated transmission mechanisms through which intangibles in the

economy can be generated and developed. In chapter seven, we discuss the tensions in the objectives of policy making due to the duality in the characteristics of intangibles. The second theme is related to the institutions for intangibles and the intangibles required for these institutions. Chapter eight details the literature associated with this theme. Chapter nine identifies the gaps from the literature survey. These include the lacunae in existing policies and policy frameworks that fail to address some of the market failures due to the particular characteristics of intangibles, imperfections in our knowledge of intangibles that hampers policy makers, and the deficiencies in our knowledge of the characteristics of the policies. We conclude by summarizing current knowledge and the deficiencies of that knowledge gathered from the overview of literature.

2 Scope and Methods

Since the 1990s, there has been a growing interest in understanding the role of intangibles at both micro and macro levels. Research in this arena has made slow progress primarily due to differences in how various disciplines use terminology and definitions, and disagreements on measures. At the international level, changes to the UN's System of National Accounts (SNA) that mandate inclusion of data on R&D, mineral exploration and evaluation, computer software and databases, and creation of artistic originals, have not been consistently adopted, and reliability of collected data needs improving. To some extent this reflects why the policy makers in most countries do not focus on policies for intangibles, but instead focus on specific intangibles.

Tables 1a and 1b present illustrated examples of the fragmented policies for different categories of intangibles across countries, and over time. One illustrative example is the “Digital Agenda for Spain”, which aims to promote digital technologies in Spain. As a part of this programme, policy instruments such as procurement, development of clusters, and FDI promotion are being used to support firms in developing and using digital technologies. Similarly, there are specific policies for the development of scientific R&D such as “The Patent Box” in Italy. We observe that policy-makers are placing strong emphasis on the importance of R&D and intellectual property for growth and innovation, and encouraging research and discussion on implementation and impact of policies for R&D. Similarly, the rise of the software industry has produced a wide range of ICT policies, and policies related to human capital have been developed under the rubric of science and technology policies (STP). This stands in marked contrast to policies on economic competencies that address organizational capital which have yet to emerge meaningfully.

Policy Instruments	Fiscal Incentives	Direct Measures	Skill Development	Access to Expertise	Collaborations & Networks	Regulations & Standards Setting	Cluster policies	Venture Capital & Angel Investors	Public Procurement	International Trade	Innovation Prizes
Components of Intangibles											
Computerised Information											
Computer Software	Conseil National de l'Industrie (CNI, National council of Industry)	Business Finland (formerly Tekes)	KMU-Digital-Paket (Austria)	KMU-Digital-Paket (Austria)	Business Finland (formerly Tekes) – the Finnish Funding Agency for Innovation	Digital Agenda – for Spain	TCUK, Digital Agenda for Spain	Smart & Start – Italy; Digital Agenda for Spain	Digital Agenda for Spain	Digital Agenda for Spain	Boost-Up/TIC, Belgium
Computerised Database	Policies pertaining to software are being applied to new technologies such as AI and machine learning, but except for GDPR introduced by EU there are few systematic policies aimed at data acquisition, consolidation and exploitation										
Innovative Property											
Design, Blueprints											
Scientific R&D	Patent box-Italy	The Austrian Research Promotion Agency cash grants	Skills Development Fellowships, MRC, UK	Innovate UK	Digital Agenda for Spain	Transfer of research and development results through standardisation (TNS) program	NRC Technology Cluster Initiatives, Canada	CSIRO Innovation Fund, Australia	Innovation oriented public procurement, Germany	R&D tax credit on incremental expenditure, Ireland	i-Lab, France
Creative Property	UK Film Council	British Screen Finance	UK Film Council – Training Fund, Digital Film Clubs for schools		British Screen Finance	Digital Economy Bill, 2009		Arts Council of England (ACE), The Premier Fund, UK Film Council		British Film Commission	

Table 1a: Public policy and growth of intangibles: Illustrative examples of policy interventions for computerised information and innovative property components of intangibles
Source: Own compilation and OECD (2019)

Policy Instruments	Fiscal Incentives	Direct Measures	Skill Development	Access to Expertise	Collaborations & Networks	Regulations & Standards Setting	Cluster policies	Venture Capital & Angel Investors	Public Procurement	International Trade	Innovation Prizes
Components of Intangibles											
Economic Competencies											
Brand Equity, Marketing and Advertising		Rural Business Investment Scheme, Derry City and Strabane District Council		Business support - West Berkshire							
Firm-Specific Human Capital		UK apprenticeship training	Digital Agenda for Spain,								
Organisational Structure											
Business Models				KMU-Digital-Paket (Austria)							DOE National Clean Energy Business Plan

Table 1b: Public policy and growth of intangibles: Illustrative examples of policy interventions for economic competencies components of intangibles

Source: Own compilation and OECD (2019)

While the table above is illustrative only, it is fair to say that broadly speaking we see inconsistency in terminology and measures, as well as uneven research and policy attention to formulation, implementation and impact analysis across the various dimensions of intangibles. To deal with this limitation, we took a multi-pronged approach to survey the literature for this review.

1. We generated a list of keywords using the taxonomy of policy instruments developed by Edler & Fagerberg (2017) and other widely used terminology for intangible assets. The keywords included “intang*”, “tang*”, “policy”, “intellectual capital”, “structural capital”, “relational capital”, “organizational capital”, “fiscal incentives”, “direct measures”, “skill development”, “access to expertise”, “collaborations & networks”, “regulations & standards setting”, “cluster policies”, “venture capital”, “angel investors”, “public procurement”, “international trade” and “innovation prizes”.
2. We conducted a structured search for literature in each of the journals in the category “Public Sector and Health Care” from the Association of Business Schools’ Academic Journal Guide 2015. We searched the abstracts of the journals using various combinations of the above keywords.
3. We also conducted a similar exercise using the search function in EBSCO research databases.
4. We then used snowballing technique by going through the literature that cited the papers in the search results as well as the key literature that was cited in the search results.
5. We used Google search to download significant reports by organisations such as OECD to examine the policy discussions in the grey literature.

The search process resulted in our examining more than 65 journals, 111 relevant articles, and 12 practitioner reports.

Three broad themes emerge from the search results. The first theme relates to the variations in policies due to the quasi-public good characteristic of intangibles. Firms cannot appropriate the returns from all categories of intangibles. They also cannot prevent knowledge flows related to the intangibles that they own. The information flows from all the firms and from public investments in an ecosystem leads to the development of a pool of intangibles or what we term as *intangibles commons*. There are two-way information flows between the firm and this pool of intangibles enabling mutual growth and development. The variations in policies exist because the transmission mechanisms through which intangibles in each of the firm-owned and pooled intangibles develops in the economy are different. These variations point to tensions in motivations and trade-offs that policy makers have to contend with while designing and implementing policies. The second theme relates to the institutions that are essential for the generation and growth of intangibles. The current institutional framework is primarily concerned with the development and growth of tangible assets. Policies developed under this framework cannot address the challenges associated with the growth and development of intangibles assets due to the differences in the characteristics between these two sets of assets. Moreover, policy makers have to develop new knowledge bases to understand the functioning of intangibles. They have to also develop new skills and tools to monitor the implementation of the policies for intangibles. In this report we term these knowledge bases, skills and tools the “intangibles for institutions”. The third theme examines these intangibles that are required for managing the institutions responsible for devising policies for intangibles and monitoring their implementation.

In this report, we explore these three themes in detail to understand the current policy mechanisms and frameworks and then highlight the gaps in our knowledge of the policies for intangibles. This comprehensive organization of knowledge on policies for intangibles is important for the development of a holistic policy framework for the growth of appropriate intangibles.

3 Definitions, Dimensions and Characteristics: Rationale for policies for intangibles

Policies for intangibles are important for the continued investments in appropriate intangibles by firms as well as for the growth and productivity improvements in the economy. These policies are significant because of a range of market and system failures. Markets for intangibles don't exist in most cases and hence, resource allocations in the generation of intangibles are not optimal. The various externalities related to intangibles lead to an underinvestment, while the regulatory, financial and broader institutional conditions favour tangibles and a limited number of intangibles (mainly R&D). Especially the duality in the characteristics of intangibles (geared towards firm appropriation vs intangibles commons) impede the functioning of the various technical, regulatory, and organisational systems. These systems contribute to the evolution of intangibles, and therefore, policy interventions that improve their functioning are important for the generation and growth of intangibles.

For the purpose of this report, in this chapter, it is useful for us to start with a brief overview of intangibles as currently defined in the literature. We examine the variations in terminology, definitions and categorisation schemata of intangibles across disciplines. We also catalogue a comprehensive list of characteristics of intangibles and the associated impact on markets. We draw upon this discussion to present the rationales that are often used to develop and justify policies for intangibles.

3.1 Intangibles: Definitions

Intangibles capture a range of concepts in the economic organisation of production processes. An overview of the literature shows the following:

1. Intangibles is the collective name given to the investments, assets, and output in the economy that cannot be physically examined, are difficult to describe, and in some cases cannot be measured meaningfully.
2. Intangible investments are the commitments of time, money and other resources to buy or improve non-physical resources that are expected to provide economic benefits.
3. Intangible assets are the non-physical and non-financial resources that are “*expected to provide a benefit over a period of time*” (Haskel & Westlake, 2018: 20).
4. Intangible resources denote those aspects of the production processes that are difficult to measure but often explain why seemingly similar processes with the same tangible factors of production yield different results across organisations (Dean & Kretschmer, 2007).
5. Intangible output is the non-physical outcome of economic activity by a firm, industry, or a country in a given period that is available for sale or for further use in an economic activity (Deardorff, 2016). Examples of intangible output include creative products such as film or cinema or music, software, and services.

In addition, we find significant diversity in literature in defining and delineating the various aspects of intangibles. The terminology used for intangible assets varies with the discipline to which the scholars and practitioners using the term belong. The use of the terms *intellectual capital* (Edvinsson, 1997; Nahapiet & Ghoshal, 1998; Subramaniam & Youndt, 2005) and *knowledge assets* (Grant, 1996; Teece, 1998, 2000; Winter, 1998; Bontis, 2001) is more widespread with management practitioners and scholars. Economists and accountants use the term *intangible assets* (Lev, 2001; Corrado, Hulten & Sichel, 2005, 2009; Skinner, 2008).

Despite the diversity in terminology, the principle underlying the definition remains consistent: “claim to future benefits that do not have a physical or financial embodiment” (Lev, 2001)².

3.2 Dimensions of Intangibles

Our overview of the literature suggests that intangibles represent a broad cross-section of assets. Lev (2001) categorises them on the basis of their origin - discovery, organisational practices, and human resources. Discovery refers to the assets that originated as a consequence of the innovative efforts of the firm. Organisational practices refer to the assets that firms develop as a result of investments in structures, processes, and marketing and advertising. These assets enable the firm to generate value for itself. Human resources based assets are developed from the firm’s investments in training, compensation, and development of learning practices within the organisation through collaborations with universities and research centres.

Some scholars additionally recognise the unique benefits that firms can obtain on the basis of their relationships with partners, suppliers, and customers through the development of relational resources such as social capital (Nahapiet & Ghoshal, 1998), reputation (Rindova, Williamson & Petkova, 2010), branding, and customer loyalty (Agostini & Nosella, 2017). In this conceptualisation of intellectual capital, the two main components are human and structural capital of which, structural capital encompasses relational capital, intellectual property, and organisational processes and structures (Massingham, 2016; Li, Pike & Haniffa, 2008; Edvinsson, 1997).

² For a more comprehensive discussion on the origin, variety in definitions, and typologies of intangible assets, see Martín-de-Castro et al., (2011).

Many economists (Andrews & de Serres, 2012; Marrano et al., 2009); categorise intangibles as computerised information, innovation property, and economic competencies. This categorisation broadly follows the body of work based on Corrado et al., (2005). Computerised information comprises software developed for the firm's use and databases of information relevant for the firm. Innovation property includes mineral exploration, scientific R&D, creative property, and design. Economic competency includes brands, firm-specific human capital, and organisational structures that generate value for the firm. The categorisation of intangibles by Corrado et al., (2005) reflects the importance accorded to automated processes, business models and human capital, but does not take into consideration the relational capital of the firm. Moreover, since the categorisation originated from an attempt to measure intangibles, the focus was on components that can be measured and did not include hard-to-measure but conceptually important items such as relational capital.

The GLOBALINTO project aims to develop new measures of intangible assets for official statistics and analyse the role of intangible assets in changing the market structure, productivity, innovation, and growth. In this project, intangible assets are broadly categorised as information and communications assets (ICT), which aligns with the computerized information category from the classification scheme developed by Corrado et al., (2005), broad research and development assets (RD) which aligns with the innovative property category, and organizational capital (OC) that aligns with economic competencies. Throughout this report, we use the terms for these three categories interchangeably.

3.3 Characteristics of Intangibles

Intangibles are important factors of production, and they constitute a significant component of the economic output across sectors. But, markets for intangibles are still at a nascent stage of

development. This is because their unique characteristics distinguish them significantly from tangible assets. An extensive literature describes the characteristics (Lev, 2001; Brynjolfsson et al., 2002; Rayna, 2008; Andrews & de Serres, 2012; Haskel & Westlake, 2018). This section summarises the existing body of knowledge and explains their implications for the functioning of the markets for intangibles.

1. ***No physical embodiment***: Most intangibles such as ideas, knowledge, skills, or brands lack materiality, i.e. they may be embedded in media or represented physically, but their value does not depend on media or physical representation. This non-physicality makes it difficult to value the stock of intangibles possessed by the firm, either through direct measurement such as counts of assets, or through the valuation of the past investments made in the accumulation of the asset (Andrews & de Serres, 2012). Thus, valuation can only be inferred through indirect measures with varying degrees of accuracy (Dean & Kretschmer, 2007). The difficulties in valuation contribute to information asymmetries between managers, investors, lenders, and other stakeholders.
2. ***Non-rivalrous***: Intangibles can be used by multiple users simultaneously without the fear of depletion of supply. Software is an example of a good which is non-rival in consumption. The marginal cost of producing additional copies of software is zero or near-zero (Lev, 2001; Rayna, 2008; Haskel and Westlake, 2018). This is a major value driver for the organisation and results in increasing returns to scale. The scalability is limited only by the overall market size, growth, and managerial diseconomies (Lev, 2001). The non-rivalrous characteristic also upends the traditional economic models of perfectly competitive markets where pricing is determined on the basis of marginal costs.

3. ***Partially excludable***: Many intangibles such as software are easy to copy and disseminate; firms cannot completely exclude competitors from benefitting from the focal firms' investments in employee training. Theoretically, producers can control the returns from only the first produced unit of intangible output such as software (Rayna, 2008). This characteristic also gives rise to the problem of free-riding by consumers and competitors who appropriate the benefits from the use of these assets without investing in their development. Although there are costs involved with replication such as reproduction cost, learning, and search costs, these costs are often less than the cost of the licensed product and the marginal cost associated with illegal duplication is also very small, just as for the original product (Rayna, 2008). In the absence of strong regulations and weak protection of property rights, private investments become sub-optimal as compared to public investments, leading to market failure. In the case of investments in employee training, it is often easier for competitors to poach skilled employees as compared to developing learning and training systems, which cumulatively leads to under-investment in an important intangible asset.
4. ***Non-tradability***: In contrast, some intangible assets (such as organisational processes and business models) are strongly tacit. While in those cases the tacit knowledge can give rise to competitive advantages due to inimitability, intangibles with significant tacit component are often difficult to value and hence the markets for these assets are invariably thin (Andrews & de Serres, 2012). There are no current commonly agreed models of valuation for different categories of intangibles (Lev, 2018). Independent assessment of the quality of the output is also difficult, which in turn leads to information asymmetry between the buyer and the seller.
5. ***Non-separability***: It is often difficult to independently value firm-embedded and firm-specific intangible assets, such as reputation, software for internal use, and organization

structures. This characteristic makes it difficult to value the firm, trade intangible assets in open markets, or use them as collateral to raise debt. It is quite often not possible to evaluate the terminal value of the firm on the basis of these assets as these assets often do not retain any value in case of bankruptcies (Webster & Jensen, 2006; Andrews & de Serres, 2012).

6. ***Synergies***: The value of investments in intangible assets increases when combined with other tangible and intangible assets (Brynjolffson et al., 2002). The synergy that results from combining intangible assets, or intangible and tangible assets creates network effects that play an important role in the development of technological platforms. As firms enhance the value proposition of their product or service offerings through synergies, other firms in the ecosystem also develop complementary products based on the knowledge gained through spillovers and more formal cooperative arrangements. Positive feedback loops and complementary products increase the customer base, and thereby, the value of the focal firm's investments in the intangible assets. Novel organizational forms and business models, such as the "Apple App store" or the Android platform emerge due to the synergy characteristic of intangible assets (Haskel & Westlake, 2018). Although synergies between different asset categories (intangibles and tangibles) produce and benefit from spillovers, they also decrease the ability of the firm to appropriate rents.
7. ***Knowledge transferability***: Although tacit knowledge is not easy to transfer directly, some aspects of the tacit knowledge can be transferred through workforce mobility. This transferability characteristic leads to spillovers that make it difficult for the firm to control and appropriate all the rents from the development of the intangible assets. In all cases, complete transfer of knowledge is not feasible because, transferability requires human capital

for desorption (Ahn, Minshall & Mortara, 2017), transfer (Easterby-Smith, Lyles & Tsang, 2008; Wiig, 1997), and absorption (Minbaeva et al., 2003).

8. ***Uncertainty and perceptions of additional sunk costs risks:*** Uncertainty results in lower valuation and higher costs of financing for projects associated with development of intangibles. This characteristic is likely to lead to private sector under-investment in intangibles. Sunk costs and high frequency of failure are the hallmarks of any innovation process, but in the case of tangible assets, residual value of the raw materials or machinery parts or production systems can be recovered, even in failed innovation ventures. In contrast, there is no residual value from the innovation processes for the development of intangible assets. The valuation of firms that have many projects related to development of intangibles hence, declines significantly. The uncertainty also makes it difficult for firms to finance projects for the development of intangible assets, especially through debt (Andrews & de Serres, 2012; Demmou, Stefanescu & Arquíé, 2019).

3.4 Why policies for intangibles?

In this section we summarise the main rationales for policy intervention for the build-up of intangibles.

3.4.1 Market Failures due to Characteristics of Intangibles

The above discussion on the characteristics of intangibles raises many questions on whether markets alone can continue to drive the investments in development of intangibles. The characteristics of intangibles make it difficult for markets to efficiently allocate resources on the basis of price (Lev, 2001). Our overview of the literature catalogues the following significant market failures that result from the characteristics of intangibles:

1. ***Scalability of intangibles***: Intangible assets are highly scalable. Due to the public nature of goods, even though there may be high upfront fixed costs for production, marginal costs are low. Efficient resource allocation becomes difficult due to increasing-return-to-scale property of assets. Setting prices at marginal cost of product is not sufficient to yield economic returns. Thus, firms are disincentivised from investing in new knowledge (Jones & Romer, 2010). Public investments alone cannot propel growth of intangibles. Governments cannot judge the customers' valuation of intangibles, and hence, decisions on quantity and quality will not be optimal (Rayna, 2008). Public policies that can incentivise private investments would be important for the growth of intangibles in the economy.
2. ***Knowledge spillovers***: Without legal protection, it is difficult for firms to deter and exclude rivals from replicating and disseminating the intangibles that they have developed. The diffusion of knowledge beyond the focal firm may benefit the society, but it reduces the ability of the focal firm to generate rents. When firms are unable to appropriate rents from investments, at a macroeconomic level, this is likely to lead to underinvestment in a socially desirable class of assets. Firms can manage spillovers to a certain extent through confidentiality clauses with suppliers and employees and enforcing trade secrets, but firms cannot prevent labour mobility through legal means (Mayer, 2006; Döring & Schnellenbach, 2006). Moreover, confidentiality and non-compete clauses in employment have expiry dates beyond which flow of knowledge cannot be restricted. Public policies are required to minimise the costs associated with spillovers and allow firms to not only supply knowledge to competitors but also gain knowledge from them (Alcácer & Chung, 2007). This becomes possible through cluster policies and entrepreneurship policies that promote creation and diffusion of knowledge (Caiazza, Richardson & Audretsch, 2015).

3. ***Information asymmetry***: A significant component of the intangible assets is tacit knowledge, which makes it difficult to benchmark and evaluate (Dean & Kretschmer, 2007). E.g., the organisational structure and processes of a firm are highly specific to its business model and strategy, making it difficult to benchmark against a competitor. Without being able to value the firm, financial institutions are unable to use these assets as collateral for any funding requirements of the firm. It also makes it challenging for firms to raise funds in the early stages of funding when the uncertainty associated with the projects is very high. Managers who have information on the risks associated with the project are unlikely to share them with the stakeholders unless mandated by statutory requirements. Policies are required at two levels to combat these asymmetries. At one level professional bodies that set standards for accounting and financial reporting have to recognise the importance of intangibles as well as the market failures due to incomplete information available with firms' stakeholders. This recognition should prompt these professional bodies to develop and modify accounting standards that increase the quality of information required for valuation and financing decisions (Lev, 2004; 2018). At the second level, governments have to incentivise venture capital firms, angel investors, and other financial agencies to fund such risky projects, especially in the initiation stage of the projects (Demmou et al., 2019). Without such incentives, many innovative projects might not be able to progress because of lack of funding.
4. ***Costs of monitoring and enforcing ownership***: Firms incur costs not only to generate intangibles, but also to assert their ownership. Intangibles are non-rivalrous and partially excludable, which makes it easy to copy and distribute these assets. This is especially true in cases where the output is intangible, such as software, creative industries such as cinema and

music, and codified knowledge such as blueprints. With the availability of internet and broadband technologies as dissemination tools, entities that can free-ride have multiplied manifold. Free-riding can take the form of piracy, illegal downloads, and corporate espionage (Rayna, 2008). Firms and governments are incurring increasing costs to monitor and enforce IPR to combat such free-riding. Apart from free-riding, firms and governments also monitor compliance of competitors to licensing agreements. These play an important role in prevention of counterfeiting, deterrence of non-compliance with standards, and achieving excludability (Andrews & de Serres, 2012).

5. **Network externalities:** The value of intangible assets increases when combined with other intangible or tangible assets. These network effects also create high barriers to entry and limit competition (Bresnahan & Greenstein, 1999; Melamed, 1999; Parker & Van Alstyne, 2005; Markovich & Moenius, 2009; Andrews & de Serres, 2012) because:
- a. Inter-operability of products with different standards/specifications is not possible, limiting the entry options for new firms.
 - b. Switching costs for all participants in the platform, including the customers, developers of complementary products, and suppliers are high
 - c. Complementary products or services are essential for optimal utilisation of the focal product or service, and quite often customers are unable to choose the components of the bundled service that they are more likely to use. In many cases, they are forced to buy the entire bundle of products and services.

Creative policies are required to achieve a balance between competition and innovation.

Regulators have to decide whether new standards and technological platforms are the

outcome of innovation (Tirole, 2015; Melamed, 1999) and increase efficiency in production and new product introductions.

6. ***Coordination failures:*** Firms that are able to define and develop standards to build a platform that drives the technological evolution of the product category are best placed to appropriate the returns due to the network effects. Development of standards encourages compatibility between different technologies, enforces a certain level of quality, provides information to competitors, and reduces variation that may be incomprehensible to users. Standards facilitate trade and increase the cost efficiency of technology adoption (McGaughey, 1998). Coordination failures arise when changing platforms or networks is dependent on the decisions of other users. On the one hand, if the focal firm or group of firms do not agree to new standards or limit the access to new firms, who may potentially improve the technology, the platform as a whole can get locked in to sub-optimal standards. On the other hand, co-existence of multiple standards can lead to difficulties in inter-operability, thereby reducing efficiency. Frequent disputes on standards and lack of coordination lead to complex and costly lawsuits which increase the costs of innovation (Menell, 2019). It creates an imperative for policy intervention, but policy makers have different points of view (Baird, 2007; Blind, Petersen & Riillo, 2017; Schot & Steinmueller, 2018) on if, and when, governments should intervene in response to coordination failures.
7. ***Infrastructural failures:*** Knowledge creation and diffusion is an important component of intangibles. Infrastructure such as schools, libraries, and research institutes, are significant drivers of knowledge creation and diffusion (Haskel & Westlake, 2018). The development of this infrastructure is a public good that has a wide societal impact and cannot be linked only to the growth of intangibles. Firms utilise the resources from the knowledge-based

infrastructure that was developed using public funds to generate private returns for shareholders. It is not feasible for firms to completely internalise the knowledge-based infrastructure. For example, GE created a learning centre intended for the growth and development of managerial skills within the firm, but the learning centre builds on the knowledge gained from the public infrastructure and cannot replicate it. Thus, public support for investments in intangibles gives rise to further debates on how rents have to be shared between social and private benefits.

Our survey of the literature suggests that markets alone cannot ensure efficient allocation of resources for intangibles. The increasing use of intangibles in the economic activities poses unique challenges. Although intangibles account for a growing share of rents in the private sector, rents from investments in intangibles are not easy to appropriate. Because intangibles possess quasi-public goods characteristics, many of the individual firms may find investments in intangibles sub-optimal, impacting the overall investments in intangibles, and thus, the growth of the economy. Evidence from Corrado et al., (2018) and Haskel & Westlake (2018) suggests that in the aftermath of the recession in 2007-2008, the growth rate of intangibles in the developed countries is slower compared to the rate before the recession. Moreover, our overview of literature also indicates that private returns from investments in intangibles are unequally distributed due to network externalities, free-riding, fast follower effects and other characteristics of the quasi-public good (Liebowitz & Margolis, 1994; Teece, 1998; Lev, 2001; Eisenmann et al., 2011; Eggers, 2012; Spithoven & Terilink, 2015; Gorzig & Gornig, 2013; Crouzet & Eberly, 2019).

The market failures discussed thus far, provide one of the reasons for policy interventions to develop intangibles (Marciano & Medema, 2015; Colander, 2015). Public investments can

stimulate and complement private expenditure on intangibles such that the stocks and flows reach an optimum level. An optimum level pre-supposes the existence of an equilibrium in the markets. However, the notion of the optimum in an economy is also dependent on other complementary growth factors. Moreover, intangibles have to be measured to evaluate the current levels against the benchmark. Thus, public policy interventions are required not only for public investments that can support private investments, but also, to measure and set guidelines for measurement of intangibles. Moreover, the discussion on market failures also makes it clear that policies are required to support the functioning of the markets by addressing issues related to enforcement of property rights, costs of monitoring and information asymmetry between the firm and its stakeholders.

3.4.2 System failures and intangibles

A second line of argumentation for policy intervention is based on evolutionary economics. In this strand of literature (Edler & Fagerberg, 2017; Peneder, 2017; Colander, 2015), the economy is conceived as an interplay of system components. The emphasis is on constant interaction and learning which results in innovation and knowledge production in certain framework conditions. The firm is an important actor in these innovation systems. It can be thought of as a site of interactions between employees, managers, owners, organizational structures and process, suppliers, channel partners, customers, and other external stakeholders. The production and growth of intangibles is the outcome of an endogenous process where intangibles interact with other tangible and with the intangible assets of the firm. Since, intangibles as a concept subsumes innovation along with other factors such as skills, structures and processes, we can extend the concept of socially desirable rates of innovation for the growth of the economy to a socially desirable rate of production of intangibles. Hence, we argue that

policy interventions are required when any of the enabling systems for intangibles do not perform at a desired level. Systems failure occurs when the conditions needed to generate intangibles such as investments, regulatory, legal and financial support are not adequate, or when the enabling capabilities within the firm are not adequate, or when there are impediments to the interactions within and between the various systems. Public policies are required to address these systems failures because they often impede the growth rate of intangibles.

3.4.3 Non-market factors and policies for intangibles

Non-market factors could also have an important influence on decision making. Each policy decision will factor in specific organisational structures and forms of organising that are historically significant in a region or country and reflect a certain implicit societal code (e.g., co-determination in Germany, and employee owned firms in the UK). These decisions are especially important in the context of policies related to cross-border M&As³. While M&As are important for resources reallocation and unlocking the value of intangibles in firms (see section 5.1.1), a desire to preserve certain organisational structures can shape policies related to cross-border M&As as is observed through the Employee Participation Rights Art. 16 of the Directive 2005/56/EC implemented by the German law (Sandrock, 2017). A firm's organisational capital is therefore, important for public policy due to the influence it can have on policies related to M&As.

With institutional changes across the developed economies, policies can no longer be justified on purely political grounds but need to have sound economic rationale (Tirole, 2015). In

³ <https://www.wsj.com/articles/SB946401682125714942>

this chapter, we provide evidence from literature and economic rationale for the need for policies for intangibles. In the case of investments in intangibles, the evidence indicates that intangibles grow in countries with public co-investment (Haskel & Westlake, 2018). Policies are required to ensure continued investment in intangibles for future economic growth and productivity.

Having outlined the basic rationales -for policy interventions, we now turn towards a more in-depth discussion about the tensions as to policy making for intangibles. We order this discussion along the duality of intangibles, referring to firm specific and intangibles commons and the different policy needs and approaches associated with them.

4 The policy dilemma: intangible ownership vs intangibles as public good

Policies for intangibles are complex to conceptualise and difficult to implement because of the duality in the characteristics of intangibles. Growth of intangibles within firm boundaries is dependent on public investments in knowledge-based infrastructure. Although firms would like to completely internalise intangibles, spillovers also contribute to the growth of network effects and firms benefits from the network effects. Thus, there are contradictory demands placed on public policy to address the challenges of growth of intangibles in the economy. In this chapter, we investigate the tensions of policy making and the trade-offs that policy makers have to make to address these conflicting demands.

Intangibles can confer strategic advantages, but certain characteristics of intangibles makes relying on intangibles to maintain these advantages difficult. On the one hand, certain types of intangibles such as organisation structures, business models, and brands are often difficult to reverse-engineer. They cannot be easily separated from the firm that owns them, and the synergies between different dimensions of intangibles such as business models and managerial know-how and other tangible assets are difficult to imitate. They are often said to possess the valuable, rare, inimitable, and non-substitutable characteristics that result in competitive advantages for the firm (Barney, 1991). On the other hand, codified intangibles can have quasi-public good characteristics. Most notably, when intangibles are “embrained” in individuals, and therefore consisting of “knowledge that depends on conceptual skills and cognitive abilities” (Blackler, 1995: 1023), they can transfer in mobile labour markets. “On the hoof” transfer of knowledge enhances knowledge flows in the economy (Langrish et al. 1972), and allows firms to develop complementary and competing products.

Thus, intangibles can be classified along two dimensions: the degree to which they can be appropriated by the private sector, in which case they can be described as firm-specific intangibles, and the extent to which they contribute to the intangibles commons. Firm-specific intangibles are assets or investments which yield rents that can be appropriated by the firm. The intangibles commons or what Pisano & Shih (2009) term as the industrial commons is the pool of knowledge, skills, and competencies, aggregated at a technological, industrial, or a geographical level. Intangibles that constitute the intangibles commons are public goods that result from public policy initiatives and spillovers from the activities of the firms.

Intangibles play two different yet key roles in the economic activities - both at a firm level, and as intangibles commons in the economy. One role is that of assets that can generate economic benefits directly in the future. The other is that of increasing the absorptive capacity (Cohen & Levinthal, 1990) of firms. At the firm-specific level, existing stock of intangibles increase the capability of firms to further add to their stock of intangibles through the synergistic characteristic of intangibles. At the intangibles commons level, the absorptive capacity takes the form of the knowledge stocks and flows in the economy that enable firms to generate new ideas and opportunities and learn from each other, thereby creating a virtuous cycle of growth of intangibles.

Policies for intangibles have dual and possibly conflicting objectives, because of the way in which firm-specific intangibles and the intangibles commons need each other to grow, but have contradictory influence on the appropriability of rents from the use of intangible assets and competition in the marketplace. On the one hand policies are needed to support private investments in intangibles, including innovations, by clarifying ownership and securing appropriation rights for investors over the rents from these investments. These can result in

limiting the intangibles commons. On the other hand, there is also a requirement for policies that support a virtuous cycle of growth of intangibles - and thereby the intangibles commons - by increasing competition in the economy and promoting knowledge flows between various entities. However such policies can in turn limit the extent to which firms can appropriate rents from their investments.

Firms use a variety of mechanisms to develop intangibles, paying particular attention to designing mechanisms that ensure appropriation of the benefits generated by the intangibles. They also contribute voluntarily and involuntarily to intangibles that enlarge the intangibles commons, through knowledge spillovers and other similar mechanisms such as joint ventures and consortia (see the case of SEMATECH, page 107). Policy instruments target these mechanisms, both to achieve their objectives for the growth of firm-specific intangibles and to expand the intangibles commons.

In the following two chapters, we present an overview of the literature that discusses firm-specific intangibles and intangibles that constitute the intangibles commons. We discuss the mechanisms through which they grow, their policy implications, as well as the tensions and trade-offs between policies that seek to promote these two categories of intangibles.

5 The nature and development of firm-specific intangibles - and the role of policy

Firm-specific intangibles are important for survival and growth of the firm, and its ability to compete with other firms. Examples include managerial skills and know-how, relationships with suppliers, channel partners, and customers, organizational processes and routines, R&D, and firm-specific human capital. According to the resource based view (Barney, 1991; Teece, 1986), these intangible assets are more likely to be valuable, rare, inimitable, and non-substitutable as compared to tangible assets.

In the following section, we summarise the different mechanisms through which these firm-specific intangibles develop and grow.

5.1 Channels for development of firm-specific intangibles

5.1.1 Entrepreneurial Skills

Policies that can develop and nurture entrepreneurial skills in firms are important for the growth of intangibles. Entrepreneurial skills are an important category of intangible assets of firms. These skills enable growth of firms through innovation and increased investments to develop new intangible assets, such as business models or brands. Although, these skills reside in individuals, they require enabling conditions such as availability of finance that can support risky ventures, an environment in which failure of an entrepreneurial venture is not viewed as a stigma, and robust bankruptcy and M&A processes that can facilitate quick reallocation of resources within the economy in cases of failure.

Entrepreneurial skills that firms use to recognise and exploit opportunities for growth and value creation are important for both established and new firms (Teece, 2015; Hitt et al., 2011). Entrepreneurs possess the skills to identify the opportunities despite the complexity of the

markets. Although, these are individual skills, they are complemented by organisations providing research, expert support, and structures that can facilitate implementation of decisions.

Depending on the market conditions and the uncertainty associated with them, entrepreneurial opportunities (Sarasvathy et al., 2003) can exist in the form of: (1) exploitation of current markets, where supply and demand exist, but an entrepreneur has to recognize their existence simultaneously and act upon the arbitrage opportunity; (2) “discovery” of markets where there is either latent demand, or supply has to be developed for existing demand; (3) creation of new markets through novel technologies, financing or marketing. By anticipating these opportunities, entrepreneurs provide skills that support innovative activities within the firm and develop intangibles such as patents, finance R&D, reorganise internal processes to operate in the new market by implementing new software, develop new business models, and create new structures such as a corporate spinoff.

Entrepreneurial skills are particularly crucial in the initial stages of any new venture. A new venture can only survive and grow by acquiring complementary tangible and intangible assets. If the entrepreneur(s) is unable to acquire the complementary assets, they can either license the intellectual property or brand, or they can be acquired by an incumbent firm through the market for ideas (Teece, 2015). Hence, for entrepreneurial skills to flourish and promote growth of intangibles, support has to be given to new ventures in the form of financing through direct and indirect measures, as well as managing bankruptcies and the resource reallocation processes that follows (Lee et al., 2011). When an incumbent firm incubates a new venture (corporate entrepreneurship), it also provides managerial, financial, and technical support. But, in some instances, the corporate parent is unable to sustain the support. Since current accounting and financial reporting policies do not recognise intangibles as assets, incumbent firms with too

many new ventures are deemed risky, resulting in loss of valuation and decreased ability to raise finance for the new ventures (Lev, 2018). Hence, new ventures resulting from corporate entrepreneurship also often rely on public policy support for survival and growth. To sum up, based on the diversity of literature, we contend that policies play an important role in the development of intangibles by supporting the entrepreneurial skills within firms.

However, policy makers have to recognize that the population of firms, given their age, size, and other attributes, are heterogeneous (Herrera & Sánchez-González, 2012; Talke, Salomo & Rost, 2010; Balasubramanian & Lee, 2008; Shefer & Frenkel, 2005). Policies must take into account firm heterogeneity when striking a balance between encouraging competition, supporting evolution of standards and platforms, and advancing innovation through temporary IPR monopolies. Moreover, resource reallocations through M&As and bankruptcies also put pressure on public expenditure needed for training, development and reskilling of the employable population, not to mention the costs of maintaining social safety nets for the employees affected by the reallocation processes (Dachs, 2018; Heyes & Hastings, 2016; Rubery, Keizer & Grimshaw, 2016; Mitra & Ranjan, 2011). Policy makers must therefore evaluate the benefits of the policies supporting the development of entrepreneurial skills and the consequent development of intangibles within the firm against the possible negative consequences for social welfare and public finances.

5.1.2 Managerial skills and capabilities

Firms need policy support to augment their managerial skills and capabilities. Young firms that need to overcome the liability of newness might lack the financial resources needed to obtain advice from the experts. Older, but smaller and medium enterprises (SMEs) might not have

sufficient number of skilled personnel who can identify and pursue entrepreneurial opportunities, develop complementary assets, and hence, grow the firm.

Managerial skills and capabilities are integral for the development of organisational processes and the routines and structures that enable the firm to pursue entrepreneurial opportunities, and successfully implement the new business models. These processes are idiosyncratic and usually difficult to imitate (Teece, 2015). Thus, managerial skills and capabilities themselves constitute an important intangible asset of the firm and they also enable the development of other intangible assets. However, since these skillsets are unique, not all firms are likely to possess them to the extent required for survival and growth. This is especially true for young firms which need support to complement the knowledge and skills of their founders so that they can overcome the liability of newness (Boeker & Wiltbank, 2005). Thus, policies that can support firms by providing advisory services would not only help them survive in the early stages of their inception, but would also help them later in developing complementary intangible assets.

5.1.3 Research, Development and Innovation

The innovation process makes an important contribution to the firm's intangible assets. Policy support therefore plays an important role in encouraging firms to continuously and systematically invest in the growth of innovation related intangible assets. There is a vast literature on the evolution of innovation and R&D policy, as well as reviews on the impact of policy (E.g., Edler & Fagerberg, 2017 and Edler et al., 2016). In this report, we do not seek to extensively review this body of knowledge, but to highlight the rationales for R&D and innovation policy and their continued relevance in the intangibles economy. We first present a brief introduction of the terms

innovation and R&D and elucidate the distinction between the two terms before discussing the relevance of innovation and R&D policy for development of firm-specific intangibles.

R&D is an important component of firm innovation and growth. According to Edler & Fagerberg (2017), innovation can be conceived as “the introduction of new solutions in response to problems, challenges, or opportunities that arise in the social and/or economic environment.” R&D is one phase of the innovation process wherein “creative and systematic work” is undertaken to increase the stock of knowledge (OECD, 2015). R&D is an important activity for firms because it generates private returns for growth through the new products and processes introduced as an outcome of its innovation processes, as well as through the stock of accumulated knowledge resulting in absorptive capacity (Cohen & Levinthal, 1990). However, firms need an R&D strategy to sustain their competitive position (Johansson & Loof, 2008). These investments have quasi-public good characteristics, hence business investments in R&D also yield social returns that in turn justify public support.

Public support for R&D investments by firms takes the form of indirect measures – primarily in the form of fiscal incentives that allow firms to reduce their tax burden (Laredo, Kohler & Rammer, 2016), and direct support such as grants, subsidised loans, and equity financing (Cunningham, Gok & Laredo, 2016). A frequently invoked rationale for public intervention is again market failures such as uncertainty and asymmetry of information which limits the willingness of firms to invest in R&D and other innovative activities. More pragmatically, public support is also provided to infant industries that are trying to displace foreign firms from domestic markets (Aghion, 2011), and MNEs because additional R&D investments can provide competitive advantages in the global markets (Impullitti, 2010).

Financial policy support is but one mechanism to help firms to compensate for their inability to appropriate all the benefits from their investments. Further instruments to support private R&D include public procurement which incentivises innovative solutions and innovation inducement prizes (for a broader overview see Edler et al 2016 and Edler & Fagerberg, 2017).

There are three different mechanisms through which support to firms increases and improves R&D activity in firms improves R&D: input additionality (whereby public support induces more business R&D expenditure), output additionality (whereby public support increases firm output for example in terms of more innovations and more turnover through innovation), and behavioural additionality (whereby firms improve the way they perform R&D through learning induced by the support measure). R&D is but one aspect of the innovation process. While many MNEs are looking to internationalise R&D and gain the advantages of the knowledge creation processes in other countries (Edler, 2003; Mudambi, 2008), firms are also increasingly evaluating and exploiting the knowledge created beyond their boundaries (Berchicci, 2013). This search for new knowledge occurs through R&D partnerships, participation in creative collaboration networks and open innovations (Hagedoorn, Roijakkers & Van Kranenburg, 2006; Chesbrough & Bogers, 2014. See section 5.1.4 for a more exhaustive discussion).

5.1.4 Innovation skills and systems

Firms generate and grow intangible assets that are essential to innovative processes and products by investing in R&D within their boundaries⁴; by entering into cooperative agreements with other firms; and increasingly through open innovation processes⁵ (Chesbrough & Bogers, 2014) such as selective revealing (Alexy et al., 2013) - where the focus is not on internalising all knowledge, but to engage with the intangibles commons under less constrictive formal arrangements. Current innovation policies supporting firms' investments in innovations are primarily concerned with resolving ownership related issues, and ensuring that firms can appropriate the returns from their investments. Firms' use of IPR as a tool of defensive and offensive strategies to gain competitive advantages are an established challenge for policy makers. The emergence of crowdsourcing-based techniques that create open innovation processes for solving intractable problems imposes new challenges for policy makers. We first discuss the challenges faced by firms before examining the policy implications of changes in firms' innovation strategies.

Different forms of open innovation require specific managerial and organisational skills to manage these external collaborations (Cassiman & Valentini, 2016; West et al., 2014). Managers have to align their innovational processes with the evolution of the knowledge in the open innovation ecosystem. This means that firms invest not only in developing new technology but also in improving the ability to reveal their knowledge – also known as desorption (Ahn et

⁴ Reviews on the innovation processes adopted by firms can be found in Garud, Tuertscher & Van de Ven (2013); Ahuja, Lampert & Tandon (2008); Foss & Saebi (2016).

⁵ See West et al., (2014) for a comprehensive analysis of open innovation research.

al., 2017) – and absorptive capacity which involves assimilating external knowledge (Cohen & Levinthal 1990; Chesbrough, 2006). The gains from open innovation are then secured through the existing intellectual property regime that allow the firm to appropriate some of the benefits. Due to the characteristics of intangibles, developing markets for ideas is extremely difficult. Public policy plays an important role in framing the intellectual property regime, funding research, education, training, and skill development, and the legal framework to support the intangibles commons, which can eventually support the development of the market for ideas.

Investments in intangibles related to innovations are extremely important to gain competitive advantage, but, the quasi-public good characteristic and the synergistic characteristic of intangibles also makes firms reluctant to invest in intangibles related to innovative property, because the firms are uncertain of the returns and their ability to appropriate the returns. As outlined in the previous section, public policy interventions have addressed this reluctance by providing fiscal incentives to firms to invest in R&D, granting property rights on the intangible assets and temporary monopolies in product markets.

However, some of the policies related to innovations at times conflict with policies that encourage competition. This can be observed in the area of property rights. IPRs are an important part of innovation policies. Firms are granted temporary monopolies on the benefits accrued from an innovation in lieu of risks undertaken and investments in the innovation process, but in return are obliged to make the technical details public. However, these temporary monopoly rights have a limiting effect on competition. Inclusion of “just-in-time” patents in technology standards, granting of patents for narrow claims of innovation, and patent thickets (Kang & Bekkers, 2015; Berger, Blind & Thumm, 2012; Heiner, 2011; Peeperkorn, 2003) are the negative consequences of the IPR regime, which firms exploit to deter entry of competitors in

a particular product market. Just-in-time patents are those patents which have low technical merit and are filed before a meeting is organised to decide new standards, just so that the filed patent can become a part of the new standard in the product market. The inclusion of the new patent in the standard increases the revenue potential through licensing and bargaining for access to competitors' patents. Patents granted for narrow claims do not necessarily extend the technological frontier, but contribute to defensive patent portfolios to protect existing monopolies. This behavior is especially visible in the pharmaceutical industry. 'Patent thickets' is the term given to overlapping patents over similar technologies. These actions are not intended to advance knowledge, and they may have the negative welfare by locking-in the industry to an inferior standard, and more broadly limiting the ability of competitors to launch new products.

The tensions between innovation and competition are often resolved through changes in the way patents are administered in different countries, so that claims of novelty and impact can be more thoroughly scrutinized. Firms also come together to create patent pools so that some of the issues related to hold-up and strategic behavior in standards setting can be avoided. However, this cooperative behavior also has the effect of limiting entry of new firms (Shapiro, 2001). We still do not understand how IPR laws shape the strategic behavior of firms. Overall, therefore, we need to gain greater insight on how to create policies that support innovation without limiting competition.

5.1.5 Organisational processes, routines, systems, and structures

Entrepreneurial and managerial skills, when complemented by flexible and responsive organizational processes, routines and structures, can generate firm-specific intangible assets in a dynamic marketplace. The flexibility and responsiveness in organizational processes, routines, and structures are an outcome of decentralized decision-making and empowered teams.

Flexibility and responsiveness are important attributes because they enable aggressive response to competition, facilitate speed in decision-making, quick information assimilation from markets, and increase the willingness of the firm to enter into alliances and joint ventures or outsourcing of activities (Teece, 2000).

However, without timely intervention, and periodic reassessment, structure, processes, and shared knowledge can ossify, reducing the impact that these structures, processes and shared knowledge can have on the firm's performance (Berman, Down & Hill, 2002). Since the structures, processes, and shared knowledge take time to develop, young firms might find it difficult to transition from the entrepreneurial stage to the mature firm, and mature firms sometimes lag behind their competitors (Mintzberg, 1979; Judge et al., 2015). While mature firms have the managerial know-how and experience to try and circumvent this decline, younger firms often lack both these factors. Since, younger firms are also unlikely to have sufficient resources to hire external expertise, these firms seek other mechanisms for survival, including participation in public programs that provide advisory services, either through service partners, or grants that support hiring of advisors.

Public policy interventions are important because systems and processes that facilitate knowledge management and growth of intangibles are difficult to acquire in markets except through M&As, and when it comes to M&As, integration related issues often arise that hamper growth of intangibles in the merged firm. Moreover, expertise that can help firms to build and reorganise their structures and processes is expensive and difficult to find. Our survey of literature indicates that while there are no specific policies in place to support and develop organisational capital, many countries offer support to young and smaller firms in the form of advisory services and business incubators (Storey & Tether, 1998; Scillitoe & Chakrabarti,

2010). For example, the European Regional Development Fund supports the AD:VENTURE programme of Leeds City Region Enterprise Partnership. The AD:VENTURE programme provides advisory services to startups along with financing, networking events, academic support, and incubation work space.

Advisory services and business incubators support firms by providing functional and technological advice that is expected to help them build their innovation organization and organize their administrative and production systems. Business incubators also provide networking opportunities and gain knowledge from spillovers (Scillitoe & Chakrabarti, 2010). These spillovers however are not unidirectional. The co-location of firms can also lead to other co-located firms gaining and internalizing knowledge from the focal firm. Firms have to evaluate how to operate in such an environment – whether to isolate themselves from their rivals, or enter into cooperative agreements to exploit the spillovers.

5.1.6 Firm specific training and development

Human capital affects firm investment in intangibles (Arrighetti, Landini & Lasagni, 2014).

While organisations can hire people with the generic and specific knowledge required for a task, and employees might be willing to invest in skill development to improve their employment prospects, employers often have to train employees on the systems and processes that are specific to the organization. Firms undertake the costs of training because they expect to appropriate the benefits from such training in the form of higher productivity (Becker, 1964). Training programmes are also important from an employee retention and satisfaction perspective. Here we find a divide between large and small firms. While large firms usually have the economies of scale to internalize the cost of organizing and managing training, this is more difficult for smaller and less mature organisations (Bryan, 2006). In addition, firms may

undertake training to meet their own strategic requirements, but they also find it difficult to prevent employees from taking jobs elsewhere - in effect denying the firms the full benefit of the training they provide.

Knowing that they will not realize the full benefit of employee training, firms often under-invest in these programmes relative to their strategic needs. (Malcomson, Maw & McCormick, 2003; Moen & Rosen, 2004; Rubery et al., 2016). Underinvestment in the case of large firms, and lack of investment in the case of small firms, invite public policy intervention. Further, due to rapid changes in technology and global scale of competition, market signals to various actors such as students, workers, employers, educational institutes, and governments are often ineffective due to time-lags as well as in establishing the demand for new skills. There is asymmetry in information in the labour market as well as the training market. It is difficult to assess in advance the quality of training programmes, and hence the linkages to jobs, thereby impeding the decision-making of students and employees when choosing programmes. Lack of standardisation in certifications makes it difficult for students and employees to communicate their skill levels to prospective employers, and for employers to take objective decisions on hiring based on skills (Jones & Grimshaw, 2016). All these factors also contribute to the challenges firm face when valuing investments in skill development as assets for the firm. Moreover, current accounting standards also prevent such valuations, preventing firms from generating further investments from external stakeholders (We discuss the role of accounting standards in a separate section 7.1). In effect, this gives an impetus for treating employee training as a public good (Acemoglu & Pischke, 1999).

Our survey suggests that there are variations in training policies across countries, especially when it comes to the question of who bears the costs of training – whether it is the

employee or the employer. Similarly there are variations when it comes to the nature of public support – whether it should consist of direct grants or indirect fiscal incentives, and likewise the extent to which employers can appropriate the benefits from the training provided (Jones & Grimshaw, 2016; Greenhalgh, 1999).

Governments are faced with a choice between incurring the costs of training and levying a charge on the firm in the form of payroll taxes, or providing fiscal incentives to firms to train the employees in-house (Dar, Canagarajah & Murphy, 2003). The choice of policy instrument depends on the broader framework of labour policies that the country has adopted. If the country has adopted flexible employment laws, significant attention has to be paid to skill development and training across hierarchies. Workers have to devote resources and time to upgrading their skills; firms have to work closely with universities; governments and training institutes have to keep firms abreast of the changing demand for various skills, and universities have to work closely with firms to develop curricula that are relevant to their needs⁶ (UKCES, 2014; Andrews & de Serres, 2012).

These training policies do not as a rule make a distinction between human capital that is essential for tangible as opposed to intangible assets. The lack of clarity in this respect is reflected in current studies which examine development of human capital from the perspective of development of tangible assets or generic knowledge, but pay little attention to training and upgrading of human capital that is essential to the development of intangible assets.

⁶ See Jones & Grimshaw (2016) for a comprehensive review of impact studies on linkages between skill development and innovation.

5.1.7 Alliances, partnerships, and joint ventures

Firms gain knowledge and technological know-how from supply chain relationships, licensing agreements, board interlocks, R&D partnerships, technological partners, and joint ventures (Pisano & Shih, 2009). While these forms of cooperation between firms exist regardless of tangible or intangible assets, there are significant considerations that need to be incorporated for intangible assets related cooperation mechanisms (Krause et al., 2019; Kumar, 2010).

Mechanisms to exercise ownership, manage and maintain control of intangible assets are significantly different from mechanisms that perform the same function in the case of tangible assets (Martinez-Noya, Garcia-Canal & Guillen, 2013; Lavie, 2007). One example is standards setting. Standard setting is usually managed and determined by professional bodies (Baird, 2007). In technology platforms where intangible assets play an important role, standard setting is more likely to be determined by dominant firms that force standards on the rest of the industry. Since standards are public goods, this creates a tension between standard setting and competition policies in industries where network effects amplify the value of intangibles.

Generally speaking, agreements between firms reflect their competitive strategies. However, the propensity to enter into such agreements and the governance of resulting organizational arrangements differ if they are motivated by tangible assets as opposed to intangible assets (Kumar, 2010). At a first glance, negotiating these agreements seem to be within the purview of the private sector, with government action confined to providing the regulatory and legal infrastructure required to sanction and enforce these agreements. In many countries, however, governments also have policies to support new ventures. Policies related to incubation, R&D cooperation, networks and clusters actively seek to promote these inter-firm agreements, and these policies also encourage partnerships with universities and other research

institutes – with a view to firms gaining from knowledge spillovers (Scillitoe & Chakrabarti, 2010; Edquist & Zabala-Iturriagoitia, 2012).

Firms also engage in cooperative strategies to grow intangibles such as brands in new country markets, and develop organisational structures and processes (He & Balmer, 2006; Roos et al., 2014). While policies supporting inter-firm cooperation, such as incubation centers and clusters are studied for their impact on innovative capabilities of firms, it is not clear whether similar policies can help firms to develop intangibles such as brands and organizational processes.

5.1.8 International trade and FDI

Inward and outward FDI also helps organisations to develop and grow their intangible assets (Dunning, 2001). Firms enter foreign markets not only to seek new markets for their existing assets (market seeking motivation), but also to seek new technologies and know-how (asset and resource seeking motivations) (Nachum & Zaheer, 2005). MNEs that invest in a new country market through a joint venture or a partnership share technology, know-how and expertise, which the host country market firm can appropriate (Huang & Chiu, 2014). However, for such agreements to work as intended, policies have to be in place to ensure completeness of contracts and framework for sharing of technology and know-how (Wang et al., 2017). In many instances, firms also receive support from home governments to acquire intangible assets through FDI and increase the knowledge base of the home country (Lu et al., 2014).

5.2 Role of public policy in development of firm-specific intangibles – A summary

Currently public policies on firm-specific intangibles are extensively geared towards increasing the productivity of the economy by increasing the innovative output and capabilities of firms.

However, these policies largely neglect firm heterogeneity (other than firm size and age). This heterogeneity is important, because within the ambit of innovation strategies of firms, allocation of resources for different innovation processes will differ depending on internal and exogenous factors including complementary assets, embeddedness of the firms and their agents in a socio-political context.

As we discussed in the previous chapter, the markets for intangibles are distorted due to the characteristics of the asset as well as the heterogeneity in the characteristics of the firms. Policy interventions seek to address different types of systems and market failures including those due to increasing returns to scale, spillovers, information asymmetry and monitoring costs of transactions. Public policy interventions range from developing entrepreneurial and managerial skills, FDI, training and development and enhancing the framework for intellectual property protections to well established R&D funding. The objectives of the policies are to enable the internalisation of intangibles by firms, and to maximize the rents that can be derived from them.

Policies related to intellectual property seek to reduce spillovers, reduce monitoring costs of transactions, and ensure that firms benefit from the network effects. However, such protections also increase the costs of inter-operability (Menell, 2019). With firms choosing to participate in open innovation ecosystems, IPRs provide the framework to protect ownership, which in turn, because firms are less concerned about appropriation of intellectual property by rivals, facilitates cooperative agreements. However, for more complex inter-firm relations such as R&D partnerships, patent pools, and joint ventures, the legal systems and frameworks have to evolve to protect and manage IPR.

The variety of mechanisms through which firms develop intangibles underscore the mix of policies that can influence firm investments in intangibles. Current policy mixes usually combine skill development, fiscal incentives, and direct measures, and invariably target software development and innovation property. But wider questions prevail. There are tensions between policies which use different mechanisms to generate firm-specific intangibles. Policies on bankruptcies, M&As, and flexibility in labour laws have implications for safety nets in the economy. Resource reallocations through bankruptcy and M&As encourage entrepreneurs and financial institutions to undertake riskier investments in intangibles. Flexibility in labour laws also increases the propensity of entrepreneurs to start risky new ventures based on intangibles. However, unless there are safety nets in place to protect the workers who were laid-off as a result of bankruptcy or M&As, income inequality accompanied with other social tensions is likely to increase (Andrews & de Serres, 2012; Haskel & Westlake, 2018).

The above example on interactions between various policies underscores our need for more insights on the kind of trade-offs that decision-makers have to agree to achieve growth in intangibles with few externalities. We also need to study the likely consequences of these trade-offs, especially in the strategic behaviour of firms to gain competitive advantages. Further attention needs to be devoted to the design of public support for private investments.

6 The nature and development of intangibles commons- and the role of policy

6.1 Introduction

Intangibles commons is the aggregation of tacit and explicit knowledge, skills, and competencies related to a certain technology or industry (Pisano & Shih, 2009). While explicit knowledge can be transferred despite the geographical and cultural distance between partners, proximity is important for the transfer of tacit knowledge. Technical knowledge is highly tacit and hence, intangibles commons are more likely to develop in certain specific locations (Gertler, 2003). The creation of the pool of intangibles, or the intangibles commons, occurs through interactions among firms, individuals in their roles as inventors and customers, not-for-profit agencies, and public agencies (Asheim & Boschma, 2011, see case of the British film industry, page 103 and NESTA, page 105).

At a firm level, inflows and outflows to the intangibles pool can lower the firm's cognitive costs, transaction costs, and organisational costs (Cassiman & Valentini, 2016). These costs are mostly notional and arise from the firms' non-utilisation of existing innovation intangibles. When firms do not reveal to or absorb information from the intangible commons, their innovative intangibles are likely to lie unused. Researchers in such firms are less likely to be effective in searching for new technology, or utilising technology from outside the firms' boundaries, thereby incurring cognitive costs. By absorbing and revealing information about innovative intangibles, firms gain knowledge of the licensing processes and are in a better position to bargain against patent holdups – this has the effect of reducing transaction costs. As the frequency of engagement with the intangibles commons increases, firms are also more likely to use their specialised organisational units for innovation activities thereby spreading the average costs of investing in the specialised units.

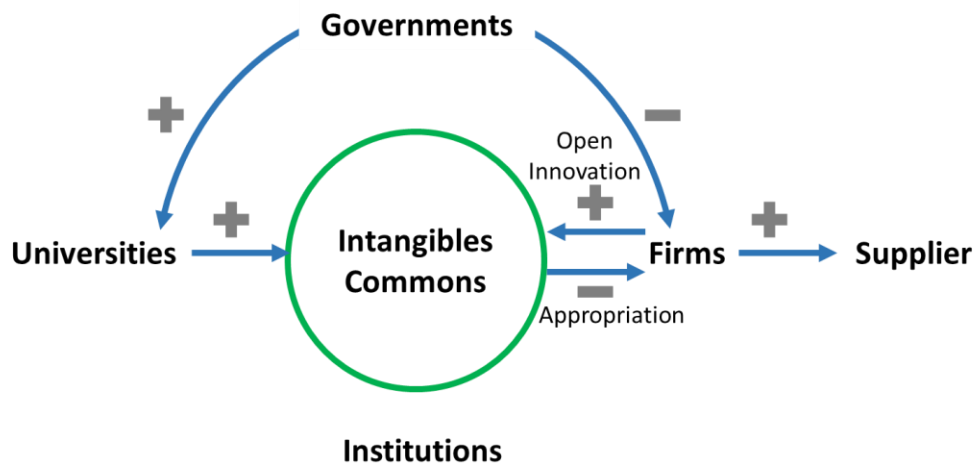


Figure 1: Pathways to develop the intangibles commons

There are multiple pathways through which intangibles commons develop. Policies related to funding of research in public institutes, universities, and higher education have a positive impact on the development of intangibles commons. The stock of knowledge in the commons also increases when firms choose open innovation strategies as a part of their larger innovation strategies, as well as when they share their knowledge with suppliers to increase the innovativeness of their products and services. However, when firms rely on appropriation strategies to gain competitive advantage, they do not share their knowledge with the commons, thereby restricting its growth. Moreover, they also seek to use the public support for growth of different types of intangibles as a competitive strategy, thereby, drawing from the intangibles commons, but not contributing to its growth. These relationships are depicted in Figure 1. We discuss each of these aspects in greater detail in the following section.

6.2 Channels for development of intangibles commons

6.2.1 Public investment in research, education and training:

Next to firm specific support for research and development activities (see section 5.1.3), government investments in research and funding especially of universities and public research institutions have been an important component of the development of the intangibles commons. Government support of research through public research institutes, universities and funding of research collaborations between public research institutes, universities, and the private sector increases the pool of knowledge available for further research and commercialisation. Research institutes and universities typically focus on “open science” where the emphasis is on rapid and complete release of information to support faster growth of new knowledge. Open dissemination of research output reduces duplication of efforts, improves cooperation between scientists, and reinforces institutionalised norms (Aghion, David & Foray, 2009). This public access to information complements private R&D efforts.

The Bayh-Dole act of 1980 in the United States, provided an alternative route to dissemination of information from research. The Act and its counterparts in other countries allows universities to claim control of intellectual property when research is funded by public agencies (Fabrizio & Minin, 2008). Such a shift in the control of intellectual property rights accords greater importance to appropriability as the incentive to commercialise research. This legislation also shifts the onus of the research-driven technology transfer from the government to the academia. Although, the impact of the legislation on commercialisation of research and further funding of research activities in universities and public research institutes is still being debated (Kochenkova, Grimaldi & Munari, 2016; Kenney & Patton, 2009; Shane, 2004), universities and public research institutes continue to be important contributors to the intangibles

commons through different modes of co-generation and transfer of knowledge and technology. Moreover, they also play a key role in dissemination of knowledge through higher education, training, and skill development, thereby developing the skills related intangibles and the absorptive capacity of the economy as a whole.

6.2.2 Open innovation

Open innovation is also an important pathway for the development of the intangibles commons. When firms selectively reveal the issues for which they seek solutions from the external environment, this suggests research areas that other firms can also exploit. Because of the wide reach of the internet, this allows also individuals and small firms to pursue small-scale low-cost research in these areas, thereby challenging innovation systems that are dominated by large well-funded organizations. These efforts link more closely the research community, which is decentralized and usually fragmented, with the needs of the industry (Alexy et al., 2013). These efforts also reduce the innovation costs for firms and increase the diversity of solutions that emerge (Terwiesch & Xu, 2008). Although firms benefit from solutions that are tailored to their specific needs, or that of the industry, they cannot appropriate all resulting benefits. Researchers who develop the solutions often publish their work in journals, thereby denying firms quasi-monopolistic profits. Or researchers become entrepreneurs, launching firms that offer the solutions first. In both instances, problem revelation generates solutions that opens up new pathways for innovation and knowledge creation, with positive and significant impact on the development of intangibles commons.

Innovation flourishes when there is a continuous supply of external knowledge, when there are few barriers to the mobility of highly-educated personnel and availability of financial resources, and when there is a well-developed regulatory systems that can protect intellectual

property rights (IPR). These factors are closely related to the national system of innovations (NSI). Nelson (1993) defines NSI as “The network of institutions in the public and private sectors whose activities and interactions imitate, import, modify, and diffuse new technologies.” Since the locus of innovation is slowly changing from the firm to innovation networks, the NSI also needs to evolve accordingly. This includes facing the mismatch of transnational build-up of intangible commons and the national reference framework of most of the policies. The division of labour and specialisation in innovation systems is evolving, with firms increasingly investing in applied research rather than basic research. The onus is on governments and universities that carry out basic research. It also means that governments have to reverse the trend of declining investments in funding basic research (Pisano & Shih, 2009).

In order to align NSI with open innovation, governments are encouraging firms to join multi-partner innovation networks. Funding for innovation is shifting from individual firms to collaborative networks for joint product development and their commercialisation. The complementary knowledge flows from various types of partners is beneficial to the intangibles commons as well as for reducing the R&D costs for the firm (Kramer et al., 2011).

Open innovation brings with it other sets of policy challenges as well. Firstly, open innovation processes still leave open many issues related to intellectual property rights. Different firms adopt different approaches to the intellectual property rights of the solutions that are generated. In certain cases, firms retain the necessary property rights, but in other cases the solution generator retains the IPRs. The ownership decision depends on the incentive design (Gambardella & Panico, 2014). For this reason, intellectual property rights have to be clearly specified and legal protections made available for different contractual arrangements so that

issues of ownership and control do not deter either problem revealing or specifying all relevant solutions.

Secondly, in a globalized economy, citizens of a country who have developed their intellectual capabilities using a country's educational and innovation systems may often participate in solving problems revealed by firms headquartered in other countries (Herstad et al., 2010). Policy makers therefore have to formulate policies that determine to what extent should knowledge systems developed for the domestic context can support and benefit from the open innovation processes run by foreign firms, and how issues pertaining to intellectual property protection would be resolved when they involve foreign firms. Going forward, policy makers have to address these evolving challenges in response to the growth of intangibles through the open innovation processes.

6.2.3 Creativity through new ventures

New ventures contribute to the intangibles commons by providing creative solutions to latent and expressed demand for products and services. They do so by developing new skills in the workforce, introducing new ways of organising information, redesigning tasks, advancing technology, and pioneering new business models. These ventures are risky and face numerous challenges and as such require a multi-pronged policy support to incubate and sustain their growth.

New ventures serve latent customer demand through creative business models, new technology, or novelty in products. These ventures contribute to the intangibles commons by introducing new business models and technological skills in the marketplace. Although, many production processes, technologies, organizational processes and structures are internal to the firm and information is protected through trade secrets and confidentiality agreements, some of

the activities of the new ventures are revealed through their actions in the marketplace. Products and technologies can be reverse engineered and some aspects of the business model such as sales practices, choice of channel partners, and pricing strategies can be retroactively understood from the startup's revealed actions (Baden-Fuller & Morgan, 2010). This knowledge adds to the intangibles commons through the novelty of ideas. Entrepreneurial firms and small and medium enterprises are a significant source of employment. In the year 2018, SMEs contributed approximately 60% of employment in the UK (FSB, 2019). Employees acquire new skills especially in innovation-based startups, primarily through firm-specific training and learning-by-doing processes (Freel, 2005; Knockaert et al., 2011). These new skills are important contributors to the intangibles commons through mobility in the labour markets and knowledge spillovers.

Moreover, startups contribute to the intangibles commons through failure as well as success. According to data provided by Enterprise Research Center (Bounds, 2017), only 50.1 percent of firms started in London in 2013 survived after three years. Managers transfer what they learn by observation and experience from past failures to new projects, using knowledge gained to guide their decision-making (Carmeli, 2007). Failure also frees up intellectual capital, human capital and other financial resources for more productive uses through M&As and imitations (Andrews & de Serres, 2012). For instance, the bankruptcy of the Canadian telecommunications equipment, maker Nortel Networks allowed a consortium of firms that included amongst others - Apple, Microsoft, and RIM - to buy more than 6000 patent assets that would not been easily available in the market. These patents enlarged the intangibles commons through their availability to a large group of firms who came together on a cooperation basis and who have undertaken to license this technology to other firms on fair, reasonable, and non-

discriminatory terms (Department of Justice, 2012). Thus, failures are also an important mechanism for the development of intangibles commons and contribute to the transfer of firm-specific intangibles.

An enabling ecosystem needs to be in place for incubation and growth of new ventures. This ecosystem prominently comprises of a robust financing network including venture capitalists and angel investors, regulatory system that simplifies the processes of both starting and winding down a new venture, and universities, public research institutes and higher education providers that support new knowledge and skill development (Meyer, 2003; Da Rin, Nicodano & Sembenelli, 2006; Capelleras et al., 2007; Lee, Peng & Barney, 2007; Peng, Yamakawa & Lee, 2009). The ecosystem contributes to the growth of the intangibles commons and in turn benefits from the intangibles commons. In order to support new ventures in the economy, multiple policy instruments have to be used in the policy mix (Flanagan, Uyarra & Laranja, 2011) so that all elements of the ecosystem receive support. In addition, policies on valuation and reporting of intangibles are also important for financing. As of now, there is no agreement within the accounting community on the standards to be adopted, and the level of details on intangibles to be included in financial reports (Lev, 2018). Although many of the policies supporting new ventures would result in the growth of firm-specific intangibles, policies related to bankruptcy, skill development, and clusters should contribute to the enhancement of the intangibles commons. Policies that ease the bankruptcy processes should help unlock the intangibles assets of firms that are close to insolvency, thus benefiting the intangibles commons. In sum, the creativity unleashed by new ventures is an important contributor to the intangibles commons. Employees of these ventures learn new skills, other firms learn about creative business models and novel technological applications. Venture capital firms, angel investors, and

academia also learn about the intangibles developed by the new ventures through their mutual interactions. Their actions contribute to the rest of the ecosystem. Thus, the next wave of new ventures can therefore make use of a substantial pool of intangibles sustained by venture capital firms, angel investors, and academia.

6.2.4 Spillovers

Knowledge is inherently a non-excludable and non-rivalrous good (Romer, 1990). Knowledge spillovers occur when it is legally difficult for firms to exclude rivals from imitating their products, technologies or ideas. Rivals learn from the innovative efforts of other firms by re-engineering products, technologies, and business models. Knowledge spillovers also occur when skilled employees, apprentices, and managers apply knowledge gained earlier in one firm when taking up employment in another firm. Contractually, this knowledge cannot be appropriated by a single firm, and its circulation as employees change jobs increases the intangibles commons, which in turn makes knowledge resources available for new ventures.

There is often a spatial aspect to knowledge spillovers because effective exploitation of spillovers require direct contact to overcome barriers posed by the tacit component of knowledge (Capello, 2009). Thus, although, a firm's innovation efforts may contribute to the intangibles commons, this contribution is often limited by barriers to the transfer of tacit knowledge.

Spillovers represent incomplete appropriation. Firms are incentivized to invest in innovation capabilities by expectations of appropriation, expectations that are often based on the appropriation policies of the country. At the same time, however, countries often have policies that address appropriability and knowledge spillovers in clusters, labour markets, and indigenisation of production (Belenzon & Schankerman, 2012; Audretsch & Keilbach, 2005;

Doring & Schnellenbach, 2004; Spencer, 2008). But these policies are not coordinated. Policy makers therefore need to develop a policy mix that strikes a balance between the two sets of policies to ensure that there is a simultaneous development of firm-specific intangibles along with that of intangibles commons.

6.2.5 Demand from lead users

Demand from sophisticated lead users tends to directly increase firm-specific intangibles, whereas demand from large firms and governments for complex technological solutions may encourage creation of an ecosystem of solution providers - thereby contributing to the development of the intangibles commons. Lead users have sophisticated knowledge of technology and are willing to risk novel solutions (von Hippel, 1986). The lead users can be individual customers, large firms, or governments. Large firms and governments also use procurement and innovation contests to incentivize supply. For large firms, the procurement is typically through dedicated supply chains, and their procurement processes differs from that of governments (An area we address in the next section).

For infrastructure services based on large socio-technical systems (LSTS), technological changes imply changes across all the components of the system (Weber, 2003). E.g., changes to the transportation system include new vehicles, fuel, fueling stations, depots for parking and maintaining the vehicles. Changes across so many sub-systems can increase the risk of failure for the system as a whole. Because of the size and scale associated with public procurement, governments are better positioned to take risks with costly changes and demonstrate the viability of the technology (Edler & Georghiou, 2007; 2015; Edquist, Vonortas & Zabala-Iturriagoitia, 2013). Such procurement can also lead to changes in the technology and production for the other suppliers of sub-systems and stimulate innovations in the entire eco-system. This is the

mechanism through which especially large infrastructure procurement supports the build-up of intangible commons. However, procurement of new technologies, especially at an infancy stage also leads to complexities associated with emergence of dominant design. Idiosyncratic requirements can restrict adoption of technology into new markets, and result in lock-ins in the case of technology platform (Edler & Georghiou, 2007; Dolfsma & Leydesdorff, 2009).

Decision-makers have to account for all these consequences when making policy choices.

Aberdeen city council's procurement of hydrogen fuel cell buses is an example of government procurement developing the intangibles commons for a new technology. Aberdeen city council along with London, Birmingham, Dundee, and Brighton is jointly procuring hydrogen fuel cell buses for the UK. These buses are more efficient than electric buses, have zero-carbon emissions, take less time to refuel, and have greater transportation range. Ballard⁷ manufactures the fuel cell, Van Hool the chassis, and BOC has invested in the hydrogen production and refueling station. Scottish & Southern Energy Power Distribution (SSEPD) is monitoring the impact of hydrogen on the grid, and Scotland Gas Networks (SGN) supports SSEPD on grid balancing. The Aberdeen city council's procurement of buses with new technology is resulting in developing an entire ecosystem for hydrogen fuel cells and will have an impact on further development of the technology for other vehicles, such as cars.

Summarising this discussion, government as a sophisticated lead user enables the demonstration of new technologies for LSTS. Different firms have to develop solutions for the varied problems that arise in each of the sub-systems. The individual firms develop problem solving skills and novel technological solutions, creating firm-specific intangibles that result in

⁷ <https://www.ballard.com/docs/default-source/motive-modules-documents/aberdeen-case-study.pdf>

improved products and service offerings. They also coordinate with other firms in the ecosystem for problem solving and inter-operability of technology and products thereby creating a pool of new knowledge on the new technology. This ecosystem is a new intangibles commons for specific technologies, which can be used in other contexts and other products.

6.2.6 Supply chains as originators and transmission belts for intangibles commons

Suppliers and channel partners are an extremely important source of market intelligence which, firms transform and internalize into their knowledge base. Production partners, especially original equipment manufacturers (OEM), learn from the production processes of the focal firm to increase their technological sophistication, and can eventually emerge as competitors (Pisano & Shih, 2009). They specialize in these production processes and eventually develop the inbound and outbound logistics required to enter the same product markets as their competitors. Supply chain relationships are another source through which high performance management practices are diffused in an economy (Fu, 2012). Computer and laptop equipment manufacturers such as Acer and Lenovo started as OEMs, before eventually becoming independent producers, and competitors to manufacturers such as IBM. Suppliers and channel partners also participate in the technology development efforts of firms and increase the pathways through which knowledge flows across the economy, thus, growing the intangibles commons.

Policy interventions to develop the intangibles commons through the linkages between the focal firm and suppliers are being prominently deployed by regional development agencies. For example, Potter (2002) documents the cases of the “Source Welsh” programme by the Welsh Development Agency, the “Supply Network Shannon” by the Shannon Development, Ireland and the “National Supplier Development Programme” by the Czech Republic. He argues that these development agencies use a mix of aftercare and retention, and long-term embedding

policies to improve the local skills base and innovation capacity. The regional development agencies are also using these programmes to build clusters to support local development. We discuss the cluster development policies in the next section.

In sum, supply chains are an important mechanism through which intangibles commons are developed. Policies related to regional development use supply chain as a mechanism for knowledge diffusion by invoking policy instruments related to FDI and clusters.

6.2.7 Clusters

Clusters develop the intangibles commons through knowledge spillovers, mobility of skilled and trained labour, shared technological knowledge, greater rivalry, and complementarities in product development (Uyarra & Ramlogan, 2016). Clusters are formed when inter-connected companies and institutions identified with a particular field concentrate in a geographical location. Co-location provides firms with better access to high-productivity employees with specialised training leading to low search and training costs, co-located suppliers and intermediate industries that provide specialised inputs, and support services such as logistical, advisory, and specialised financial services. These lead to lower cost of production due to internal economies of scale, and deeper insights into firm requirements.

Cluster policies emerge at the cusp of industrial policy, innovation policy, and regional policy (Uyarra & Ramlogan, 2016). There is increasingly greater focus on supporting drivers of competitiveness, creation of SME networks, promotion of FDI, and restructuring declining sectors due to technological changes, as opposed to an industrial policy that supports a narrow set of industries. As discussed in the previous section, regional development agencies as a part of the regional policy are increasingly using cluster policies to address regional imbalances. The

goal is to go beyond infrastructure development to focus attention on institutional development and to foster networking and building social capital of firms (Oughton et al., 2002).

Policies for clusters consist primarily of policies to promote entrepreneurship, financing of new ventures, development of strong industrial and scientific base, networks between industry and science, and development of social capital of members of the cluster (Su & Hung, 2009). Since clusters have a strong spatial aspect, these policies are also applicable within those spatial limits. The policies related to entrepreneurship, financing, and building of networks with universities/science can be achieved through fiscal incentives and grants. In order to help managers in key positions develop their social capital, it is important to organize events, tradeshow, seminars, and other meet-and-greet events. These help to develop repeated interactions between different members of the cluster leading to increased trust between members. These conditions foster knowledge flows between firms, and greater formal cooperative arrangements.

However, clusters could also lead to over-specialisation resulting in lock-in of technology and inability to adapt with changing economic and technological conditions. Clusters could also lead to increase in costs of inputs especially when specialised labour is crucial. Moreover, clusters could also grow at the expense of other regions, creating a different regional disparity (Swann, 2006; OECD, 2009). Moreover, evidence on the purposive role of public policy in the creation of clusters is also scarce. Although these disadvantages and concerns associated with clusters are not confined to the development of intangibles, it is still worthwhile repeating these arguments to underscore the need for caution while evaluating and implementing cluster policies.

In sum, clusters play an important role in diffusion of knowledge through spillovers, development of organisational structures and routines and development of social capital through

networking and repeated interactions. Many policies to support clusters have shown to be beneficial in generating cluster benefits, even if a lot attention is still needed to understand the relative efficacy of policy instruments in developing clusters.

6.3 Role of public policy in development of intangibles commons – A summary

Policies for the intangibles commons seek to promote the growth, accessibility and flow of knowledge in the economy. These policies have two aspects. One, they attempt to increase interactions between the various actors making knowledge and information sharing easier. Second, they seek to limit the extent to which actors in the ecosystem can appropriate benefits from the interactions at the expense of other actors. Although the emphasis of these policies is on knowledge; relational capital which is also an intangible, also increase in value because of the repeated interactions between various stakeholders and the focal firm.

From the survey of literature on the various agencies and avenues that develop the intangibles commons, we find that policies related to IPR, financing of risky ventures, especially through venture capital and angel investors, bankruptcy, competition, skill development, innovation systems, clusters, procurement, and social safety nets have a significant impact on the growth of the intangibles commons. Some of these policies while important for the growth of intangibles commons are also important for the growth of firm-specific intangibles.

Policies related to IPRs enable firms to protect and monetise their innovations (Edler et al., 2015). These policies also spur further firm investments in R&D, and permit firms to use IPRs as aggressive and defensive competitive strategies. However, they are also important in facilitating interactions with alliance partners, participating in the open innovations processes, creating new supply chains, and becoming the lead firm around which clusters evolve, thereby a kernel for enlarging the intangibles commons. The protections afforded by the IPR policies

allows firms to interact with other members of their ecosystem without fear of losing control of key assets.

Policies that encourage formation of venture capital are vital for financing new ventures and are therefore important for creation of firm-specific intangibles, but they also simultaneously grow the intangibles commons by creating knowledge resources, and evolving venture capital ecosystems. Venture capital firms not only provide finance but also provide advisory services to their clients. They also provide networking opportunities to the new firms thereby encouraging technology collaboration, facilitating raising of additional finance, and brokering M&As. Thus, venture capitalists act as important disseminators of information and contribute to the intangibles commons both directly and indirectly.

Policies that shape bankruptcy laws are important because they provide a viable exit option. Well-designed bankruptcy laws ensure that investments in a new venture are not all sunk costs, that some can be recouped if the firm is dissolved. Simultaneously, bankruptcy proceedings also provide an avenue for competitors and consortia to gain valuable firm-specific knowledge, thus indirectly adding to the intangibles commons.

Systems related policies enable simultaneous growth of firm-specific intangibles and the intangibles commons. All the three sets of policies encourage two-way interactions between firms and their ecosystems such that firms can draw knowledge on technology, organizational processes, structures, and business models from the intangibles commons to develop their own specific intangibles and then share the updated knowledge with the pool to create a virtuous cycle of growth of intangibles. Policies for clusters, innovations, systems, and procurement all have the desired goal of increasing collaborative growth. However, they differ in the specific instruments that they use, their ability to grow specific dimensions of intangibles e.g., brands,

and the nature of interactions that they encourage between firms, e.g., formal or informal interactions.

Policies for the development of intangibles commons are a part of a complex landscape, where different elements such as firms, suppliers, academia, and governments are constantly collaborating and competing with each other and different policy instruments interact with each other to either mutually reinforce or dilute each other's impact. Policy mixes therefore have to be carefully crafted and implemented for optimal benefits to both firms and the intangibles commons.

In the following chapter we turn to policy gaps challenges and tensions. This includes the limited ability to measure intangibles and their effects, and thus a lack of communicating the importance of intangibles, and the tensions and trade-offs that arise due to the interactions between the various policies for firm-specific intangibles and the intangibles commons.

7 Policy challenges, tensions and trade-offs

One of the important challenges for policy makers is to simultaneously address the interdependence between firm-specific intangibles and the intangibles commons - and the limits they pose to the other's growth. Measurement is one area where the interdependence between firm-specific and intangibles commons can be prominently observed. Measurement issues also highlight the tensions between the firm-specific intangibles and the commons, as the increase in one might imply a decline in the other.

7.1 Significance of accounting standards for policy-making

Measurement of firm-specific intangibles is important for the valuation of the firm, which again is important for firms to raise financing from external sources, as well as provide a more accurate picture of the operations of the firm. Of the different types of intangibles, valuation of the organisational capital is the most challenging because the development of organisational capital is internal and highly firm-specific. Organisational capital is an important component of intangibles which helps the firm to respond to the task environment. Without clear principles and guidelines on measures and measurement of organisational capital, it is difficult for the markets for intangibles to develop due to the severe information asymmetry between potential buyers and sellers (Skinner, 2008). While national systems of accounting are starting to include key components of intangibles such as software and innovative property in their reporting, they have yet to find ways to include organisational capital in their measurement systems (Haskel & Westlake, 2018). The situation is not much better at Firm level where accounting systems are yet to make substantial progress in including any of the intangibles developed within the organisation in financial reporting, even though there are guidelines for those that are acquired in the form of goodwill (Lev, 2018).

Although measurement and financial reporting fall under the remit of professional accounting bodies such as FASB (Financial Accounting Standards Board) and IASB (International Accounting Standards Board), there are public policy implications due to inadequate financial reporting of intangibles. Firstly, without firm level reporting of intangibles, the national level reporting on output of the economy would be difficult to accomplish. Secondly, there would be fewer methods to evaluate the impact of public policies such as financial incentives and subsidies on intangibles. It is hence becoming increasingly important to develop the coordination between policy makers and professional accounting bodies needed to constructively discuss, evaluate and align existing divergence between national accounting systems and firm level financial reporting systems.

Measurement of the intangibles commons is another area which will challenge the professional accounting bodies. The intangibles commons reflects the shared knowledge of various actors in an ecosystem and as such, this shared knowledge is difficult to evaluate because there is no central controlling or ownership entity. Since the intangibles commons is a notional concept, its measurement is more likely to be derived from the valuation of the intangibles of individual firms and from the value of the intangibles captured in national accounting - and thus is by definition incomplete. However, valuation of the shared knowledge is also important because it helps policymakers evaluate the degree of effectiveness of the pipes through which the knowledge flows between the firms and the commons. There is a need to develop new models of valuation that can reflect the complex reality of the intangibles commons as well as provide a meaningful representation for action from various participants of the ecosystem.

We now turn our attention to the complex interactions between policies for the development of firm-specific intangibles and the intangibles commons that result in tensions in

goals and processes of individual policies and require trade-offs between various elements to ensure that overall objectives are met.

7.2 Tensions between policies encouraging appropriation and increasing competitiveness

Policies that target different components of intangibles reflect the tensions between appropriability, competition, cooperation, and innovation. Appropriation regimes in the form of IPRs provide temporary monopoly benefits, in principle they are designed to incentivize firms to innovate. But these benefits also have the effect of limiting competition and thus limiting the intangibles commons. In some situations, however, appropriation regimes can stimulate competition and increase the intangibles commons. Firms might voluntarily choose to forgo rents from licensing, in order to obtain solutions by resorting to open innovation. Coopetition between firms can lead to the growth of firm-specific intangibles as well as the intangibles commons. Policy-makers and researchers need to investigate these processes in greater detail to understand the different facets of such arrangements, and how these can lead to sustained action rather than piecemeal efforts in response to idiosyncratic situations.

Standards setting also impacts the development of the intangibles commons. The size of network effects depends on the standards by which the platform operates. Policies must avert a proliferation of standards that can stymie technological progress, but at the same time work to ensure that standards that result from IPR monopolies do not lock-in consumers to sub-optimal technological standards. Standard setting is not the exclusive domain of governments. For example, standards in two-sided markets, such as operating systems platforms, evolve in the marketplace. It is in this private sphere that governments, while not directly involved, can still steer the technology development through laws that regulate competition and govern dispute resolution.

Another set of policies that are expected to enable the growth of firm-specific intangibles are those related to markets for corporate control. Here there are tensions between support for competition, and markets for corporate assets that tend to concentrate control through M&As. Although M&As are supposed to increase the dynamism of the economy by releasing intangibles and human capital trapped in inefficient processes and structures (Andrews & de Serres, 2012), over time, M&As can lead to market consolidation and reduced competition. Licensing arrangements allow for firms to unlock some value from intangibles, but these arrangements incur high search and bargaining costs and hence are not easily developed. Ironically, lack of accounting standards for valuation and disclosure of intangible assets, means that currently M&As and bankruptcies may be the only time when information about the valuation of intangibles is more freely available.

To sum up, there are few alternative mechanisms by which the intangibles can be traded like other assets. Regulators have to evaluate the role of anti-trust legislation for the growth of intangibles and alternate mechanisms to unlock the value of intangibles mired in unproductive firms.

7.3 Tensions between policies encouraging appropriation and increasing innovation

Competition regulators are increasing scrutiny of firms that resort to “patents ambush”, a process by which a firm that is part of the standards setting organisation (SSO) fails to disclose essential patent(s) during the standard setting, but extracts licensing fees after new products have been launched by competitors (Hemphill, 2005). There are ongoing debates on the extent to which firms have to disclose their IPRs portfolio to be eligible to be a part of any SSO, and the what role should competition regulators adopt in enforcing those guidelines (Layne-Farrar, 2014; Hemphill, 2005). Gans & Persson (2013) analytically demonstrate that due to the strong IP laws,

new entrants are more likely to use cooperative strategies such as sale of innovations, M&As or long-term licensing of innovations instead of competing with incumbents directly. They argue that in light of the growing strength of the IP laws, competition regulators should offer more protections to new entrants when they enter into negotiations over the cooperative arrangements.

In view the multiple strategic actions of firms to gain competitive advantages using IPRs, public policies for the development of the intangibles commons can design a role for innovation intermediaries that can support the markets for intangibles. Such a market would promote knowledge flows, prod firms to unlock the value of IP that sits on the shelf unused, and fuel development of business models that are more efficient in allocation of corporate resources as well as the resource allocation efficiency of markets.

7.4 Tensions between policies encouraging growth of intangibles and safety nets

Policies for markets for corporate control and intangibles have implications for labour market policies as well. One of the sources of growth of intangibles commons is knowledge spillovers. An important agency for spillovers is mobility of skilled workers. However, mobility is more likely to be high when there are flexible labour laws in place. When employment protection laws are strong, employers are more reluctant to dismiss workers without cause, and workers are less likely to be motivated to reenter the labour market. While these protections are beneficial for the growth of firm-specific intangibles, they reduce the scope of an important inter-firm learning process. However, when flexible labour laws are adopted, governments should increase spending on re-skilling, training and safety nets.

7.5 Firm vs. Public investments in training

Governments invest in skill development through two main avenues. One is through educational policies pertaining to schooling, higher education, and vocational training. The other is through reskilling programs and training programs that are required to meet the challenges of changing technological and business landscape of the economy. Both the approaches are required for developing firm-specific intangibles as well as the intangibles commons. However, there is a need for distinct institutional foundations for professional education and training, which are typically short-term courses. Moreover, funding has to be evenly spread between the universities and institutions providing short-term courses so that enrolment choices are not distorted by funding patterns. Examples of institutions providing these facilities include the vocational colleges in Austria and community colleges in USA.

Governments also support firms by providing reskilling opportunities and training to employees who have been made redundant by firms. Such support carries challenges of providing redundant employees with unemployment benefits while they get trained and search for a new job, provide assistance in training and job search, and provide counselling during the challenging period. Governments take different approaches to fund their various skill development programs, including levies from firms, differentiated schemes to target specific categories of firms, and tuition fees; but governments cannot invest equally in all these approaches. Government priorities in terms of support of higher education, vocation training, and support for redundant workers will depend on many factors, including the degree of structural change in the economy. Involvement of the private sector in providing apprenticeships, incentives to hire workers with gaps in their employment history, and better feedback to ensure that curricula are updated to reflect the technological changes are but some measures being

increasingly undertaken to ensure that different sectors work together for skill development and reduce unemployment.

7.6 Large and/or mature firms vs new ventures and small firms

There are distinct requirements from large and/or mature firms as opposed to new and small firms when it comes to developing intangibles. For small and new firms, the main challenge pertains to survival. For larger firms, the challenge is to maintain innovativeness of the firm while ensuring that its structures, process, and routines do not ossify with age. Thus, governments have to ensure that services they provide to small/new firms, for instance advisory services and support for R&D, are more accurately targeted, and are not exploited by large firms. Moreover, larger firms are also more prone to anti-trust scrutiny that could limit their ability to gain advantages through M&As. Governments have to strike a balance between providing exit opportunities for smaller firms through M&As while ensuring that inorganic growth of large firms does not limit the ability of smaller firms to compete with the larger firms. Although anti-trust legislation is important for acquisition of both tangible and intangible assets, the characteristics of intangibles magnify the competitive advantages that can be retained by firms to a greater degree as compared to tangible assets, and hence, the role of the competition regulator becomes extremely important.

This discussion further strengthens the necessity of balanced institutions and appropriate policy mixes that can address the tensions between the needs of the firms to secure rents and the development of intangibles commons. More attention also needs to be devoted on how policies can support all components of intangibles. Policy makers need to update the tools associated with assessments of policy impact on intangibles. Moreover, multiplicity of actors have to come together to develop and maintain the intangibles commons. While governments have an

important role to play through financial incentives, funding and developing rules that can strengthen the activities of the involved actors, trade bodies and non-governmental organisations also have an important role to ensure knowledge flows on an ongoing basis.

8 Institutions for Intangibles and Intangibles for Institutions

8.1 Institutions for intangibles

Investments in intangibles have created many situations where coordination between firms, and between firms and public systems, and between governments is increasingly important. Firms have to come together and agree on inter-operability criteria, technical standards, and licensing of intellectual property for advancement of technology. Inability to cooperate on these decisions leads to risks of lock-in to sub-optimal standards or co-existence of multiple co-existing standards. Governance of networks such as the Internet requires cooperation between firms, governments and various civil society actors. Therefore, the supporting role of institutions is crucial when it comes to the growth and development of intangibles. Institutions underpin the functioning of markets through rules, norms, and shared values. They safeguard property rights and foster trust between various actors, thereby encouraging investments. In this section we primarily focus our attention on the regulatory aspects of institutions and their influence on the development of intangibles. Extant literature on policies for intangibles delves extensively on the appropriability aspect of intangibles, paying particular attention to IPR. This skewed focus is also reflected in our discussion on the institutions for intangibles.

The characteristics of intangibles lend themselves to contests over control, ownership, and appropriation. The contests emerge due to ambiguities in ownership, standards, measurement and valuation (Haskel & Westlake, 2018). The resolution of these ambiguities requires greater clarity from formal institutions as well as development of norms and values. Formal institutions take the form of regulatory agencies such as the Competition and Markets Authority in the UK, political institutions that constitute the rules and standards through which power is exercised, and economic institutions that shape the governance of financial resources (Scott, 1995; North, 1990;

Holmes et al., 2011). While there is no single institution or authority that governs all intangibles in any country; the rules, legal frameworks, and regulatory institutions are the most developed for intangibles related to innovative property such as patents and copyrights (Menell, 2019). Across the developed economies there is relative consistency in the principles on the basis of which the regulatory institutions for innovative property have developed. When differences between countries arise, it is due to variations in administrative structures, legal systems and country specific norms (Andrews & de Serres, 2012).

Contests over knowledge related assets, whether software, or patents and other intellectual property also arise due to the partially-excludable characteristic of knowledge and spillovers. It is essential to establish ownership rights to be able to appropriate any rents from related investments. In highly fragmented industries where technology plays an important role, ownership of intellectual property is also highly fragmented (Gilroy & D'Amato, 2009). Firms accumulate defensive patents to countersue potential plaintiffs and mitigate holdup risk (Ziedonis, 2004). They also engage in portfolio races to gain competitive advantages (Jell, Henkel & Wallin, 2017). Institutions that can adjudicate these contests are therefore extremely important for the development of markets. They become all the more important in technical standards which govern access to platforms, play a critical role in the decisions of firms to provide complementary products, and encourage programmers to adopt certain technical standards and programming languages (Menell, 2019).

Standards setting for platforms is an area where public policy plays an extremely important role. The design of these standards is a function of the type and degree of ownership, sponsorship, and governance of the network access. Standards set by governmental agencies, intergovernmental organisations or formal standard setting organisations are referred to as the de

jure standards. They have the official backing and can be enforced by law. Individual firms or consortiums also sponsor network standards and these are referred to as de facto standards.

Another manner in which standards are classified is by the degree to which they regulate access to the standards. Standards can be free, open, closed or somewhere in between. The degree of regulation is, however, distinct from the restrictions standards impose. The “Free Software Movement” (FSM) allows the other entities or individuals unrestricted access to run, study, copy, share, and modify the software as long as the modifications or other derived products are also made available on the same terms. Thus, in the case of the FSM, although there are few to no regulations on access, the standards are highly restrictive in terms of further dissemination of modifications and complementary products. The “open source” software standards have similar unrestricted access to the source, but impose fewer restrictions on the dissemination of modifications and complementary products. The closed or proprietary standards highly regulate access through licensing of intellectual property rights. However, there are fewer restrictions on appropriation of benefits from the dissemination of complementary products.

The legal challenges to the enforcement of standards arise due to the complexity in the enforcement of different categories of standards. One such example is that of the disagreements between Sun Microsystems (and later Oracle) and Google, which arose out of the different standards each enforced on their own platforms. Sun Microsystems promoted the “Write Once, Run Anywhere” (WORA) principle and made its Java programming language available on that basis. Sun promoted WORA in order to check Microsoft from extending its dominance in the desktop operating systems monopoly to the development of software and applications related to websites. Google developed the Android platform based on the less restrictive open source software standards. This difference in standards has led to the protracted legal battle between

Google and Sun Microsystems (and now Oracle). Such legal challenges increase the complexity of knowledge required to adjudicate disputes (Menell, 2019; Vishnubhakat, Rai & Kesan, 2016).

Institutions are also needed to support the organization of data, especially those related to customer information. The development of digital technologies has led to unprecedented rise in the ability of firms to gather and transfer data with ease across borders. Data is being gathered through websites, smartphones and usage of intelligent systems such as the IoT (internet of things), and cloud computing (Kshetri, 2013; Schwartz, 1994). Databases with customer information are important intangible assets, because this data is confidential and hence, it is not freely available in the markets (Matwyshyn, 2009). Firms such as Acxiom collect information using public records and consumer surveys to mine information and generate insights for their customers⁸. Firms' ability to process this available information has also increased exponentially through improved hardware, storage and processing through cloud computing, and techniques such as machine learning and artificial intelligence. The EU General Data Protection Regulation (GDPR) is leading regulatory efforts on data and privacy protection across the globe (Schwartz, 2012; Dala & Venter, 2016). In light of the changing regulations, firms have to evaluate the trade-off between data privacy and the advantages of business models that aggregate and provide information. Developing policies in this realm also requires new regulatory institutions, agreement on norms to be followed by various organisations across the globe and the underlying principles on which these systems rest.

⁸ <https://www.nytimes.com/2012/06/17/technology/acxiom-the-quiet-giant-of-consumer-database-marketing.html>

8.2 Intangibles for Institutions

Intangibles play an important role in the functioning of formal institutions that regulate intangibles (Menell, 2019; Vishnubhakat, Rai & Kesan, 2016; Antonova 2011; Minogue & Cario, 2006; Quaglia, 2005). Along with regulatory institutions for intangibles, there is also a need for intangibles to develop and support the activities of these institutions. Technical skills in regulatory institutions (for example, skilled anti-trust regulators, and regulators of financial markets), are important to design compliance systems and processes, to determine when the law is violated, and adjudicate in case of disputes. Participation in multi-stakeholder process develops shared understanding of issues and fosters intellectual capital of the members of the process, thus building the capacity of various stakeholders.

Administration of intellectual property is increasing in complexity because of the rules and regulations around it and the use of patents, copyrights and other property are increasingly used as a defensive tactic to preserve the firm's competitive advantage. Thus, administrators have to be aware of issues surrounding patent thickets, and judges have to be aware of the technical complexities involved in inter-operability, technical standards, and standards around licensing while adjudicating cases regarding technology platforms. This requires capacity building in various regulatory institutions. In many of the emerging economies that are transitioning to market economies, institutions have to be developed along with skill development of the regulators (Kirkpatrick & Parker, 2004; Eldridge, 2004). One of the mechanisms is knowledge transfer from developed countries through institutional specialists. Specialized agencies such as EBRD are undertaking this activity along with their role as lending agencies to improve the effectiveness of the loans in achieving desired objective (See page 109 for further details).

Although intangibles have been an important part of the functioning of the economies across the globe, it is only in the last two to three decades that significant attention is being invested to their growth. This reflects variations in the development of norms and rules that govern their development and growth and the institutions that govern their functioning. In this chapter, we highlighted their increasing importance, as well the necessity of building institutional capacity due to the complexity associated with transactions related to intangibles. Institutions and institutional capacity are extremely important for the evolution of markets for intangibles, which are currently only peer-to-peer transactions.

9 Policy and Knowledge Gaps

9.1 Major policy gaps

In this section we summarise what we see as major gaps in terms of policy making and policy instruments.

The first main gap is the lack of operationalisation and measurement of intangibles as a pre-condition for evidence based policy design and implementation. There has been a growing focus on intangibles as a key explanatory factor in the so called “productivity puzzle” - a stagnant productivity despite an increasing output (Goodridge, Haskel & Wallis, 2013). Deeper understanding of the role of intangibles in productivity depends on improving measurement, and the use of these measurements in policy making (Corrado et al., 2005).

Lack of consensus when it comes to definition, principles, guidelines, measures, and measurement of intangibles in the firm’s accounting systems and their reporting impacts the extent to which current financial reporting formats present an accurate picture of the financial health of the firm to its stakeholders. Such misrepresentation leads to increased information asymmetry between the managers and various stakeholders, making it difficult for investors to make informed investment decisions as well as making it difficult for managers to raise funding for different innovation and growth projects that rely on intangibles (Lev, 2001; Wen & Moehrle, 2016). Certain components of intangibles are slowly getting incorporated in the national accounting systems, but there is still little to no progress on their treatment in financial accounts of firms and their reporting (Lev, 2018). This focus on measurement and lack of consensus on measurement between the micro and the macro levels in the economy has also had an impact on policy making.

The second main gap relates to the lack of overarching, holistic or at least coordinated policies to tackle the overriding importance of the variety of intangibles and their interplay. There is extensive literature that demonstrates a link between components of innovative property such as patents and copyrights and the firm's innovative capabilities and processes (Edler et al., 2015). This is reflected in the public policy sphere as well. Our survey of the literature indicates that there are few if any specific policies on intangibles per se. Most policies are directed toward individual components or at most a few complementarities between different components (OECD, 2019; Andrews & de Serres, 2012). A notable exception is the Irish Capital Allowances for Intangible Assets policy, which recognises growth in intangible assets such as, intellectual property, trade secrets, and software, as the target for public action (Donohoe, 2018). On the whole, however, there is no coherent attempt to strike a balance between firm specific policies that increase appropriability and policies that expand intangibles commons.

A third main gap is the absence of policies or policy coordination for the development of organisational capital. The divergence between national systems of accounting and financial accounts of firms impedes the measurement of firm-specific intangibles such as organisational capital that are extremely tacit (Lev, 2018; Zimmerman, 2015; Zéghal & Maaloul, 2011). Organisational capital reflects not only the firm-specific skills of the employees, but also investments in brands and other marketing activities, as well as organisational structures and managerial capabilities, which are important for the firm's valuation (Osinski et al., 2017). Organisational capital also includes social capital - the accumulated history of the relationship between the firm and its customer base, and beyond that the firm's relationship with the ecosystem and its embeddedness in the wider socio-cultural-political context (Nahapiet & Ghoshal, 1998). Organisational capital is highly specific to the firm, and is an important marker

of the difference between the firm and its competitors. Lack of measurements of organisational capital, and the consequent lack of policies relevant to these intangibles make it difficult to formulate future policies as well as study their impact.

Finally, there are no systematic policies on data acquisition, integration and dissemination, especially with regards to data privacy. However, these policies would be critical to shape the trajectory for the evolving AI, machine learning and cloud computing technologies. Lack of clarity from decision makers increases the risk profile of companies competing in these industries, and makes it difficult to choose particular policy paths due to existing firm investments (Horvitz & Mulligan, 2015; Kusiak, 2017).

9.2 Knowledge Gaps on Intangibles

The gaps in policies emerge partly from the knowledge gaps on intangibles. Since there is considerable progress yet to be made in the subject area, policy makers are reluctant to design policies that can be difficult to reverse when further knowledge emerges (Skinner, 2008). In addition, consensus has to emerge between national systems of accounting and financial reporting on the measures and measurements. Consensus would also have to form on how information needs to flow between the two systems to improve the reliability of both macroeconomic data and company financial reports. In order to facilitate this, scholars need to reach an agreement on definitions and typologies that help to understand the components of intangibles (Wall, 2005; Corrado et al., 2005; Piekkola, 2009).

There is also a dearth of empirically rigorous studies examining the individual relationships and interactions between various components of intangibles and firm growth and profitability. There are multiple studies in the strategic management and innovation literature with a theoretical foundations in resource based view, knowledge based view and dynamic

capabilities that explore these themes (Riley, Michael & Mahoney, 2017; Arrighetti et al., 2014; Gomez & Vargas, 2012; Chiu et al., 2008), but these studies have used broad constructs and proxies due to the difficulties in measurement related to intangibles (Molloy, et al., 2011).

We also need to understand how firms develop the processes and structures that enable the growth of intangibles within a firm. There are multiple studies that study the processes related to intangibles growth from the perspective of marketing (Zhang, Liang & Wang, 2016; Joshi & Hanssens, 2010), people management (Yang & Lin, 2009), training systems (Ballot, Fakhfakh & Taymaz, 2006), skill development (Petrick et al., 1999), and organizational development (Witt, 2000), but research that integrates or studies the underlying common processes has yet to evolve.

Another important knowledge gap that stands in the way of policy is the variation in the strategies that firm use to develop intangible assets. Firms are increasingly relying on the intangibles commons to complement their innovation efforts through open innovation processes. However, firms have to navigate the “paradox of openness” (Laursen & Salter, 2014), the trade-off between opening up to collaborators and the declining power to appropriate knowledge from the collaboration. Alexy, Criscuolo & Salter (2009) argue that firms participating in the open innovation processes should formulate their IP strategy based on the task environment and the concentration of knowledge between different firms in the competitive landscape. Arora, Athreya & Huang (2016) contend that the choice between “spillover prevention” and “organizational openness” is contingent upon the technological and innovation leadership position of firms. However, with collaboration partners changing across different divisions in multidivisional firms, and variations in leadership position across divisions, we still do not know enough as to how firm strategies change with organisational complexity.

Our survey of literature reveals the strides being made in the developing intangibles commons related to innovation property (e.g., see discussion in above paragraph), but we do not know how the intangibles commons functions for certain types of intangibles such as brands and organisational processes. Brands and organisational processes are highly specific to the firm, and emerge from idiosyncratic conditions. Replication in the ecosystem is contingent on many factors and could easily morph the focal process or brand into something new. We need more conceptual and empirical studies on the functioning of the intangibles commons for some of these firm-specific intangibles.

There is also a spatial element to the concept of intangibles commons. The forces of globalisation and improvements in communications technology are making it easier to share information and knowledge across greater distances than before. It is hence of greater interest to understand the spatial effects and limits of the intangibles commons, and the implications of the differences in these spatial limits for different types of intangibles. Moreover, with the recent trends of increasing protectionism and nationalism, it is also important to understand how these factors are going to influence the development of the intangibles commons.

9.3 Knowledge Gaps on policies for intangibles

The other area that deserves a closer examination is related to the impact of policies for some intangibles. More studies are required to systematically examine the relationship between public policies and components of organisational capital such as organisational structure, business models, branding, and marketing and advertising. While there are policies in place for certain aspects of the intangibles, such as software and innovation property, we do not know if, and how, these existing policies can be extended to other types of intangibles such as organisational capital. For example, although there are policies in place, such as those related to incubation

centres and clusters, which support inter-firm cooperation in order to develop innovative capabilities of firms, it is not clear whether similar policies can help firms to develop intangibles such as organizational capabilities and processes.

Further empirical studies are also required to examine the impact of public policies on the growth of the intangible assets per se. Research on cross-country variations in policies (OECD, 2019) and policy mixes and their impact on growth and productivity of intangibles are also needed to fill in the knowledge gaps on intangibles. These studies underscore the heterogeneity in policy formulation and response to differences in national systems. Studies are also predicting significant reallocation of labour resources in response to ongoing technological changes. Existing labour policies guide the scope of the reallocation process and the steps that can be taken to retrain and redeploy the labour force in response to mass layoffs (Silva et al., 2019). However, there are few studies on the efficacy of such responses. While there are policies on intangibles as output of the firm (e.g., film and music industry, software), more attention needs to be paid on intangibles as factors of production (Lampel, Bhalla & Jha, 2006; 2007).

In contrast, an area where policies have gained maturity is intellectual property. These policies are important for IPR valuation and tradability (Andrews & de Serres, 2012). However, the functioning and impact of institutions underpinning markets for ideas are not well understood. This is especially true for administrative response to challenges regarding patent thickets and granting of patents (Menell, 2019; Vishnubhakat et al., 2016). Further research on these issues from a policy perspective not only can help address the challenges for the future, but also, understand the effectiveness of the current policy mix.

Despite the growing interest in intangibles we still do not understand the processes by which policies that shape intangibles emerge. Nor do we have sufficient knowledge of how

discussions between the various actors involved in the policy making process, whether political leaders, administrators, managers, or trade unions result in these policies. We also do not know whether and to what extent policy makers are aware of the need for policies on intangibles when policy makers consider how to increase growth. Although we distinguish between the intangibles commons and firm specific intangibles, the mechanisms through which policy makers address the balance between growth of the intangibles commons and growth of firm specific intangibles are largely unknown. We clearly have to make greater progress in developing knowledge on the effectiveness of policy making in creating intangibles.

To sum up, policies for intangibles are imbalanced, as is our knowledge about the relative meaning and effects of policies on intangibles. There are strong and highly differentiated policies for some firm specific intangibles, such as RDI, and a considerable knowledge base as regards policy effectiveness. For other firm specific intangibles, such as organisational capabilities or software investment, and for intangible commons, policies and our knowledge about policies are much more limited. Thus, there is a growing realization that intangibles as a class of assets need to be studied in much more depth and breadth in order to develop appropriate and effective policy portfolios across the board of intangibles.

10 Conclusion

Intangible assets are a key component of the productive assets in the economy. Investments in intangible assets are outpacing investments in tangible assets in most developed countries. This is reflected in firm valuations. Even when firms have to dispose of assets under fire sale conditions, firms gain higher sale prices for intangibles as compared to tangible assets. Socio-politico-economic systems are evolving significantly with technology. Internet and digitalisation are significantly changing productive economic activities, political structures, and social activities. While there are significant changes taking place due to the growth of intangibles, policy-making is playing catch-up with rapidly changing conditions.

One of the important components of the GLOBALINTO project is exploring and focusing attention on the role of policies for growth and development of intangibles. Although, there is a growing literature on the measurement and productivity impact of intangibles, policy research on this topic has lagged behind policy research on other areas. In this study, we first conducted a structured and systematic literature review and investigated the role of policy, regulatory and fiscal framework conditions for the generation and development of intangible assets. We searched and aggregated academic and practitioner literature to develop a framework for the policy interventions related to investments by firms as well as governments. We took a market failure and systems approach to explain the rationale for policies for intangibles. Further, we sought to shed light on the complexities of policy-making for intangibles due to the inherent tensions and trade-offs between various policy approaches. We also examined the infrastructure that underlay the still nascent markets for some of the knowledge assets like software and patents. In this chapter, we summarize our findings.

Summarizing the review of available literature, we found that there are no policies on intangibles as a category. Policies are fragmented and target one or two components of intangibles. Although policies may target areas where creation of intangibles is crucial, the motivation is rarely intangibles themselves. We therefore find specific IPR policies in recognition of the impact of innovation on productivity and economic growth, and there are policies for software development in recognition of the changing technological basis of production processes. This skewed focus on IPRs is also reflected in our discussion throughout this report.

A major obstacle for making progress on policies for intangibles is the fact that policies are often in conflict with each other, e.g., development of the intangibles commons may conflict with policies that ensure firm appropriation of benefits from intangibles. Conflicts in policies also arise due to the heterogeneity in firms due to age, size, and organisational complexity. In addition, the mechanisms linking creation of intangibles at the macro and micro levels are complex and poorly understood. Moreover, policies may focus on certain components of intangibles distorting creation of intangibles overall.

The accumulated literature thus far suggests that progress has been made in recognising the importance of intangibles for productivity and growth at the economy level, and likewise the importance of intangibles in creating competitive advantage at the firm level. Scholars have to build on this stock of knowledge and delve deeper into understanding the complex lifecycle of intangibles from generation to revitalisation of stocks of knowledge.

We hope that this report stimulates conversations on the policies for intangibles as an entirety. We conceive of two major research directions that can be derived from this report. One major research avenue can be the development of conceptual models and frameworks for the

interactions between firm-specific intangibles and the intangibles commons under the different regimes of competition, cooperation, and coopetition. Another significant research avenue can be the study of policy instruments for intangibles, the interaction effects of bundling them in policy mixes and delineating the significant changes required in these instruments to implement them for various categories of intangible assets. Scholars can also extend this work to examine the impact of heterogeneity of countries, regions and firms on the policies for intangibles. We intend this report to be the beginning of a comprehensive conversation on the intangibles economy.

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Appendix A: Case Studies

A.1 Intangibles commons for creative property: Case of the British Film Industry

The 1980 saw a gradual decline in UK cinema attendance. The British Government became increasingly willing to intervene in film policy and accepted that declining film production below a critical threshold justified fiscal incentives if the industry was to sustain key capabilities. Policies for the film industry developed under the umbrella of creative industries that also included design, music, and video games. The distinctive aspect of this step was also to recognise the importance of intangibles other than software as important output not only from a cultural but also economic standpoint. During the period 2000-2010, a variety of policies were introduced that aimed at reviving the intangibles commons, with the UK Film Council spearheading policy actions. Policies were aimed at reviving demand, as well as supply in the film industry. The mission of the UK Film Council was twofold:

- To develop film culture by improving access to and education about the moving image.
- To help develop a sustainable domestic film industry

The UK Film Council was tasked with supporting film production, inward investment activities of the British Film Commission (BFC), ‘cultural’ production provided by British Film Institute (BFI) and development and production provided by the British Screen Finance. The UK Film Council developed a multi-pronged strategy to achieve its objectives. It developed policies to shape the industry such that it is led by distribution. It supported policies that encouraged skill development to create a highly skilled and flexible workforce for the film and TV industry worldwide. It also stimulated infrastructure development through state-of-the-art studios and post-production companies, complemented by outstanding service companies operating at every level of the international film business.

Policies supported by the Film council (see picture 1) included financial incentives in the form of tax breaks, subsidies and tax credits, a regional investment fund that promoted growth of cinema in each of the regions, venture capital to finance film production, financing of film schools from a supply perspective and film festivals to educate consumers and stimulate demand. In order to encourage demand for cinema, subsidies were also provided to install digital projectors and support print and advertising costs. Film is a creative industry where the inputs and output to the production process are primarily intangible. To safeguard the industry from free riding problems, policies were also enacted to protect the industry from copyright infringement and piracy through illegal DVDs and downloads.

In the period 2000-2009 (both years included), cinema admissions grew at the compounded annual growth rate (CAGR) of nearly 2%⁹. The number of films produced in the UK increased from 80 in the year 2000 to 334 in 2009 at a CAGR¹⁰ of 15.4%. The policy measures from the UK Film Council reflect the importance of policy mix and highlight the interplay between entrepreneurship, skill development and collaborations with foreign firms in the development of the intangibles commons.

⁹ <https://www.launchingfilms.com/research-databank/uk-cinema-admissions>

¹⁰ Statista, <https://www.statista.com/statistics/296454/volume-of-film-production-uk/>

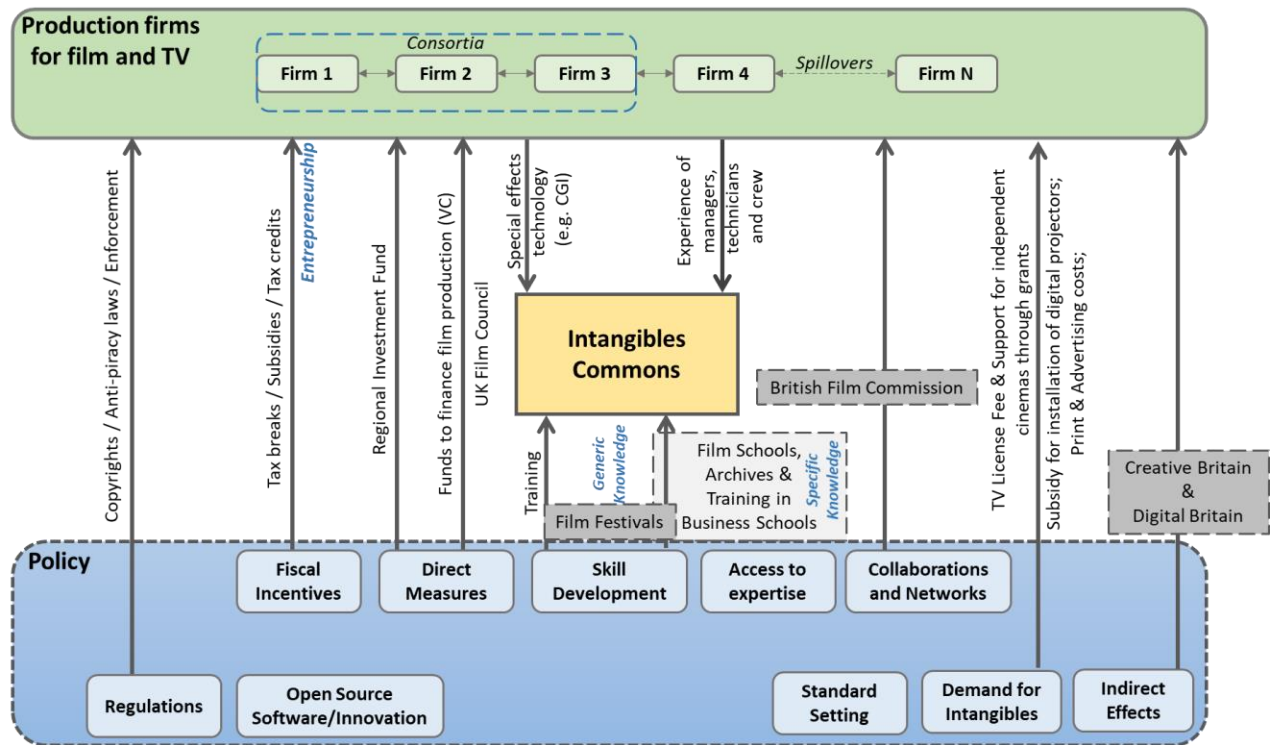


Figure 2: Policy and development of the intangibles commons: Case of the British Film Industry

A.2 Policy Mix and Role of Non-Governmental Organisations: The Case of NESTA

The intangibles commons can also be envisaged as the absorptive capacity of the economy. In order to sustain the technological growth in the economy, structures and systems have to be in place to ensure that skill development underlying the technological growth is aligned not only with current advances but also anticipates possible future challenges.

Governments source ideas for policies from a variety of actors ranging from policy experts, academia, industry, and citizen forums. National Endowment for Science Technology and the Arts (NESTA) is an important policy advocate for innovation in the UK. It was established in 1998 with an endowment from the UK National Lottery and became an independent charity in 2012. The organisation supports policy interventions through research, by organising events, advocacy with various actors in the policy field, through investments in innovations, and providing grants to various entities.

One of the important policy challenges that NESTA anticipates is the scaling of the skill levels of the participants in the global economy that grows on the basis of innovation and creativity.

NESTA has promoted technological skill development of students as a mean to address this challenge. It has published research reports where it has proposed policies for computer science education of school children. NESTA has advocated for its policy recommendations with the UK government resulting in the addition of computer science as a subject in the curriculum. It has also supported its policy recommendations through grants to organisations which teach and encouraging coding activities of school children and invested in development of digital content for children with various partner organisations, as well as building crowdfunding platforms for schools to develop the necessary infrastructure. The various activities of the organisation reinforce its policy advocacy of ICT education for children in order to prepare them for the digital economy. It also reinforces the conclusion that changes required for the development of the intangibles commons cannot be introduced on a piecemeal basis; rather, coordinated action has to be undertaken by various actors and across multiple dimensions.

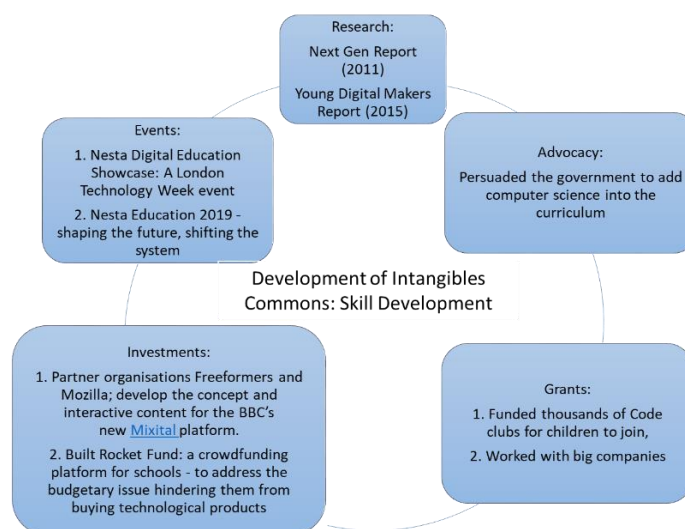


Figure 3: Role of non-government actors in policy and development of the intangibles commons

A.3 Policy for Intangibles and the Role of Trade Bodies: The Case of SEMATECH

In the 1980s, the machine tool industry in the US was fragmented. The lifetime of a company depended on success of narrow very product lines. Leadership in lithography tools, a crucial technology in semiconductors, was moving away from the US. Due to lack of coordination, there was a duplication of solutions in response to technological and competitive challenges. The US domestic semiconductor industry faced tough competition from Japanese producers. The US share of the global markets in this industry declined significantly. The low global market shares made it clear that individual firms would be unable to respond to the technological challenge. A consortium seemed a logical strategy. However, such a consortium, even for technological advances would have been deemed illegal due to anti-trust considerations. The National Cooperative Research Act (NCRA) was signed in 1984 to industries to engage in collaborative research and facilitated the formation of Semiconductor Manufacturing Technology Consortium (SEMATECH). The Semiconductor Industry Association created SEMATECH for technology development to regain competitiveness in the semiconductor industry. It was funded in equal parts by the DARPA and the semiconductor industry.

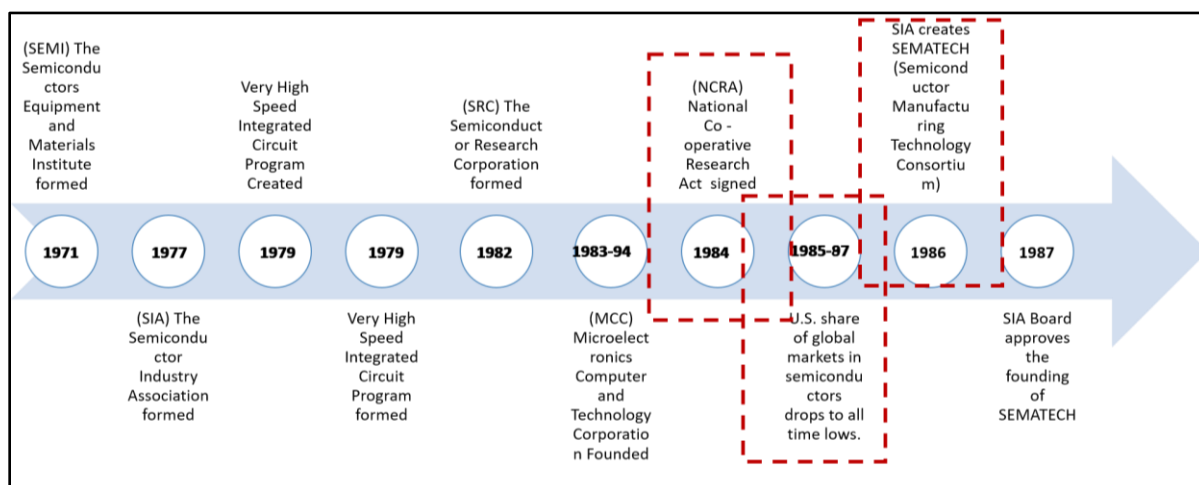


Figure 4a: Timeline for the creation of SEMATECH

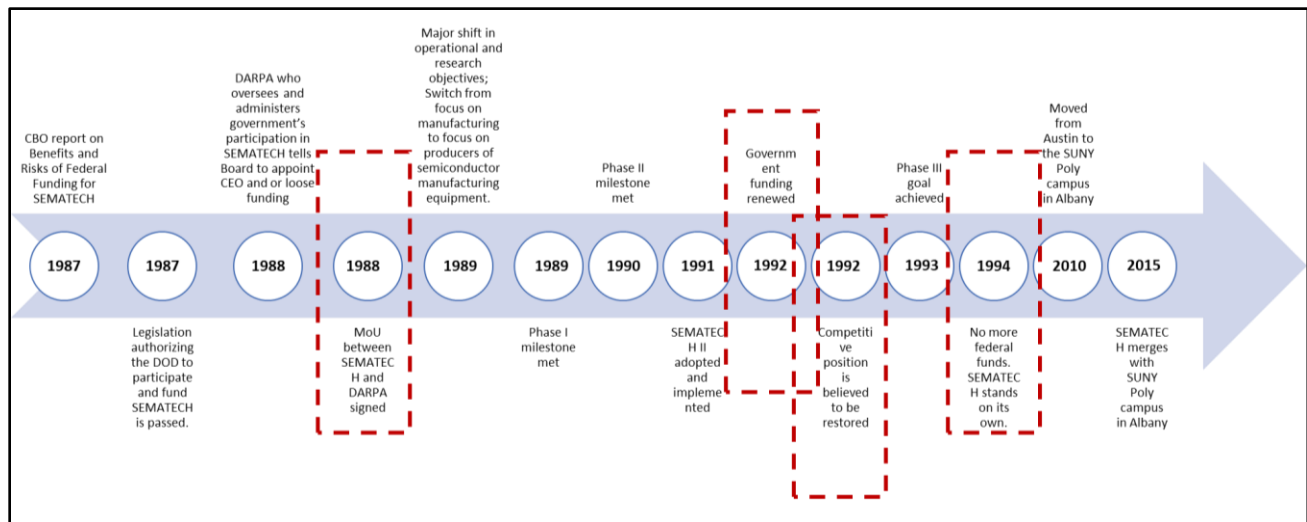


Figure 4b: Key milestones in the life of SEMATECH

SEMATECH had a transformative effect on the semiconductor industry. It fostered an industry perspective on technology development by developing industry-wide technology roadmaps. Standards were developed for the industry and for industry-wide testing of tools. It created a forum for open communication, and increased the efficiency of the internal research process. Technological achievements with the coordinated research process included funding the development of new 300-mm tools, research in mask-making tools, lithography using very-short-wavelength (157-nm) ultra-violet light from a special laser, next-generation lithography consensus, and low-dielectric-constant materials.

While technology development was a key objective of SEMATECH, organisational changes were also required to restore competitiveness. In order to develop the organisation capital of the firms participating in the industry, SEMATECH advanced a cost-of-ownership model for manufacture of tools, increased the sophistication of the manufacturing process and also taught Total Quality Control. With its success in reviving the competitiveness of the industry, the consortium ended its funding arrangement with DARPA in 1994. However,

challenges with its organisation structure and the nature of cooperative arrangements resulted in SEMATECH becoming an exclusive club, which was difficult to enter. Participation in SEMATECH was confined to founding members with no new domestic companies joining the consortium since, consolidation in the industry left only 4 major domestic players in the arena. With the industry moving away from optical lithography, the technological basis of the competition changed and new highly funded R&D programs needed to be seeded.

The case of SEMATECH highlights the tensions in the government/industry interactions associated with generating intangibles commons. By any measure SEMATECH has been a success because of its generation of knowledge for the industry based on a co-operative basis rather than appropriation basis. This knowledge is manifested in patents for the consortium, process improvements in manufacturing as a result of research and new products. However, for this effort to succeed, the government had to amend the anti-trust laws and allow for consolidation within the industry. Public policy needs to further evaluate funding and management of such programmes to manage these tensions across industries and contexts.

A.4 Intangibles for Institutions: Case of EBRD

The European Bank for Reconstruction and Development (EBRD) was established to help build a new, post-Cold War era in Central and Eastern Europe. It has developed a reputation for expertise in managing a transition to the open market by supporting local banking systems reform, liberalisation of prices, privatisation (legalisation and policy dialogue), and creation of proper legal frameworks for property rights. The mission of EBRD is to develop open and sustainable market economies in countries committed to, and apply, democratic principles. It offers services related to project finance, loans and syndications, equity investments, trade finance through guarantees, assistance through financial intermediaries, business advisory

services, providing economic expertise - expert regional analysis and forecasts, and political engagement through policy reform with governments.

In order to restore market economies in post-communist Eastern Europe, which has under-developed institutions supporting markets functioning, EBRD develops intangibles commons through knowledge transfers in key areas of regulations and regulatory institutions. The objective is to strengthen economic governance through state institutional capacity-building and build local capacity to deliver economic reforms. E.g., with support from the UK Good Governance Fund, the EBRD has helped the Commission for the Protection of Competition (CPC) in Serbia to enhance its capacity to use econometrics and interact with regulators. It is also institutionalising processes within EBRD and develop the ability to put together innovative, yet robust, new projects that strengthen this advisory function.

Project Selection Criteria	Technical Cooperation (TC) project	Funding	Results Framework designed with the beneficiary	Community of Practice
<ul style="list-style-type: none"> • Is there a clear, private sector related need? • Is the government committed to the project? • Experiences of other International Financial Institutions (IFIs) and bilateral donors in this area • Expertise of EBRD in implementing the project 	<ul style="list-style-type: none"> • Work closely with beneficiary to deliver substantive impact - Key political leader of the beneficiary as a sponsor • Sustainable – Knowledge Transfers of best practices from EU countries to beneficiaries • Develop local technical knowledge E.g., econometrics training to the Commission for the Protection of Competition (CPC) in Serbia • Develop institutions to support systemic changes e.g., providing judicial training in competition law in Serbia 	<ul style="list-style-type: none"> • Leverage EU and other agencies grants • Donor support from the EBRD Shareholder Special Fund 	<ul style="list-style-type: none"> • Monitor the output of the project team • Measure progress against specific milestones and deliverables 	<ul style="list-style-type: none"> • An in-house network of experts – to share knowledge and experience in this area across the Bank • Best practice standards are disseminated across the various EBRD teams • Build up a database of successful projects

Figure 5: EBRD: Institutionalising delivering of advisory services