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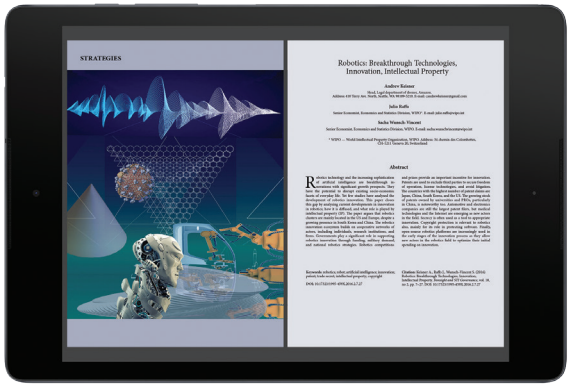

ABOUT THE JOURNAL

Foresight and STI Governance is an international interdisciplinary peer-reviewed open-access journal. It publishes original research articles, offering new theoretical insights and practice-oriented knowledge in important areas of strategic planning and the creation of science, technology, and innovation (STI) policy, and it examines possible and alternative futures in all human endeavors in order to make such insights available to the right person at the right time to ensure the right decision.

The journal acts as a scientific forum, contributing to the interaction between researchers, policy makers, and other actors involved in innovation processes. It encompasses all facets of STI policy and the creation of technological, managerial, product, and social innovations. *Foresight and STI Governance* welcomes works from scholars based in all parts of the world.

Topics covered include:

- Foresight methodologies and best practices;
- Long-term socioeconomic priorities for strategic planning and policy making;
- Innovative strategies at the national, regional, sectoral, and corporate levels;
- The development of National Innovation Systems;
- The exploration of the innovation lifecycle from idea to market;
- Technological trends, breakthroughs, and grand challenges;
- Technological change and its implications for economy, policy-making, and society;
- Corporate innovation management;
- Human capital in STI;

and many others.

The target audience of the journal comprises research scholars, university professors, post-graduates, policy-makers, business people, the expert community, undergraduates, and others who are interested in S&T and innovation analyses, foresight studies, and policy issues.

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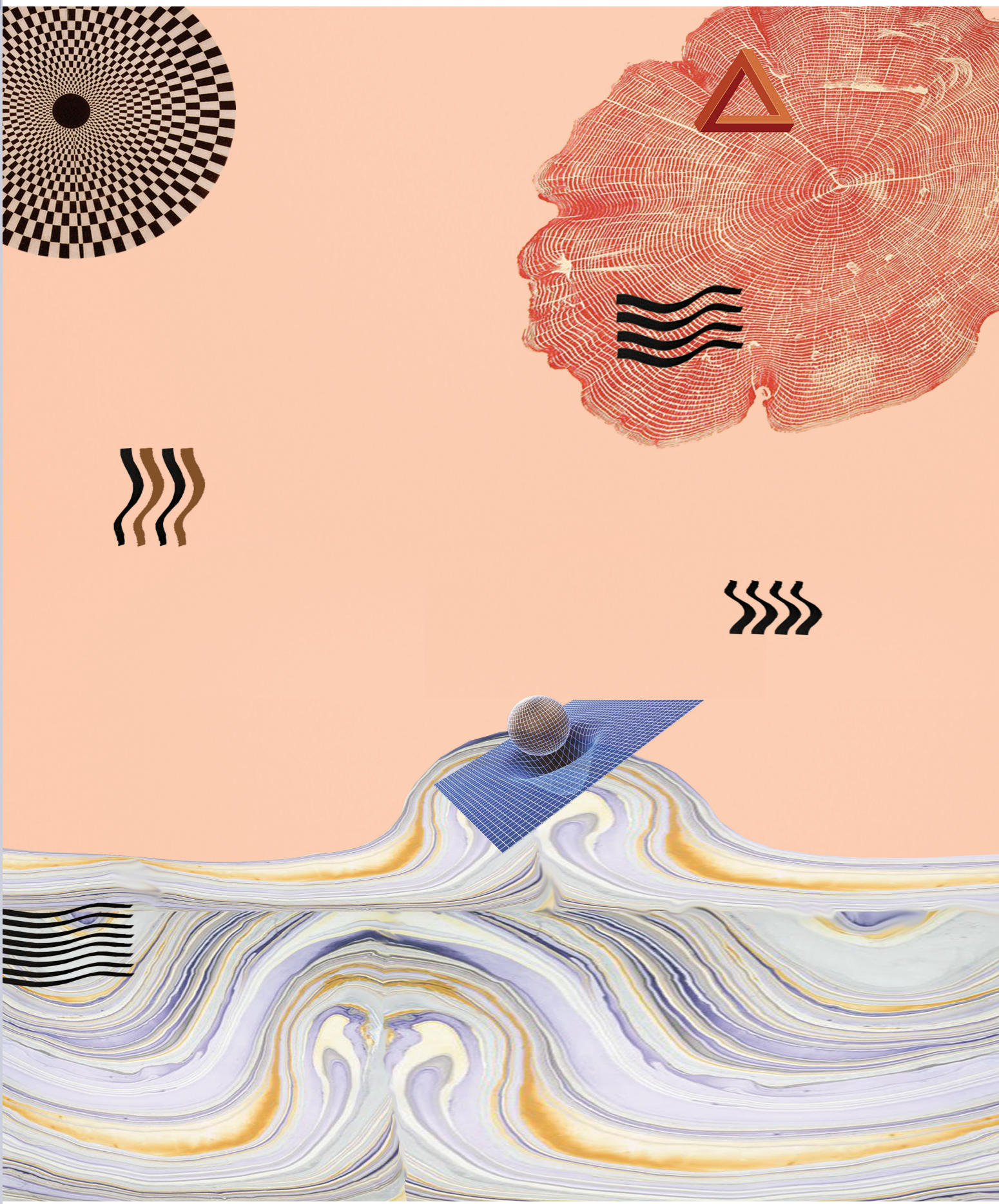

The Practice and Future of Financing Science, Technology, and Innovation

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Abstract

The importance of financing science, technology and innovation (STI) is growing increasingly relevant and is changing its content. New, more comprehensive financing mechanisms are emerging. With STI costs rising and government budgets shrinking, research and innovation has become more cooperative and network-based.

The paper discusses the different instruments and incentives available for governments to improve the financing of innovation. Two case studies illustrate government efforts from the United Kingdom and Brazil towards innovation financing issues. Lastly, recent and future STI financing trends are reviewed.

Governments continue to play a crucial and determining role in STI financing, whether through financial incentives, fiscal incentives or a mix of both. Countries with low national innovation performance should assign more weight to fiscal incentives, while countries with high innovation performance financial incentives prove more efficient.

Keywords: science, technology and innovation (STI); funding; public-private partnerships; financial incentives; fiscal incentives; project financing.

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Financing science, technology, and innovation ("STI") has grown in importance and complexity over recent decades. The move towards a national innovation system approach, as opposed to linear-model-based efforts, has become prevalent in the STI field [OECD, 1997a, 1999]. Concurrently, an increasing number of mechanisms have been made available in order to channel resources toward STI activities. Governments continue to play a critical and determining role in STI financing. However, with STI costs on the rise and increasing government budget restrictions, simple government grants and subsidies have begun giving way to the use of more complex instruments. Governments may now also engage in investment arrangements with the private sector, recognizing "the fact that research and innovation are increasingly cooperative and network-based" [OECD, 2014]. Public-private partnerships ("PPP") are ever more popular in STI, with PPP projects generally being financed via Project Finance arrangements [*Hodge, Greve,* 2007].

In such context, a complete understanding of a country's national innovation system is crucial for identifying leverage points for enhancing innovative performance and overall competitiveness. After a brief discussion of the concept, origin, and development of STI financing, this paper focuses on the different instruments and incentives governments may use to improve the financing of innovation. Two case studies are then explored, illustrating government efforts from the United Kingdom and Brazil towards innovation financing issues. Lastly, the paper reviews recent and future STI financing trends.

The Development of Approaches to STI Financing

Early innovation models were developed around the concept that innovation occurred in a linear fashion, with basic research as the primary initiator of innovation, following through design, engineering, and manufacturing, to marketing and sales [*Rothwell,* 1994]. Therefore, increasing scientific inputs into the pipeline would lead to a direct increase in the number of new innovations and technologies [OECD, 1997a]. As a result, STI funding generally also followed simplistic, linear-fashion methods. Initial phases of the innovation process (basic research) were heavily dependent upon public sector funding, while the diffusion process (marketing and sales) relied nearly exclusively on the private sector, with intermediary processes (applied research and development and manufacturing) being funded by both the public and private sectors.

With the rise of and shift to systemic approaches to the study of technological development, the innovation process is no longer seen as a sequential pattern, with the preceding phase having to be cleared before moving to the next. Innovation can come from different sources and at any stage of innovation process and may also include product adaptations and incremental improvements to processes. Hence, innovation is a function of complex interactions among several stakeholders, with feedback loops occurring throughout. These stakeholders include cooperating and competing firms, public and private research institutes, universities and transfer institutions, interacting regionally, nationally, or internationally. As a nation's economy becomes more knowledge-intensive, an increasing number of players – in the private sector, public sector, and academia – are involved in the production and diffusion of innovation, and the effectiveness in gathering and utilizing knowledge from these institutions becomes an essential determinant of a country's competitiveness [OECD, 1997a]. Consequently, STI financing also grew in complexity and scope, incorporating new concepts to leverage innovative performance, recognizing regional, national, and international interactivity and cooperation among actors, as well as the economic importance of knowledge and knowledge flows. Such mechanisms include:

- formal measures such as tax policies and government subsidies;
- long-term funding commitments by government and industry organizations;
- government budget allocation to universities, research institutes, libraries, and other organizations involved in learning and innovation;
- funding programs managed by international and regional organizations;
- target funding managed by specialized institutions, such as Science and Technology Councils and Foundations;
- single-project funding via Project Finance.

Governments play, and will continue to play, a crucial and determining role in STI financing. Simple grants and subsidies are giving way to more complex instruments. With STI infrastructure and operating costs on the rise, governments have begun to engage in investment arrangements with the private sector. Public-private partnerships ("PPP") have become increasingly common across the globe [*Hodge, Greve,* 2007], with PPP projects generally being financed using Project Finance arrangements [EIB, n.d.].

The following sections discuss the basic fiscal and financial incentives available to governments, assess their advantages and disadvantages, as well as Project Finance tools.

Government STI Financing

Government policies involving regulations, taxes, financing, competition, and intellectual property can largely influence interactions and knowledge flows in innovation systems [OECD, 1997a]. Governments

Table 1. **Basic Government STI Financing Instruments**

Financial (non-fiscal) Incentives	Fiscal Incentives
• Grants, loans, subsidies • Venture Capital Programmes • Equity Investment Guarantees • Credit Guarantees	• Tax allowances • Tax credits • Special depreciation rules • Tax exemptions and deferrals
Source: [European Commission, 2001].	

can support innovation through financial incentives, fiscal incentives, or a mix of both. Financial incentives include grants, subsidies, low-interest loans, guarantee schemes, and venture capital programs. Fiscal incentives reduce the cost of a business to develop innovation activities and include tax allowances, tax credits, accelerated depreciation of assets, total or partial exemptions of capital gains, and favorable treatment for dividends [European Commission, 2001]. Table 1 summarizes the basic government STI financing instruments.

Financial Incentives

Government Loans

Governments may provide funding to venture capital or small firms via low-interest, long-term and non-refundable loans. Low-interest loans provide below-market, subsidized interest rates to the borrower. Long term, or extended duration loans are aimed at relieving the capital constraints of early stage companies. Non-refundable loans are offered for strategic R&D projects or in the case of borrower failure. Government loans may exert pressure on national budgets as exposure to default is both cyclical and unpredictable.

Venture Capital Programs

Government venture capital programs may be designed to help companies at various stages of development, either to finance the launch, early development, expansion, or even restructuring of a business. However, studies support the premise that start-up firms should benefit the most from such programs, as private funding to these firms is inadequate in most countries [OECD, 1997b].

Venture capital is usually riskier and less liquid than most other forms of financing. Governments can leverage the development of the venture capital industry directly by creating state-sponsored venture capital funds or establishing public incubators, or indirectly, by improving the venture capital industry infrastructure [OECD, 1996]. Table 2 summarizes measures that have been implemented at the European and national levels [*Christofidis, Debande,* 2001]:

Guarantee Mechanisms

A guarantee can be defined as "the assumption of responsibility for the payment of a debt or performance of some obligation if the liable party fails to perform to expectations".[1] Guarantee instruments include equity investment guarantees, export credit guarantees, political risk insurance, and credit guarantees. Equity investment guarantees and credit guarantees, in particular, are of greater importance for start-up and technology-based firms and are discussed in further detail below. *Equity guarantee programs* are aimed at reducing investors' aversion to high-risk investments [OECD, 1997b]. Such programs are important to smaller venture capital funds, where the write-off of a significant portion of the portfolio may "reduce the level of residual operating funds to below a viable limit" [*Murray, Marriott,* 1998]. Equity guarantee programs "can be implemented as an instituted publicly supported insurance scheme or as a measure for the State to share in the cost of investment", covering up to 75% of an investment, with

Table 2. **Policy Measures to Support the Venture Capital Market**

	Demand-side Measures	Supply-side Measures
Direct Intervention	• Public incubators	• Public (-sponsored) venture capital funds
Indirect Intervention	• Promotion of enterprise and entrepreneurship • Management and skilled workforce • Business incubators, Science and technology parks, and clusters • Tax incentives	• Down-side protection scheme • Upside leverage scheme • Fund's operating costs scheme • Exit schemes • Tax incentives • Business angels network
Source: compiled by the authors.		

[1] See Campbell R. Harvey's Hypertextual Finance Glossary: http://people.duke.edu/~charvey/Classes/wpg/glossary.htm

Table 3. **Advantages and Disadvantages of Tax Credit Schemes**

Scheme	Advantages	Disadvantages
Volume-based	• Easy to operate and can be exploited irrespective of when the expenditure is incurred. • Easy to calculate for both companies and tax authorities	• Increased cost to burden on governments, without the guarantee that companies will opt to reinvest the value of an incentive in increased levels of innovation activity
Incremental	• Focuses the relief on companies that increase their innovative activity.	• Increased complexity of administration

Source: [European Commission, 2001].

a cap per portfolio [*Christofidis, Debande,* 2001]. However, a potential pitfall of equity guarantees is that venture capitalists may become less willing to make sound investment decisions.

Credit guarantee schemes may be used in countries where the venture capital industry is not yet developed. Is such economies, financial institutions and commercial banks may be the only source of financing for start-ups and technology firms. Since these companies seldom have a credit history or collateral to back bank loans, credit guarantees compensate banks in the event of a default, reducing their overall transaction risk. In return, governments usually charge a premium [OECD, 1997b]. The main advantages for governments are that credit guarantees limit the need for direct budget allocations, as they are used to encourage borrowers to provide financing to early-stage firms; and that potential borrowers' assessment is completely or partially transferred to the lender. The main problem associated with credit guarantees is the potential for borrowers to become less willing to observe the terms and conditions of loan agreements.

Fiscal Incentives

Governments can identify specific innovation-related activities and introduce appropriate tax incentives to support them. A study by the European Commission found that the following activities have been selected by a number of governments for targeted fiscal incentive support [European Commission, 2001]:

- Business R&D expenditure
- R&D capital expenditure
- Technology transfer
- Industrial design and process engineering
- Implementation of Quality Certificates
- E-commerce, information, and communication technologies
- Software
- Patent applications
- Training of personnel
- Contracting of researchers
- Cooperation between firms and research institutes/universities
- Share ownership at new or innovative firms.

Some tax incentives aimed at supporting the general business environment may also promote innovation indirectly by reducing the obstacles impeding the innovative process. These incentives may foster relevant aspects related to innovation, including the training of staff, the contracting of researchers, the cooperation between firms and research institutes or universities, the creation or financing of innovative firms, and the encouragement of share ownership in innovative firms [European Commission, 2001].

The majority of the tax incentives for innovation activities are included in the corporation tax regimes of each country. Companies are usually allowed to write off all current expenditure on R&D against their taxable profits in the year the expenditure was made. To further reduce the cost of innovation, the following incentives are also used: extra tax allowances, allowing firms to deduct more than 100% of their innovation expenditure from their tax base; tax credits; and special depreciation rules [European Commission, 2001].

A tax credit allows a firm to deduct a percentage of their innovation expenditure from their tax base. In a volume-based (flat rates) scheme, all expenditure incurred over a fiscal year is considered for the credit. In an incremental scheme, only expenditure increases over a pre-determined level are rewarded. Mixed schemes, with both volume-based and incremental measures may also be put in place. Table 3 offers a summary of the advantages and disadvantages of each scheme [European Commission, 2001].

Special depreciation rules allow larger sums of innovation-related asset values to be written off earlier in their useful lives. Free depreciation allows companies to deduct up to 100% of their asset value immediately. Accelerated depreciation enables larger percentages of the asset value to be written off in earlier years.

Table 4. **Advantages of Financial and Fiscal Incentives**

Type of Incentive	Advantages
Financial (non-fiscal)	• Fine-tuning within the economy. • Complete control over expenditures • Useful for countries with high innovative performance
Fiscal	• Allows the market to decide which sectors present the greatest opportunities for future business success • May be accessed by all companies, regardless of size or sector of operation • Administrative burden shifted to the companies • Particularly useful for countries with low innovative performance
Source: compiled by the authors.	

Fiscal incentives outside of corporation tax are normally offered through one of the following mechanisms [European Commission, 2001]:

- A reduction on the tax rate levied on capital gains
- A deferral on capital gains deduction payment
- A partial or total exemption of capital gains
- Favorable treatment for dividends from specific venture capital investments
- Favorable treatment within personal income tax of researchers.

Financial vs. Fiscal Incentives

The main difference between financial and fiscal incentives is that financial incentives allow the government to choose which activities to prioritize, while fiscal incentives enable the market to decide which activities present the greatest opportunities for future success.

According to a study by the European Commission [European Commission, 2001], in countries with relatively low national innovation performance, governments tend "to prioritize incentives that seek to stimulate activity across the whole economy, as opposed to within specific sectors". Fiscal incentives thus have the advantage of allowing the market to decide on fund allocation. On the other hand, in countries with a relatively high national innovation performance, "the preferred method of incentive support is through financial aids, which allow governments to choose those sectors or technologies which they wish to prioritize".

The advantages of each incentive are summarized in Table 4 [European Commission, 2001]. Table 5 summarizes the factors to be considered when designing some financial and fiscal incentives.

Table 5. **Factors to be Taken into Account when Designing Financial and Fiscal Incentives for STI**

Tools	Factors
Government loans	• Debt service capability • Limiting government financing share • Private sector expertise • Critical interest rates • Private sector leverage • Failure rate and additionality
Government venture capital programmes	• Target equity gaps for early-stage and technology-based firms or funds • Sufficient fund size • Fund management by experienced venture investors • Management, strategy, and finance support for portfolio companies • Contribution to the creation of a commercially viable market • Attractiveness to private sector participation • Limited duration of government participation
Equity guarantees	• Risk sharing • Additional advantages from partial funds without guarantee • Programmed allocations for payment against failures • Added value from experience and skills of personnel • Pooled or individual investments for risk exposure control
Government loan guarantee programmes	• Risk sharing with lenders • Types of loans to be guaranteed • Fees on the guaranteed portion of the loan • Personal guarantee/personal stake required • Project appraisal • Default rate
Fiscal incentives	• Fiscal policy involves trade-offs between varying goals and priorities • Support should not be given to individual innovative activities Activities outside of R&D, such as technology transfer, training, and contracting of researchers should not be neglected • Unambiguous fiscal legislation, clearly defining the activities that will be supported by each incentive
Source: compiled by the authors based on [OECD, 1997b; European Commission, 2001].	

Table 6. **Financing Instruments by Activity**

Activity	Type & Source of Financing
Pre-investment and development costs	• Risk capital from project sponsors • Pre-investment Fund
Bidding and procurement	• Risk capital from project sponsors • Financial support from government
Financial structuring and development of the security package	• Equity capital from project sponsors, investors and dedicated funds and bonds • Loans from banks, MDBs, insurance companies, financing brokers, mezzanine funds providers • Insurance contracts
Agreements with institutional and other investors	• Financial support from government (grants) • Equity capital from institutional and other investors
Agreements with equipment suppliers	• Long-term loans from export credit agencies for equipment purchase
Agreements with prime contractor and subcontractors on the cost of construction/ installation	• Short-term loans from commercial banks to finance construction/installation
Financing restructuring as the completion of construction/installation approaches	• Long-term loans from non-bank financial institutions and specialist investment funds
Financial closing Start of construction/installation	• Drawdown of equity and loan funds • Financial support from government (grants)
Operation Re-financing	• Working capital from the project company and short-term loans from commercial banks • Financial support from government (grants) • Tax and non-tax incentives • Public and corporate bonds • Stock shares of the project company
Source: compiled by the authors.	

Project Financing

Project financing may be formally defined as a method of structured financing, with both debt and equity components, which is used to fund individual projects. Project financing is based upon lending and investing based on the cash-flows generated by a project alone, as opposed to on the borrower's balance sheet strength, as in standard corporate lending. Its applicability depends on a detailed evaluation of a project's construction or implementation, operating and revenue risks, and adequate contractual and financial arrangements between investors, lenders, and other parties.

The Project Financing scheme has two components:

- Equity provided by investors or sponsors of the project, their return being dependent upon the success of the project
- Senior debt provided by one or more lenders, this debt having a priority on the project's net operating cash flow.

The financial structuring of a project financing transaction consists in finding the optimum allocation between the debt and equity components. For investors, the higher the leverage of a project, the higher their returns will be.

Sponsors or financing sources in Project Financing transactions include:

- Public-sector financing (public budget)
- Public and commercial banks
- Investors and equity providers (for instance, pension funds)
- Multilateral and bilateral financing institutions
- Bond issuances or capital market investors
- Mezzanine and subordinated debt
- Lease financing
- Vendor financing (Export Credit Agencies – ECA's)
- Users fees
- Product/service sales income
- Arising intellectual property rights (in case of R&D&I).

Project Financing requires a robust and sustainable stream of revenues to balance financial inputs and outputs, thereby supporting the repayment of expected equity returns and debt service. In STI projects, the main sources of revenues are Arising Intellectual Property (AIP) rights and co-sharing in the commercialization and exploitation of the research results, which are embodied in trading products or services.

Table 7. **Parameters of the Main Contracts, Arranged by the Project Company**

Type of agreement	Counterpart	Defined issues
Project or Concession Agreement	Government	Governance, conditions, rights and risk allocation and mitigation
Stakeholders Agreement	Sponsors	Core activity, corporation form, responsibilities and liabilities, and internal regulations

Source: compiled by the authors.

Financing and cash flow arrangements occur during the economic life of the project, where their availability and employment serve to make the project viable and funded throughout. Table 6 provides a list of types and sources of financing by activity.

In Project Financing transactions, a special purpose company, the Project Company, is usually set-up for implementing the project. Such company "will act as a borrower under the underlying financing agreements and will be party to a number of other project-related agreements" [EIB, n.d.]. This framework constitutes a security package for managing performance and risks involved in arranging the financing structure.

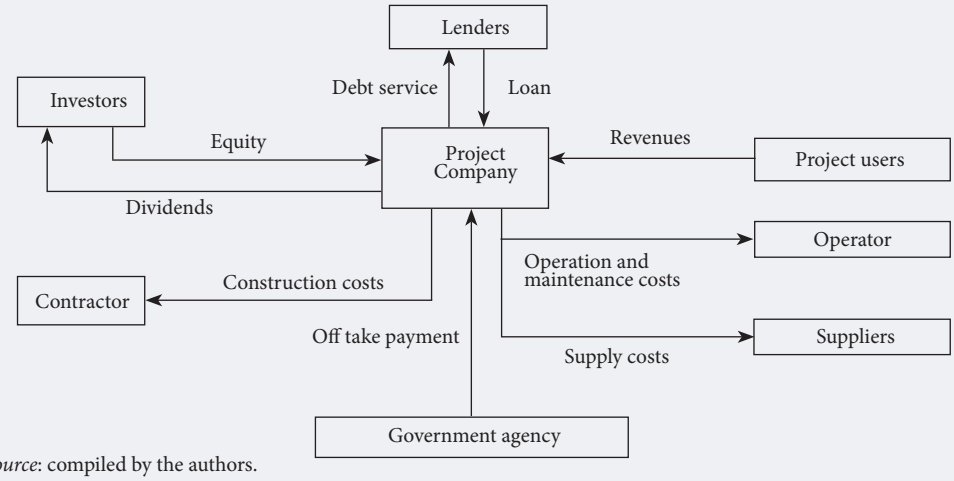
The project company signs a minimum of two main contracts whose characteristics are depicted in Table 7. The entering of other ancillary contracts depends upon the substance and context of the project. Figures 1 and 2 depict a typical Project Financing structure.

The government is responsible for defining the envisaged project and the concession or project agreement is awarded based on competitive bidding. Such a process emerged in the infrastructure and industrial sectors as a form of public-private partnership and is therefore a reflection of the experience and needs of such sectors.

The application of Project Financing schemes to STI was introduced by the Government of the United Kingdom in the 1990s with the implementation of the Private Finance Initiative ("PFI") in the sector of Education (schools, universities, and libraries) and Research (laboratories, science and technology parks, offices, and industrial parks). According to HM Treasury "PFI was introduced in order to engage the private sector in the design, build, finance, and operation of public infrastructure, with the aim of delivering good quality and well-maintained assets that provide value for money for the taxpayer." [HM Treasury, 2015].

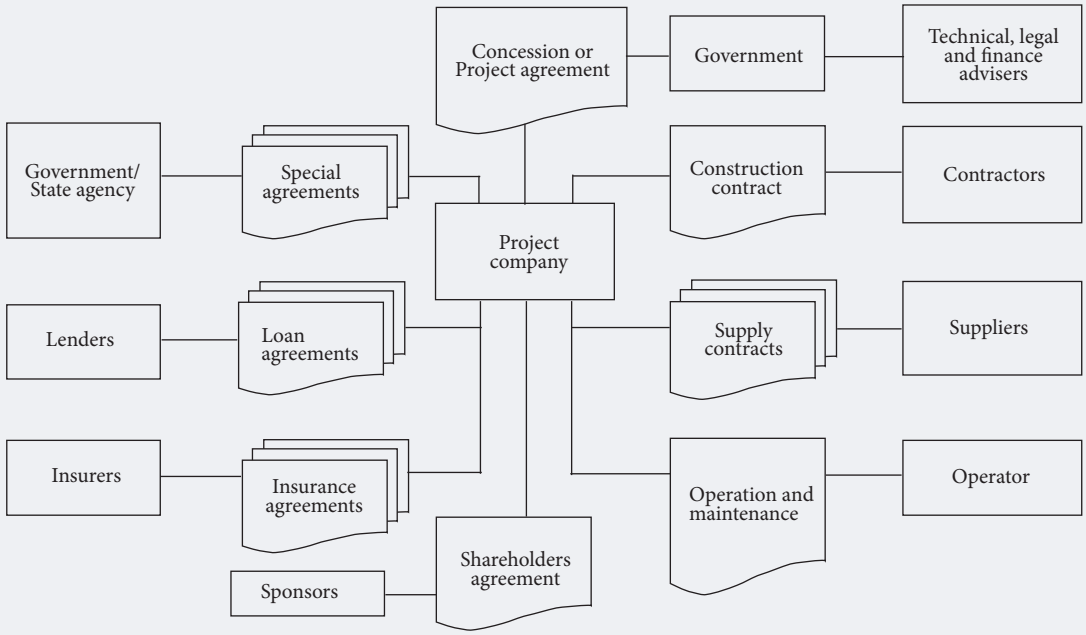
A study by the OECD [OECD, 2014] analyzed various forms of strategic public-private partnerships and identified the reasons for their increased popularity in the STI sector. As noted in the study, "traditionally used for physical infrastructure, PPPs are increasingly popular in R&D and innovation policy because they are perceived as a more adaptive tool than traditional subsidies for achieving such objectives in an environment in which the nature of R&D and innovation processes is changing (e.g., increased user-centered content, higher dependency on external sources of knowledge and know-how, as illustrated by open innovation approaches), and business R&D strategies and social needs are rapidly evolving (e.g., ageing population, the environment, sustainable cities). Finally, PPPs are a useful policy tool in demand-side innovation policy such as the public procurement of innovation or in efforts to foster smart specialization strategies in regions."

Figure 1. **Cash Flows among Project Financing Parties**



Source: compiled by the authors.

Figure 2. **Typical Structure of a Project Financing Scheme**



Source: compiled by the authors based on [UNIDO, 1996].

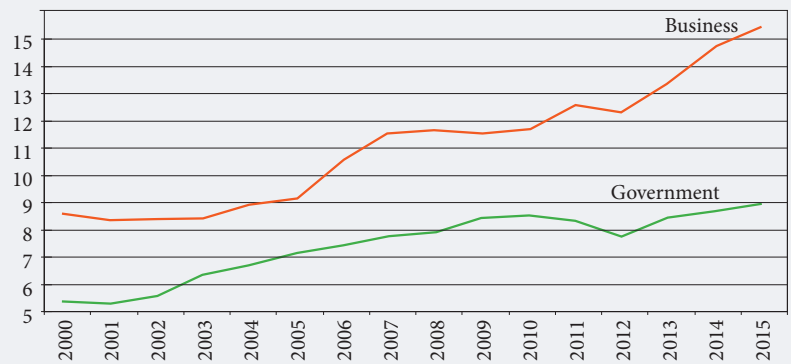
It is worth noting that a wide range of public-private partnerships definitions are available and many forms of PPPs have been used in the STI sector. This section, however, is focused on Project Financing as the main PPP financing instrument.

The same study by the OECD [OECD, 2014] also indicated the critical factors for Project Financing implementation, as follows:

- "Partnership implies some sharing of costs, risks, and benefits between participants"
- Intellectual property rights should be shared both in upstream research and downstream commercialization, including residual rights
- Seek to promote the participation of knowledge-based SMEs
- Support for international and cross-border research programs should be given
- Project design, award, and implementation should be on a competitive basis
- Seek financial sustainability, including measures to counter the tendency to underinvest as well as undue practices.

According to the authors of the aforementioned OECD report, focus should be given (i) to areas where the collaboration between the government and the private sector is essential, such as in healthcare,

Figure 3. **Total R&D Expenditure by Source of Financing: UK 2000-2015 (billion £)**



Source: [European Commission, 2015].

sustainable transportation, and environment protection; (ii) to business access to research infrastructure and achievements in public research; and (iii) to reducing technological and financial risks upstream;

STI Financing in Practice

The extension and grade of application in practice of those finance instruments discussed here will be revealed in two selected countries with sophisticated and complex national innovation systems, though they are at different stages of experience and development. In this paper, we will study the cases of the United Kingdom and Brazil. The application analysis presented below indicates the modes of financing, their potential and limits as well as possible combinations to enhance their viability and effectiveness.

UK: PFI in practice

In the United Kingdom, the predominance of the business sector in financing STI has further expanded over the course of the last decade. Figure 3 indicates how far the business sector has been overtaking the government on expenditures in STI over the years.

The distribution and flows of funds in the country has become highly complex and diffuse, showing the prevalence of the business sector, as presented in the Figure 4.

The increased participation of the business sector in supporting STI in the UK could make the efforts and schemes more relevant and viable for strengthening the cooperation between public and private sector in order to promote a focus in STI areas of public interest, such as healthcare, sustainable transport, and environmental protection. It may also facilitate businesses' access to research infrastructure and achievements in public research and reduce technological and financial risks in high capital investment research endowments. In this context, one can observe a number of funding initiatives based on the models proposed by the UK Private Financing of Infrastructure – PFI. The Department of Energy and Climate Change (DECC) is one of the agencies in the country promoting the PFI scheme for STI funding. Figure 5 illustrates the DECC projects' financing model.

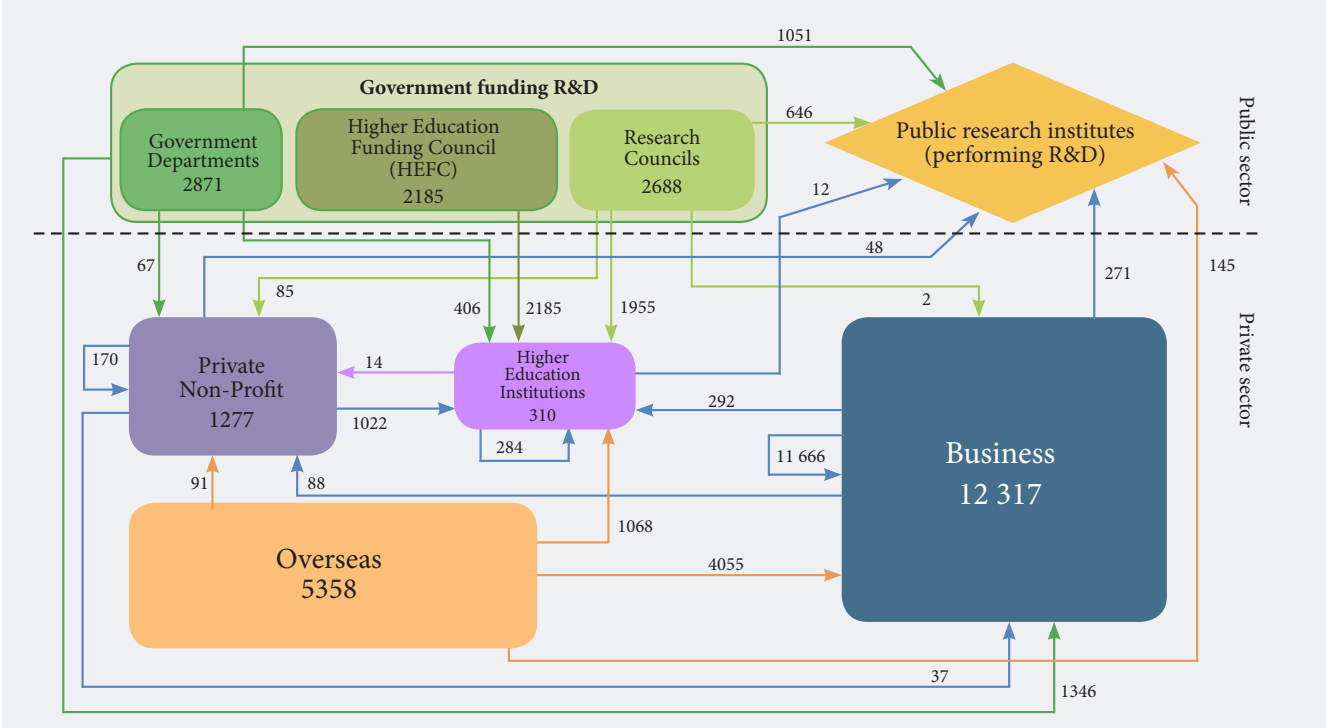
Project financing in this model is applied to provide funding to consolidate the efforts of making projects commercially viable using the declining cost of capital to one's advantage.

Another interesting example of the use of PFI under a Public-Private Partnership arrangement is the Energy Technology Institute (ETI) sponsored by the Secretary of State for Business, Innovation, and Skills (SSBIS). The main characteristics of this scheme are indicated in Table 8.

The main idea of the creation of the ETI is to consolidate and improve strong operational links between academia, industry, and government on targeted R&D projects.

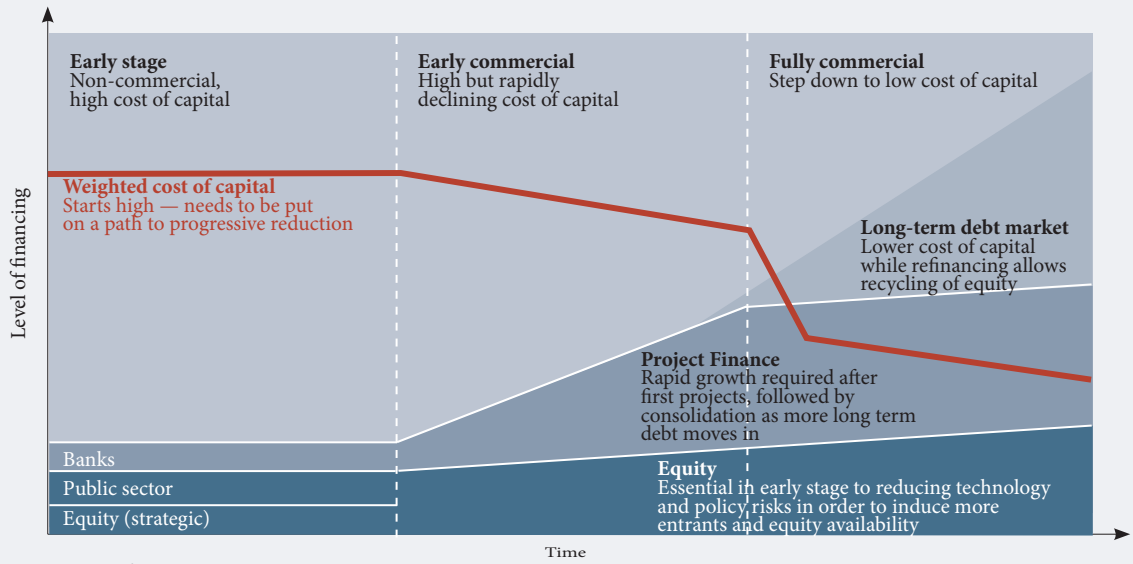
Figure 6 presents the ETI arrangement structure and the flow of funds.

Figure 4. **STI Funding Framework in the UK: 2012 (million £)**



Source: [European Commission, 2015].

Figure 5. **DECC-UK projects financing model**



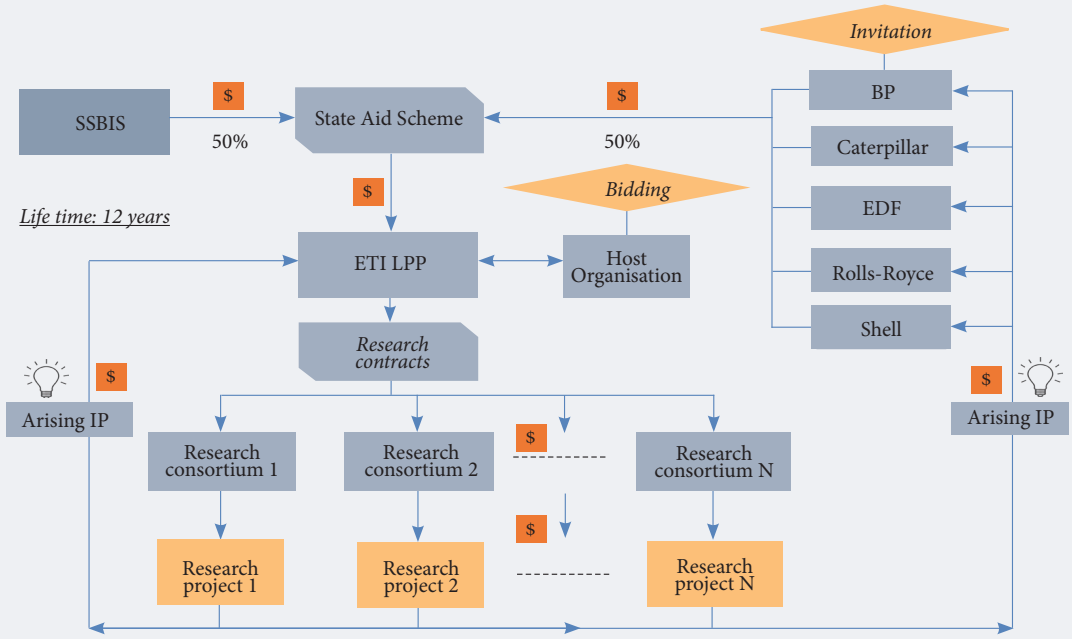
Source: [ETI, Ecofin, 2012].

Table 8. **Basic characteristics of the ETI**

Item	Characteristics
Concept	The ETI is a Public-Private Partnership between global energy and engineering companies and the UK Government
Constitution	ETI is the core node constituted as a Limited Liability Partnership, formed by a consortium of companies
Role	To act as a conduit between academia, industry, and the government to accelerate the development of low carbon technologies
Objective	To bring together engineering projects that develop affordable, secure, and sustainable technologies to help the UK address its long term emissions reduction targets as well as delivering nearer term benefits
Action	It makes targeted commercial investments in nine technology programs across heat, power, transport, and the infrastructure that links them

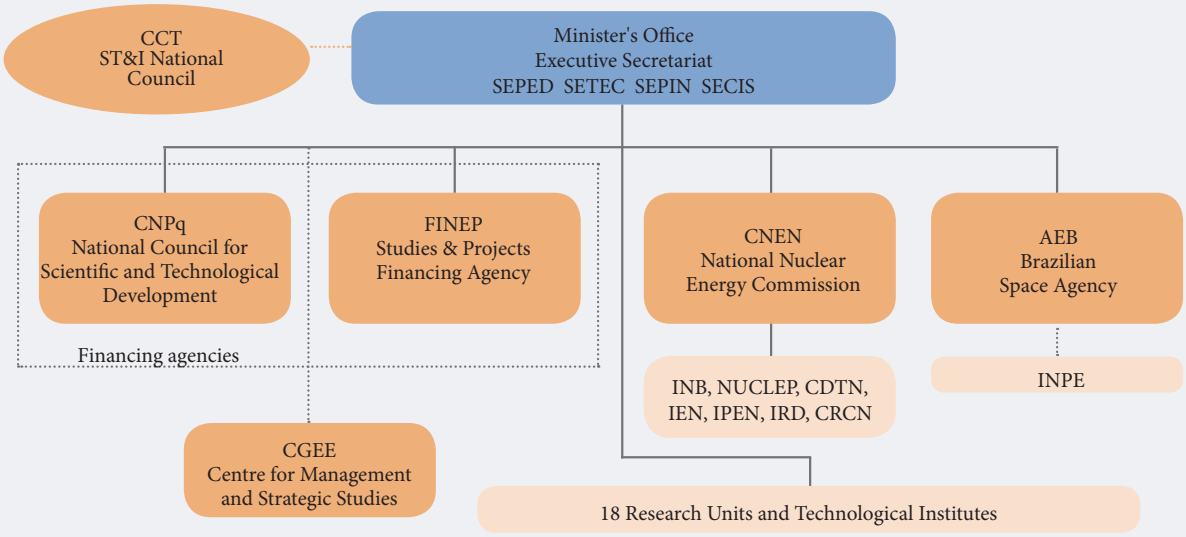
Source: [ETI, 2012].

Figure 6. **ETI Partnership and Financing Framework**



Source: compiled by the authors.

Figure 7. **Institutional Coverage of the MCTIC**



Note: INB is a group of companies Indústrias Nucleares do Brasil; NUCLEP is a company Nuclebrás Equipamentos Pesados. For definitions of other acronyms see Table 9.

Source: [*Leitão,* 2010].

Following a general description of a PPP/PFI framework, the core and special purpose institution in this case is the Energy Technology Institute (ETI) LLP[2], registered as a Limited Liability Partnership in the United Kingdom[3]. The mobilized founding members, constituting the ETI LLP, under a State Aid Scheme[4], are: from the Public Sector, the Secretary of State for Business, Innovation and Skills (SSBIS); from the Private Sector, a consortium formed by British Petroleum (BP), Caterpillar, EDF Energy, Rolls-Royce, and Shell International. Hitachi jointed joined a program associated with the scheme. Through competitive bidding, a host institution was selected to provide research facilities, offices, and infrastructure for the ETI management and support staff. The winning bidder was the Midlands Consortium, which is comprised of the Universities of Birmingham, Loughborough, and Nottingham with financial support from Advantage West Midlands and the East Midlands Development Agency. The main location of ETI is at Loughborough University, on the Holywell Park area of the campus, at the heart of the University's Science and Enterprise Park.

On the basis of a research agenda defined and monitored by the core members of ETI, R&D projects are procured through competitive bidding by centers of excellence across the United Kingdom and overseas, organized in consortia consisting of SMEs and large enterprises, universities, and other expertise organizations. R&D projects shall refer to IPR arrangements and focus on the commercial deployment of their results.

Regarding funding, funds are provided on a 50:50 basis by the public and private sectors and they are supposed to be allocated to the best R&D projects. The expected revenues for the ETI and the private sector members are the contractual definition of Arising Intellectual Property Rights and the eventual results of commercial deployment.

Brazil: Funding STI via Sector Funds

The Brazilian government, motivated by and in consultation with the private sector, launched a comprehensive set of fiscal measures in 1999 to channel financial contributions from the private and manufacturing sectors, known as STI Sectorial Funds. Traditionally in Brazil STI has been almost fully funded by the public sector. Indeed, the role of the state in Brazil in both the financing and execution of STI activities is highly determinant and even dominant. Presently, the Ministry of Science, Technology, Innovation, and Communication (MCTIC)[5] is directly responsible for the most important actors, such as promotion agencies, major R&D institutes and units as well as sectorial technological institutes (Figure 7).

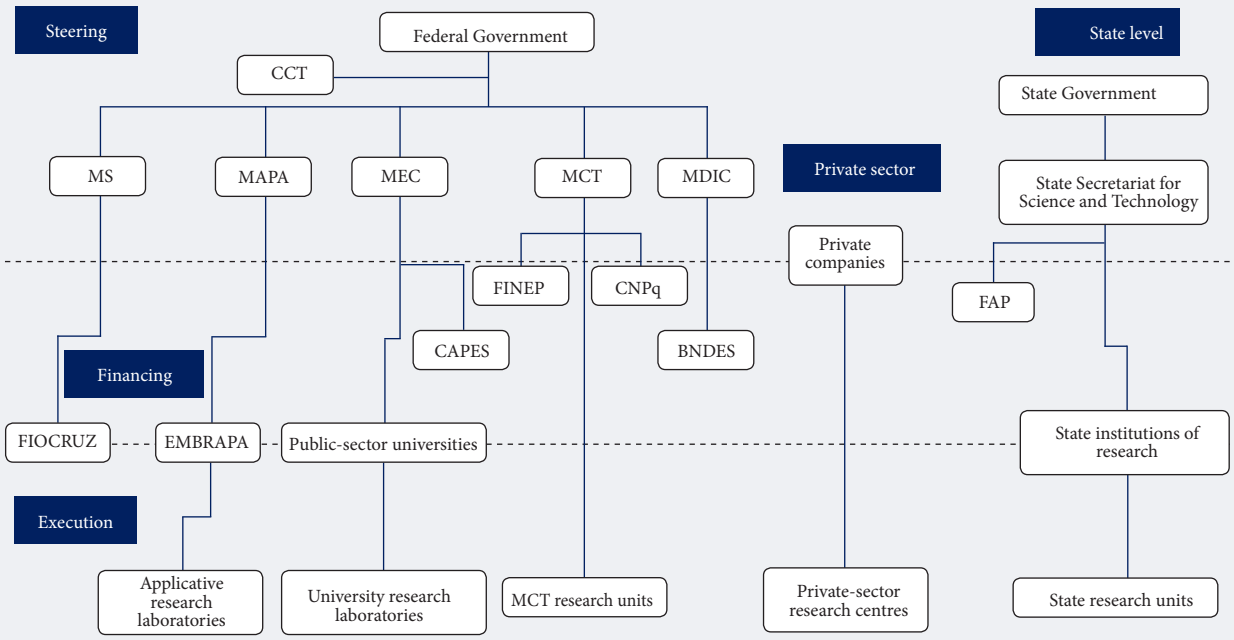
[2] http://www.eti.co.uk/about

[3] Under the Limited Liability Partnership Act 2000 (https://www.legislation.gov.uk/ukpga/2000/12/contents)

[4] https://d2umxnkyjne36n.cloudfront.net/documents/Summary-of-Scheme-for-GBER.pdf?mtime=20160912110613

[5] Name in Portuguese — Ministério da Ciência, Tecnologia, Inovações e Comunicações. Previous names — Ministry of Science and Technology (Ministério da Ciência e Tecnologia, MCT) (until August 2011); Ministry of Science, Technology and Innovation (Ministério da Ciência, Tecnologia e Inovações, MCTI) (until May 2016).

Figure 8. **Overview of the Brazilian System of Research and Innovation**



Note: For definitions of all acronyms see table 9.

Source: S&T Landscape Brazil, Access4.EU. Available at: http://www.access4.eu/brazil/330.php, accessed 12.11.2017.

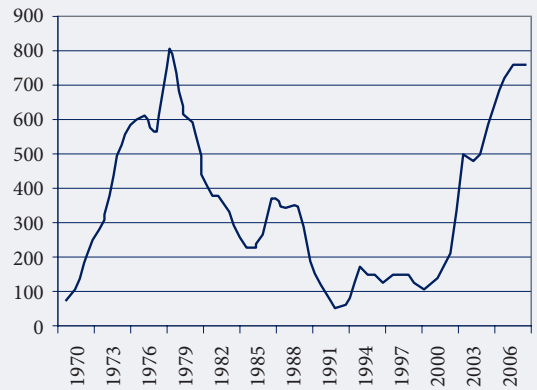
Figure 8 indicates the overall picture of the Brazilian STI system. The private R&D sector is practically an isolated sector. At the state level, the same framework is reproduced.

Regarding the actual allocations from the state, after significant growth observed in the 1970s, when they reached an historic high of 800 million Real in the National Fund for Scientific and Technological Development (FNDCT), they dropped steadily to between 80 to 200 million Real in the 1990s. With the advent of the STI Sector Funds in 1999, the allocations returned to a growth trajectory. Figure 9 illustrates such development.

Meanwhile, the FNDCT, supplemented by the STI Sector funds, became the major financial source of support for Brazil's STI system. Figure 10 shows the evolution of the FNDCT after the implementation of the STI sector funds.

The STI Sector Funds are designed to follow the Systemic Model of Innovation. Their main policy goals can be summarized as follows:

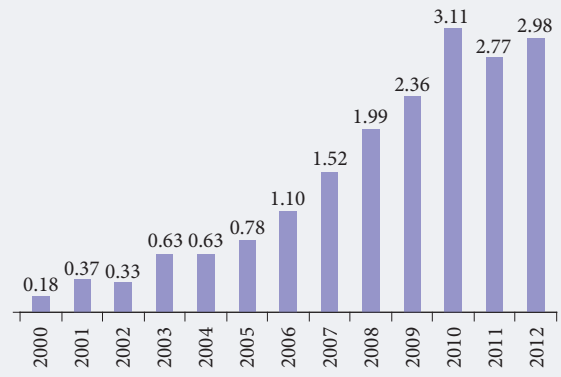
Figure 9. **Evolution of the Allocations from the Brazilian National S&T Fund (FNDCT) between 1970 and 2006**



Note: values in constant Real adjusted by the annual consumer price index (IPCA)

Source: [*do Canto*, 2007].

Figure 10. **Evolution of the FNDCT Expenditures in 2000-2012 (current R$ billion)**



Source: compiled by the authors по данным MCTIC.

Table 9. **Definitions of Acronyms of Brazilian Organizations and Institutional Terms Mentioned in Figures 7 and 8**

Acronym	Name in Portuguese	Name in English
AEB	Agência Espacial Brasileira	Brazilian Space Agency
BNDES	Banco Nacional de Desenvolvimento Econômico e Social	*Brazilian Development Bank*
CAPES	Coordenação de Aperfeicoamento de Pessoal de Nível Superior	Coordination Commission for the Improvement of Personnel's Qualifications in the Higher Education Sector
CCT	Conselho Nacional de Ciência e Tecnologia	National Council for Science and Technology
CDTN	Centro de Desenvolvimento da Tecnologia Nuclear	Center for the Development of Nuclear Technology
CGEE	Centro de Gestão e Estudos Estratégicos	Center for Strategic Management and Studies
CNEN	Comissão Nacional de Energia Nuclear	National Nuclear Energy Commission
CNPq	Conselho Nacional de Desenvolvimento Científico e Tecnológico	National Council for Scientific and Technological Development
CRCN	Centro Regional de Ciências Nucleares do Nordeste	Nuclear Sciences Regional Center, North-East
EMBRAPA	Empresa Brasileira de Pesquisa Agropecuária	Brazilian Agricultural Research Corporation
FAP	Fundação de Apoio à Pesquisa	State Funding Agency
FINEP	Financiadora de Estudos e Projetos	Funding Authority for Studies and Projects
FIOCRUZ	Fundação Oswaldo Cruz	Oswaldo Cruz Foundation
IEN	Instituto de Engenharia Nuclear	*Nuclear Engineering Institute*
INPE	Instituto Nacional de Pesquisas Espaciais	The National Institute for Space Research
IPEN	Instituto de Pesquisas Energéticas e Nucleares	Nuclear and Energy Research Institute
IRD	Instituto de Radioproteção e Dosimetria	Institute of Radiation Protection and Dosimetry
MAPA	Ministério da Agricultura, Pecuária e Abastecimento	Ministry of Agriculture, Livestock and Supply
MDIC	Ministério da Indústria, Comércio Exterior e Serviços	Ministry of Industry, Foreign Trade and Services
MEC	Ministério da Educação	Ministry of Education
MS	Ministério da Saúde	Ministry of Health
SECIS	Secretaria de Inclusão Social	Secretariat for Social Inclusion
SEPED	Secretaria de Políticas e Programas de Pesquisa e Desenvolvimento	Secretariat for R&D Policies and Programs
SEPIN	Secretaria de Política de Informática	Secretariat for Informatics Policy
SETEC	Secretaria de Desenvolvimento Tecnológico e Inovação	Secretariat for Professional and Technological Education

Source: compiled by the authors.

- to increase and promote the stability of financial resources allocated to the STI system;
- to promote the manufacturing sector;
- to create an institutional environment conducive to the shared management of funds by the relevant government agencies (Finep and CNPq) and the private sector.

The resources of the Sector Funds come from different federal taxes and contributions of selected sectors, such as oil and gas (being the highest input), healthcare, agribusiness, energy, and aeronautics:

- The state share of profit derived from the exploitation of natural resources (for example 0.75% to 1% of the net profit of concessionary companies involved in the generation, transmission, and distribution of electricity),
- The share of the tax on industrialized products (IPI) for certain sectors (at least 43% for the goods and products benefiting from the Informatics Law[6])
- The share (7.5% to 17.5%) of payments for the Contribution for Intervention in the Economic Domain (CIDE) on the values that pay off the use or acquisition of technological knowledge or technology transfer from abroad (service payment, royalties, specialized technical, or professional services).

The acquired resources are allocated by the National Fund for Scientific and Technological Development (FNDCT) and managed by two agencies: the National Council for Scientific and Technological Development (CNPq) and the Funding Authority for Studies and Projects (Finep). The resources are dedicated to

[6] http://www.institutoslactec.org.br/en/submenu-ped/lei-de-informatica/

Table 10. **FNDCT's Budget Breakdown (2013)**

Cost items	Current RS Million
Total FNDCT	3056.1
Support to R&D in universities and research institutions	2004.9
Scholarships (Science without Borders Program)	307.6
S&T Infrastructure	367.0
Equalization	308.3
Grants to firms	345.0
Support to MCTI research institutions	320.1
Other actions	77.8

Source: [FNDCT, 2013].

14 subjects and two interdisciplinary fields: Aeronautics, Agribusiness, Amazon Region, Waterways, Biotechnology, Energy, Space, Water Resources, Information Technology, Infrastructure, Minerals, Oil and Natural Gas, Health, Transportation, "Yellow Green Technologies", and Telecommunications.

Table 10 presents the distribution of the resources allocated by the FNDCT in 2013.

Recent and Future Trends

The contribution of science, technology, and innovation is expected to remain a vital pillar for economic and social development. As costs related to the infrastructure and production of scientific and technological advances are expected to rise steadily, modern and robust financing instruments are indispensable for adequately supporting STI efforts and overcoming financing difficulties. A study by the United Nations Framework on Climate Change (UNFCCC) [UN, 2009] reviewed the financial barriers at each stage of technological development and proposed different financing schemes available to overcome such obstacles. Table 11 summarizes the main findings of this study.

A discussion about recent and future STI financing trends follows below.

Systemic Approach

Although there is a consensus among experts that the linear approach for modelling and financing STI infrastructure and efforts is no longer appropriate or efficient for generating new sources of knowledge and know-how, nor is it viable for making new products and services available, much more effort is needed in order to fully develop systemic models and practices.

In STI financing, much of the attention and prioritization of different actors still follows a linear model, where public funds are dedicated primarily to basic research, while business expenditures are directed towards applied R&D and commercialization. Only through taxes and subsidies are business R&D expenditures relevant in basic research.

Moreover, the different stages of STI (basic-applied-development) are increasingly interdependent and overlapping. To overcome such difficulties, a major drive will include consolidating the STI stages, environments, actors, and sponsors into dedicated programs, which deal with specific products, as opposed to a central theme. Here, the concepts of clusters, nodes of excellence, and value chains will play important roles. Research-supporting programs from the European Union, Organization for Economic Cooperation and Development (OECD) and United Nations specialized agencies are fair examples of this systemic approach trend.

Strategic Role of Governments via Grants and Fiscal Incentives

Governments can be expected to remain a major supporter of STI development for at least two reasons. The first reason involves the responsibility of the public sector in enhancing, gathering, and protecting knowledge and culture. Here, the main public duty is to guarantee that the necessary institutional and infrastructural foundation of a sustainable national innovation system is in place. Access to STI efforts, including their results, should be granted both for people and businesses. The second reason relates to the state's responsibility in mobilizing scientific and technological knowledge to address issues of the general well-being of its population. Such public responsibilities shall continue as strong justifications for allocating government budgetary funds and maintaining tax and other non-fiscal incentives for the support of STI initiatives.

International Funding and Project Preparation

While the internationalization of STI has become very relevant, only a few international funding mechanisms have been established and coordination between countries remains insufficient. The development of some of mechanisms such as the Kyoto and Montreal Protocols might be an interesting vector for the further creation and expansion of global funding schemes.

Table 11. **Financing Barriers and According Funding Instruments by Stage of Technological Maturity**

Stages of technological maturity*	Category of barriers	Financing barriers		Financing vehicles and schemes
		Public finance	Private finance	
I	Proof of concept	• Other political priorities for public finance • Unclear results of fundamental research (difficult to monitor, report, and verify) • Unclear results of education and training (difficult to monitor, report, and verify)	• Insufficient rate of return • Spill-over effects prevent private financiers from capturing the benefits of investment	• R&D support • R&D grants • Crowd financing • Tax credits
I	Technical	• Other political priorities for government budgets and public finance	• Lack of good technical information, resulting in high-risk profiles • Spill-over effects prevent private financiers from capturing the benefits of investment	• R&D grants
I, II	Scale	• Relatively high costs to scale up from prototype	• Lack of technological track record, resulting in high-risk profiles	• Angel investors • Innovation prizes • Incubators • Public/Private VC fund
I, II, III	Costs	• High costs to reach significant deployment	• Lack of policy to overcome costs, leading to low IRR	• Venture capital • Public/private equity fund • Soft loans • International project development mechanism
I, II, III, IV	Economic	• Unwillingness to interfere in the market, especially when drastic changes harm vested interests • Inflexibility of tax policy	• Energy pricing and subsidies; insufficient carbon price • High upfront capital costs • Lack of valuation of co-benefits, leading to low IRR • Requirement of large parallel infrastructure, leading to high upfront costs	• Equity • Mezzanine finance • Debt • PPPs • Public procurement • Guarantees • International investment facilitation
I, II, III, IV	Social	• Vested interests in social/ consumer preferences • Underinvestment in education and training	• Lack of a consumer or user market • Split incentives (principal-agent problem) • Lack of labor skills	• Loan facilities • Credit lines
I, II, III, IV	Institutional	• Vested interests in institutional settings • Public finance policy failures	• Lack of regulatory framework • Absence of international standards • Technology lock-in • Lack of match between ECA conditions and local financing conditions on ESTs	• R&D Programs • Systemic financing • Investment banking • Research contracting
V	Market failures and transaction costs	• Lack of recognition of public role in resolving market failures and transaction costs • Vested interests in bureaucracies	• Inefficient regulatory environment and bureaucracy • Lack of risk assessment and management tools specific to ESTs • Lack of appropriate financial packages • Lack of awareness and information • Imperfect markets • Technology market failure	• Public procurement • Private financing and management

* I — research and development, II — demonstration, III — deployment, IV — diffusion, V — commercially mature.

Source: [UN, 2009].

Project preparation is a field that has grown in importance. Given the difficulties involved in accurately forecasting STI efforts' results (including their monetary returns), as well as the stringent requirements from national and international investors, bankers, and sponsors, STI project developers and managers have increasingly sought finance facilities to support project preparations at the pre-investment phase. Recognizing such a trend, International Financial Institutions (IFI) such as the World Bank [World Bank, 2017], the European Bank for Reconstruction and Development (EBRD), and the Asian Development Bank, have created special Project Preparation Facilities (PPF) to support stakeholders. The expanding use of public and private procurement for awarding R&D-dedicated resources will also further reinforce such growing demand.

Private Financing and Management

The emergence of robust technology-based industries has introduced new ways of organizing and managing STI efforts as a whole. The strengthening of private labs and collaborative schemes between

public and private entities are evidence of such a trend. The experience of the Fraunhofer Society for the Advancement of Applied Research[7], based in Germany, but active internationally, could also prove a winning example for the future. This organization operates institutes and research units directly or in collaboration with public and private universities and other research institutes, earning its income mostly through contracts with industry or specific government projects.

Investment Banking

The continuous search for promising, break-through innovative investments has resulted in an increasing number of financial institutions focusing on supporting and investing in research labs, technology companies, and innovation development projects. A number of banking facilities have become available for well-structured STI projects and programs, such as soft loans from development banks, mezzanine debt from syndicate arrangements, long-term debt offers, trust funds, refinancing for maturated R&D, or the leverage of debt-equity deals.

Public-Private Partnerships

Successful past experience with PPPs in a number of areas of public and business common-interest should result in their increased use in the STI field. There is a clear trend towards establishing or improving the contractual and legal framework in many countries and internationally among countries. The participation of the World Bank and other international financing institutions has been paving the way for the more intensive use of PPPs in STI in the future. The PPP models used in the United Kingdom are proving to be successful approaches and schemes in the STI area.

Research Contracting with the Prevalence of Intellectual Property Rights

The impressive development of technology-intensive products and services should give rise to contracting R&D based upon IPR arrangements. The protection of IPRs on a global scale allows for the necessary legal security in establishing consistent R&D-to-commercialization contracts, with IPRs included as a guarantee in equity and debt financing agreements.

Venture Capital and Business Angels

Operators within the technology-based industry increasingly seek business angels for financing start-ups and venture capital for supporting their expansion towards maturity.

Private investors purchase shares in new technology-based companies looking for dividends and market valorization. Well-organized stages have been available for investors, comprising seed funds, angel round with access to board sits, series A round and beyond, which are granted by venture capital firms and further on until the issuing of Initial Public Offerings (IPOs).

Crowd Financing and e-Financing

The steady expansion of internet-based social networks has supported the launch of new financing structures, such as crowd financing and e-financing, which provide resources for deals and projects with common interests, across sectors such as the health, education, mobility, and environmental sectors. Specific areas of STI coverage have unlimited potential for raising funds.

Conclusion

STI costs have risen, as have government budget restrictions. The STI field has become more complex, collaborative, and network-based, with the private sector also becoming more dependent on innovation for productivity and competitiveness gains. This environment demands more robust and complex solutions, combining both public and private financing. Instruments from venture capital to public-private partnerships have gained importance in supporting STI efforts.

After discussing a number of instruments and incentives available to governments for improving their national innovation systems, two case studies demonstrated how government efforts from the United Kingdom and Brazil successfully tackled innovation-financing issues. Lastly, the paper reviewed recent and future STI financing trends.

References

Christofidis C., Debande O. (2001) *Financing Innovative Firms through Venture Capital*, Luxembourg: European Investment Bank. Available at: http://www.eib.org/attachments/pj/vencap.pdf, accessed 12.11.2017.

do Canto O.A.M. (2007) *Incentives to Support Innovation in the Private Sector: The Brazilian Experience*, Rio de Janeiro: Financiadora de Estudos e Projetos (FINEP). Available at: https://publications.iadb.org/handle/11319/4628, accessed 11.03.2018.

[7] https://www.fraunhofer.de

EIB (n.d.) *Project Finance. EPEC PPP Online Guide*. Available at: http://www.eib.org/epec/g2g/annex/1-project-finance/, accessed 12.11.2017.

ETI (2012) *Delivering the UK's Future Energy Technologies. Annual Review 2012*, Loughborough: Energy Technologies Institute. Available at: http://www.all-energy.co.uk/__novadocuments/29285?v=635035415144670000, accessed 12.11.2017.

ETI (2016) *State Aid*, Loughborough (UK): Energy Technologies Institute. Available at: https://d2umxnkyjne36n.cloudfront.net/documents/Summary-of-Scheme-for-GBER.pdf?mtime=20160912110613, accessed 12.11.2017.

ETI, Ecofin (2012) *Mobilising Private Sector Finance for CCS in the UK*, Loughborough: Energy Technologies Institute; London: Ecofin Research Foundation. Available at: https://s3-eu-west-1.amazonaws.com/assets.eti.co.uk/legacyUploads/2014/03/Ecofin_CCS_Report1.pdf, accessed 12.11.2017.

European Commission (2001) *Corporation Tax and Innovation: Issues at Stake and Review of European Union in the Nineties*, Brussels: European Commission. Available at: http://www.cordis.lu/innovation-policy/studies/fi_study1.htm, accessed 12.11.2017.

European Commission (2015) *RIO Country Report 2015: United Kingdom*, Brussels: European Commission. Available at: https://rio.jrc.ec.europa.eu/en/library/rio-country-report-united-kingdom-2015, accessed 12.11.2017.

FNDCT (2013) *Relatório de Resultados do FNDCT 2013*, Rio de Janeiro: FNDCT. Available at: http://www.finep.gov.br/images/a-finep/Fontes_de_Recursos/Relatorio_de_Resultados_FNDCT_2013.pdf, accessed 12.11.2017.

HM Treasury (2015) *Private Finance Initiative and Private Finance 2 Projects: 2015 Summary Data*, London: Crown.

Hodge G.A., Greve C. (2007) Public–Private Partnerships: An International Performance Review. *Public Administration Review*, vol. 67, pp. 545–558. DOI: 10.1111/j.1540-6210.2007.00736.x.

Leitão S. (2010) *An overview of current and future agenda of Brazilian policy in science, technology and innovation*, Brasília: Ministry of Science, Technology and Innovation. Available at: https://www.rvo.nl/sites/default/files/2014/06/Leitao_Brazil_0.pdf, accessed 11.03.2018.

Murray G.C., Marriott R. (1998) Why has the investment performance of technology-specialist, European venture capital funds been so poor? *Research Policy*, vol. 27, pp. 947–976.

OECD (1996) *Venture Capital and Innovation*, Paris: OECD. Available at: http://www.oecd.org/dataoecd/35/59/2102064.pdf, accessed 12.11.2017.

OECD (1997a) *National Innovation Systems*, Paris: OECD. Available at: http://www.oecd.org/dataoecd/35/56/2101733.pdf, accessed 26.02.2016.

OECD (1997b) *Government Venture Capital for Technology-based Firms*, Paris: OECD. Available at: http://www.oecd.org/dataoecd/14/7/2093654.pdf, accessed 12.11.2017.

OECD (1999) *Managing National Innovation Systems*, Paris: OECD. Available at: http://echo.iat.sfu.ca/library/oecd99_managing_National_IS.pdf, accessed 12.11.2017.

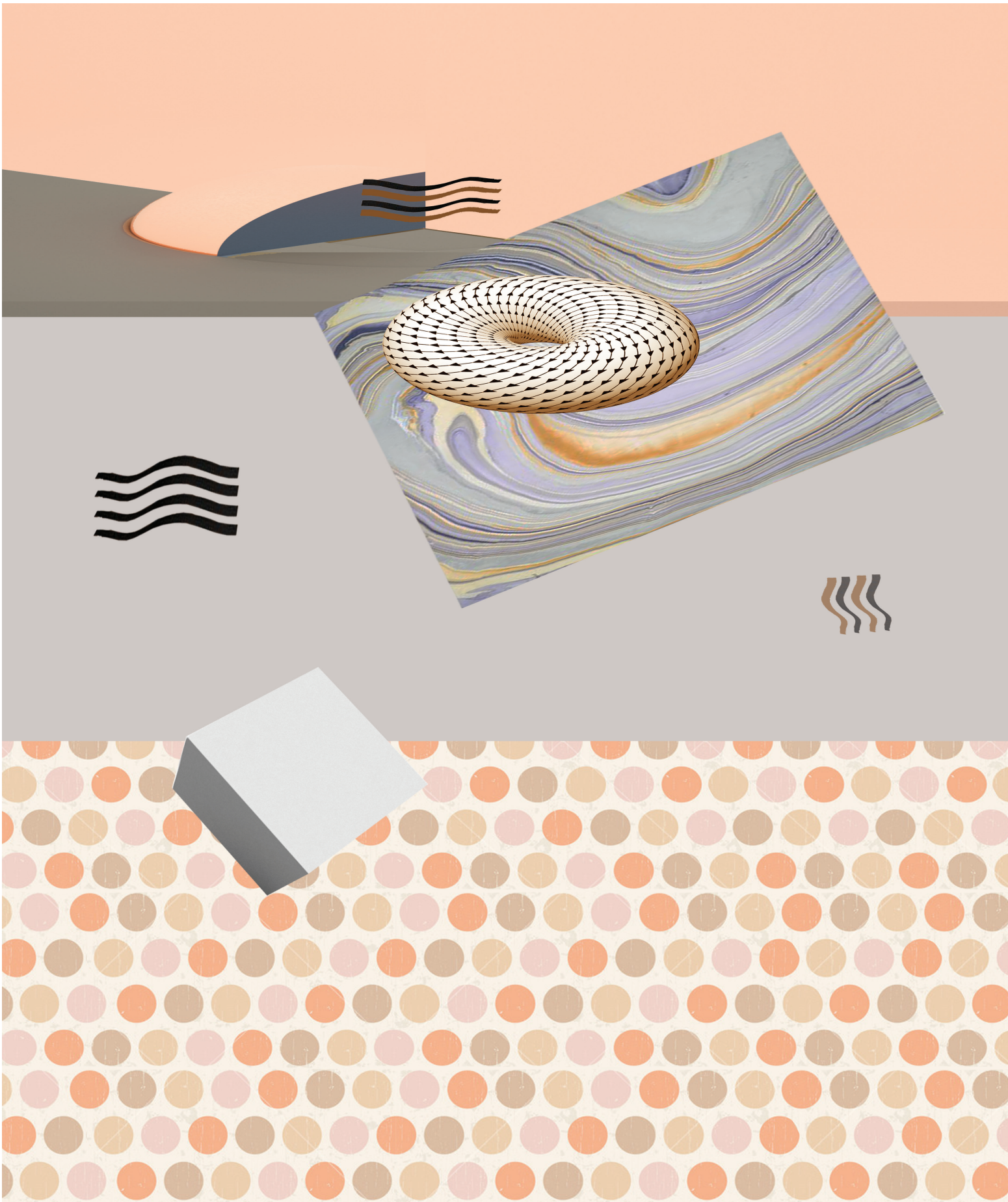
OECD (2014) *Strategic Public/Private Partnerships in Science, Technology and Innovation*, Paris: OECD.

Rothwell R. (1994) Towards the Fifth-generation Innovation Process. *International Marketing Review*, vol. 11, no 1, pp. 7–31. Available at: https://doi.org/10.1108/02651339410057491, accessed 26.02.2016.

UN (2009) *United Nations Framework Convention on Climate Change (UNFCCC). Recommendations on future financing options for enhancing the development, deployment, diffusion and transfer of technology under the Convention*, Vienna: United Nations. Available at: http://unfccc.int/resource/docs/2009/sb/eng/02.pdf, accessed 12.11.2017.

UNIDO (1996) *Guidelines on Infrastructure Development through BOT Projects* (BOT Guidelines UNIDO.95.6.E), Vienna: UNIDO.

World Bank (2017) *Project Preparation Facility: Increase in Commitment Authority and Enhanced Scope (Chair Summary)*, Washington, D.C.: World Bank Group.



Perspectives of Manufacturing Subsidiaries of Foreign Companies in Russia: Frontier, Faubourg or Sticks?

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Abstract

We present the dynamics of the position of Russian manufacturing subsidiaries of Western MNCs in 2012–2016. The analysis is based on interviews with the heads of subsidiaries, a repeated survey of plant managers and on secondary data on subsidiaries' activities. We propose a new portfolio model that desalinates "the core" and "the periphery" of the corporation and further allocates peripheral subsidiaries into several classes depending on intensity of value transfer from and to a subsidiary and the possibility to apply a "standard" set of instruments for capital allocation decisions. We argue that in the current situation of the Russian economy the only possibility for Russian manufacturing subsidiaries to remain close to the corporate core is to demonstrate high net profitability of assets. Otherwise subsidiaries are downgraded into "sticks". That position enables subsidiary managers to enjoy high autonomy and wide subsidiary mandates, but endanger the long-term perspectives on maintaining innovativeness and competitiveness of subsidiaries.

Keywords:
multinational companies; manufacturing; Russia; sanctions; corporate development; portfolio models; forecast.

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Despite the sanctions and "countersanctions" (or thanks to them), the Russian subsidiaries of international companies still retain key positions in many industries of the Russian economy. In 2012, the share of Russian subsidiaries of Western corporations amounted to 30% of total Russian consumer product output [*Gurkov et al.*, 2013, p. 79]. Taking into account the more than 300 new production facilities launched by Western companies in Russia in 2012–2016 (200 factories and 108 new production lines launched at existing facilities [*Gurkov, Kokorina,* 2017]), their role and importance have increased even more, not just in the consumer products segment (food, pharmaceuticals), but also in mechanical engineering (119 new production lines in various sectors), chemistry (37), and construction materials (30).

However, in spite of Western corporations' seemingly steadily growing presence in Russian industry, they face significant problems with current operations and their prospects are unclear. This paper points out the main problems encountered by Russian production facilities of international companies and outlines possible development paths for them.

Data Sources

This study was conducted in several stages. The first one (2012-2013) was focused on learning about the object of research, i.e., Russian production facilities owned by international corporations. We visited 18 factories owned by 16 companies[1], interviewed their management teams and toured the production facilities. During the second stage (2014), the focus shifted towards studying the general aspects of operations of the Russian subsidiaries of Western corporations. This involved interviewing executives, surveying managers, and collecting data about particularly important decisions made by international corporations in Russia. In 2014–2016, 20 heads of Russian subsidiaries of international corporations and foreign company executives were interviewed in order to learn about specific features of managing Russian enterprises. Some of these interviews were conducted within the scope of various business forums (the videos are available on YouTube[2]), but most of them took place on the corporations' premises and were devoted to particularly complex issues such as the "mandate" of the relevant Russian subsidiary, relations with the head office, and tactical and strategic steps taken by the Russian offices in 2014–2016.[3]

The company manager survey conducted in the middle of 2014 covered 52 CEOs of Russian subsidiaries of international corporations. An emphasis was placed upon the subsidiary's relationship with the parent company. Thirty-six of the participants also took part in the second survey conducted in 2016, which allowed them to assess changes in their firms' economic situation and their relationship with the parent company.

Finally, in 2015 we began to collect information about the construction of new production facilities and the expansion of existing enterprises' capacities owned by international corporations in Russia. An analysis of specialized websites, federal and local media, and national and local TV news allowed us to identify practically all new enterprises launched by Western corporations in Russia between January 2012 and December 2016, along with a significant number of projects on the expanding capacities of their existing factories[4].

Russian Subsidiaries of International Corporations before the Current Crisis

In order to correctly estimate the current state of and the prospects for Russian production facilities owned by Western companies, we focused on the period between 2010–2012. This is the period when the basic growth model for Western corporations' Russian production subsidiaries had fully matured and companies began to adjust their growth models to deal with more complex objectives.

The basic growth model is defined as follows:

- setting up not simply advanced production facilities in Russia, but such that would exceed the parent company's average level in terms of production processes, technological culture, and discipline. In a number of cases unique enterprises were built in Russia for the parent company, both in terms of the output and technological level (so-called "dream factories" [*Gurkov,* 2014, p. 227]);
- using the "small innovations" potential of Russian enterprises to the maximum extent possible (i.e., product modifications, production process improvements, approaches to and techniques of installing and launching new equipment, etc.). Some of such innovations were awarded the *best*

[1] The first co-author visited (and conducted interviews at) all of the factories, while others visited 4–6 factories each.

[2] See, for example, the interview with Magnus Brännström, CEO, Oriflame Holding AG (available at: https://www.youtu.be/-ruS41ypHzo, last accessed on 20.02.2017), and Maurizio Patarnello, CEO, Nestle Russia (available at: https://www.youtu.be/WTh8WNJjM5Y, last accessed on 20.02.2017). The interviews were recorded in 2014 and 2015 during the Adam Smith Conferences.

[3] The conditions of using the information collected during the interviews were becoming increasingly stringent: in 2015 it required partial anonymity, and in 2016 it required complete anonymity, i.e. not just the interviewees' names, but even the names of their companies could not be published.

[4] A launch of a new factory in Russia cannot go unnoticed; all such events are covered by local media. On the other hand, launching a new production line at an existing factory in most cases is treated as a commercial secret.

corporate practice status when Russian-designed technologies and methods were applied at the parent company's other facilities, for example, in the United States [*Gurkov, Filippov*, 2013];

- the "cascade" development of Russian production facilities, with "launch teams" comprised of the most highly skilled engineers and workers being transferred, on a temporary or permanent basis, from the international corporation's existing Russian facilities to the newly launched factories [*Gurkov*, 2014];
- fully matured behavioral standards for the staff of Russian subsidiaries of Western companies in order to employ world-level work practices (attention to detail, production discipline, health and safety norms, highly dynamic production processes, constantly learning new knowledge and skills). These behavioral standards were encouraged and promoted by the stability-oriented HR management system adopted by such companies (the preferred use of permanent employment contracts, an emphasis on a guaranteed proportion of remuneration (as opposed to bonuses), strict adherence to stringent health and safety norms, a broad range of compensation benefits, etc.) [*Gurkov*, 2016a];
- stringent control over investment resources by the head office, even at the most successful Russian subsidiaries [*Gurkov et al.*, 2014]: any project involving the acquisition of new equipment has to be approved by the regional or global head office.

At the same time, in 2011–2012 the top management of the global corporations became aware that the basic growth model of their Russian subsidiaries was rather shaky in terms of its potential for further expansion, and more importantly, for increasing returns. First of all, by that time Western corporations achieved total superiority in a number of sectors: for example, in 2012 they controlled 90% of the tobacco and car markets, more than 85% of the Russian beer market, various segments of the construction materials market, etc. Thus, further growth through mergers with and the acquisition of Russian companies became simply impossible (all noteworthy factories or even promising sites were already bought). The remaining opportunities involved the active development or modernization of the existing factories, switching to contract-based production, and increasing the degree of localization by building new factories from scratch. All three of these options were implemented in various industries to a greater or lesser extent. In the construction and decoration materials industry, priority was given to modernizing existing factories and (to a lesser extent) building new ones. In the automotive sector, the construction of new assembly plants and active use of contractors began as early as in the 2000s; however, in 2010–2012, this strategy was supplemented by increasing the degree of localization (e.g., Ford and Volkswagen have built engine factories) and encouraging international parts and components suppliers to launch production in Russia (Bosch, Nemak, Continental, Fuyou Glass, Fijikura, Schaeffler, etc.). In the food industry, Western corporations have been using contractors since the 1990s, but due to various reasons this was considered an induced policy. Accordingly, in the 2010s, they took active steps to increase the range of products manufactured at their own facilities in line with the contractual approach. As a result, in 2010–2013 the food industry companies focused on advancing and upgrading their existing facilities and optimizing production assets.

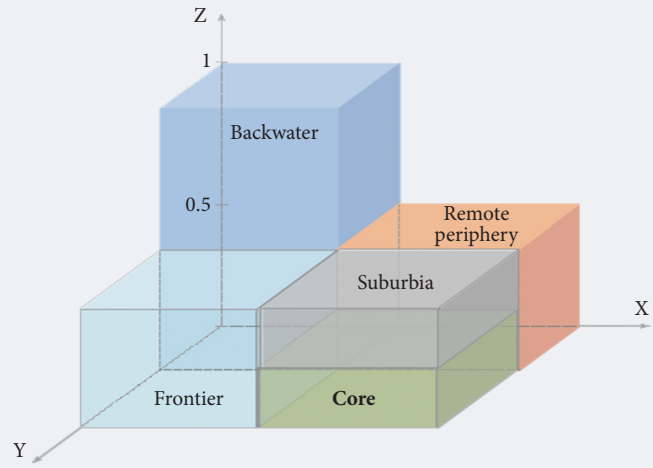
Secondly, the sheer scale of Russian operations prompted corporations to extend the mandate of their Russian subsidiaries. The latter were given more autonomy regarding pricing, product naming, promotion techniques, and the composition of the product matrix. At a number of enterprises, capital construction departments were recreated (or their activities stepped up), which were actively involved in selecting equipment suppliers to expand Russian production facilities, supervising the installation of equipment, and accepting the completed production lines and workshops. For some enterprises it was a matter of honor to exceed output targets while adhering to the technological regimes and quality standards. Employees' innovation activities were actively encouraged as well: a worker who proposed an efficient improvement could count on an impressive bonus [*Gurkov, Kossov*, 2014].

Numerous Western production corporations became aware of Russia's potential as an *another* (after Ireland, China, and India) location for their corporate R&D centers, not so much to serve the local market as to help meeting overall corporate demand.

Formally most of the Russian subsidiaries demonstrated sustainable growth and more than acceptable product quality, as well as became sources of new ideas on product range and, notably, production technologies and the organization of work. In terms of informal relations, global head offices of leading international corporations showed a high level of trust in and empathy towards Russian subsidiaries. The high performance figures and empathy level achieved in 2010–2012 favorably distinguished Russian subsidiaries from the overall corporate background, attracting executive management's attention and bringing in investments. The vast majority of Russian offices of major Western industrial corporations invested in the development of the production facilities they controlled in 2012–2013. That was the period when the projects to build new factories (which became operational in 2014–2016) were developed and the work on their implementation began [*Gurkov*, 2016b].

Generally, by 2012–2013, Russian subsidiaries secured good positions in the (in)formal hierarchies of Western companies. Some of the Russian subsidiaries in effect managed to get rid of their *periphery* status, while others were confidently moving on from the periphery towards the corporate core.

Figure 1. **Corporate Subsidiary Types**



Axes:

X shows the rate of extracting value from the subsidiary;

Y – the rate of adding value to the subsidiary;

Z – the scope for applying standard tools to support strategic decision-making, including decisions on investing into the subsidiary.

Source: compiled by the authors.

Corporate Periphery and Core

The "distance" between core and periphery corporate divisions is quite obvious in corporate asset management practices and is quite well described in management textbooks, though it still lacks precise theoretical substantiation.

From a strategic management point of view, it is all very simple. Within the scope of the "business portfolio" model, all areas of activity are broken down using a few easily measured parameters, for example, the growth rate or market share compared with the firm's closest rival (Boston Consulting Group matrix [*Henderson,* 1984; etc.]). Everything above a certain value is seen as a core business to be supported and developed, while everything else is regarded as periphery businesses which, depending on the circumstances, should be either "milked" (used as a source of revenue to promote the development of core businesses), or liquidated. As they were developed further, portfolio models became increasingly more complex [*Nippa et al.*, 2011], incorporating parameters that could not be explicitly measured, for example, the "degree of matching core corporate competences", "market appeal", and "company strength" [*Gurkov*, 2001]. This complexity reflected the reality of large corporations' management practices, which indeed clearly delineate core and periphery assets though they do so on the basis of not only objective, but subjective, criteria.

Large corporations commonly use the following parameters to distinguish between their core and periphery assets:

- The ability to fully take into account factors affecting the business and therefore apply standard tools to manage them, especially when making decisions on allocating resources between company divisions [*Rust*, 1994; *Aharoni*, 2011; *Graham et al.*, 2015];
- The ability, when the need arises, to quickly add value to, or extract it from a specific company division [see *Gurkov*, 2015a].

In line with the above parameters, corporate businesses can be divided into five groups, or zones: core, suburbia, frontier, remote periphery, and backwater (Figure 1).

Core: subsidiaries that the parent company constantly exchanges value with, in both directions, and which is suitable for the application of standard capital asset management tools.

Suburbia (close periphery): subsidiaries that the parent company also regularly exchanges value with, in both directions, but these (still) remain unsuitable for the full application of standard capital asset management tools.

Frontier: subsidiaries that are the recipients of value from the head office and other corporate divisions, on the whole, they are suitable for the application of standard investment management tools; however, these investments are not expected to yield immediate returns. Younger corporate subsidiaries can be seen as frontier, whose status and prospects are not yet completely clear. Corporate management may have certain hopes and expectations for them, but these too remain unconfirmed. When they do get confirmed, the frontier subsidiary starts drifting towards the core. Conversely, unmet expectations can push the subsidiary farther away towards the "remote corporate periphery". The frontier may simultaneously include subsidiaries drifting alongside with or towards each other. The frontier can be seen as the most dynamic part of the company. Given sufficiently successful overall business results, the frontier tends to drift towards the corporate core.

Remote periphery: the subsidiaries that mostly transfer value to the corporate core or to other subsidiaries. Sustainable value extraction first of all requires identifying its sources and to do that, management needs to have specialized knowledge and skills.

Finally, *backwater* corporate subsidiaries are also worth one's attention. Channelling assets from the corporate core or other subsidiaries into this area is either very difficult or not particularly sensible, since nothing can be extracted back from it. If a decision was made to leave such subsidiaries be, their suitability for the application of standardized strategic investment decision-making tools ceases to matter. During periodic corporate "ballast dropping" exercises, such divisions are liquidated and the costs of closing them down are written off as a general corporate loss[5]. Between such "clean-ups" backwater subsidiaries can drag on for years, if not for decades. In rare and unusually lucky cases (new opportunities arise, employees inspired by new prospects discover new talents), a subsidiary can move out of the backwater into the frontier, and then on into the corporate core. For example, an Austrian tram factory bought by a Canadian snowmobile manufacturer as a tie-in became the basis of the Bombardier Transportation Company (a subsidiary of Bombardier Inc.) – mainly because a group of workers to be made redundant were asked to design a new project and did a spectacular job [*Baghai et al.,* 1997]. In 2014 Bombardier Transportation employed 39,700 people, its annual revenue reached $9.6 billion, and the portfolio of orders reached $32.6 billion [Bombardier, 2015].

Dividing corporate subsidiaries into "core" and "periphery" is a quite common economic geography tool [*Gluckler*, 2014; et al.], but it is rarely applied in international business theory. Numerous studies were devoted to analyzing the concept of "distance" (institutional, mental, and psychological) between the head office and international subsidiaries [*Ambos el al.*, 2016; *Ando, Paik*, 2013; *Bae, Salomon*, 2010; *Berry et al.,* 2010; *Dikova*, 2009; *Harzing, Pudelko*, 2016; *Hernández, Nieto*, 2015; *Johnson et al.*, 2009; *Merchant et al.*, 2012; *Phillips et al.*, 2009; *Salomon, Wu*, 2012; *Stahl et al.*, 2016; *Xu, Shenkar*, 2002]. However, nobody succeeded in merging different kinds of distance into a single model. This was largely because theoretical literature, with very few exceptions [*Murphy, Ackroyd*, 2013; *Schönbohm, Zahn*, 2016], pays little attention to issues associated with *value extraction*.

Meanwhile tension and conflicts at corporations mainly arise between the head office and "remote periphery" specifically, due to the unequal exchange of value between the subsidiary and the parent company. Remote periphery companies frequently cannot accept the "cash cow" role, which explains their desire to draw the head office's attention to their real or imagined potential [*Bouquet, Birkinshaw*, 2008], or to problems they face trying to create value without receiving substantial support from the "center" [*Conroy, Collings*, 2016]. In the case that such tactics fail, the subsidiary management may resort to "opportunistic behavior", i.e., they will reduce the efficiency of value creation [*Kostova et al.*, 2017]. Sometimes subsidiaries succeed in stepping down the "center's" requirements concerning the amount of value they must create and move into the "backwater"; but in most cases the corporation simply gets rid of the business that no longer generates profits [*Barney et al.*, 2015; *Belderbos, Zou*, 2009; *Benito*, 2005; *Berry*, 2010; *Berry*, 2013; *Dorrenbacher, Gammelgaard*, 2010; *Dorrenbacher, Gammelgaard*, 2011; *McDermott*, 2010; *Song*, 2014].

In the light of the subsequent analysis, we should explain exactly what we mean by "standard tools" for supporting capital investment-related decision-making and which factors affect the circulation of value between the corporate head office and subsidiaries (or between subsidiary companies, i.e., firms owned by the same parent company).

Surveys of the CEOs of approximately 1,000 of the largest international companies conducted in the 2000s allowed us to identify the parameters of the "standard toolset" they use to make decisions concerning the allocation of capital between corporate subsidiaries [*Graham et al.*, 2015, p. 463]:

- net present value (NPV) rank;
- project managers' reputation;
- managers' confidence of success;
- cash flow timing;
- market share;
- top managers' gut feeling.

All of the above tools are typically applied simultaneously. When the external environment becomes more uncertain, using quantitative indicators such as net present value rank and cash flow timing becomes problematic. Top managers' gut feelings move to the forefront. This raises the issue of the partial applicability of standard approaches to decision-making. However, intuition is based upon knowledge, as well as on an understanding of global industry development trends and the "local context" (i.e., specific features of doing business in a particular region, country, etc.) [*Ahworegba*, 2017]. When the

[5] For example, Unilever restructured its business portfolio in 2000 selling some of the brands it owned and closing down more than 100 factories. The brand sale yielded $642 million to the corporation, while the closure of the factories cost it $2.3 billion, which was written off as a loss [*Gurkov*, 2008, pp. 138-139].

Table 1. **An Incomplete List of Value Types and Ways to Transfer Value within Corporations**

Value type	Ways to "pour" value into corporate subsidiaries	Ways to extract value from corporate subsidiaries
	Financial resources	
Profits		Dividends paid by the subsidiary to the parent company
Gross revenue		Fees for use of trademarks owned by the parent company (royalties)
		Excessive payments for goods and services supplied by other divisions of the parent company
		Excessive payments for services provided by the head office
Equity	Capital infusions into the subsidiary's authorised capital by the parent company	The subsidiary buys shares of the parent company, or other firms owned by the parent company
Current and long-term liabilities	Reduced rate loans granted to the subsidiary by the parent company or its other divisions	The subsidiary excessively borrows from banks, handing the loans over to the parent company
	Parent company's or its divisions' guaranties on bank loans granted to the subsidiary	
Current and long-term assets	Preferred (exclusive) rights to use patents owned by the parent company	Reduced-rate loans granted by the subsidiary to the parent company, or to other firms it owns
		The subsidiary guarantees bank loans provided to the parent company or its divisions
Deadweight loss		Intentional reduction of the output below the level of demand
Liquidation value		Discontinuing the subsidiary's operations (closure, sale, or liquidation)
	Material assets	
Production facilities	Transfer of equipment from the parent company's other divisions for permanent or temporary use, at prices below the market level	Transfer of equipment from the subsidiary to the parent company's other divisions for permanent or temporary use, at prices below the market level
(Raw) materials and finished products	Transfer of raw materials, semi-finished and finished products from the parent company's other divisions at prices below the market level	Transfer of raw materials, semi-finished and finished products from the subsidiary to the parent company's other divisions at prices below the market level
	Knowledge	
	Free transfer of codified knowledge (technical documentation, procedures) from the parent company to its subsidiaries	Free transfer of codified knowledge (technical documentation, procedures) from the subsidiary to the parent company
	Free transfer of tacit knowledge (work methods) from the parent company to its subsidiaries	Free transfer of tacit knowledge (work methods) from the subsidiary to the parent company
	The subsidiary is granted access to the corporate databases of reliable suppliers and contractors	The corporation is granted access to the subsidiary's databases of reliable suppliers and contractors
	Subsidiaries patent valuable solutions discovered by the parent company	The parent company patents valuable solutions discovered by its subsidiaries
	Subsidiaries are granted access to the parent company's patent databases	The parent company is granted access to the subsidiary's patent databases
	Internships for the subsidiary's employees at other divisions of the parent company	Internships for employees of other parent company divisions at the subsidiary
	The parent company subsidises the subsidiary staff's participation in meetings, conferences, and other knowledge and skill transfer events	The subsidiary subsidises the parent company staff's participation in meetings, conferences, and other knowledge and skill transfer events
	Talent	
	Temporary project teams comprising staff of the parent company and other divisions take part in projects implemented by the subsidiary	Temporary project teams comprising the subsidiary staff take part in projects implemented by other divisions of the corporation
	Transfer, on a temporary or permanent basis, of the head office or other divisions' staff into the subsidiary	Transfer, on a temporary or permanent basis, of the subsidiary's staff into the head office or other divisions of the parent company
	The parent company helps the subsidiary with recruiting, selecting, and hiring staff	The subsidiary helps the parent company with recruiting, selecting, and hiring staff for its other divisions or the head office

Note: legally risky, uncomfortable, or inefficient actions are shown in grey.

Source: composed by the authors based on [*Gurkov*, 2015a].

top management lacks such knowledge, when all they can rely on is "confidence of success", standard strategic decision-making support tools become less applicable.

Possible formats that corporations can use to add value to their subsidiaries or extract it from them are presented in Table 1 (for more detail see [*Gurkov*, 2015a]).

Identifying specific techniques for adding or extracting value as well as explaining their interaction and combined use is a rather notional and imprecise exercise. Under certain conditions, loans provided by parent companies can be converted into the subsidiary company's equity, while members of a temporary "launching team" may become permanent employees. Applying many of the above techniques requires a specific institutional environment, in particular having detailed legislation about intellectual property rights and the sufficient tolerance of tax authorities towards transfer pricing. Being able to quickly transfer staff from one subsidiary to another, on a temporary or permanent basis, is very important for talent circulation. Transferring tacit knowledge above all implies recognizing its value. At international companies this requires overcoming ethnic prejudices and biases, and the promotion that all, no matter one's ethnic background, can suggest valuable ideas that can be applied in other countries too".

On the whole, the suggested model of dividing corporations into core, suburbia, frontier, remote periphery, and backwater allows one to clearly define corporate subsidiaries' prospects following significant changes in economic and institutional conditions in particular countries. Next, we take a look at the processes that were unfolding at Russian production subsidiaries of international companies in 2014-2016 in terms of the actual facts and the proposed corporate structure model.

The War of Sanctions, December 2014's "Black Tuesday", and the Reaction of Parent Companies' Executive Management

The first wave of Western sanctions did not affect the vast majority of international corporations' Russian subsidiaries. The beginning disruption of economic ties with Ukraine was much more critical. A significant portion of Russian enterprises' production capacities depended upon exporting finished products to that country as well as importing raw materials and components from it. With very few exceptions, the introduction of Russian "counter-sanctions" had a positive effect, first of all, for food industry companies. Even in early December 2014, the management of many Western corporations were cautiously optimistic about the current developments, and when asked "How much money are Russian consumers going to have left to buy your products?", they tended to answer "Enough".

The moment of truth came in the second half of December 2014. The ruble had dropped sharply, electronics stores and car dealerships were hit by panic buying. Russian subsidiaries of Western corporations realized that they would have to revise all their plans for 2015. As the financial director of the Russian office of a leading global consumer products corporation told us in the summer of 2015, "we had a meeting on the 24th of December, took one last look at our wonderful operational plan for 2015 and binned it. Then we started to draft a new one and finished just hours before New Year's Eve. Our assumptions turned out to be 70% correct"[6].

The collapse of the ruble happened at a most unfortunate time: at the end of the calendar year, which for most of the Western corporations coincides with the end of the financial one. Due to the devaluation of the ruble, impairment loss was recorded for the 2014 financial year on consolidated corporate balance sheets. Companies who had heavily invested in Russia in the first half of 2014 and had to convert their investments into capital assets before December 31 of the same year faced the most serious problems. Since parent companies' consolidated accounting is maintained in dollars, euros, and other "hard currencies", these investments were practically nullified due to the aforementioned devaluation of the ruble. Against the background of a general decrease in the capital assets of Russian subsidiaries and their affiliates on the corporate balance sheets and the devaluation of the financial results of their activities, this "evaporation of investments" added to the problems managers of Western corporations faced when reporting the 2014 results to their shareholders.

Still, the fact remains that corporate top management deserve near top marks for the tactics they adopted regarding their Russian subsidiaries over the course of the next year. Responsibility for the problems had not been placed on the CEOs of the Russian subsidiaries. On the contrary, summarizing the results of the first quarter of 2015, the heads of the global corporations generally noted that "we have an excellent team in Russia, excellent productivity enhancement programs, sensible pricing policies, and excellent profit management practices" [PepsiCo, 2015]. Of course, the amounts allocated to Russian subsidiaries by head offices in 2015 had dropped, but in practically all cases it was decided to complete the construction of factories that were close to approaching the operational stage. Money was made available to launch specific production lines, workshops, and production facilities that were expected to increase sales by refocusing on segments that still displayed growth trends (e.g., baby food). All in all, between January 2015 and December 2016, Western corporations launched 86 new factories in Russia and completed 59

[6] We interviewed the same respondent again in July 2016. When asked what had changed since our last meeting he said, quite sincerely: "Was that really a year ago? I feel like it's still 2015".

important projects at existing facilities. Out of the 86 newly launched factories 15 were chemical and pharmaceutical ones, 12 manufactured transport vehicles, 11 belonged in other mechanical engineering industries, nine made construction materials, seven – food stuffs, and six operated in the forest and pulp-and-paper industry. Out of the 59 facilities installed at existing plants, 26 specialized in the food industry, seven – in making transport vehicles, and seven – in other mechanical engineering segments.

Notably, the number of sold or closed factories owned by Western corporations was completely incomparable with the sheer scale of decline in demand or with the number of newly opened facilities. Certain markets (beer, juices, cars, railway rolling stock, and locomotives) declined in 2015 by at least 20-30%. During the next year the contraction continued. Still, despite all this, no more than 16 factories owned by Western corporations were closed or sold in 2015–2016, and they were liquidated in the softest possible way in terms of the treatment of their employees[7].

During the same period, with active support by the global head offices, Russian subsidiaries tried all "operational and tactical" approaches to coping with shrinking or stagnating markets, in particular:

- the sharp reduction of the product range offered to Russian consumers (some of the Russian subsidiaries of global corporations reduced the range of their products by as much as 40-50%);
- breaking the product range down into "drivers of sales" (with minimal price increase), and "drivers of revenues" whose prices grew at a rate higher than the average inflation;
- "pulsation" of advertising budgets (sharp reduction, or conversely, dramatic increase of unit advertising costs for specific product groups);
- making use of the government export promotion initiatives;
- participation in import substitution programs.

None of the above (and many other) measures were sufficient to break the overall negative trend: the declining purchasing power of the population, reduced public procurement of civil products, and reduced investment programs of public corporations. Still, they did help many of the international corporations' Russian subsidiaries somewhat improve their situation. Also, throughout 2016, thanks to the strengthening of the ruble, foreign corporations made significant profits converting Russian sales into dollars and euros. Accordingly, the perception of Russian assets by the financial departments of international corporations changed for the better.

Russian Subsidiaries' Position in the Structure of International Corporations

The overall situation Russian production subsidiaries of international corporations found themselves in can be summarized by a quote attributed to German General Ludendorff about the position of the "Axis Powers" (Germany, the Austro-Hungarian Empire, Bulgaria, and Turkey) in 1918: "The strategic situation… was very hard, but the operational one was quite acceptable, while tactically things were simply excellent" (*cit. ex.*: [*Pereslegin*, 1999, p. 480]). From a tactical point of view, Western corporations had by now learned how to operate on stagnating and shrinking markets; operationally, they had identified the precise local market segments that continued to grow, the ones related to declining imports of consumer (especially manufacturing) products and import substitution (pharmaceuticals, agricultural machinery, etc.), along with certain export opportunities for Russian production facilities.

Strategically, however, international corporations recognized the institutional limitations related to adding value to and especially extracting it from their Russian industrial assets. There were no formal grounds to complain: the terms of net profit repatriation from Russia through the payment of dividends were still much more liberal than, for example, in China, while the terms for investing in subsidiaries' authorized capital were much more favorable than, say, in India, until recently. Still, having encountered the need to add value using formats other than investing in equity and extracting it outside the scope of net profit repatriation, Western companies discovered that many such activities either fell into a "grey area", or were fraught with serious economic or moral losses.

For example, the Russian tax authorities and the Ministry of Finance believe that transfer pricing rules are applicable to loan contracts. Therefore, a Russian subsidiary can lend money to the parent company (or to any other corporate structure), but such loans to "interdependent" legal entities have to be provided using "normal market interest rates". Furthermore, the Russian company must inform the tax authorities about such loans and provide documentation confirming that the interest rate was indeed close to the average market level [*Lazareva,* 2015; etc.].

[7] Before closing down its factory near St. Petersburg, GM paid six months' wages to all workers who were made redundant. Closing its Chelyabinsk beer factory, Baltica spent 300 million rubles to lay off 458 workers. The money was used to pay them lump sum compensation (seven average monthly wages), plus vacation money, bonuses for 2014, sickness pay, maternity leave pay, and money to pay job placement agencies that were supposed to help the laid off workers find new jobs (for more detail see: http://ob-zor.ru/news/baltika-vyplatit-sotrudnikam-zakryvshegosya-v-chelyabinske-zavoda-kompensacii-summa-porazhaet, last accessed on 10.02.2017).

[8] Though in most such cases Western corporations were able to successfully defend themselves from the taxman's accusations.

Several cases lost by international companies in Russian courts in 2014–2015 show that repatriating gross revenues (as opposed to net profits) from Russia by paying royalties to the parent company (e.g., for trademarks) involves a high level of risk. Importing and exporting equipment or supplying products at too low prices are fraught with serious customs problems. In some cases, litigation between foreign corporations and Russian tax authorities concerned the provision of head offices' services to local divisions at inflated prices[8].

The adoption of more strict immigration laws threatened recruiting foreign professionals for work, on a temporary or permanent basis, at Russian enterprises due to the more complex administrative procedures for obtaining work permits.

Hopes to gain additional profits by cutting production capacities did not come true: closing a couple of factories was not enough to balance the market due to the excessively fast contraction. The liquidation value of closed Russian factories in most cases turned out to be *negative* (see, e.g., footnote 6). In 2015-2016, three factories were sold, while in some cases the corporations carried on with production at newly launched facilities bearing the significant costs of relocating the workforce from the liquidated plants [*Gurkov, Morgunov*, 2015]. Thirteen more factories were simply closed; some of them were mothballed, which resulted in additional costs (maintaining security, paying property tax, etc.). The greyed-out sections in Table 1 above show the legally risky, uncomfortable, or inefficient ways to extract value from Russian subsidiaries of international corporations under the current conditions.

Obviously, except for the *rare cases* of generating sustainably high net profits, *in the current crisis, Russian production subsidiaries of international corporations have no chance of remaining in the core, suburbia, or remote periphery zones* given that the scope for extracting value from them in any other way than by paying some of their net profits to the parent company remains extremely limited. In the best possible case, if financial and other infusions by the parent company remain in place (primarily due to opening new factories or launching new facilities at existing ones), they have a chance to slide into the frontier. Otherwise, Russian subsidiaries may find themselves in the backwater, with minimal support from parent companies, which many CEOs of such subsidiaries have already experienced. In the survey conducted in the middle of 2014, between 45–55% of the managers noted they received significant support from their parent companies and other corporate divisions to implement development projects, develop new products, advance production processes, and retrain personnel [*Gurkov*, 2015b]. Practically none of the respondents assessed such support as "insignificant".

When *the same managers* were surveyed in the middle of 2016, the following shares of respondents assessed the support they received from the parent company as significant:

- financial support — 33%;
- new product development —30%;
- advancing production processes —34%;
- improving personnel —17%.

At the same time, the shares of respondents who described support by their parent company as "insignificant" were as follows: 28% for advancing production processes, 37% for new product development, and 50% for improving personnel.

Notably, Russian subsidiaries' mandate (i.e., their area of competency) has not been cut down [*Birkinshaw*, 1996; *Birkinshaw, Hood*, 1998; *Gurkov*, 2016c], it remains the same or has actually been extended, so that the subsidiaries have to deal with the problems they face on their own. Potentially, reduced support by the parent company for new product development and especially the advancement of production processes can disrupt the competitive advantages that Russian subsidiaries of Western corporations have over "purely local producers", which would only push them further into the backwater. The lack of interaction with the parent company makes generating new ideas valuable for the whole corporation less likely; accordingly, the perceived value of the local personnel drops. In other words, the last opportunities to transfer value from the subsidiary into the corporation via knowledge or talent are also disappearing.

Conclusions

During this article, we considered the main problems that the Russian production subsidiaries of international corporations are facing in terms of their position in the parent company's structure after the well-known events of 2014. We proved that in the absence of high profit margins and significant net profits, these firms are doomed to slide into the corporate "backwater". It can turn out to be very comfortable for them, since it provides a high degree of autonomy regarding current operations but it threatens their long-term competitiveness. So far, the process of parent companies' getting rid of subsidiaries with reduced competitiveness has been slowed down by the low liquidity of their assets (no buyers, either foreign or Russian).

If the overall economic situation in Russia improves it may lead to paradoxical developments, in particular, a larger-scale exit of international corporations from Russian assets by selling their factories to Russian firms or to "second rate" international corporations (i.e., those from developing countries).

When we surveyed companies in 2012–2013, we observed such enterprises: those that have left the leading international corporations to join the second-rate ones.

When a leading international corporation sells an enterprise to a second-rate parent company, the enterprise gets the chance to survive and sustain its production output. However, its productivity and technological efficiency inevitably diminishes given that the enterprise no longer has access to unique know-how and technological solutions supplied by advanced global corporations. Developing new brands or using popular Western ones also becomes problematic: now the companies have to pay real royalties for them to their international owners. Thus, if the objective is to specifically preserve and increase the presence of leading international corporations in Russia, new original solutions should be sought in the economic policy domain in order to increase the appeal of Russian production assets for such investors.

In the middle of 2016, we tried to prepare a number of recommendations concerning how to make Russian production assets more attractive to leading Western corporations. These suggestions were presented at various investment fora [*Gurkov*, 2016d], and submitted to the Consultative Foreign Investment Board of the Russian Government. Among other things, it was proposed to take steps to improve the quality of secondary vocational training in Russia, which would allow firms to sharply reduce the costs of launching and maintaining advanced production facilities[9]. Another group of recommendations addressed the promotion of the development of Russian suppliers of equipment for international corporations' production facilities. Of course, the aforementioned suggestions do not include an exhaustive list of possible steps that would help Russian subsidiaries of international corporations retain their current status or move closer to the parent company's "core" in order to sustain and improve the technological level of companies operating in particularly important sectors of the Russian industry.

References

Aharoni Y. (2011) Behavioral elements in foreign direct investment decisions. The Future of Foreign Direct Investment and the Multinational Enterprise. *Research in Global Strategic Management*, vol. 15, pp. 23–60.

Ahworegba A.H. (2017) The role of local context in headquarters–subsidiaries relationships: A global analysis of the literature. *Journal of East-West Business*, vol. 23, no 1, pp. 71–103. DOI: 10.1080/10669868.2016.1228554.

Ambos T.S., Ambos B., Birkinshaw J. (2016) Perspectives on headquarters-subsidiary relationships in the contemporary MNC // Research in Global Strategic Management (eds. T.S. Ambos, B. Ambos, J. Birkinshaw), vol. 17, Bingley, UK: Emerald Group Publishing Limited, article III. Available at: http://www.emeraldinsight.com/doi/pdfplus/10.1108/S1064-485720160000017017, accessed 19.02.2017.

Ando N., Paik Y. (2013) Institutional distance, host country and international business experience, and the use of parent country nationals. *Human Resource Management Journa,* vol. 23, no 1, pp. 52–71.

Bae J.-H., Salomon R. (2010) Institutional distance in international business research. *Advances in International Management*, no 23, pp. 327–349.

Baghai M.A., Coley S.C., Farmer R.H., Sarrazin H. (1997) The growth philosophy of Bombardier. *McKinsey Quarterly*, no 2, pp. 4–29.

Barney J.B., Damaragu N.L., Makhija A.K. (2015) Real options in divestment alternatives. *Strategic Management Journal*, vol. 36, no 5, pp. 728–744.

Belderbos R., Zou J. (2009) Real options and foreign affiliate divestments: A portfolio perspective. *Journal of International Business Studies*, no 40, pp. 600–620.

Benito G.R.G. (2005) Divestment and international business strategy. *Journal of Economic Geography*, vol. 5, no 2, pp. 235–251.

Berry H. (2010) Why do firms divest? *Organization Science*, vol. 21, no 2, pp. 380–396.

Berry H. (2013) When do firms divest foreign operations? *Organization Science*, vol. 24, no 1, pp. 246–261.

Berry H., Guillén M.F., Zhou N. (2010) An institutional approach to cross-national distance. *Journal of International Business Studies*, vol. 41, no 9, pp. 1460–1480.

Birkinshaw J. (1996) How multinational subsidiary mandates are gained and lost. *Journal of International Business Studies*, vol. 27, no 3, pp. 467–495.

Birkinshaw J., Hood N. (1998) Multinational subsidiary evolution: Capability and charter change in foreign-owned subsidiary companies. *Academy of Management Review*, vol. 23, no 4, pp. 773–795.

Bombardier Inc. (2015) *Sharpening Our Focus. Activity Report 2014*, Montreal: Bombardier Inc. Available at: http://www.bombardier.com/content/dam/Websites/bombardiercom/supporting-documents/Sustainability/Reports/CSR/Bombardier-Activity-Report-2014-en.pdf, accessed 10.12.2016.

Bouquet C., Birkinshaw J. (2008) Weight versus voice: How foreign subsidiaries gain attention from corporate headquarters. *Academy of Management Journal*, vol. 51, no 3, pp. 577–601.

[9] When launching advanced production facilities, Western companies frequently have to send large groups of local staff (engineers and workers) for long (in excess of one month) on-the-job training at the company's other production facilities abroad.

Conroy K., Collings D. (2016) The legitimacy of subsidiary issue selling: Balancing positive and negative attention from corporate headquarters. *Journal of World Business*, vol. 51, no 4, pp. 612–627.

Dikova D. (2009) Performance of foreign subsidiaries: Does psychic distance matter? *International Business Review*, vol. 18, no 1, pp. 38–49.

Dorrenbacher C., Gammelgaard J. (2010) Multinational corporations, inter-organizational networks and subsidiary charter removals. *Journal of World Business*, vol. 45, no 3, pp. 206–216.

Dorrenbacher C., Gammelgaard J. (2011) Conflicts in headquarters–subsidiary relationships: Headquarters-driven charter losses in foreign subsidiaries. Politics *and power in the multinational corporation: The role of institutions, interests and identities* (eds. C. Dörrenbächer, M.Geppert), Cambridge: Cambridge University Press, pp. 231–254.

Gluckler J. (2014) How controversial innovation succeeds in the periphery? A network perspective of BASF Argentina. *Journal of Economic Geography*, vol. 14, no 5, pp. 903–927.

Graham J.R., Harvey C.R., Puri M. (2015) Capital allocation and delegation of decision-making authority within firms. *Journal of Financial Economics*, vol. 115, no 3, pp. 449–470.

Gurkov I. (2001) *Strategicheskii menedzhment organizatsii* [Strategic Management of the Organization], Moscow: Intel-Sintez (in Russian).

Gurkov I. (2014) Management practices in Russian manufacturing subsidiaries of foreign multinational corporations: Challenging some beliefs about contemporary Russian industrial management. *Post-Communist Economies*, vol. 26, no 2, pp. 220–240.

Gurkov I. (2015a) Corporate Parenting Styles of the Multinational Corporation: A Subsidiary View. *Progress International Business Research* (eds. R. van Tulder, A. Verbeke, R. Drogendijk), vol. 10, Bingley, UK: Emerald Group Publishing Limited, pp. 57–78. Available at: http://www.emeraldinsight.com/doi/full/10.1108/S1745-886220150000010003, accessed 18.06.2016.

Gurkov I. (2015b) Russian manufacturing subsidiaries of Western multinational corporations: support from parents and cooperation with sister-subsidiaries. *Journal for East-West Business*, vol. 21, no 3, pp. 157–181.

Gurkov I. (2016a) Human resource management in Russian manufacturing subsidiaries of multinational corporations. *Post-Communist Economies*, vol. 28, no 3, pp. 353–372.

Gurkov I. (2016b) Against the wind — New factories of Russian manufacturing subsidiaries of Western multinational corporations. *Eurasian Geography and Economics*, vol. 57, no 2, pp. 161–179.

Gurkov I. (2016c) Oriflame CIS: The successful evolution of a regional subsidiary's mandate. *Global Business and Organizational Excellence*, vol. 35, no 4, pp. 44–54.

Gurkov I. (2016d) *Investimenti Diretti Stranieri in Russia e Nuove Opportunità*, Verona: Conoscere Eurasia Edizioni.

Gurkov I., Filippov S. (2013) Innovation processes in the Russian manufacturing subsidiaries of multinational corporations: An integrated view from case studies. *Journal of East-West Business*, vol. 19, no 4, pp. 260–290.

Gurkov I., Kokorina A. (2017) *Who cut the ribbon? A quantitative analysis of solemn opening ceremonies of new plants of multinational corporations in Russia* (SSRN Working Paper). Available at: https://papers.ssrn.com/sol3/papers2.cfm?abstract_id=2917572, accessed 22.02.2017.

Gurkov I., Kossov V., Morgunov E., Saidov Z. (2013) *Innovatsionnye praktiki rossiiskikh proizvodstvennykh podrazdelenii mezhdunarodnykh korporatsii — faktory sozdaniya, otbora i rutinizatsii effektivnykh form deyatel'nosti* [Innovative Practices of the Russian Manufacturing Subsidiaries of Multinational Corporations — Factors of Efficient Activities Creation and Routinization]. *Ekonomicheskaya nauka sovremennoi Rossii* [Economics of Contemporary Russia], issues 2 and 4, pp. 76–87, and 76–93 (in Russian).

Gurkov I., Kossov V., Morgunov E., Saidov Z. (2014) *Rossiiskie obrabatyvayushchie proizvodstva zarubezhnykh korporatsii: global'nye upravlencheskie praktiki i vozdeistvie na mestnye instituty (Doklad k XV Aprel'skoi mezhdunarodnoi nauchnoi konferentsii po problemam razvitiya ekonomiki i obshchestva, Moskva, 1–4 aprelya 2014 g.)* [Russian Manufacturing Operations of Foreign Corporations: Global Management Practices and Impact on Local Institutions (Paper presented at the the 15th April International Scientific Conference on the Development of Economics and Society, Moscow, April 1-4, 2014)], Moscow: HSE (in Russian).

Gurkov I., Kossov V.V. (2014) Combining contemporary and Soviet-era management practices to achieve excellence at Knauf CIS. *Global Business and Organizational Excellence*, vol. 33, no 6, pp. 21–34.

Gurkov I., Morgunov E. (2015) Pereezd proizvodstva. Moment istiny, ili kak rabotnikam byl predostavlen pochti tselyi god, chtoby opredelit'sya so svoim resheniem o pereezde proizvodstva [Moving production. The moment of truth, or how the workers were given almost a year to decide on their decision to move production]. *Upravlenie personalom* [Personnel Management], no 12 (328), pp. 37–46 (in Russian).

Gurkov I.B. (2008) *Strategiya i struktura korporatsii* (2-e izd.) [The Strategy and Structure of the Corporation (2nd ed.)], Moscow: Delo Publishing House (in Russian).

Harzing A.-W., Pudelko M. (2016) Do we need to distance ourselves from the distance concept? Why home and host country context might natter more than (cultural) distance. *Management International Review*, vol. 56, no 1, pp. 1–34.

Henderson B. (1984) *Logic of Business Strategy*, New York: Harper Collins.

Hernández V., Nieto M.J. (2015) The effect of the magnitude and direction of institutional distance on the choice of international entry modes. *Journal of World Business*, vol. 50, no 1, pp. 122–132.

Johnson D.K.N., Siripong N., Brown A.S. (2009) The demise of distance? The declining role of physical proximity for knowledge transmission. *Growth and Change*, vol. 37, no 1, pp. 19–33.

Kostova T., Nell P.C., Hoenen A. (2017) Understanding agency problems in headquarters-subsidiary relationships in multinational corporations: A contextualized model. *Journal of Management*, vol. 3, no 1, pp. 57–81. DOI: 10.1177/0149206316648383. Available at: http://dx.doi.org/10.1177/0149206316648383, accessed 17.12.2017.

Lazareva E. (2015) Vnedrenie sistemy transfertnogo tsenoobrazovaniya v Rossii [The System of Transfer Pricing in Russia Implementation]. *Universum: Ekonomika i Yurisprudentsia (elektronnyi nauchnyi zhurnal)* [Universum: Economics and Law (electronic journal], no 6 (17). Available at: http://7universum.com/ru/economy/archive/item/2176, accessed 14.11.2016 (in Russian).

McDermott M.C. (2010) Foreign divestment. *International Studies of Management and Organization*, vol. 40, no 4, pp. 37–53.

Merchant H., Tung R.L., Verbeke A. (2012) The tenuous link between cultural distance and international strategy: Navigating the assumptions of cross-cultural research. *Handbook of Research on International Strategic Management* (eds. H. Merchant, R.L. Tung, A. Verbeke), Cheltenham: Edward Elgar, pp. 310–327.

Murphy J., Ackroyd S. (2013) Transnational corporations, socio-economic change and recurrent crisis. *Critical Perspectives on International Business*, vol. 9, no 4, pp. 336–357.

Nippa M., Pidun U., Rubner H. (2011) Corporate portfolio management: Appraising four decades of academic research. *Academy of Management Perspectives*, vol. 25, no 4, pp. 50–66.

PepsiCo Inc. (2015) *Edited Transcript PEP — Q1 2015 PepsiCo Inc Earnings Call*. Available at: http://www.pepsico.com/docs/album/Investor/q1_2015_pep_transcript_jzerxrllbnw4hsb.pdf?sfvrsn=0, accessed 27.10.2016.

Pereslegin S. (1999) Mirovaya voina i krizis evropeiskogo voennogo iskusstva [The World War and the Crisis of European Military Art] // Entsiklopediya voennogo iskusstva (ed. B. Liddel-Gart), Moscow: AST Publishing; Saint-Petersburg: Terra Fantastica, pp. 464–493 (in Russian).

Phillips N., Tracey P., Karra N. (2009) Rethinking institutional distance: Strengthening the tie between new institutional theory and international management. *Strategic Organization*, vol. 7, no 3, pp. 339–348.

Rust D.R. (1994) The budgeting process in a multinational firm. *Multinational Business Review*, vol. 2, no 2, pp. 59–63.

Salomon R., Wu Z. (2012) Institutional distance and local isomorphism strategy. *Journal of International Business Studies*, vol. 43, no 4, pp. 343–367.

Schönbohm A., Zahn A. (2016) Reflective and cognitive perspectives on international capital budgeting. *Critical Perspectives on International Business*, vol. 12, no 2, pp. 167–188.

Song S. (2014) Unfavorable Market Conditions, Institutional and Financial Development, and Exits of Foreign Subsidiaries. *Journal of International Management*, vol. 20, no 2, pp. 279–289.

Stahl G., Tung R., Kostova T., Zellmer-Bruhn M. (2016) Widening the lens: Rethinking distance, diversity, and foreignness in international business research through positive organizational scholarship. *Journal of International Business Studies*, vol. 47, no 6, pp. 621–630.

Xu D., Shenkar O. (2002) Institutional distance and the multinational enterprise. *Academy of Management Review*, vol. 27, no 4, pp. 608–618.

Technology Acceptance and Future of Internet Banking in Vietnam

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Abstract

The technology acceptance model (TAM) has long been applied to investigate consumer attitudes towards novel solutions and identify incentives that increase their willingness to adopt them. A cumulative tradition has already been developed in this stream of research. Using a modified TAM model, the authors explore factors that affect the intention of Vietnamese banks and their clients to adopt internet banking services. Currently, there is a number of factors hindering the diffusion of internet banking, particularly the underdevelopment of the technological infrastructure, the lack of investment, and the habits of the majority of providers and consumers of services to interact via traditional formats.

The study finds out that the adoption of internet banking could be encouraged by perceived usefulness, perceived ease of use, and, finally customer satisfaction. Among the important factors to ensure these conditions are an advanced customer support system, user-friendly interface, promptness of services, and transparency of banking operations. Among the recommendations put forward by the authors, special attention is given to the requirements for the skills of bank personnel, the need for continuous training, and the establishment of targeted strategic indicators at the public level that facilitate the embeddedness of internet banking in the life of Vietnamese society.

Keywords:
Internet banking; Technology Acceptance Model (TAM); perceived usefulness; perceived ease of use; customer satisfaction; intention to adopt; Vietnam.

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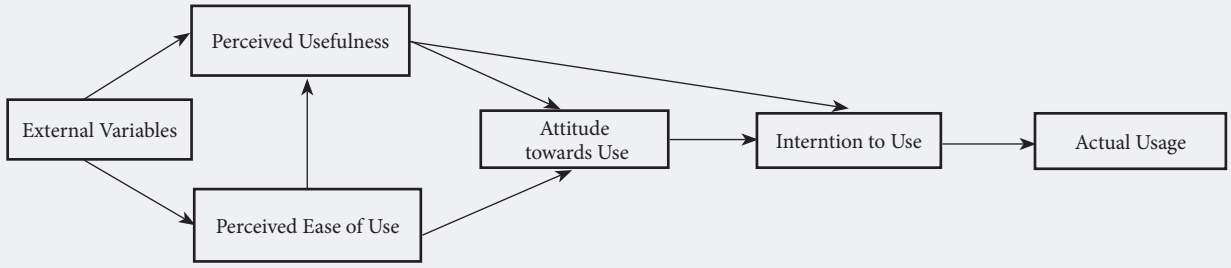
The rapid development and progress of internet technology in recent years has changed our way of life. Internet banking is a service among several information systems implemented by banks in the recent past. Internet technology has given e-banking such qualities as security, fast transactions, cost reduction, and convenience. Banks can create facilities that allow customers to engage in banking activities on an electronic device on a virtual technology platform that can be used for other activities such as online shopping, stock trading, online bill payments, online auctions, and so on [*Blut,* 2016; *Bryman,* 2007].

Internet banking was launched by Vietnamese commercial banks starting in the 2010s. The number of internet users in Vietnam has rapidly increased over time. For instance, at the end of 2000 there were about 200,000 internet users (0.23% of total population), this number reached to 64 million (about 66.3% of the total population) in 2017[1]. However, the size of the e-commerce market in Vietnam has only reached about $4 billion, which accounts for 2-3% of the total retail value of goods. Compared with Japan and South Korea where e-commerce makes up 17% and 18% of the retail market, respectively, the share of this indicator in Vietnam does not exceed 2-3% [*Quyen,* 2018]. Thus, the potential for e-commerce development is still great, especially in the context of Vietnam's integration into the global economy. Along with the increase in the number of bank cards issued and investments in payment infrastructure, now banks have begun providing the following services via online banking: money transfers, payments for electricity, water, internet, telephone, or TV cable bills. Furthermore opportunities have been arising for the use of this technology for plane ticket purchases, online shopping, and insurance payments. Despite the many benefits of using internet banking, only about 30% of commercial bank customers use internet banking in their transactions. It is clear that the adoption of internet banking services is still very low among customers of commercial banks in Vietnam. There are still large cluster of clients who prefer the traditional ways of banking, the reasons for which can be attributed to the following:

1. Vietnamese commercial banks' individual customers open accounts at banks mainly in order send and borrow money, they seldom pay fees for their transactions via internet banking. Most of these customers can understand the benefits of using internet banking but they do not have much access to online baking because they think the service is complicated and difficult to use.
2. In contrast to other markets in the world, the direct purchase of goods in Vietnam is much easier in person than online.
3. Many services in Vietnam are not part of the e-commerce market. Many restaurants do not offer online booking and retailers do not sell their goods on the internet.
4. The habit of using cash among the Vietnamese also affects the propensity to use internet banking services. People usually use cash to buy goods, go to the market, pay taxes or fees like electricity, water or even telephone fees.
5. The infrastructure for the development of internet banking is still limited, wireless internet does not have wide coverage, card payment terminals and ATM machines are usually located only in densely populated areas.
6. Commercial banks are not actively engaged in marketing the relevant services. Access to popular services remains limited, there are few resources available to help customers learn about online banking, and customer service remains much to be desired.
7. Customers are concerned about the safety and reliability of online banking services, worried about risks such as hacker attacks, financial fraud, and unpredictable events. Financial fraud usually occurs when hackers access the system, steal customer's information by searching for passwords, then making a credit transfer. Many banks in Vietnam think that they face many difficulties in detecting cheating and fraud, the main cause is the lack of financial resources or qualified human resources.
8. The lack of investments has slowed down the development of banking services. Online banking services require a large amount of capital in order to complete the development of banks' IT infrastructure and needs to meet two conditions: first, the presence of advanced and modern techniques and equipment, and, secondly, affordability (services that are affordable for people to access).
9. Commercial banks also face many difficulties regarding human resources. When implementing internet banking, each employee must equip themselves with the skills to use IT effectively, have the habit of working electronically and also be highly proficient in banking because they no longer work directly with customers. Further, banks need to have a group of IT professionals who are capable of ensuring the stable development of the online banking system.

[1] Internet World Stats, Usage and Population Statistics – December 2017, www.internetworldstatistic.com

Figure 1. **Technology Acceptance Model**



Source: compiled by the authors.

Literature Review

There are a number of previous studies about interest in internet banking, which were mostly based on the Technology Acceptance Model (TAM). TAM was first introduced by Fred Davis in 1986. His TAM was based upon an adaptation of the Theory of Reasonable Action and describes consumer behavior in the context of different information systems and technologies. After that, Davis introduced TAM 2 [*Davis,* 1989] in Figure 1 and TAM 3 [*Venkatesh, Davis,* 1996]. All three TAM models include and assess two specific beliefs: Perceived Usefulness (PU) and Perceived Ease of Use (PEU). PU is defined as the potential user's subjective belief in the likelihood that the use of a certain system will improve his/her fulfillment of tasks and PEU refers to the degree to which the potential user expects the target system to be effortless [*Davis,* 1989].

Foley and Jayawardhena [*Foley, Jayawardhena,* 2000] stipulate that internet banking brings advantages to commercial banks including cost saving, reaching customers at a global level, accessing new business strategies, and enhancing banks' performance and efficiency. Internet banking can make banking services more flexible and easy to use. Sheshunoff [*Sheshunoff,* 2000] suggests that when customers adopt a new technology like internet banking, this provides the bank with a competitive advantage and helps it maintain its market share. Customers that use internet banking save both money and time by avoiding long queues at banks and having the ability to conduct the necessary transactions at any time from any location.

Lichtenstein and Williamson [*Lichtenstein, Williamson,* 2006] interviewed individual and focus-group customers to identify trends in the consumer use of internet banking in Australia. Their results found that participants were impatient about not obtaining immediate assistance, they were not confident in their ability to find information quickly from online databases, and considered online banking difficult to use. Laukkanen et al. [*Laukkanen et al.,* 2007] found that there are still number of bank customers using traditional ways of banking and who do not intend to adapt or accept new technologies, especially banking technologies. This initial resistance is one of the greatest barriers to the spread of internet banking. Musiime [*Musiime,* 2011] recognized various factors that affect the choice of customers to adopt a new technology. These factors include the experience and skill of the customer to use internet, the demographics of the user population, perceived security, market activity, the reliability of the service provider, etc.

Along with the studies based on TAM and focused on PU and PEU, there were studies that modified the TAM by adding the new determinants such as risk, security, experience, skill of usage, and customer satisfaction

Sathye [*Sathye,* 1999] studied the adoption of internet banking in Australia and found that security concerns about it also affected the adoption of online banking. Using the Technology Acceptance Model to examine consumer acceptance of online banking in Finland, Pikkarainen *et al.* [*Pikkarainen et al.*, 2004] pointed out that concerns about security impacted online banking adoption. Many other studies have identified risk and security as important concerns for the adoption of technological innovations (e.g., [*O'Connell,* 1996; *Polasik,Wisniewski,* 2009; *Venkatesh, Davis,* 2000]). Waite [*Waite,* 2002] shows that the competitive advantages of the services, along with the ease of use, determine expectations about the accessibility of online information about retail banking services and their adoption.

Lule et al. [*Lule et al.*, 2012] applied TAM in researching the factors that influence the adoption of mobile banking in Kenya. Confirmatory factor analysis of the data and structural equation modeling were

Table 1. **Theoretical Constructs and Hypotheses of the Study**

Construct	Description	Hypotheses suggested
Perceived Ease of Use	If, in the opinion of the client, the use of the system (in this case internet banking) does not present any difficulties, then he or she will be more inclined to use the service [*Hair et al.,* 2013, 2017]	H1: Perceived Ease of Use has a positive influence on Customer Satisfaction. H2: Perceived Ease of Use has a positive influence on Perceived Usefulness.
Perceived Usefulness	The degree to which an individual believes that using a particular system will enhance his/her job performance [*Hair et al.,* 2010]. Perceived usefulness has been presented as the ease in conducting transactions, online payments, checking financial statements, online request for checks. Depending on the development of the technology, other advantages may appear.	H3: Perceived Usefulness has a positive influence on Customer Satisfaction.
Customer Service	Customer service relates to online customer support prior to, during, or after the online order has been placed [*Bauer et al.,* 2006]. Customer service is especially important for internet banking clients.	H4: Customer Service has positive influence on Customer Satisfaction. H5: Customer Service positively affects customers' Intention to Adopt Internet Banking.
Customer Satisfaction	Customer Satisfaction to a great extent determines one's intention to adopt internet banking.	H6: Customer Satisfaction has a positive influence on the Intention to Adopt Internet Banking.
Mediation Analysis	Mediation occurs when a third mediator variable interferes in the cooperation of two other constructs. This study tests whether there are mediator variables between the following constructs: Customer Service and the Intention to Adopt Internet Banking; Perceived Usefulness and the Intention to Adopt Internet Banking.	H7: Customer Satisfaction mediates the relationship between Customer Service and the Intention to Adopt Internet Banking. H8: Customer Satisfaction mediates the relationship between Perceived Usefulness and the Intention to Adopt Internet Banking. H9: Customer Satisfaction mediates the relationship between Perceived Ease of Use and the Intention to Adopt Internet Banking.

Source: compiled by the authors.

used to validate the research model. The results found that perceived ease of use, perceived usefulness, perceived efficacy, and perceived credibility significantly influenced customers' attitude towards the use of mobile banking.

Geetha and Malarvizhi [*Geetha, Malarvizhi,* 2012] carried out an assessment of a modified Technology Acceptance Model among e-banking customers in India. Their study determined the factors influencing the consumer's adoption of e-banking in India, which include perceived ease of use, perceived usefulness, and perceived risk. The results suggest that Indian commercial banks need to highlight the benefits of e-banking, make it easy to use, and ensure its security to improve consumers' trust.

Alsamydai [*Alsamydai,* 2014] adapted the TAM to study the use of mobile banking services in Jordan. In his study, the TAM model was modified by introducing two new dimensions, quality and experience, to the five dimensions of TAM model, which was introduced by Davis [*Davis,* 1986]. The results show a positive correlation between all of these components and demonstrate the strong correlation between the attitude toward and the use of mobile banking services. Among these dimensions, the strongest correlation was found between perceived ease of use and experience.

Ghani et al. [*Ghani et al.,* 2017] investigated the technology acceptance model (TAM) for internet banking and focused on the dimensions of customer service and customer satisfaction. Their study shows that the intention to adopt internet banking could be encouraged by perceived ease of use, perceived usefulness, customer services, and customer satisfaction. The result also demonstrates that customer satisfaction takes on a significant mediating role among the proposed variables. An importance performance matrix analysis (further, IPMA) test demonstrated that customer service is the most important factor.

In order to supply a theoretical basis for researching the adoption of internet banking, in this study the TAM model has been modified by integrating two new dimensions, which are customer service and customer satisfaction (Figure 2). With the help of the modified TAM, a deep analysis of the state of the banking sector in Vietnam will be carried out with a focus on the use of internet banking services.

The main goals of this study are as follows:

- To evaluate the contribution of the modified TAM in assessing the readiness of customers to use internet banking
- To investigate the opportunity of using and influence of the two new factors included in the model.

The constructs and hypotheses of this study are synthesized in Table 1.

Table 2. **Constructs and Indicators Used in the Study**

	Factors and indicators	Epoxy
I	***Perceived Ease of Use***	
1	Most of the Vietnamese population is used to using cash and think that using cash is easier than internet banking	PE1
2	In order to use internet banking, I need to have knowledge about information technology	PE2
3	In order to use internet banking services, I need serious help and support on the bank's portal	PE3
4	Interaction with the system requires a great deal of mental effort	PE4
II	***Perceived Usefulness***	
1	I do not need to the bank on a regular basis	PU1
2	Using internet banking saves me a lot of time	PU2
3	I can manage my money online at any time	PU3
4	I can save time paying bills at the post office and the airport	PU4
5	Using internet banking services raises my status compared to those who do not.	PU5
III	***Customer Service***	
1	Vietnam commercial banks seldom provide online support to customers using internet banking.	CS1
2	The infrastructure for internet banking is still lacking, many restaurants have not offered online booking and the stores do not have the necessary card terminals and devices for using internet banking.	CS2
3	The internet banking system has effective tools to help me resolve problems	CS3
4	Vietnamese commercial banks should invest more in the improvement of technologies used to detect fraud and information theft	CS4
IV	***Customer Satisfaction***	
1	I am not particularly worried about the risks of hacker attacks or financial fraud when using internet banking	SA1
2	In Vietnam, the infrastructure of internet banking is still limited, there is limited wireless coverage	SA2
3	I am satisfied with my previous internet banking experience	SA3
V	***Intention to Adopt Internet Banking***	
1	I intend to start using internet banking services in the near future	INT1
2	I predict that I will start using internet banking service in the near future	INT2
3	In the future, I intend to use internet banking whenever I have a need	INT3

Source: compiled by the authors.

Materials and Methods

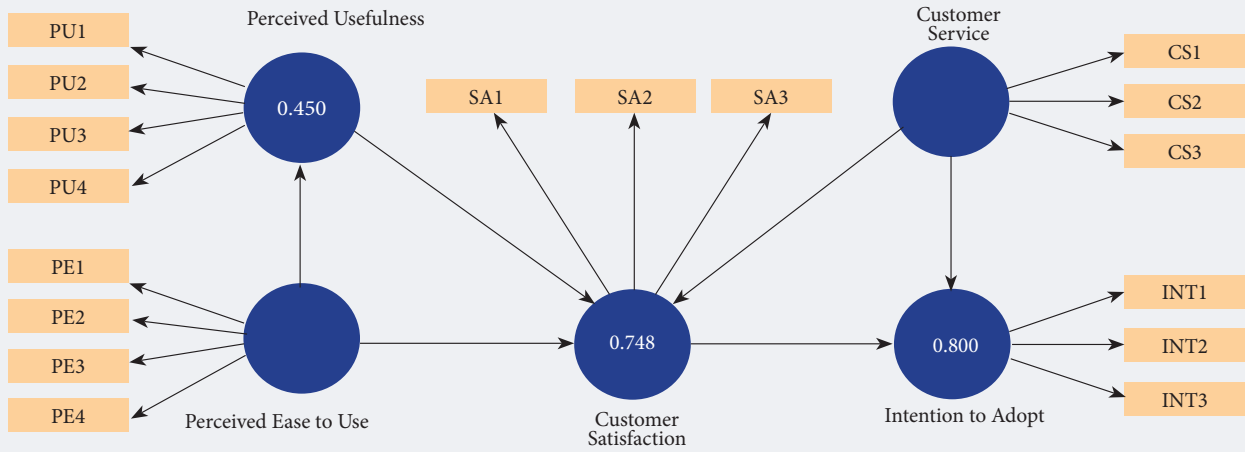
In this study, internet banking is used to describe banking transactions via mobile, ATM, and tablet apps. For data collection, the convenience sampling method was used as supported by Hair et al. [*Hair et al.,* 2013, 2014] because this method allows the researcher to receive responses in a cost-effective way [*Martins,* 2014]. The investigated individual customers of Sacombank own smartphones and tablet apps and they can implement banking transactions via mobile, ATM, and tablet apps. The constructs and the indicators of this study are shown in Table 2. The five-point Likert scale was used in the questionnaire (SD — strongly disagree, D — disagree, N — neutral, A — agree, SA — strongly agree) for the collection of primary data. The responders' demographic characteristics are provided in Table 3.

The survey was conducted from November 2017 to December 2017 in Vietnam with 195 respondents, in which, there are 20 surveys unfit for analysis, leaving 175 samples that are suitable for analysis. Among the 175 individual customers, some use internet banking and some do not. The percentage of users and non-users of internet banking is depicted in Table 2.

Data collected from survey were analyzed by using SmartPLS 3. PLS-SEM (partial least squares-structural equation modeling) allowed the researchers to estimate any complex model with many constructs and indicator variables, especially when prediction is the goal of the analysis. Furthermore PLS-SEM generally allows for more flexibility in terms of data requirements and the specification of relationships between constructs and indicator variables [*Sarstedt et al.,* 2017]. PLS – SEM is a nonparametric statistical method. Different from maximum likelihood (ML)-based CB-SEM, it does not require the data to be normally distributed [*Hair et al.,* 2017]. PLS–SEM relies on a bootstrap procedure to test coefficients for their significance [*Davison, Hinkley,* 1997]. Prior research stated that a sample size of 100 to 200 is usually a good starting point in carrying out path modeling [*Hoyle,* 1995].

This study uses reflective measurement constructs, it includes five: Customer Service, Perceived Ease of Use, Perceived Usefulness, Customer Satisfaction, and Intention to Adopt (Figure 2).The measurement model has 19 indicators, but PU5 and CS4 indicators were eliminated because their outer loadings are smaller than 0.70.

Figure 2. **Theoretical Framework**



Source: compiled by the authors.

Table 3. **Demographic Features of the Respondent Sample**

Categories	Percentage
Gender	
Male	54%
Female	46%
Age	
Less than 25 years old	32.2%
26–35 years old	34.6%
36–45 years old	22%
More than 46 years old	11.2%
Education	
High school education	36%
In college	20%
Bachelor or post-graduate degree	44%
Source: compiled by the authors.	

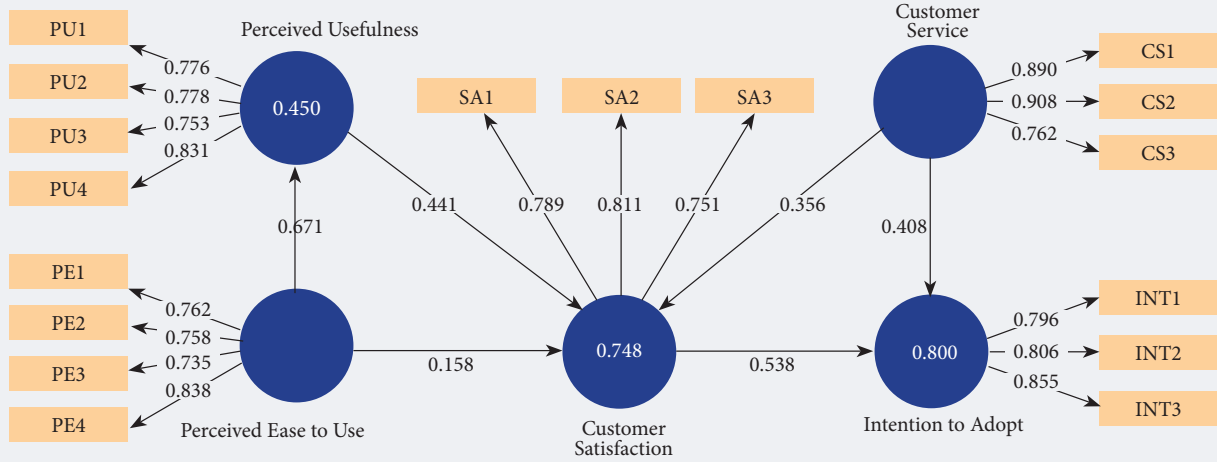
Table 4. **Percentage of Respondents that Use or Do Not Use Internet Banking**

Answers	Frequency	Percent
Yes	50	30%
No	125	70%
Total	175	100%
Source: Survey Result, 2017		

Table 6. **R Squared**

	R Squared	R Squared Adjusted
Intention to Adopt	0.800	0.797
Perceived Usefulness	0.450	0.445
Customer Satisfaction	0.748	0.741
Source: compiled by the authors.		

Figure 3. **Measurement Model**



Source: compiled by the authors.

Table 5. **Outer Loadings**

Question code	Perceived Ease of Use	Perceived Usefulness	Customer Service	Customer Satisfaction	Intention to Adopt
PE1	0.762				
PE2	0.758				
PE3	0.735				
PE4	0.838				
PU1		0.776			
PU2		0.778			
PU3		0.753			
PU4		0.831			
CS1			0.890		
CS2			0.908		
CS3			0.762		
SA1				0.789	
SA2				0.811	
SA3				0.751	
INT1					0.796
INT2					0.806
INT3					0.855

Source: compiled by the authors.

Measurement Model

To evaluate the convergent validity of the reflective constructs, the study analyzes the outer loading of the indicators and the average variance validity. The outer loadings of all indicators should be statistically significant and the standardized outer loading should be above 0.70. The square of a standardized indicator's outer loading represents how much variation in an item is explained by the construct and is described as the variance extracted from the item.

An established rule of thumb is that a latent variable should explain a substantial part of each indicator's variance, usually at least 50%. This means that an indicator's outer loading should be above 0.708 based on the square of that number (0.708^2=0.50). R^2 value of 0.75, 0.50, or 0.25 for endogenous latent variables can be respectively described a substantial, moderate, or weak [*Henseler et al.,* 2009]. The R-Square values are shown inside the blue ellipse for endogenous latent variables (Figure 3). For the endogenous variable Intention to Adopt, the R Square value is 0.80, meaning that about 80% of the variance in Intention to Adopt is explained by the model (Table 6); this is a substantial level.

Cronbach's Alpha: Cronbach's Alpha values in this reflective measurement construct are larger than 0.677, and thus ensure reliability (Table 7). Cronbach's Alpha is the traditional criterion for internal consistency, which provides an estimate of reliability based on the intercorrelations of the observed indicator variables. Cronbach's Alpha assumes that all indicators are equally reliable, but PLS-SEM prioritizes the indicators according to their individual reliability and moreover Cronbach's Alpha is sensitive to the number of the items in the sample and generally tends to underestimate the internal consistency reliability. In this case a different measure of internal consistency reliability can be used, Composite Reliability [*Hair et al.,* 2017]. The composite reliability (CR) method depicts the degree to which the construct indicators represent the latent constructs. With a value of 0.981 (Customer Service), 0.857 (Perceived Ease of Use), 0.865

Table 7. **Construct Reliability and Validity**

	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Customer Service	0.814	0.891	0.732
Intention to Adopt	0.755	0.860	0.671
Perceived Ease of Use	0.777	0.857	0.599
Perceived Usefulness	0.792	0.865	0.616
Customer Satisfaction	0.688	0.827	0.615

Source: compiled by the authors.

Table 8. **Confidence Intervals Bias Corrected**

	Original Sample (O)	Sample Mean (M)	Bias	2.5%	97.5%
Perceived Ease of Use → Customer Satisfaction	0.158	0.159	0.000	0.040	0.288
Perceived Ease of Use → Perceived usefulness	0.671	0.677	0.006	0.552	0.750
Perceived Usefulness → Customer Satisfaction	0.441	0.439	-0.002	0.259	0.606
Customer Service → Customer Satisfaction	0.356	0.359	0.003	0.202	0.499
Customer Service → Intention to Adopt	0.408	0.408	0.000	0.293	0.528
Customer Satisfaction → Intention to Adopt	0.538	0.537	0.000	0.415	0.648

Source: compiled by the authors.

(Perceived Usefulness), 0.827 (Satisfaction) and 0.860 (Intention to Adopt), all five reflective constructs have a high level of internal consistency reliability.

Discriminant validity: Discriminant validity is the extent in which a construct is truly distinct from other constructs by empirical standards. Thus, establishing discriminant validity implies that a construct is unique and captures phenomena not represented by other constructs in the model. A common measure to establish convergent validity on the construct level is average variance extracted (AVE). An AVE value of 0.50 or higher is accepted, which means that the construct explains more than half of the variance of its indicators. Other approaches can be used to assess the discriminant validity of the indicators, for example, the Fornell–Larcker criterion [*Fornell, Larcker,* 1981] and the Heterotrait Monotrait Ratio (HTMT). HTMT is used in this study. Henseler et al. [*Henseler et al.,* 2015] suggest a threshold value of 0.90 if the path model includes constructs that are conceptually very similar. In other words, an HTMT value above 0.90 suggests a lack of discriminant validity. The HTMT can serve as the basis of a statistical discriminant validity test. In this study, we rely on a procedure called bootstrapping to derive a distribution of the HTMT statistic.

The lower and upper bound of the confidence interval of HTMT for the relationship between Perceived Ease of Use and Customer Service are 0.04 and 0.228, respectively (Table 8). Similarly, the lower and upper bound of the confidence interval of HTMT for the relationship between Customer Service and Customer Satisfaction are 0.202 and 0.499. Thus all HTMT values of five constructs in the study are smaller than 0.90. Thus, the reflective measurement construct possesses discriminant validity.

Confidence intervals: We need to analyze the outer weights for their significance and relevance. We first consider the significance of the outer weights by means of bootstrapping. Bootstrap confidence intervals provide further information about the stability of the model estimates. Researchers should draw on the bias correction method to construct bootstrap confidence intervals.

In Table 8, the estimated path coefficients of the reflective measurement model do not include zero, then we confirm the significant effects and that their values indicate the extent to which the exogenous constructs are associated with the endogenous constructs.

Inner Variance Inflation Factor (VIF) Value: PLS-SEM is a distribution–free multivariate data analysis technique and, as such, does not rely on distributional assumptions. As a consequence, it is different from, for example, an Ordinary Least Squares (OLS) regression, PLS-SEM does not initially provide *t* or *p* values to evaluate the estimates' significance. Instead, this study has to rely on the bootstrapping procedure that provides bootstrap standard errors.

Table 9. **Inner VIF Value**

	Customer Satisfaction	Customer Service	Intention to Adopt	Perceived Ease of Use	Perceived Usefulness
Customer Satisfaction			2.630		
Customer Service			2.630		
Intention to Adopt					
Perceived Ease of Use					1.000
Perceived Usefulness	2.810				

Source: compiled by the authors.

Table 10. **Path Coefficients**

Hypotheses	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T-Statistics	P-Values	Is the Hypothesis Valid?
H1: Perceived Ease of Use → Customer Satisfaction	0.158	0.159	0.064	2.468	0.014 (<0.02)	Yes
H2: Perceived Ease of Use → Perceived usefulness	0.671	0.677	0.049	13.796	0.000 (<0.01)	Yes
H3: Perceived Usefulness → Customer Satisfaction	0.441	0.439	0.089	4.970	0.000 (<0.01)	Yes
H4: Customer Service → Customer Satisfaction	0.356	0.359	0.076	4.655	0.000 (<0.01)	Yes
H5: Customer Service → Intention to adopt	0.408	0.408	0.060	6.786	0.000 (<0.01)	Yes
H6: Customer Satisfaction → Intention to Adopt	0.538	0.537	0.060	8.925	0.000 (<0.01)	Yes

Source: compiled by the authors.

The study first assesses the lateral collinearity of constructs. Collinearity occurs when two variables that are hypothesized to be causally related measure the same construct. Diamantopoulos and Siguaw [*Diamantopoulos, Siguaw,* 2006] stated that values of VIF 3.3 or higher indicate potential collinearity. The results of inner VIF values are shown in Table 9. According to the results in Table 9, Perceived Usefulness has the highest inner VIF value (2.810), hence, inner VIF values are uniformly below the threshold value of 5%.

Results

Hypothesis Testing

The bootstrapping procedure was used to assess the significance and relevance of the structural model relationships. When an empirical t-value is larger than the critical value, we conclude that coefficient is statistically significant with a certain error probability. Commonly used critical values for two-tailed tests are 1.65 (significance level=10%), 1.96 (significance level=5%), and 2.57 (significance level=1%) [*Hair,* 2017]. The results in Table 10 depict the path coefficients of the respective constructs with their level of significance in order to validate some of the considered hypotheses.

The relationship between perceived ease of use and customer satisfaction is accepted by H1: (t-statistic = 2.468, p< 0.02). Hereafter, the relationship between perceived ease of use and perceived usefulness is supported by H2: (t-statistic = 13.796, p< 0.01)

Following, H3 showed that perceived usefulness is positively related to customer satisfaction (t-statistic = 4.970, p< 0.01). The relationship between customer service and customer satisfaction is accepted by H4: (t-statistic = 4.655, p< 0.01). The relationship between customer service and intention to adopt internet banking is accepted by H5: (t-statistic = 6.786, p< 0.01). Meanwhile, the relationship between customer satisfaction and intention to adopt internet banking is supported by H6: (t-statistic = 8.925, p< 0.01).

Total Indirect Effects and Total Effects

The study need to evaluate not only one construct's direct effect on another, but also its indirect effects via one or more mediating constructs [*Hair,* 2017]. The direct effects are the relationships linking constructs with a single arrow. Indirect effects are those relationships that involve a sequence of relationships with

Table 11. **Total Indirect Effects**

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T-Statistics (|O/STDEV|)	P-values
Customer Service → Intention to Adopt	0.191	0.192	0.039	4.870	0.000
Perceived Ease of Use → Customer Satisfaction	0.296	0.297	0.065	4.529	0.000
Perceived Ease of Use → Intention to Adopt	0.244	0.247	0.052	4.655	0.000
H9: Perceived Usefulness → Intention to Adopt	0.237	0.238	0.062	3.814	0.000

Source: compiled by the authors.

Table 12. **Direct, Indirect and Total Effects on Intention to Adopt**

	Direct Effect	Indirect Effect	Total Effect
Customer Service	0.408	0.191	0.599
Perceived Usefulness	-	0.237	0.237
Perceived Ease of Use	-	0.520	0.520
Customer Satisfaction	0.538	-	0.538

Source: compiled by the authors.

at least one intervening construct involved. All the indirect effects in Table 10 have significance at a level of 5% (Figure 3, Table 11, Table 12).

Customer Service and Intention to Adopt are linked by a direct effect (=0.408) and an indirect effect (0.356 x 0.538 =0.1915). Then, the total effect is: 0.408 + 0.191=0.599. In the same way, the total effect of Perceived Ease of Use and Customer Satisfaction is: 0.158 + (0.671 x 0.441) =0.454. The total effect of Perceived Usefulness to Intention to Adopt is: 0.2372. The total effect of Perceived Ease of Use to Intention to Adopt is 0.520.

Mediation Analysis

Mediation occurs when a third mediator variable intervenes between two other related constructs [*Hair,* 2017]. More precisely, a change in the exogenous construct causes a change in the mediator variable, which, in turn, results in a change in the endogenous construct in the PLS path model. Thereby, a mediator variable governs the nature of the relationship between two constructs.

This study analyzes the significance of the indirect effect of Customer Service on Intention to Adopt via the mediator variable (Customer Satisfaction). If the indirect effect is not significant, we conclude that Customer Satisfaction does not function as a mediator in the tested relationship. From Figure 3 and Table 11, it follows that Perceived Usefulness serves as mediator variable in the relationship between Perceived Ease of Use and Customer Satisfaction. The latter in turn may foster Intention to Adopt along with Customer Service.

From the aforementioned results, hypothesis H7, H8 and H9 are accepted.

Thus, the results of proposed hypothesis revealed that, all nine hypotheses have a significant relationship with their respective endogenous variables.

Evaluating Effect Size

The size of the f^2 effect enables us to analyze the relevance of the constructs in explaining the selected endogenous constructs. In addition to evaluating the R^2 value of all endogenous constructs, the change in the R^2 value when a specified exogenous construct is omitted from the model can be used to evaluate whether the omitted construct has a substantive impact on the endogenous constructs. This measure is referred to as the f^2 effect size and is increasingly encouraged by journal editors and reviewers. Guidelines for assessing f^2 are that values of 0.02, 0.15 and 0.35, respectively, represent the small, medium, and large effects of the exogenous latent variable. Effect size values of less than 0.02 indicate that there is no effect [*Cohen,* 1988]. All f^2 in this suggested model are larger than 0.02 (e.g., the effect size of the construct Customer Satisfaction on the endogenous latent variable Intention to Adopt is 0.551), therefore, the omitted construct has a substantive impact on the endogenous construct (Table 13).

Table 13. **f-Square**

	Customer Satisfaction	Customer Service	Intention to Adopt	Perceived Ease of Use	Perceived Usefulness
Customer Satisfaction			0.551		
Customer Service	0.204		0.317		
Intention to Adopt					
Perceived Ease of Use	0.052				0.817
Perceived Usefulness	0.275				

Source: compiled by the authors.

Table 14. **Summary of the IPMA Data**

	Importance	Performance
Customer Service	0.599	39
Perceived Usefulness	0.237	61
Perceived Ease of Use	0.520	50
Customer Satisfaction	0.538	49

Source: compiled by the authors.

Importance Performance Matrix Analysis (IPMA)

The IPMA compares the structural model's total effects on a specific target construct (Intention to Adopt) with the average latent variable scores of this construct's predecessors (Customer Service, Customer Satisfaction, Perceived Usefulness, Perceived Ease of Use). The total effects represent the predecessor constructs' importance in shaping the Intention to Adopt while their average latent variable scores represent their performance. The goal is to identify the predecessors that have relatively high importance for Intention to Adopt but also a relatively low performance

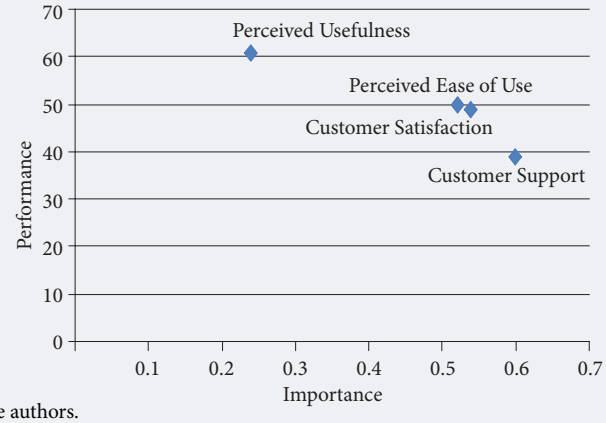
The aspects underlying these constructs represent a potential area for improvement that may be of interest. Using the IPMA data allows us to create an important performance map as shown in Figure 4. The x-axis represents the (unstandardized) total effects of Customer Service, Customer Satisfaction, Perceived Usefulness on the target construct (Intention to Adopt). The y-axis depicts the average rescaled (unstandardized) latent variable scores of Customer Service, Customer Satisfaction, and Perceived Usefulness.

Table 14 shows the index values and total effect scores. It can be seen that Customer Service is the most important factor in determining the Intention to Adopt internet banking due to its higher importance values compared to other latent variables. Customer Satisfaction and Perceived Ease of Use also are the important factors, while Perceived Usefulness has the lowest level of importance. The Importance – Performance Matrix map (Figure 4) showed that customer service has the highest potential to influence customers considering the adoption of internet banking, the constructs customer satisfaction and perceived ease of use demonstrated intermediate importance and performance compared with other constructs. In other words, the managers of commercial banks need to focus on improving the performance of customer service, customer satisfaction, and the perceived ease of use.

Conclusions and Recommendations

In the study, the technology acceptance model has been modified by integrating two new dimensions, which are customer service and customer satisfaction. The suggested model, aimed at assessing the

Figure 4. **IPMA**



Source: compiled by the authors.

Table 15. **Strategic Targets for the Development of the Banking Sector in Vietnam**

Planning horizon	Type of payments accepted via banks	Service providers (target share)	Service consumers (target share)
2020	Payment for medical services	Hospitals in large cities (50%)	Patients (-)
2022	Tuition fees	Universities and colleges (100%)	Students (80%)
2025	Power and water bill payments	Suppliers (80%)	Households in large cities (50%)

Source: compiled by the authors.

intention to adopt internet banking in Vietnam, included five constructs with 17 indicators. The results find that the study's model ensures the indicator reliability, composite reliability, and discriminant validity. For the endogenous variable Intention to Adopt, the R Squared value is 0.80, meaning that about 80% of the variance in Intention to Adopt is explained by the model (which is a substantial level).

Implementing the IPMA and f^2 effect, the study also derives that a change in the exogenous construct causes a change in the mediator variable, which, in turn, results in a change in the endogenous construct in the PLS path model. The omitted construct (if such occurs) will have a substantial impact upon the endogenous construct. All nine hypotheses of the study were confirmed and the study reveals that customer service is the most important factor in determining a customer's intention to adopt internet banking due to its higher importance values compared to other latent variables. The constructs customer satisfaction and perceived ease of use demonstrated intermediate importance and performance. Overall, the study shows that the integration of the two new elements in the technology acceptance model was a good fit and that analyzing the reflective measurement constructs can bring new ideas to the management of Vietnamese commercial banks.

In order to encourage clients to continue to use internet banking services, the bank must explain to them the advantages of such mechanisms, in particular the opportunities to save both time and money. An easy-to-use interface must be developed for informing customers who are new to the service, simple and clear instructions must be prepared, and clients must be informed about their transactions in a timely manner. It is necessary to constantly work to update and provide relevant information on the bank's website, which should be regularly checked by bank managers to receive client feedback.

Restaurants and stores need to be equipped with devices for processing non-cash payments. In addition, businesses such as those in the medical, dairy, home improvement, and office supplies sectors should not ignore the development of e-commerce.

In order to develop internet banking services in Vietnam, it is important to create and promote a good business environment, provide socioeconomic stability, invest in the development of infrastructure, improve living standards, promote the provision and use of modern services, and discourage the habit of using cash. The Vietnamese government needs to build a legal framework for internet banking and e-banking services. The State Bank of Vietnam should coordinate with the Ministry of Public Security to take measures to promptly prevent and stop crime, ensure the information security (including the protection of customer passwords when carrying out bank transactions), protect customers' interests, and reduce risks and losses for the banks themselves.

Furthermore, the Vietnamese government is developing regulations to promote non-cash payments throughout the period of 2018–2025 and is working to develop e-government regulations and enhance the use of banking services. In particular, 80% of tax payments in cities are to be made via banks by 2022. For some other strategic targets, see Table 15.

The management of Sacombank must focus on continuously improving the knowledge and professional qualifications of its staff so that they can fully understand the products and services offered, confidently inform clients, and sell products. It is important to attentively listen to all complaints and wishes of clients, to thoroughly study and comprehend them, and to provide timely feedback, which will help banks objectively assess the work they do.

Finally, it is possible to add other constructs to the model used in this article for the study of the behavior of customers of Vietnamese banks, in particular, Comprehension of Risks and Brand Value.

References

Alsamydai M.J. (2014) Adaptation of the TAM to the use of mobile banking services. *International Review of Management and Business Research*, vol. 3, no 4, pp. 2016–2028.

Bauer H.H., Falk T., Hammerschmidt M. (2006) eTransQual: A transaction process-based approach for capturing service quality in online shopping. *Journal of Business Research*, vol. 59, no 7, pp. 866–875.

Blut M. (2016) E-Service Quality: Development of a Hierarchical Model. *Journal of Retailing*, vol. 92, no 4, pp. 500–517.

Bryman A.B. (2007) *Business Research Methods*, Oxford: Oxford University Press.

Cohen J. (1988) *Statistical power analysis for the behavioural sciences* (2nd ed.), Hillside Mahwah, NJ: Lawrence Erlbaum.

Davis F.D. (1986) *A technology acceptance model for empirically testing new end-user information systems: Theory and results*, Cambridge, MA: Massachusetts Institute of Technology.

Davis F.D. (1989) Perceived usefulness, perceived ease of use and user acceptance of information technology. *MIS Quarterly*, vol. 13, no 3, pp. 319–340.

Davis F.D., Bagozzi R.P., Warshaw P.R. (1989) User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, vol. 35, no 8, pp. 982–1003.

Davison A.C., Hinkey D.V. (1997) *Bootstrap methods and their application*, Cambridge, UK: Cambridge University Press.

Diamantopoulos A., Siguaw J.A. (2006) Formative versus reflective indicators in measure development: Does the choice of indicators matter? *British Journal of Management*, vol. 17, no 4, pp. 263–282.

Foley P., Jayawardhena C. (2000) Changes in the banking sector-the case of Internet banking in the UK. *Internet Research*, vol. 10, no 1, pp. 19–30.

Fornell C., Larcker D.F. (1981) Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research*, vol. 18, no 1, pp. 39–50.

Geetha K., Malarvizhi V. 2012) Assessment of a Modified Technology Acceptance Model among E-banking Customers in Coimbatore City. *International Journal of Innovation, Management and Technology,* vol. 3, no 2, pp. 181–187.

Ghani M.M., Rahi S., Yasin N., Alnaser F.M. (2017) Adoption of Internet Banking: Extending the Role of Technology Acceptance Model (TAM) with E-Customer Service and Customer Satisfaction. *World Applied Sciences Journal*, vol. 35, no 9, pp. 1918–1929.

Hair J.F., Black W.C., Babin B.J., Anderson R.E., Tatham R.L. (2010) *Multivariate Data Analysis* (7th ed.), Upper Saddle River, NJ: Prentice Hall.

Hair J.F., Hult G.T., Ringle C.M., Sarstedt M. (2017) *A primer on partial least squares structural equation modeling* (2nd ed.), Thousand Oaks, CA: SAGE Publications.

Hair J.F., Hult G.T.M., Ringle C., Sarstedt M. (2013) *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*, Thousand Oaks, CA: SAGE Publications.

Hair J.F., Sarstedt M., Hopkins L., Kuppelwieser G.V. (2014) Partial least squares structural equation modeling (PLS-SEM): An emerging tool in business research. *European Business Review*, vol. 26, no 2, pp. 106–121.

Henseler J., Ringle C.M., Sarstedt M. (2015) A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Academy of Marketing Science Journal,* vol. 43, no 1, pp. 115–127.

Henseler J., Ringle C.M., Sinkovics R.R. (2009) The use of partial least squares path modeling in international marketing. *Advances in International Marketing*, vol. 20, pp. 277–320.

Hoyle R.H. (ed.) (1995) *Structural Equation Modeling*, Thousand Oaks, CA: SAGE Publications.

Laukkanen P., Sinkkonen S., Kivijarvi M. and Laukkanen T. **(2007)** *Consumer Resistance and Intention to use Internet banking service*. Paper presented at the *EBRF Conference, Jyvaskyla, Finland, September* 25.

Lichtenstein S., Williamson K. (2006) Understanding Consumer Adoption of Internet Banking: An Interpretive Study in the Australian Banking Context. *Journal of Electronic Commerce Research, vol. 7, no* 2, pp. 50–66.

Lule I., Omwansa T.K., Waema T.M. (2012) Application of Technology Acceptance Model (TAM) in M-Banking Adoption in Kenya**.** *International Journal of Computing and ICT Research,* vol. 6, no 1, pp. 31–43.

Martins C., Oliveira T., Popovie A. (2014) Understanding the Internet banking adoption: A unified theory of acceptance and use of technology and perceived risk application. *International Journal of Information Management*, vol. 34, no 1, pp. 1–13.

Musiime A., Ramadhan M. (2011) Interment banking consumer adoption and customer satisfaction. *African Journal of Marketing Management,* vol. 3, no 10, pp. 261–269.

O'Connell B. (1996) Australian Banking on the Internet-Fact or Fiction? *The Australian Banker,* December, pp. 212–214.

Pikkarainen K., Karjaluoto H., Pahnila S. (2004) Consumer acceptance of online banking: An extension of the technology acceptance model. *Internet Research,* vol. 14, no 3, pp. 224–235.

Polasik K., Wisniewski T. (2009) Empirical Analysis of Internet Banking Adoption in Poland. *International Journal of Bank Marketing, vol.* 27, no 1, pp. 32–52. DOI: 10.1108/02652320910928227.

Quyen D.V. (2018) E-commerce: Much room left for growth. *The Saigon Times*, no 13 (1381), March 24, 2018.

Sarstedt M., Ringle C.M., Hair J.F. (2017) Partial Least Squares Structural Equation Modeling. *Handbook of Market Research* (eds. C. Homburg, M. Klarmann, A. Vomberg), Heidelberg; New York; Dordrecht; London: Springer (print version forthcoming). DOI: 10.1007/978-3-319-05542-8_15-1. Available at: http://www.researchgate.net/publication/319669432, accessed 02.05.2018.

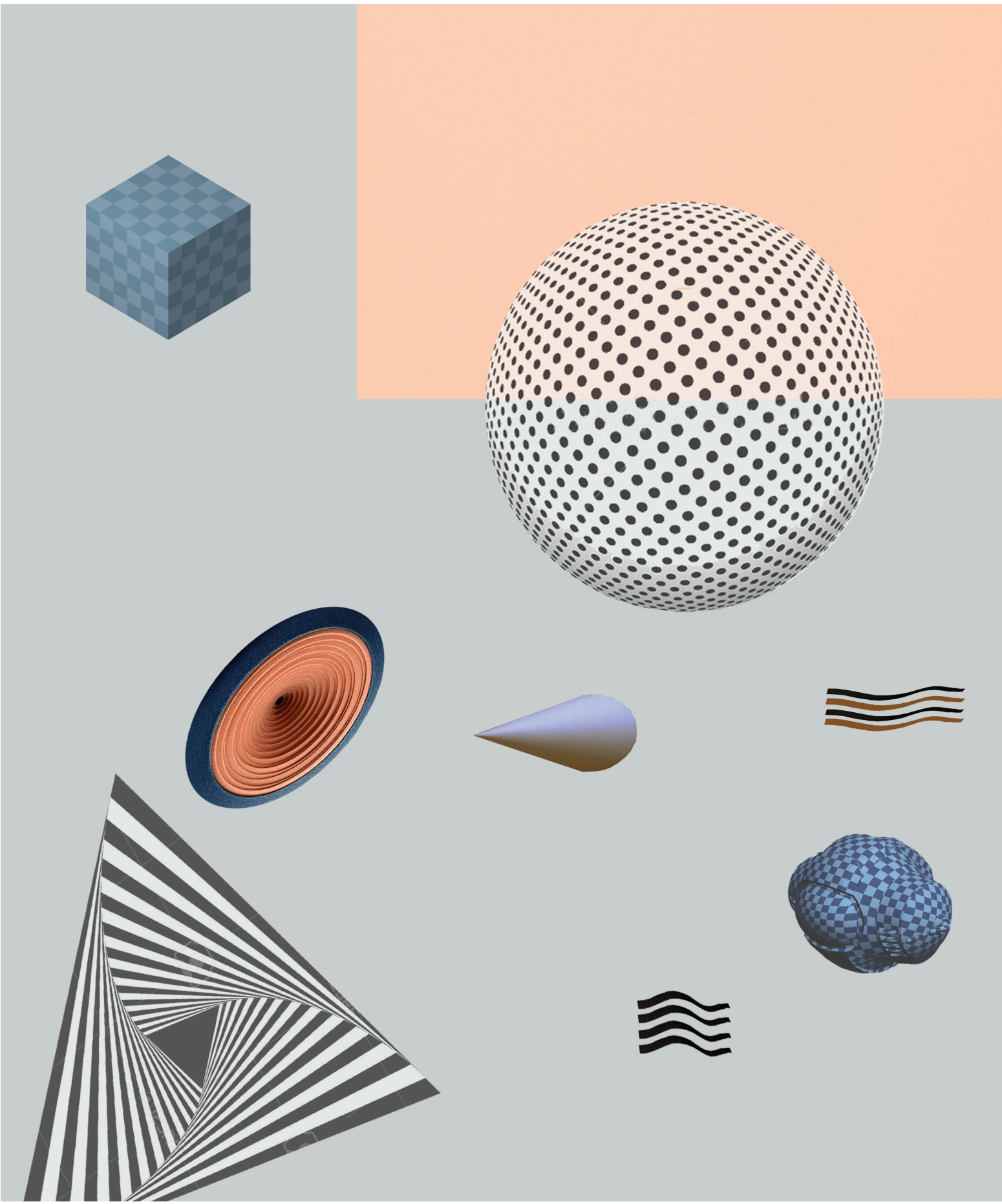
Sathye M. (1999) Adoption of Internet Banking by Australian Consumers: An Empirical Investigation. *International Journal of Bank Marketing,* vol. 17, no 7, pp. 324–334.

Sheshunoff A. (2000) Internet banking: An update from the frontlines. *ABA Banking Journal,* vol. 92, no 1, pp. 51–53.

Venkatesh V., Davis F.D. (1996) A model of the antecedents of perceived ease of use: Development and test. *Decision Sciences*, vol. 27, no 3, pp. 451–481.

Venkatesh V., Davis F.D. (2000) Theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science, vol. 46, no* 2, pp. 186–204.

Waite K., Harrison T. (2002) Consumer Expectations of Online Information Provided by Bank Websites. *Journal of Financial Services Marketing, vol.* 6, no 4, pp. 309–322. Available at: http://dx.doi.org/10.1057/palgrave.fsm.4770061, accessed 17.04.2018.



Beyond Education: The Role of Research Universities in Innovation Ecosystems

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Abstract

Universities are increasingly perceived as agents involved in regional development. It is now recognized that academic contributions to the socioeconomic environment go well beyond scientific investigation and teaching activities, and incorporate market-oriented initiatives to the academic mission. However, these effects are geographically bounded. Given these conditions, this article aims at addressing universities' impacts upon output vectors of localized innovation ecosystems. Using data from cities and microregions in the state of São Paulo, Brazil observed throughout the period of 2002-2014, we address universities' effects upon the local-level generation of patents and utility models, software production and emergence of knowledge-intensive entrepreneurship. Besides the scant available evidence on innovation ecosystems located outside developed economies, dealing with a developing country also means we are addressing an analytical unit in which universities play a critical role in terms of knowledge production and diffusion, a function of the weak competences of local firms.

Findings support the hypothesis that major academic institutions lie at the heart of innovation ecosystems, but impacts are mostly local, happening more strongly at the level of cities. While the formation of human capital also contributes to innovative output, its impacts are of minor relevance as compared to higher education institutions that achieve excellence in research. This poses severe challenges for policymakers when targeting the formation and enhancement of initiatives to develop innovative ecosystems, particularly for peripheral areas. First, these regions are not likely to reap substantial benefits from proximity to successful hubs. Beyond that, creating local conditions is not as straightforward as sometimes announced in political discourse. In this regard, some fundamental vectors are not easily manipulated in the short-term and there seems to be fundamental importance attributed to long-term, evolutionary conditions. Such is the case for high-quality universities.

Keywords:
regional systems of innovation; innovation ecosystems; universities.

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Universities can be perceived as institutions that shape research activities, create a supply of qualified labor, and generate and diffuse knowledge across socioeconomic systems [*Clark*, 2004; *Etzkowitz, Leydesdorff*, 2000]. Accordingly, they function as agents involved in regional development through direct and indirect contributions to productive structures [*Mowery, Sampat,* 2005]. It is within this context that the concept of the 'entrepreneurial university' has gained ground [*Etzkowitz,* 1998, 2004]. Following this rationale, universities' contributions to society go well beyond scientific investigation and teaching activities, but also incorporate market-oriented initiatives into the academic mission. Such a perspective places an emphasis upon university-industry interactions, research contracts, consultancy, patenting, and licensing of research results, as well as academic entrepreneurship [*Bercovitz, Feldman*, 2006; *D'Este, Perkmann,* 2011; *Perkmann et al.,* 2013].

In this regard, literature underscores the key role performed by these institutions within the context of innovation ecosystems. The main impacts are attributed to the supply of human capital [*Benneworth, Hospers,* 2007; *Youtie, Shapira,* 2008], collaborative research with industry leading to an upsurge in patenting, co-patenting, and scientific publications [*Cowan, Zinovyeva,* 2013; *Hong,* 2008; *Jaffe,* 1989; *Fritsch, Slavtchev,* 2007; *Wal, Boschma,* 2009], and a spawning of new, knowledge-intensive businesses [*Agrawal, Cockburn,* 2003; *Feldman,* 2001; *Saxenian,* 2006; WEF, 2013]. Consequently, academia does not only enhance capabilities in incumbent firms, but also is responsible for creating entirely new enterprises [*Collini,* 2012].

However, these effects are geographically bounded as they are connected to the industrial structure of each region, the characteristics of its firms, the patterns of existing connections among agents, and the intrinsic traits of individual universities [*Agrawal, Cockburn,* 2003; *Bercovitz, Feldman,* 2006; *Buesa et al.,* 2006]. Hence, it is not the mere presence of universities that drives the consolidation of innovation ecosystems [*Brown,* 2016]. 'Soft' infrastructure, consisting of dynamic relationships involving universities, research institutes, firms, and other support institutions is necessary. These are the conditions needed for the generation of human resources that fit regional needs as well as for the accumulation and transfer of knowledge [*Buesa et al.,* 2006].

Given these conditions, this article aims at addressing universities' impacts upon the output vectors of localized innovation ecosystems. We want to further understand the extent of academic contributions to these productive structures. Additionally, we also focus on the distinct geographical units in order to assess the spatial reach of such effects. In order to accomplish these goals, we assess data from the State of São Paulo, Brazil. The application of the empirical model comprises data coming from 645 cities and 43 microregions observed throughout the period of 2002–2014. As indicators of innovative ecosystems' output, we look into patents and utility models, software production, and the emergence of knowledge-intensive entrepreneurship (KIE) activity. Estimations control for other vectors of interest, including market size, agglomeration economies, localization economies, local infrastructure, and internationalization. Findings support the proposition that major academic institutions lie at the heart of innovation ecosystems, but impacts are mostly local, happening more dramatically at the level of cities.

This research is relevant as it pertains to an emerging economy. Besides the scant available evidence on innovation ecosystems located outside developed economies, dealing with a developing country also means we are addressing an analytical unit in which universities play a key role in terms of knowledge production and diffusion, which is a function of the weak competences of local firms. Hence, in nations that lag behind in innovation activities, universities can be understood as institutions capable of leveraging aggregate competitiveness thus shaping the conditions for the catching-up processes [*Mazzoleni, Nelson,* 2007; *Suzigan, Albuquerque,* 2011; *Suzigan et al.,* 2009].

Innovation Ecosystems

The growing importance attributed to innovation as a mechanism of economic development has generated a large body of research that aims at understanding how agents and their respective patterns of interaction are related – and how, ultimately, they can boost innovative capabilities. One approach of key interest within this sphere deals with the dynamics of Regional Systems of Innovation. These local units are defined as systems "*in which firms and other organizations are systematically engaged in interactive learning through an institutional milieu characterized by embeddedness*" [*Cooke et al.,* 1998, p. 1581].

Regional Systems of Innovation, or innovation ecosystems as they have been addressed more recently, are characterized by innovative activities that rely on collaborative arrangements between firms and local institutions, including universities, research institutes, technology transfer offices, sources of funding, and others. Within this context, innovative culture and policy are fundamental drivers in setting the conditions for interactions [*Asheim, Isaksen,* 2002; *Cooke et al.,* 1997; *Doloreux,* 2002; *Doloreux, Parto,* 2005]. This (eco)systemic nature of the relationships can only arise in local contexts where the productive

(*knowledge exploitation subsystem*) and the knowledge (*knowledge generation subsystem*) structures are engaged in processes of interactive learning [*Clarysse et al.,* 2014; *Cooke,* 2001; *Jiao et al.,* 2016]. Hence, innovation ecosystems/regional systems can be understood as dynamic systems, possessing an inherently social character and being composed by the interaction of its subsystems [*Cooke,* 2005; *Uyarra,* 2010].

The main argument behind this rationale is related to the idea that the generation and diffusion of innovations, as well as entrepreneurial activity, are shaped by the local infrastructure, its externalities, specialized services, and levels of trust involved in relationships between agents. In its turn, these dynamics lead to localized economic development [*Alvedalen, Boschma,* 2017]. One of the key aspects in this debate concerns the existence of multidimensional contexts, which are dependent upon the interactions among agents (non-linearity), characterized by systemic relationships and bound by historical trajectories that lead to spatially constrained learning processes. This latter proposition is a function of the fact that networks of interaction are fundamentally embedded in local productive structures since geographical proximity is a key determinant of knowledge sharing [*Agrawal, Cockburn,* 2003; *Asheim et al.,* 2011], especially those of a tacit nature [*Leydesdorff, Fritsch,* 2006; *Cooke,* 2008].

Hence, spatial proximity, the existence of common institutions, along with formal and informal mechanisms forging trust in relationships, facilitate effective knowledge flows [*Asheim, Coenen,* 2005; *Cooke,* 2001; *Jackson,* 2011; *Uyarra,* 2010; *Wal, Boschma,* 2009]. In addition, the diffusion of knowledge between firms is also influenced by other elements, such as the distinct learning trajectories and capability building processes of firms [*Boschma,* 2005; *Breschi, Lissoni,* 2009; *Doloreux,* 2002; *Dosi,* 1988; *Giuliani,* 2013].

Furthermore, the spatial proximity is of utmost relevance for establishing interactions with universities and research institutes [*Fritsch,* 2001; *Fritsch, Slavtchev,* 2007; *Moodysson et al.,* 2008; *Uyarra,* 2010], making the case for academic units to be considered the 'anchors' of innovation ecosystems, which foster aggregate competitiveness at the local level [*Xu et al.,* 2017]. This situation underscores the importance assigned to universities as central agents in the processes of knowledge absorption and diffusion within regions, furthermore they also connect agents to external systems and reduce the risks of lock-in [*Fritsch, Schwirten,* 2006].

Universities at the Heart of Innovation Ecosystems

Universities are agents that generate and diffuse knowledge as well as promote regional development through its connections with the socioeconomic environment [*Jiao et al.,* 2016; *Poods et al.,* 2010]. Accordingly, these academic institutions lie at the heart of innovation ecosystems, feeding the local environment with qualified labor, interacting with local businesses, generating patents (and licensing these patents) and new ventures, attracting investments from incumbents, and acquiring and disseminating external knowledge [*Benneworth, Hospers,* 2007; *Bercovitz, Feldman,* 2006; *Fritsch, Schwirten,* 2006; *Galan-Muros, Davey,* 2017; *Harrison, Leitch,* 2010; *Youtie, Shapira,* 2008]. These activities endow universities with an entrepreneurial character, including market-related initiatives [*Etzkowitz,* 1998, 2004; *Siegel, Wright,* 2015].

As already outlined, spatial proximity matters when accounting for the impacts of universities upon the dynamics of innovation ecosystems [*Hong,* 2008; *Jiao et al.,* 2016], a function of the high levels of tacit knowledge involved in the knowledge flows between academia and industry [*Fritsch, Schwirten,* 2006]. Illustratively, Ács et al. [*Ács et al.,* 2002] note that the effects of academic R&D in the United States are circumscribed within a radius of roughly 75 miles. Fritsch [*Fritsch,* 2005] corroborates with these findings, pointing out that university-industry relationships in Europe are essentially local. Such effects are magnified when the analytical subject concerns academic spin-offs, where the location of new ventures is closely connected to the location of universities [*Asheim et al.,* 2011; *Harrison, Leitch,* 2010].

The role attributed to universities in the dynamics of innovation ecosystems is even more critical when the focus is directed towards the context of developing countries [*Chen, Kenney,* 2007; *Cowan, Zinovyeva,* 2013]. In these countries, universities stand out as influential agents in the process of technological improvement and catch up [*Jiao et al.,* 2016; *Li,* 2009; *Youtie, Shapira,* 2008]. This happens as a consequence of the low levels of innovative capabilities embedded in firms, making academia a strategic source of information, knowledge, and innovation [*Rapini et al.,* 2009].

However, this is far from representing a deterministic prerequisite for universities' contributions to innovation ecosystems. Even if its local presence can be interpreted as a prerequisite for regional systems of innovation [*Bercovitz, Feldman,* 2006; *Hong,* 2008], other elements of technological infrastructure and the very quality of universities' research capabilities are indispensable for knowledge flows to occur and confer itself and other agents with enhanced competitiveness [*Cowan, Zinovyeva,* 2013].

Universities' Spillovers

Patents are recognized by the literature as a key area of interest when analyzing the economic impacts of universities at the local level. Accordingly, the generation of intellectual property seems to be positively affected by academic expenditures on research activities [*Jaffe,* 1989]. Agrawal and Cockburn [*Agrawal, Cockburn,* 2003], Cowan and Zinovyeva [*Cowan, Zinovyeva,* 2013] and Li [*Li,* 2009] observe the existence of a 'co-location' effect between overall patenting activity in a given technological domain and the existence of strong academic research in the same domain in the same region. Buesa et al. [*Buesa et al.,* 2010] identify universities as determinants of *per capita* patenting activity. Moreover, patent deposits performed by firms have a high propensity of citing academic publications that are produced in the same area, highlighting the spatial boundedness of these connections [*Hicks et al.,* 2001].

In turn, the generation of academic spin-offs can also be deemed an important source of economic impact arising from universities within the context of innovation ecosystems [*Bercovitz, Feldman,* 2006; *Chen, Kenney,* 2007; WEF, 2014]. Following this rationale, the importance of academic entrepreneurship as a mechanism of research commercialization has received increasing attention from the literature on entrepreneurial universities [*Galan-Muros, Davey,* 2017]. Since new ventures are mostly embedded within the social context, their creation often takes place within ecosystems where universities have established connections with other agents [*Alvedalen, Boschma,* 2017]. Furthermore, universities can be considered the key drivers in instituting and developing new knowledge-intensive firms, as identified in the case of Beijing [*Chen, Kenney,* 2007]. In this way, universities take on a double function, interacting and collaborating not only with incumbents, but also giving birth to new enterprises [*Collini,* 2012]. Therefore, we expect knowledge-intensive entrepreneurial activity to be significantly influenced by the local presence of academia within innovation ecosystems in emerging economies following recent evidence

Methodological Procedures and Data

A first step in our assessment consists of assembling an empirical model aimed at testing the role of universities in shaping the capabilities of innovation ecosystems. As shown in our theoretical background, the underlying hypothesis of this model must reflect the expectations that academic institutions function as central agents within the local and regional dynamics of innovative activity [*Asheim et al.,* 2011; *Autio,* 1998; *Bercovitz, Feldman,* 2006; *Clarysse et al.,* 2014; *Cooke et al.,* 1997; *Diez,* 2000; *Guerrero et al.,* 2016; *Mazzoleni, Nelson,* 2007]. To this end, we propose the following analytical structure:

$$Y_{it} = \alpha + Univ_{it}^{\beta} + \sum i\, \Omega_{it}^{\theta} + \boldsymbol{\varepsilon_{it}} \quad (1)$$

Where Y_{it} represents any given output of innovation ecosystems in location 'i' in time 't'. α is a constant. $Univ_{it}^{\beta}$ stands for universities' impacts upon the outcomes with elasticity β. The term $\sum i\, \Omega_{it}^{\theta}$ determines the aggregate behaviour of controls and other potential sources of influence on Y_{it} with a combined elasticity θ. The main effects here can be associated with local market dynamics, the infrastructure, and level of internationalization (see Table 1 for a description of operational variables). $\boldsymbol{\varepsilon_{it}}$ is the model's error term.

The application of the empirical model comprises data coming from 645 cities and 43 microregions[1] in the State of São Paulo observed over the course of 13 years (2002–2014). This geographic scope justifies city-level analysis as an adequate subject for the evaluation of innovation ecosystems [*Qian et al.,* 2013], but the expansion of the analysis can offer insights into the spatial reach of universities' influence on innovative performance. The complete set of analytical variables is depicted in Table 1.

Our outcome variable, *Y*, is assessed through three different indicators aimed at generating a multidimensional perspective of innovation ecosystems, namely: (i) patents and utility models; (ii) software production; and (iii) knowledge-intensive entrepreneurship (KIE) activity. While the first two variables are straightforwardly represented by traditional intellectual property statistics, KIE activity is approximated by the number of PIPE projects within a city/region in a given year. This program is an initiative from FAPESP (the research funding agency of the State of São Paulo) to support innovation in small enterprises, resembling the structure and objectives of the Small Business Innovation Research (SBIR) program in the United States[2]. We estimate the model for KIE including transformed (binary)

[1] According to the definition of micro-regions adopted by the São Paulo Statistics Office. Their nomenclature refers to these geographic areas as 'Regions of Government'.

[2] It is important to note that academic degrees or formal appointments at universities are not among the conditions for receiving grants for projects. Instead, priority is given to individuals with previous professional experience and technical capabilities. This feature of PIPE substantively reduces biases towards cities that contain university campuses.

Table 1. **Analytical Variables**

Variable	Description	Source of data
Patents and Utility Models	Sum of deposits of patents and utility models assigned to a city/region in a given year.	Brazilian Patent Office
Software	Amount of software developed by residents of a city/region in a given year.	Brazilian Patent Office
KIE	Sum of entrepreneurial projects' grants (PIPE/FAPESP) assigned to a city/region in a given year.	São Paulo Research Foundation, FAPESP
GDP	City-/Regional-level gross domestic product. Data in current local currency.	São Paulo Statistics Office
Population	Total inhabitants.	São Paulo Statistics Office
Population Density	Inhabitants per square kilometer	São Paulo Statistics Office
LQ KIA	Location Quotient of Knowledge-Intensive Activities in a city/region in a given year*.	Calculated based on data from the Brazilian Ministry of Labor
Infrastructure Investments	City/regional level investments in infrastructure. Data in current local currency.	São Paulo Statistics Office
Energy Consumption	Consumption of electric energy (MWh).	São Paulo Statistics Office
Incubators and Science Parks	Binary variable. It takes the value of '1' if the city/region possesses a business incubator and/or a science park; '0' if otherwise.	São Paulo Investment Promotion Agency
Trade	Sum of imports plus exports. Data in current local currency.	São Paulo Statistics Office
Enrollment in HEIs	Share of the population enrolled in Higher Education Institutions.	São Paulo Statistics Office
High-Quality University	Presence of at least one high-quality university campus in the city/region.	Scimago Ranking
High-Quality University System	Presence of two or more high-quality university campus in the city/region.	Scimago Ranking

* The quotient is given by:

$$\left(\frac{KIA_{it}}{TF_{it}}\right) \Big/ \left(\frac{KIA_{St}}{TF_{St}}\right),$$

where KIA corresponds to total knowledge-intensive firms and TF represents total firms. First, we assess KIA's weight in location "i", period "t" as a share of TF in this location, then we analyze the local specialization respective to the State ("S") profile. The following Knowledge-Intensive Sectors were used for the Location Quotient (LQ KIA) Analysis (NACE Rev. 2 – 2 Digits): Manufacture of chemicals and chemical products (20), Manufacture of rubber and plastic products (22), Manufacture of computer, electronic and optical products (26), Manufacture of motor vehicles, trailers and semi-trailers (29), Repair and installation of machinery and equipment (33), Computer programming, consultancy and related activities (62), Information service activities (63), Activities auxiliary to financial services and insurance activities (66), Legal and accounting activities (69), Activities of head offices; management consultancy activities (70), Architectural and engineering activities; technical testing and analysis (71), Scientific research and development (72), Advertising and market research (73), Other professional, scientific and technical activities (74).

Source: compiled by the authors.

forms of patenting activity and software production, as these indicators can feed entrepreneurs with inputs for firm-level innovation[3].

Our main target concerns the contributions made by high-quality academic universities as influential agents within innovation ecosystems. In order to achieve robust results, the corresponding indicators of these institutions were differentiated based upon the following: (i) the presence of at least one campus of a high-quality university; and (ii) the presence of a 'system' of high-quality university campuses, i.e., presence of two or more units of these institutions at the city/regional-level. The use of dummy variables follows the analytical approach found in [*Fischer et al.,* 2018a; *Alcácer, Chung,* 2007]. The focus on top-tier institutions is based upon [*Laursen et al.,* 2011].

The operational definition of high-quality universities was built upon institutions located in the State of São Paulo and appearing in the Scimago ranking[4]. Non-university institutions were excluded. We also excluded universities that did not consistently qualify for the ranking. We interpreted this situation as an indicator of 'shaky' quality. If an institution entered the ranking and remained on it for at least four years in a row, we added it to the sample as a high-quality university beginning with its first year of inclusion. This procedure allows us to add universities that have demonstrated improved quality over the period of study. Furthermore, some institutions and campuses began operations after the initial year of the

[3] Provided that these variables present extreme levels of concentration (particularly for city-level analysis), their treatment as predictors becomes troublesome. See details on estimation procedures for these indicators as dependent variables below.

[4] For further details on the Scimago Institutions Rankings Methodology, see: http://www.scimagoir.com/methodology.php. For the years not covered by the ranking, we applied the same methodology of inclusion as the one used by Scimago.

Table 2. **City-level Descriptive Statistics**

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Patents	8385	0.00	1,444.00	4.28	50.09
Software	8385	0.00	237.00	0.60	8.36
KIE	8385	0.00	33.00	0.10	1.07
GDP	8385	6,233,930.00	628,064,882,140.00	1,705,420,922.98	16,340,733,232.15
Population	8385	800.00	11,513,836.00	62,590.08	447,177.19
Population Density	8385	3.73	12,796.46	294.47	1,170.44
LQ KIA	8385	0.00	5.25	0.49	0.42
Infrastructure Investments	8385	0.00	4,397,255,759.00	12,917,986.01	117,447,952.00
Energy Consumption	8385	655.00	30,073,839.00	180,139.83	1,094,208.41
Incubators and Science Parks	8385	0.00	1.00	0.03	0.16
Trade	8385	0.00	23,814,616,506.00	154,078,636.26	932,951,809.40
Enrollment in HEIs	8385	0.00	0.28	0.01	0.02
High-Quality University	8385	0.00	1.00	0.05	0.22
High-Quality University System	8385	0.00	1.00	0.01	0.12

Source: compiled by the authors.

analysis, so we controlled effects to state either when the campus began its operation (in the case of being a campus belonging to an institution already identified as high quality) or, in the case of a new institution, when it achieved 'high-quality' status according to the defined parameters.

In total, we have a sample of fifteen high-quality universities located in 37 cities and 25 microregions. In order to verify the robustness of our procedure, we cross-checked our sample with data from the São Paulo Research Foundation (FAPESP) Grants and Scholarships database. The locations selected as having high-quality universities corresponded to the group of relevant cities/microregions in terms of research funding. We complemented this analysis with the variable Enrollment in HEIs. While this indicator somewhat overlaps with the presence of high-quality universities, it better reflects the overall supply of an educated workforce, not necessarily capturing academic research and its associated effects. This allows us to address the impacts arising from both academic research and teaching, thus offering a comprehensive picture of universities' impacts upon innovation ecosystems.

Ancillary variables (included in the vector Ω) control for market size (GDP, Population), agglomeration economies (Population Density), localized economies (Location Quotient of Knowledge-Intensive Activities – LQ KIA[5]), local infrastructure (Infrastructure Investments, Energy Consumption[6], and Incubators & Science Parks), and internationalization (Trade). Although not exhaustive, these indicators offer a comprehensive set of controls for the performance of innovation ecosystems.

Concerning our evaluation strategy, as we are dealing with small numbers given the city/year structure of our analysis, analyses were carried out with General Linear Models for count data. Given the presence of overdispersion in the sample for both cities and microregions, Negative Binomial approaches were applied. Continuous variables were addressed via natural logs to simplify the interpretation of the results.

Results

Before dedicating our attention to an analysis of the results of the evaluative models, we present the descriptive statistics (Tables 2 and 3) for the cities and microregions according to variables' natural structures (without logarithmic transformations). A noteworthy aspect in the dataset's structure concerns the number of zeros in some variables. This is of particular relevance for a city-level analysis. Such an outcome in this situation can be the generation of missing values that significantly reduce the sample for econometric estimations, although it still leaves us with a substantial number of observations for analytical purposes.

We begin our assessment with an evaluation of the results at the city-level. In line with the hypothesis presented in this paper's theoretical background, the presence of high-quality universities yields positive

[5] Knowledge-intensive activities entail an adaptation of the definitions provided by Ortega-Argilés et al.[*Ortega-Argilés et al.,* 2011] for high-technology manufacturing activities, and Fischer [*Fischer,* 2015] for Knowledge-Intensive Business Services (KIBS).

[6] As infrastructure investments may suffer from simultaneity issues, we use energy consumption as a proxy for infrastructure quality (as in [*Fischer et al.,* 2018a]).

Table 3. **Microregion-level Descriptive Statistics**

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Patents	559	0,00	1.951,00	64,18	256,71
Software	559	0,00	281,00	9,02	37,54
KIE	559	0,00	47,00	1,57	4,81
GDP	559	691.797.400,72	723.802.678.913,45	19.994.544.928,05	71.513.895.104,02
Population	559	104.656,00	19.875.809,00	938.851,14	2.812.857,11
Population Density	559	23,08	3.019,21	245,87	586,63
LQ KIA	559	0,18	1,59	0,47	0,22
Infrastructure Investments	559	0,00	7.496.336.686,06	208.066.415,95	698.684.753,55
Energy Consumption	559	120.541,25	58.805.957,45	3.048.096,38	8.398.491,30
Incubators and Science Parks	559	0,00	1,00	0,28	0,45
Trade	559	0,00	54.966.359.270,60	1.972.653.288,99	6.533.900.871,03
Enrollment in HEIs	559	0,00	0,03	0,01	0,01
High-Quality University	559	0,00	1,00	0,56	0,50
High-Quality University System	559	0,00	1,00	0,28	0,45

Source: compiled by the authors.

and significant effects for all three dependent variables included in our calculations. This is valid for both variables representing these institutions (High-Quality University and High-Quality University System). These results seem to confirm the existence of a 'co-location' effect in terms of universities' spillovers as observed by [*Agrawal, Cockburn,* 2003; *Cowan, Zinovyeva,* 2013; *Li,* 2009] regarding the generation of patents. Additionally, we found evidence that an academic presence demonstrates heightened relevance as a driver of entrepreneurial activity [*Bercovitz, Feldman,* 2006; *Chen, Kenney,* 2007; *Galan-Muros, Davey,* 2017; WEF, 2014].

Interestingly, for software developments and KIE activity, the coefficient associated with the presence of at least one major university is greater than the effects from the existence of a system (at least two) of such

Table 4. **City-level Estimates**

Variable	Patents		Software		KIE	
	I	II	I	II	I	II
Constant	−4.078***[0.871]	−3.224***[0.875]	−4.799***[1.876]	−2.159[1.830]	−3.507[2.504]	−0.494[2.504]
GDP	−0.298***[0.100]	−0.383***[0.097]	−0.128[0.249]	−0.391*[0.234]	−0.572*[0.317]	−0.778**[0.305]
Population	0.438***[0.095]	0.556***[0.093]	−0.829***[0.233]	−0.544**[0.219]	−0.013[0.278]	−0.381[0.277]
Population Density	0.162***[0.036]	0.158***[0.036]	0.503***[0.095]	0.526***[0.096]	−0.029[0.109]	−0.045[0.107]
LQ KIA	0.737***[0.086]	0.775***[0.087]	1.241***[0.197]	1.172***[0.195]	0.668**[0.296]	0.693**[0.288]
Infrastructure Investments	0.001[0.057]	−0.005[0.056]	0.080[0.155]	0.151[.149]	0.241[0.194]	0.167[0.188]
Energy Consumption	0.389***[0.097]	0.401***[0.097]	0.877***[0.249]	0.855***[.244]	0.586*[0.300]	0.631**[0.295]
Incubators and Science Parks	0.857***[0.108]	0.751***[0.112]	1.083***[0.255]	1.090***[.264]	1.043***[0.240]	0.910***[0.271]
Patents Binary	—	—	—	—	0.568[.389]	0.884**[0.385]
Software Binary	—	—	—	—	0.802***[0.214]	0.926***[0.212]
Trade	0.070***[0.022]	0.061***[0.022]	0.125*[0.073]	0.086[0.069]	0.089[0.084]	0.009[0.078]
Enrollment in HEIs	0.014[0.031]	0.057*[0.030]	0.393***[0.093]	0.502***[0.090]	0.072[0.118]	0.268**[0.111]
High-Quality University	0.604***[0.094]	—	1.233***[0.228]	—	1.661***[0.226]	—
High-Quality University System	—	0.829***[0.140]	—	1.192***[0.299]	—	1.283***[0.288]
Alpha	0.875***[0.049]	0.877***[0.049]	3.032***[0.275]	3.083***[0.282]	2.080***[0.337]	2.371***[0.384]
Overdispersion	Yes	Yes	Yes	Yes	Yes	Yes
Valid N	1319	1319	1319	1319	1319	1319

Note: Std. Errors in brackets, *sig. at 10%; **sig. at 5%; ***sig. at 1% .
Source: compiled by the authors.

Table 5. **Microregion-level Estimates**

Variable	Patents		Software		KIE	
	I	II	I	II	I	II
Constant	−10.614***[1.755]	−12.106***[1.724]	−27.160***[3.837]	−27.323***[3.609]	−35.002[89.553]	−31.191[81.024]
GDP	0.430**[0.177]	0.474***[0.179]	1.799***[0.380]	1.837***[0.372]	1.355**[0.552]	1.355**[0.572]
Population	0.710***[0.157]	0.671***[0.160]	−0.360[0.344]	−0.323[0.340]	−0.210[0.443]	−0.361[0.456]
Population Density	0.026[0.065]	−0.031[0.063]	−0.020[0.155]	−0.055[0.154]	−0.381[0.238]	−0.356[0.245]
LQ KIA	0.665***[0.141]	0.517***[0.141]	0.681**[0.304]	0.784***[0.294]	1.295***[0.402]	0.772*[0.417]
Infrastructure Investments	−0.314***[0.089]	−0.251***[0.090]	−0.239[0.206]	−0.296[0.206]	−0.624**[0.257]	−0.443*[0.260]
Energy Consumption	0.220**[0.105]	0.255**[0.105]	−0.004[0.205]	−0.001[0.201]	0.218[0.275]	0.354[0.281]
Incubators and Science Parks	0.673***[0.095]	0.737***[0.096]	0.545**[0.214]	0.618***[0.206]	1.022***[0.244]	1.179***[0.237]
Patents Binary	—	—	—	—	24.957[89.553]	18.633[81.024]
Software Binary	—	—	—	—	0.640***[0.240]	0.595**[0.247]
Trade	−0.159***[0.043]	−0.175***[0.044]	−0.125[0.113]	−0.117[0.111]	−0.273*[0.144]	−0.325**[0.143]
Enrollment in HEIs	−0.086[0.053]	−0.073[0.054]	0.239*[0.139]	0.250*[0.136]	0.647***[0.209]	0.616***[0.218]
High-Quality University	0.400***[0.092]	—	−0.070[0.223]	—	1.068***[0.316]	—
High-Quality University System	—	0.251***[0.094]		−0.301[0.199]	—	0.721***[0.240]
Alpha	0.390***[0.035]	0.408***[0.036]	1.150***[0.169]	1.118***[0.168]	1.100***[0.235]	1.168***[0.246]
Overdispersion	Yes	Yes	Yes	Yes	Yes	Yes
Valid N	386	386	386	386	386	386

Note: Std. Errors in brackets, *sig. at 10%; **sig. at 5%; ***sig. at 1% .
Source: compiled by the authors.

institutions. Even for the case of patenting activity, the difference is not substantial. This is an interesting indicator of the role played by even one preeminent, research-oriented university within the city-level dynamics of innovation ecosystems. In any case, the impacts of these universities present a dominant behavior respective to most of the other variables included in the calculations.

Complementarily, when we address the levels of Enrollment in HEIs, it becomes clear that the impacts arising from the provision of an educated workforce can be beneficial for the local innovation environment. However, these effects are much more limited than those expected for high-quality academia. At least this seems to be the case for the State of São Paulo, Brazil. This situation highlights the strategic importance of major universities as research hubs that can improve the generation of knowledge and the emergence of new, innovation-driven firms.

A general evaluation of the other variables included in the calculations renders some noteworthy findings. For instance, agglomeration economies associated with the population density seem to be present for patenting activity and software production, in line with the extant literature on the geography of innovation (e.g. [*Florida, Mellander,* 2014]). However, these effects do not drive entrepreneurial activity, which supports recent evidence in the field [*Fischer et al.,* 2018b]. Another area of great relevance concerns the existence of a support structure of local businesses in knowledge-intensive activities, a marked signal of localized economies as drivers of innovation ecosystems' capabilities [*Delgado et al.,* 2010]. In turn, the incubators and science parks seem to play an important role in shaping local conditions for innovative output. Surprisingly, the levels of city-level internationalization are weakly related to the dependent variables, with the exception of patenting activity. Infrastructural conditions also perform as expected, providing innovation ecosystems with the necessary operational platforms, nonetheless, this is valid solely for the proxy Energy Consumption.

Turning to the analysis of microregions, we notice that effects associated with our three university-related variables (Enrollment in HEIs, High-Quality University, and High-Quality University System) are significantly diminished as compared to findings observed for the city-level analysis. Still, some significant impacts can still be observed, but with consistently reduced coefficients. This carries with it theoretical and methodological implications. From the perspective of theory, it implies that geographical spillovers are frail and that higher education institutions' impacts upon innovation ecosystem dynamics are mostly constrained to the level of cities. From a methodological point of view, this means that analytical approaches to these ecosystems should be directed toward these smaller geographic units.

Per the remaining variables, some changes can be noted. Remarkably, the role of GDP is inverse to what was noticed in the previous step of the assessment. Latent agglomeration economies associated with population density vanish. This can be considered an expected outcome, as the benefits from agglomeration are likely to be weaker when larger areas are under scrutiny. Localized economies continue to play an important role, underscoring the strategic weight of a support business structure. In turn, infrastructural conditions lose importance, except for the specific case of business incubators and science parks. Again, internationalization levels perform poorly as drivers of output within the realm of innovation ecosystems.

Conclusions

In this article we have assessed the role of universities in shaping the dynamics of innovation ecosystems within the context of a particular developing country, Brazil. In order to do so, we designed an empirical approach that tests the relevance of the presence of high-quality universities in a given location as well as the overall supply of a qualified workforce (regardless of the quality of the *alma mater*). We then evaluated three outcome vectors of innovative activity, namely: patenting activity, software development, and knowledge-intensive entrepreneurship. Drawing on data from the State of São Paulo, we found consistent indicators that major academic institutions lie at the heart of innovation ecosystems, thus corroborating the 'anchor' hypothesis outlined in [*Xu et al.,* 2017]. While the formation of human capital also contributes to innovative output, its impacts are of minor relevance compared to higher education institutions that achieve excellence in research.

These results highlight not only the importance of universities in structuring successful ecosystems, but it also demonstrates that encouraging research at such institutions can have pervasive impacts upon socioeconomic development at the local level. Yet, there remains the challenge of further integrating academia into the markets of Brazil. Achieving closer interactions between universities and commercial systems can boost technological innovation and, consequently, catch-up dynamics [*Caraça et al.,* 2009; *Cohen et al.,* 2002; *Jiao et al.,* 2016; *Li,* 2009]. However, in the Brazilian context, these interconnections still suffer from institutional and market deficiencies [*Fischer at al.,* 2018a]. Improvements in the conditions and incentives for these interactions, as we have demonstrated, can prove to be a fruitful strategy for the Brazilian Innovation System.

Interestingly, our empirical approach suggests that such effects are mostly circumscribed to cities, which suggests that larger regions might not be adequate geographic units for evaluating innovation ecosystems' development [*Audretsch, Belitski,* 2017; *Bruns et al.,* 2017; *Qian et al.,* 2013]. This finding emphasizes the importance of spatial proximity [*Fritsch, Schwirten,* 2006], but it also draws attention to the geographical limits of innovation spillovers. These conditions bring significant implications for the way in which innovation policies at the regional level are addressed, given that connections among ecosystems' dimensions seem to happen within restricted areas.

This poses severe challenges for policymakers when targeting the formation and enhancement of innovation ecosystems, particularly for peripheral areas. First, as outlined by our findings, these regions are not likely to reap substantial benefits from proximity to successful hubs, if that is even the case in the first place. Beyond that, creating local conditions is not as straightforward as sometimes announced by policymakers. Establishing incubators and science parks is good, but such initiatives are only part of ecosystems' structures. In this regard, some fundamental vectors are not easily manipulated in the short term and there seems to be fundamental importance attributed to long-term, evolutionary conditions. Such is the case for high-quality universities. These institutions cannot be simply instated in a given location by fiat, as new campuses may take an extensive amount of time to mature into preeminent schools and research centers. Complementarily, leading institutions are not likely to open new units indefinitely, which consequently leaves many locations without the key presence of these drivers of innovation at the local level.

We expect our contributions to generate further research on the role of academia in shaping the dynamics of innovation ecosystems of developing countries. While case studies and econometric analyses exist for developed economies, there are few approaches dealing with the reality of relatively laggard systems, where the connections between the necessary agents are still immature [*Rapini et al.,* 2009]. Avenues for future studies should include additional and alternative qualifications for the presence of a university, as well as a deep dive into the qualitative nature of academic research as a driver for innovative activity at the city level. These studies will help in creating a body of knowledge that can feed the policymaking process with more informative insights than those generated by anecdotal evidence collected from dissimilar contexts.

References

Ács Z.J., Anselin L., Varga A. (2002) Patents and innovation counts as measures of regional production of new knowledge. *Research Policy,* vol. 31, no 7, pp. 1069–1085.

Agrawal A., Cockburn I. (2003) The anchor tenant hypothesis: Exploring the role of large, local, R&D-intensive firms in regional innovation systems. *International Journal of Industrial Organization*, vol. 21, no 9, pp. 1227–1253.

Alcácer J., Chung W. (2007) Location strategies and knowledge spillovers. *Management Science*, vol. 53, no 5, pp. 760–776.

Alvedalen J., Boschma R. (2017) A critical review of entrepreneurial ecosystems research: Towards a future research agenda. *European Planning Studies,* vol. 25, no 6, pp. 887–903.

Asheim B., Coenen L. (2005) Knowledge Bases and Regional Innovation Systems: Comparing Nordic clusters. *Research Policy,* vol. 34, no 8, pp. 1173–1190.

Asheim B., Isaken A. (2002) Regional Innovation Systems: The integration of local 'sticky' and global 'ubiquitous' knowledge. *Journal of Technology Transfer,* vol. 27, no 1, pp. 77–86.

Asheim B., Smith H., Oughton C. (2011) Regional Innovation Systems: Theory, Empirics and Policy. *Regional Studies*, vol. 45, no 7, pp. 875–891.

Audretsch D., Belitski M. (2017) Entrepreneurial ecosystems in cities: Establishing the framework conditions. *Journal of Technology Transfer*, vol. 42, no 5, pp. 1030–1051.

Autio E. (1998) Evaluation of RTD in regional systems of innovation. *European Planning Studies*, vol. 6, no 2, pp. 131–140.

Benneworth P., Hospers G.J. (2007) The new economic geography of old industrial regions: Universities as global-local pipelines. *Environment and Planning,* vol. 25, no 6, pp. 779–802.

Bercovitz J., Feldman M. (2006) Entrepreneurial universities and technology transfer: A conceptual framework for understanding knowledge-based economic development. *Journal of Technology Transfer*, vol. 31, no 1, pp. 175–188.

Boschma R. (2005) Proximity and innovation: A critical assessment. *Regional Studies,* vol. 39, no 1, pp. 61–74.

Breschi S., Lissoni F. (2009) Mobility of skilled workers and co-invention networks: An anatomy of localized knowledge flows. *Journal of Economic Geography,* vol. 9, no 4, pp. 439–468.

Brown R. (2016) Mission impossible? Entrepreneurial universities and peripheral regional innovation systems. *Industry and Innovation,* vol. 23, no 2, pp. 189–205.

Bruns K., Bosma N., Sanders M., Schramm M. (2017) Searching for the existence of entrepreneurial ecosystems: A regional cross-section growth regression approach. *Small Business Economics*, vol. 49, no 1, pp. 31–54.

Buesa M., Heijis J., Baumert T. (2010) The determinants of regional innovation in Europe: A combined factorial and regression knowledge production function approach. *Research Policy,* vol. 39, no 6, pp. 722–735.

Buesa M., Heijis J., Pollitero M.M., Baumert T. (2006) Regional systems of innovation and the knowledge production function: The Spanish case. *Technovation,* vol. 26, no 4, pp. 463–472.

Caraça J., Lundvall B., Mendonça S. (2009) The changing role of science in the innovation process: From queen to Cinderella? *Technological Forecasting and Social Change*, vol. 76, no 6, pp. 861–867.

Chen K., Kenney M. (2007) Universities/Research Institutes and Regional Innovation Systems: The Cases of Beijing and Shenzhen. *World Development,* vol. 35, no 6, pp. 1056–1074.

Clark B. (2004) *Creating Entrepreneurial Universities,* Oxford: IAU Press-Elsevier.

Clarysse B., Wright M., Bruneel J., Mahajan A. (2014) Creating value in ecosystems: Crossing the chasm between knowledge and business ecosystems. *Research Policy*, vol. 43, no 7, pp. 1164–1176.

Cohen W.M., Nelson R.R., Walsh J.P. (2002) Links and impacts: The influence of public research on industrial R&D. *Management Science*, vol. 48, no 1, pp. 1–23.

Collini S. (2012) *What Are Universities for?,* London: Penguin.

Cooke P. (2001) Regional Innovation Systems, Clusters and the Knowledge Economy. *Industrial and Corporate Change,* vol. 10, no 4, pp. 945–974.

Cooke P. (2005) Regionally asymmetric knowledge capabilities and open innovation: Exploring 'globalisation 2' — A new model of industry organization. *Research Policy,* vol. 34, no 8, pp. 1128–1149.

Cooke P. (2008) Regional innovation systems: Origin of the species. *International Journal of Technological Learning, Innovation and Development,* vol. 1, no 3, pp. 393–409.

Cooke P., Uranga M., Etxebarria G. (1997) Regional innovation systems: Institutional and organizational dimensions. *Research Policy*, vol. 26, no 4, pp. 475–491.

Cooke P., Uranga M., Etxebarria G. (1998) Regional systems of innovation: An evolutionary perspective. *Environment and Planning,* vol. 30, no 9, pp. 1563–1584.

Cowan R., Zinovyeva N. (2013) University effects on regional innovation. *Research Policy,* vol. 42, no 3, pp. 788–800.

D'Este P., Perkmann M. (2011) Why do academics engage with industry? The entrepreneurial university and individual motivations. *Journal of Technology Transfer,* vol. 36, no 3, pp. 316–339.

Delgado M., Porter M., Stern S. (2010) Clusters and entrepreneurship. *Journal of Economic Geography*, vol. 10, no 4, pp. 495–518.

Diez J. (2000) The importance of public research institutes in innovative networks — Empirical results from the Metropolitan innovation systems Barcelona, Stockholm and Vienna. *European Planning Studies*, vol. 8, no 4, pp. 451–463.

Doloreux D. (2002) What we should know about regional systems of innovation. *Technology in Society,* vol. 24, no 3, pp. 243–263.

Doloreux D., Parto S. (2005) Regional innovation systems: Current discourse and unresolved issues. *Technology in Society,* vol. 27, no 2, pp. 133–153.

Dosi G. (1988) The nature of the innovative process. *Technical Change and Economic Theory* (eds. G. Dosi, C. Freeman, R. Nelson, G. Silverberg, L. Soete), London: Pinter, pp. 221–238.

Etzkowitz H. (1998) The norms of entrepreneurial science: Cognitive effects of the new university-industry linkages. *Research Policy,* vol. 27, no 8, pp. 823–833.

Etzkowitz H. (2004) The evolution of the entrepreneurial university. *International Journal of Technology and Globalization,* vol. 1, no 1, pp. 64–77.

Etzkowitz H., Leydesdorff L. (2000) The dynamics of innovation: From National Systems and "Mode 2" to a Triple Helix of university-industry-government relations. *Research Policy,* vol. 29, no 2, pp. 109–123.

Feldman M.P. (2001) The Entrepreneurial Event Revisited: Firm Formation in a Regional Context. *Industrial and Corporate Change,* vol. 10, no 4, pp. 861–891.

Fischer B. (2015) On the Contributions of Knowledge-Intensive Business-Services Multinationals to Laggard Innovation Systems. *Brazilian Administration Review*, vol. 12, no 2, pp. 150–168.

Fischer B., Schaeffer P., Phaiffer J. (2018a) Universities' gravitational effects on the location of knowledge-intensive investments in Brazil. *Science and Public Policy*, forthcoming. Pre-print available online at: https://doi.org/10.1093/scipol/scy002, accessed 29.03.2018.

Fischer, B., Queiroz S., Vonortas N. (2018b) On the location of knowledge-intensive entrepreneurship in developing countries: Lessons from São Paulo, Brazil. *Entrepreneurship and Regional Development*, forthcoming. Pre-print available online at: https://doi.org/10.1080/08985626.2018.1438523, accessed 29.03.2018.

Fischer B., Schaeffer P., Vonortas N., Queiroz S. (2018c) Quality comes first: University-industry collaboration as a source of academic entrepreneurship in a developing country. *Journal of Technology Transfer*, vol. 43, no 2, pp. 263–284.

Florida R., Mellander C. (2014) *Rise of the startup city: The changing geography of the venture capital financed innovation* (Working Paper no 377), Jönköping, Sweden: Centre of Excellence for Science and Innovation Studies.

Fritsch M. (2001) Co-operation in regional innovation systems. *Regional Studies,* vol. 35, no 4, pp. 297–307.

Fritsch M. (2005) Do regional systems of innovation matter? *The New Economy in Transatlantic Perspective: Spaces of Innovation* (ed. K. Huebner), London: Taylor & Francis, pp. 189–206.

Fritsch M., Schwirten C. (2006) Enterprise-University co-operation and the role of public research institutions in regional innovation systems. *Industry and Innovation,* vol. 6, no 1, pp. 69–83.

Fritsch M., Slavtchev V. (2007) Universities and innovation in space. *Industry and Innovation,* vol. 14, no 2, pp. 201–218.

Galan-Muros V., Davey T. (2017) The UBC ecosystem: Putting together a comprehensive framework for university-business cooperation. *Journal of Technology Transfer,* forthcoming. Pre-print available online at: https://link.springer.com/article/10.1007/s10961-017-9562-3, accessed 29.03.2018.

Giuliani E. (2013) Network Dynamics in Regional Cluster: Evidence from Chile. *Research Policy,* vol. 42, no 8, pp. 1406–1419.

Guerrero M., Urbano D., Fayolle A., Klofsten M., Mian S. (2016) Entrepreneurial universities: Emerging models in the new social and economic landscape. *Small Business Economics*, vol. 47, no 3, pp. 551–563.

Harrison R.T., Leitch C. (2010) Voodoo institution or entrepreneurial university? Spin-offs companies, the entrepreneurial system and regional development in the UK. *Regional Studies,* vol. 44, no 9, pp. 1241–1262.

Hicks D., Breitzman T., Olivastro D., Hamilton K. (2001) The changing composition of innovative activity in the US: A portrait based on patent analysis. *Research Policy,* vol. 30, no 4, pp. 681–703.

Hong W. (2008) Decline of the center: The decentralizing process of knowledge transfer of Chinese universities from 1985 to 2004. *Research Policy,* vol. 37, no 4, pp. 580–595.

Jackson D.J. (2011) *What is an Innovation Ecosystem,* Arlington, VA: National Science Foundation.

Jaffe A.B. (1989) Real effects of academic research. *The American Economic Review,* vol. 79, no 5, pp. 957–970.

Jiao H., Zhou J., Gao T., Liu X. (2016) The more interactions the better? The moderating effect of the interaction between local producers and users of knowledge on the relationship between R&D investment and regional innovation systems. *Technological Forecasting and Social Change,* vol. 110, pp. 13–20.

Laursen K., Reichstein T., Salter A. (2011) Exploring the effect of geographical proximity and university quality on university–industry collaboration in the United Kingdom. *Regional Studies*, vol. 45, no 4, pp. 507–523.

Leydesdorff L., Fritsch M. (2006) Measuring the knowledge base of regional innovation systems in Germany in terms of a Triple Helix dynamics. *Research Policy,* vol. 35, no 10, pp. 1538–1553.

Li X. (2009) China's regional innovation capacity in transition: An empirical approach. *Research Policy,* vol. 38, no 2, pp. 338–357.

Mazzoleni R., Nelson R. (2007) The roles of research at universities and public labs in economic catch-up. *Research Policy*, vol. 36, no 10, pp. 1512–1528.

Moodysson J., Coenen L., Asheim B. (2008) Explaining spatial patterns of innovation: Analytical and synthetic modes of knowledge creation in the Medicon Valley life-science cluster. *Environmental Planning A,* vol. 40, no 5, pp. 1040–1056.

Mowery D.C., Sampat B.N. (2005) Universities in national systems. *The Oxford Handbook of Innovation* (eds. J. Fagerberg, D. Mowery, R. Nelson), Oxford: Oxford University Press, pp. 209–239.

Ortega-Argilés R., Potters L., Vivarelli M. (2011) R&D and productivity: Testing sectoral peculiarities using micro data. *Empirical Economics*, vol. 41, no 3, pp. 817–839.

Perkmann M., Tartari V., McKelvey M., Autio E., Broström A., D'Este P., Fini R., Geuna A., Grimaldi R., Hughes A., Krabel S., Kitson M., Llerena P., Lissoni F., Salter A., Sobrero M. (2013) Academic engagement and commercialisation: A review of the literature on university-industry relations. *Research Policy,* vol. 42, no 2, pp. 423–442.

Poods R., Oort F., Frenken K. (2010) Innovation, spillovers and university-industry collaboration: An extended knowledge production function approach. *Journal of Economic Geography*, vol. 10, no 2, pp. 231–255.

Qian H., Ács Z., Stough R. (2013) Regional systems of entrepreneurship: The nexus of human capital, knowledge and new firm formation. *Journal of Economic Geography*, vol. 13, no 4, pp. 559–587.

Rapini M.S., Albuquerque E.D.M., Chave C.V., Silva L.A., Souza S.G.A., Righi H.M., Cruz W.M.S. (2009) University-industry interactions in an immature system of innovation: Evidence from Minais Gerais, Brazil. *Science and Public Policy,* vol. 36, no 5, pp. 373–386.

Saxenian A.L. (2006) *The New Argonauts: Regional advantage in a global economy,* Cambridge (MA): Harvard University Press.

Siegel D.S., Wright M. (2015) Academic Entrepreneurship: Time for a Rethink? *British Journal of Management,* vol. 26, no 4, pp. 582–595.

Suzigan W., Albuquerque E. (2011) The underestimated role of universities for the Brazilian system of innovation. *Brazilian Journal of Political Economy,* vol. 31, no 1, pp. 3–30.

Suzigan W., Albuquerque E., Garcia R., Rapini M. (2009) University and industry linkages in Brazil: Some preliminary and descriptive results. *Seoul Journal of Economics,* vol. 22, no 4, pp. 591–611.

Uyarra E. (2010) What is evolutionary about 'regional systems of innovation'? Implications for regional policy. *Journal of Evolutionary Economics,* vol. 20, pp. 115–137.

Wal A.L.J.T., Boschma R. (2009) Applying social network analysis in economic geography: Framing some key analytic issues. *Annals of Regional Science,* vol. 43, no 3, pp. 739–756.

WEF (2013) *Entrepreneurial Ecosystems Around the Globe and Company Growth Dynamics,* Geneva: World Economic Forum.

WEF (2014) *Entrepreneurial Ecosystems and around the Globe and Early-stage Company Growth Dynamics: An Entrepreneurs Perspective,* Geneva: World Economic Forum.

Xu G., Wu Y., Minshall T., Zhou Y. (2017) Exploring innovation ecosystems across science, technology, and business: A case of 3D printing in China. *Technological Forecasting and Social Change,* forthcoming. Pre-print available online at: https://doi.org/10.1016/j.techfore.2017.06.030, accessed 29.03.2018.

Youtie J., Shapira P. (2008) Building an innovation hub: A case study of the transformation of university roles in regional technological and economic development. *Research Policy,* vol. 37, no 8, pp. 1188–1204.

Open Innovation Platforms as a Knowledge Triangle Policy Tool – Evidence from Finland

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Abstract

Open innovation platforms (OIPs) as a new tool fostering the convergence of innovation, education, and research activities have been gaining popularity over the course of recent years. Innovative activities are evolving towards more agile and user-driven processes. OIPs are the key mechanism for orchestrating these processes, providing a qualitatively new space for the interactions between science, education, and innovation. Platform actors have the opportunity to share knowledge and use the urban environment as a 'living lab'.

Using the case of Tampere (Finland), the paper explores OIPs' role in the orchestration of joint innovation projects within the framework of the 'smart city' model. The functions of the platforms in coordinating innovation are illustrated by the practices of three universities implementing the 'knowledge triangle' strategy. The initial data for the analysis of the cases were collected within the framework of the Six Cities Strategy project. The authors were guided by a participatory action research (PAR) approach and directly participated in events aimed at the development of strategy.

The results of the case analysis should contribute to the evolution of the OIPs concept both from the academic and policy perspectives. The authors highlight some tentative policy implications and recommendations.

Keywords: open innovation platforms (OIPs); knowledge triangle; network effect; university–industry cooperation; innovation policy; orchestration of innovation; Finland.

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In recent years, innovation policy has been aimed at the integration of research, education, and innovation in the framework of knowledge triangle. Previously it focused upon science parks and cluster- and sectoral-based policies, with science-based and semi-closed development projects led by a few large companies. Currently, innovation policy is evolving towards more agile and user-driven processes of innovation, in which ecosystems and open innovation and platform models are key elements. OIPs provide a new generation of co-creation spaces, fostered by advanced digitalized platform management tools. This paper focuses on the orchestration of innovation activities by higher education institutions (HEIs) with external service providers applying the *platform approach.*

The OIP approach enables one to engage a much broader knowledge base in order to provide user-oriented open innovation services**.** This approach moves beyond the living lab or experimental environment concepts and stresses service and management aspects within the framework of a digitalized platform economy context [*Brynjolfsson, McAfee,* 2017]. It integrates knowledge bases —including users — for mutual value creation and capture on the platforms, thus enabling network effects**.** Innovation services frequently reflects well-organized co-creation and open innovation practices, but we focus more on the organization of these services: *how the orchestration of co-creation and open innovation is organized between the HEIs and service providers.* Traditional innovation-fostering services between universities and businesses have focused on networking and matchmaking at the early phase of the innovation process. However, recent innovation services proceed in line with the ecosystem approach [*Moore,* 1993] and aim to provide more concrete outputs from the process and, thus, focus on later phases of the innovative process, when products are closer to the market. Innovation services with recognizable outputs and monetized value are often closer to private business services than public or semi-public support actions for innovation [*Katzy et al.,* 2013].

The knowledge triangle and OIPs are often integrated or overlap one another, thus an analysis of OIPs would contribute to the discussion on how to foster of the development of the KT, both from a research and policy-making perspective. Using the case of Tampere (Finland), this paper describes how collaboration is organized within the framework characterized by the open innovation platform approach in the context of the knowledge triangle. First, we define the concept of an OIP, then, empirical data and methods are described, and the case studies are introduced. Finally, a discussion and short conclusion with tentative policy recommendations and some future research challenges are provided.

The KT and OIP Approaches to Organizing Innovative Activity

The KT approach emphasizes the linkages between education, research, and innovation. The KT places HEIs at the core of innovation ecosystems, and their performance is crucial for scaling up national and even European innovative performance. However, there is still a lack of illustrative examples of the KT in practice and at the university level [*Markkula*, 2013, p. 11]. To distinguish the KT — that is, a policy concept rather than academic approach — from the more established university, industry, and government models, such as the triple helix [*Etzkowitz,* 1993], we chose to focus on the orchestration of the two phenomena upon which the KT approach focuses.

Firstly, the open innovation and open co-creation activities represent the logic that is increasingly applied to the change in interactions between university, industry, and society. This suggests that the collaboration culture of the HEIs forgo silo structures or, at the very least, make them more porous. New types of environments for interaction fostering an open innovation culture, communality, and a collaborative way of working are labelled *innovation platforms* in this context [*Markkula,* 2013, pp. 17, 22; *Kautonen et al.,* 2017; *Raunio et al.,* 2013]. Innovation platforms facilitate open innovation and cooperation between people, education, research, and industry which increases the chances of receiving partial government support at the pre-commercial stage [*Lehenkari et al.,* 2015]. Nevertheless, this does not really distinguish this concept from many other similar ones such as living labs [*Leminen,* 2015]. In this paper, we hope to accomplish this task by defining the three categories of OIPs based on their roles as orchestrators of the provision of innovative services: bilateral, multilateral, and the 'platform economy' [*Brynjolfsson, McAfee,* 2017; *Gawer,* 2009].

Due to its broad nature the KT framework does not define the *innovation platform* in detail, or much at all. In order to facilitate a meaningful discussion, we provide theory- and practice-based working definitions of OIPs. In the KT context, OIPs may be seen as a collaboration model that HEIs may deploy while interacting with the surrounding social environment and economy to fulfil their 'third mission'.

The discussion of innovation platforms has been vague and fragmentary in the literature and even more so in the policy and the business sectors. Thus, the study at hand is linked not only to one but

to several academic discussions and literature streams, including regional studies, innovation policy, business management, and economics. *Open innovation*, as such, has been discussed extensively over the last two decades [*Chesbrough,* 2003; *von Hippel,* 2005], and fairly solid and commonly shared ideas and concepts exist within both academic and practical discussions. Among the noteworthy concepts is the 'lean-start-up' approach and its emphasis upon shorter and more agile innovation *processes* [*Ries,* 2011]. Meanwhile, the concept of a *platform* is much more ambiguous.

In the literature on knowledge-based regional economic development, the concept of an innovation platform refers to a policy fostering *related variety* [*Asheim et al.,* 2011]. The theory on related variety suggests that combining different knowledge bases (i.e., synthetic, symbolic, and analytical) foster innovative activities between different sectors and technology bases. This focus on 'horizontal knowledge flows' and facilitating the integration of different knowledge bases distinguishes the platform approach from the cluster approach [*Cooke, de Laurentis,* 2010a]. This rather ambiguous and abstract definition draws, however, only a fine line between the innovation platform and the cluster approaches. We would argue that a role of openness in the OIP approach also distinguishes it from the cluster approach [*Kautonen et al.,* 2017; *Raunio et al.,* 2013]. Importantly, the cluster and OIP approaches introduced here are not mutually exclusive; instead, they may be overlapping and complementary, and the actors in clusters, for example, may extend their activities by setting up OIPs. The breaking up of clusters and the globalization of value-chains and 'unbundling' have made business ecosystems global. The development and innovation processes in this context offer 'bundles' that advanced and knowledge-intensive regions are eager to focus on due to their high-value creation potential for local economies.

The existing literature proposes some interpretations, which distinguish the concept of platforms from other *modes of organization*. In most cases, a platform is used to define how to organize production- and innovation-related interactions with external partners [*Gawer,* 2009; *Thomas et al.,* 2014]. *Platform* defines the modes of cooperation that usually open the process for new actors and consider new forms of value creation. These include technological product platforms (e.g., iPhone), value chain platforms (e.g., the car industry), and industrial platforms (e.g., technologies). More recently, a platform has been used to describe internet-based business models deployed on digital platforms (e.g., Facebook and Uber) on which value creation is highly dependent upon the ability to attract users or developers to use the platform (network effects) [*Choudary,* 2013; *Hagiu,* 2014]. The ability to attract users or developers who create value for the platform is a shared concern in all platform approaches to various degrees.

Thus, discussions related to regional economic development remain on a fairly abstract level of related variety of knowledge bases [*Asheim et al.,* 2011]. Despite this, it is clear that innovation platforms integrate different knowledge bases, actors, and technologies. The literature, again, offers interpretations on how to organize this communication via digital and physical environments in more detail and how to make it a profitable activity [*Brynjolfsson, McAfee,* 2017]. A platform is then an organizational model for the coordination of open innovation processes. Importantly, platform owners do not produce all, or *any of,* the key products, innovations, or services on the platform but rather facilitate the process. Instead, *users of the platform provide the most value for other users of the platform or develop complementary services*. The latter may be developers providing new applications for iPhone users, while the former may be Uber drivers offering a taxi services to Uber clients, who may be drivers themselves. The fact that users are creating value for each other makes it possible to foster network effects; that is, every new user on the platform provides more value for the other users [*Gawer, Cusumano,* 2002, 2008; *Sawhney,* 1998].

This provides many opportunities for knowledge-based developments and policy measures that frequently refer to intermediaries that aim to bring together knowledge producers and users in order to foster innovation. There are several private services working as digitalized platforms providing open innovation services (e.g., *Innocentive* or *NineSigma*) that may be considered innovation intermediaries [*Howells,* 2006] and whose practices link clients with innovation challenges and knowledge holders with potential solutions. They are frequently considered more suitable for organizing partnerships than traditional semi-public development agencies. The qualities of these platforms include well-defined innovation processes that may be monetized, for which ROI is visible for the service users [*Katzy et al.,* 2013; *Hallerstede,* 2013].

It should be noted that innovation intermediaries [*Howells,* 2006] work according to a bilateral or multilateral platform model, by providing, for example, science park environments and cluster programs with actors (e.g., research institutions) that bring in other actors (e.g., companies) to the platform. This resembles a shopping mall business model, where good quality shops attract customers that encourage more shops to set up their branches at the mall, fostering a network effect

based on mutual benefits and complementary services (e.g., cafeterias and parking spaces), which make it even more feasible for both groups of actors (i.e., retailers and shoppers) to use the platform that the shopping mall offers for their interaction as a multilateral or bilateral platform [*Boudreau, Hagiu,* 2009, p. 177]. Science park environments have, in principle, benefitted from network effects and complementary services that make platforms attractive to their users (e.g., industry–university collaboration). Recently intermediary activities have applied digitalized solutions that aim to increase the efficiency of the network effect substantially.

The business model of open innovation wholly corresponds with the characteristics of a platform as defined by the literature. In the majority of cases the open format of platform collaboration encourages innovative activity, it provides mutual benefits in new value creation. The platform and platform economy concepts [*Gawer, Cusumano,* 2002; *Choudary,* 2013], may be seen as a continuation of the discussion on networks and network society in the 1990s [*Castells,* 1996] as an attempt to understand the new logic behind interactions between economic players. Currently, the term 'platform' is used to explain and describe the emerging modes of interaction in both the social and economic fields. In general, the platform approach reflects the demands of the new socio-technological paradigm, in which megatrends in the digitalization of technology (e.g., *internet-based business)*, and globalization of the markets (e.g., *business ecosystems*) also transform behavior in the economy (e.g., a *sharing economy*) and foster the emergence of new modes for organizing cooperation in innovative (and production) activities.

In sum, the ability to combine different knowledge bases (i.e., synthetic, symbolic, and analytical) and forms of knowledge in general (i.e., science- and experience-based knowledge, codified knowledge, and tacit knowledge) as well as social capital (or trust) are frequently seen as the key to fostering innovation by policy and management. Both digital and physical platforms may enhance this knowledge 'cross-pollination', for example, by integrating different industries and research disciplines, or user groups for co-creation processes (e.g., this may be done in living labs in order to utilize experience-based knowledge). Various innovation centers, platforms, labs, or science parks are largely discussed in the literature, and they are broadly used as examples of how to implement innovation policy [*Boschma,* 2005; *Cooke, de Laurentis,* 2010a, 2010b; *Harmaakorpi et al.,* 2011]. Also, the ability to accelerate the innovation process from knowledge to markets in an agile and user-oriented innovation process is critical. Organizing and engaging users and other external actors so that they are part of the innovation process (e.g., in living labs or proto projects) are typical steps towards implementing this goal. Chesbrough [*Chesbrough,* 2003], Ries [*Ries,* 2011] and Thiel [*Thiel,* 2014] are among the key authors discussing these dynamics.

The discussion also relates to business and innovation ecosystems and how they facilitate open innovation activities. Examples include user-communities, living labs, and other methods to integrate users or other external parties in innovation processes during the pre-market stage. It is appropriate to distinguish business ecosystems from innovation ecosystems, according to their expected outputs. In business ecosystems, the aim is to organize value creation and value appropriation in an systemic setting, while 'the main output of innovation ecosystems is the increase of information flows and collaboration and therefore the creation of new business-relevant knowledge, ideas, and technologies that lead to new products, successful companies, and economic growth' [*Huhtamäki, Rubens,* 2016, p. 11]. The internet-powered and digitalized multilateral platform model seeks network effects in the provision of innovative services, the scaling of production, and lowering of marginal costs. These things encourage the emergence of services that foster the knowledge triangle in accordance with the latest developments of the 'platform economy' [*Brynjolfsson, McAfee,* 2017; *Sundararajan,* 2016]. Thus, our aim is to describe how to orchestrate the innovative activities of these business and innovation ecosystems, to identify the relationships between service providers, the possible benefits from fostering cross-pollination, and open innovation within the framework of these platforms.

National and Regional Context of KT-related Strategies

System of HEIs and Innovation Policy

According to some studies, university and industry collaboration is more intensive in Finland than in most of the European Union (EU). However, while the share of the companies cooperating with HEIs was 33%, only 4.9% of firms announced that the interactions with the university mattered. Still, both figures are significantly higher than the average among EU countries [Finnish Government, 2009; *Pelkonen, Nieminen,* 2015]. In short, HEIs' impact upon firms' real innovative outcomes can be considered as rather moderate and typically more indirect and therefore perhaps difficult to recognize, than direct and linear.

Table 1. **Key programs for the innovative development of regions in Finland**

Name	Years	Source
Centres of Expertise I, II, III	1994–2013	[*Kavonius*, 2013]
Open Innovation Environments	2008–2012	[*Turunen,* 2010]
Innovative Cities, INKA	2014–2020	[Tekes, 2013]
Six Cities Strategy of Finland: Open and Smart Services	2015–2020	[Six Cities Strategy Office, 2016]

Source: compiled by the authors.

The share of research and development (R&D) expenditures in total GDP has been among the highest in the world in Finland from the early 2000s and onwards. The share of R&D expenditures in Finland's GDP peaked in 2009 at 3.9%, but then it decreased to 3.1% in 2015. The major reason for this decline is lower product development investments in the private sector, whereas the higher education sector and the public sector reduced their investments only slightly from the peak years [Statistics Finland, 2016].

The incentives to cooperate with industry or to conduct innovation-related activities are to a great extent lacking in the basic funding mechanisms of Finnish HEIs, but they are included in the practices of the HEI's main government funding organization. Tekes, the National Agency for Technology and Innovation[1], demands and fosters cooperation between the private sector and the universities in its funding programs. Furthermore, the European Social Fund (ESF) and the European Regional Development Fund (ERDF) projects encourage multilateral cooperation by focusing on supporting universities of applied sciences (UASs) (i.e., polytechnics) [*Hyytinen et al.,* 2012]. The direct funding from companies is fairly modest in the case of both types of HEIs and concentrated at the few universities of technology or medical schools among the universities. The direct funding from companies has also decreased over recent years [Vipunen.Fi, n.d.].

At research universities the share of external funding (1.215 million euros in 2015) was around *55% of the total research funding* (i.e., the highest figure was 59% from the Academy of Finland and Tekes). At the UASs, R&D funding was 167 million euros in 2013 in total (major funding came from the ministries and the EU's development funds). Domestic companies provided less than 10% for external funding and foreign companies provided only a small fraction of the funding for research universities and virtually nothing for UASs [Vipunen.Fi, n.d.].

In sum, the profiles of universities and UASs differ from each other very clearly in terms of the amount and sources of external R&D funding. Further, cooperation with businesses is limited to a few universities in terms of corporate funding (e.g., in 2014, the University of Tampere alone gathered 57% of the total national funding from *foreign* companies in Finland, mainly due to its vaccination-related research; Aalto University (technology-oriented) and Tampere University of Technology together collected about 45% of the total national funding from *domestic* companies).

Place-based innovation policies provide support for the development of knowledge triangle activities. In the 1960s, Finland established a wide network of general universities and universities of applied sciences, which subsequently became the base for carrying out regional programs for innovative development, including the interactions between educational institutions and local and regional enterprises and wider society (Table 1).

The most recent national programs link innovation strategies closely to economic development at the regional and urban levels. For example, INKA (Tekes funded) is embedded in the regional and urban development framework and aims to foster the *innovative activities of firms* and develop 'internationally attractive innovation clusters in Finland' [Tekes, 2013]. It partially overlaps with the Six Cities Strategy program (ERDF-funded) which focuses on *building the competences of cities and local public actors* to foster (open) innovation. Since the latter provides the context for this study, we define it in more detail later on.

The Innovation Landscape of Tampere Region

The Tampere region is centrally located in southwestern Finland and, together with the capital city region of Helsinki, forms the most dynamic regional economic zone in the country in terms of population growth and investments. The administrative Tampere region has approximately 500,000 inhabitants, of which about half live in the city of Tampere.

[1] Named Business Finland from the beginning of 2018.

Table 2. **Profiles of the HEIs in Tampere**

HEIs in Tampere	University of Tampere (UTA)	Tampere University of Technology (TUT)	Tampere University of Applied Sciences (TAMK)
Year of establishment	1960	1965	1996
Profile	Society and Health	Industrial	Polytechnic
Main areas of research and education	• Information, information technology and knowledge • Cities, the environment and the regions • Journalism and media • Changes of society • Individual and collective health	• Signal processing • Optics and photonics • Intelligent machines • Bio-modelling • Built environment	• Computer science • Media and graphics • Digital gaming …and many others
Students, 2014	14952	8390	10290
Teaching and research personnel, 2014	1068	1118	421.4
Foreign students, 2013	535	797	293
Degrees/graduates, 2014	2571	1598	1856
HEI spin-offs, 2014	..	3	2
Basic budget funding, mln. euros, 2014	116.3	82.0	65.3

Source: compiled by the authors.

The main HEIs in the region are *University of Tampere* (UTA), *Tampere University of Technology* (TUT), and *Tampere University of Applied Sciences* (TAMK) (see Table 2)[2]. In addition, the large R&D facilities of the Technical Research Centre of Finland VTT (with more than 300 experts) provide companies with an R&D partner, especially in those three areas of competence that are at the core of strong local clusters.

The integration of research, innovation, and education may be found in the strategies of all three institutions in Tampere. However, the 'third mission' and especially the links to industry and business are much more explicitly formulated in the strategies of TUT and TAMK than at UTA, which is more focused on social sciences and medicine.

According to statistics covering the last decade, every fifth inhabitant of Tampere is a student at a higher education institution and every third inhabitant, over 15 years of age, has a degree from a higher education institution. Out of almost 10,000 R&D workers in 2010, more than half were employed by the private sector. Recently the situation changed dramatically due to lay-offs from big high-tech companies. Changes have been significant and it is likely that they are not yet fully reflected in the numbers provided in Table 1, although it seems that the employment of knowledge workers has not fallen due to the growth of many new companies and growing entrepreneurship.

It seems that the recession in the 1990s sped up development towards a more knowledge-intensive mode of the economy. In the Tampere city region, R&D expenditures represented approximately 15% of the national total for many years (i.e., more than 900 million euros annually). This is more than 2,000 euros per inhabitant from 2006 until recently; thus, Tampere has been a national leader in R&D intensity. Of the gross regional product, R&D has accounted for about 7%.

There are **three key clusters** and industrial agglomerations based on competences developed over time, and it is not likely that fundamentally new knowledge bases will emerge in the region.

The information and communication technology (ICT) cluster employed more than 6,000 engineers until 2015, but recent turbulence in the ICT industry has made the situation less clear. A key long-term strength of the cluster is its wide-ranging spectrum of industries, application domains, and product competences. Key areas include telecommunication networks, the Internet, and cloud services.

Intelligent machines represent a traditionally strong technology cluster in Tampere and its immediate vicinity, with more than 1,000 companies that account for the total turnover of more than 7 billion euros (2011) and employ more than 34,000 people. The R&D investments account for more than 750 million euros annually, which can be attributed to the serious attempts of leading companies to maintain their innovativeness. In fact, ten world market leaders operate in Tampere. Many have

[2] The three HEIs have started a merger process that will be completed at the beginning of 2019.

Table 3. **Outcomes of Cluster-based Innovation Policy in Tampere**

Policy approach	Outcomes
Supply-driven	• Rapid growth in the ICT cluster • Implementation of large innovation programmes (e.g., eTampere, BioNext and Creative Tampere)
Demand-driven	• Increasing efficiency in the large public sector (i.e., innovative procurement) • Exploiting hidden potential in highly educated population (i.e., democratisation of innovation) • More active IPR management of companies and HEIs (e.g., Open Tampere)

Source: compiled by the authors.

invested in the local innovation environment (e.g., the world's largest production automation and testing site for container terminals, as the Cargotec Group invested approximately 35 million euros in its new technology center in 2012).

Within the **life sciences cluster**, the city has a combination of multidisciplinary, technological, biomedical, and medical expertise in the education, research, healthcare, and business sectors. In recent years, the health, wellness, and biotechnology sectors in the city have been the fastest growing in Finland and received the largest number of private investments in business development.

In addition, (digital) **media** have been a strategic field for Tampere, mainly due to the potential that the location of the national broadcasting company has provided for the region. Of course, it has in many ways been integrated into the strong ICT cluster. ICT and digitalization clearly influence all the clusters of the region.

The knowledge-based development policy in the Tampere over the past decades includes the construction of basic innovation infrastructure, such as universities and their mechanisms for technology transfer, science parks, programs for centers of expertise and clustering, and so forth. Large, locally initiated public and private partnership-based innovation programs have generated cumulative competences and confidence to conduct further innovation policy operations with expected high impacts (see, e.g., [*Wallin, Laxell,* 2013]). The latter part of the 1990s saw the emergence of a supply-driven, cluster-based innovation policy, followed by a more demand-driven approach since 2005. Outcomes of both supply- and demand-driven approaches are represented in Table 3.

OIPs as tools with the potential to implement strategic goals under the open innovation and 'smart city' frameworks are applied, for example, in the territorial strategies and regional funding decisions of the Regional Council.

Context, Data, and Method of the Study

Our study aims to reflect the OIP approach with smart city development as a part of the aforementioned Six Cities Strategy implemented by the six largest cities in Finland: Helsinki, Espoo, Vantaa, Tampere, Turku, and Oulu, with support from the ERDF. It is a strategy for *sustainable urban development* and it aims *to increase the amount of service innovations and to promote competitive business and employment*. The strategy aims to strengthen Finland's competitiveness by using the country's *six largest cities as innovation development and experimentation environments in the spirit of open innovation*. The strategy is based upon open 'operating models that let the entire city community participate in development work'. The functional city community is seen as an entity, consisting of citizens, companies, research and development operators, and the authorities. The open operating model is based upon the creation and testing of innovations while also increasing productivity, including the development of innovative procurement practices [Six Cities Strategy Office, 2016].

OIPs are seen as environments that enable the development of new products, services, business, and markets throughout their lifespan, from idea to testing and from testing to ready-made products. OIPs engage the whole city community in the development processes. The approach is user-driven and encourages short and agile experiments in innovation activities. It may also support cities in their efforts to develop their innovative procurement practices in stakeholder engagement to provide better services and enable business development around the new services [Six Cities Strategy Office, 2016].

We utilize the participatory action research (PAR) approach to answer this question, because it aims to provide knowledge and solutions to practical problems that hinder the achievement of given goals or everyday practices. Researchers are part of the process and aim to foster reflectivity, learning, and

Table 4. **Summary Data Gathered from January 2015 to December 2017**

Sources	Quantity	People engaged
Interview with OIP representatives (three cases)	14 interviews	14
Workshops and seminars engaging people from the three OIPs in question and involving them in a wider discussion on OIPs (operational and strategic aspects, both regionally and nationally)	12 workshops and seminars	c/a 400 (20-40 people in each)
Strategic and operational level engagement meetings discussing OIP development (regional and national level), varying events from those involving a few people to festival events	c/a 100 meetings	c/a 500 (altogether these events have gathered approximately 2,000 people)
Discussion forum on OIP development (development of views) from spring 2016 to spring 2017	13 platforms in Tampere, 25 platforms nationally	40 from Tampere region, altogether 80 people
Innovation project (facilitated by an OIP in question)	2	The authors have been involved in two innovation projects (Lintukoto by Mediapolis and Demola case project)

Source: authors.

communication in the target community and among the stakeholders to solve the problems and to foster development [*Susman et al.,* 1983; *Ladkin,* 2004]. PAR can also be a way of involving more people and new groups in the research in order to reach the set objectives [*DeLyser, Sui,* 2013].

The professional background and personal involvement in a series of projects listed below enabled the authors of this paper to gather the initial data:

- Developing management and analysis tools for the OIPs in the Six City Strategy project (Mika Raunio & Nadja Nordling),
- Long experience in regional development and research in the Tampere region (Mika Kautonen),
- Membership on the regional council as an innovation and future manager, and involvement in incubating some of the regional OIPs (Petri Räsänen).[3]

The data has been collected as part of frequent practical joint activities with the OIP representatives, including workshops, seminars, and a facilitated discussion forum. Policy makers, developers, and other stakeholders have been engaged in various activities. These have either been recorded (and transcribed) or notes have been taken. In addition, documentary data analysis, consisting of reports, evaluations, strategy documents, project plans, and research diaries have been consulted. The data has been analyzed using an inductive data analysis method (Table 4).

The specific context for the study is the three-year spearhead projects: (1) the *OIPs*, in which OIPs are used to create and test new services and products in real-world conditions; (2) the *open data*; and (3) the *open participation and services*. These projects provide the models for cooperation in order to enable the city to work as a community. Additional pilot projects further support, test, and develop the spearhead projects.

Our three cases were explored in order to better understand what the OIP approach means in practice, here in the context of the KT and HEIs. Three specific examples of OIP development in Tampere focus on the practices and explain how HEIs and other key actors have worked to realize these ambitions and how they orchestrate the relevant platforms differently.

Cases: the Knowledge Triangle and Orchestrating Interaction through OIPs

Both the city of Tampere and the Tampere region (Regional Council) have fostered the innovation platform-based policy since 2008. The first application of the innovation platform approach was the New Factory and its four 'engine rooms' in 2008. The following substantial investments were Mediapolis (est. 2013) and the Campus Arena (est. 2015), which both included physical environments as a key element, while 'the original platform laboratory of New Factory' focused more upon the provision of services. For example, in the implementation plan of the wider city strategy, it is also aligned with other key policy strategies (i.e., 'to make Tampere the best place in Finland to do business'). The policy

[3] The project team members, in addition to the authors, were as follows: senior advisor Jukka P. Saarinen (TaSTI, UTA), project manager Taina Ketola, regional analyst Anniina Heinikangas, and regional analyst Henrika Ruokonen (Council of Tampere Region).

measure is defined as the 'developing and scaling of innovation platforms and environments to new lines of business in order to create new business, growth companies, and jobs' [City of Tampere, 2013].

However, the 'innovation platform', as a policy measure, is still evolving. For example, the sub-regional development agency, Business Tampere, introduces various OIPs on its website (including all three cases discussed here) where the common denominator is the opportunity for companies to somehow join innovation and development projects on these platforms. More precisely, the various forms of collaboration (e.g., living labs and demo-projects) that foster open innovation processes and well-organized facilitation that enables the provision of numerous innovation projects, are the defining qualities of such platforms [*Lehenkari et al.,* 2015]. However, our interest in this paper is to understand the orchestration of OIPs in the KT context. The orchestrator in this chapter refers to the actor(s) who provide value by organizing relationships and interactions on platforms for the members of the ecosystem and beyond. It should be noted that a multilateral platform model applies to both physical (tangible) and digitalized (intangible) platforms that aim to facilitate open innovation practices. By digitalizing and scaling services, it might be possible to run them more efficiently (e.g., without project funding from EU). Due to specific service processes, they may possibly create a consistent and comprehensive set of innovation services.

The cases provide examples of HEIs orchestrating both physical and digitalized platforms. Three cases accommodate the diversity of types of HEIs as well as the different partnering of key orchestrators of the platforms:

- The platform management company, New Factory International ltd. (NFI), orchestrates student-company innovation projects in partnerships with 58 universities in 13 countries (i.e., the Demola Network). NFI provides innovation services globally with the support of digitalized platform tools, including all three HEIs in the Tampere region.
- Finnish University Property Ltd. (SYK) works in partnership with Finnish universities (i.e., 16 locations in Finland) and, in our case of the Campus Arena, in close operation with TUT, orchestrating university and industry interactions by gathering and curating various innovation services and practices as well as companies to the new building on campus.
- The Finnish Broadcasting Company (YLE) is a 'keystone company' located on the premises owned by Technopolis Ltd. (i.e., a company that rents out the premises for businesses in four locations in Finland and more in five other countries) with the TAMK.

Three simplified models represent the close partnership of HEIs with companies that focus on providing tangible (e.g., physical premises) or intangible assets (e.g., services, software or processes) that aim to foster KT activities to varying extents.

Demola: Digitalized Global OIP for the Local Innovation Ecosystem

The Demola network is a 'lean corporate innovation engine' and a 'global co-creation platform to connect universities and business', according to its website[4]. The Demola network is facilitated by NFI, a platform management company that has more than 650 customers. The concept of the Demola network was established and developed in Tampere by the local development agency as a part of the New Factory Innovation Center in 2008. In 2011, the NFI was established by the key persons of Demola to run and develop the growing international network of Demola sites. In 2018, Demola in Tampere was acquired by the NFI and the whole network was placed under the private 'platform management company'. To a large extent, the spread of the service may be seen as a result of employing the business model of a multilateral platform with a well-defined concept and a supportive internet interface and software. The service brings together university students and companies as an 'on-line-to-off-line type of a service that uses a digital platform to link the users, but an actual service process takes place in a physical space and provides benefits for both sides of the platform [*Brynjolfsson, McAfee*, 2017].

At first, Demola was part of NFI, which represented a new type of 'innovation platform laboratory', an innovation center in Tampere. It consisted of four 'engine rooms': (1) Demola (to generate prototypes and demonstrations from ideas typically coming from private firms, developed in projects by multidisciplinary student teams); (2) Protomo (a similar service for self-employed persons and experts often in the process of a career transition); (3) Suuntaamo (an open test laboratory for new products and processes); and (4) Accelerators (a service for start-ups). The aim was to be 'customer focused, down-to-earth, agile, cost-efficient and effective' and, then, clearly to foster the development of new

[4] Available at: https://www.demola.net/, accessed 09.05.2018.

types of practical innovative services compared to traditional cluster-based R&D projects [*Raunio et al.,* 2013].

Up to present, a typical collaboration scenario in Demola includes a multidisciplinary team gathering (the cross-fertilization of knowledge) students from the universities and polytechnic institutes, and a project contract signed by the stakeholders (the firm and the team), including issues related to intellectual property rights (IPRs) and the timetable. The demonstration of the concept or prototype is carried out by the student team, followed by a project evaluation and the finalization of license agreements.

The benefits of Demola are not limited to a single firm, since the student team also has the opportunity to utilize the intangible assets created by setting up a start-up company in the case that the firm does not acquire a license for the IPRs. Students may also be recognized for their talent, leading to employment. All the IPRs generated during the project belong to the student team. At the end of the project, the partner firm can acquire a license for the results and reward the students for their work, in accordance with the performance criteria agreed upon earlier. The method is effective due to the well-defined IPR framework (which avoids the contractual costs of collaboration), the focus on the concepts pre-selected by the firms, and the diverse set of skills and ideas of the students working on it.

Importantly, in case of Tampere, the projects are conducted by students from the three different HEIs, with wide disciplinary backgrounds. Student are also provided by academic credit by the participating HEIs, with varying practices.

However, in terms of orchestration, the most distinct quality is that this structure makes the service scalable, and the digitalized customer interface and management process facilitates the management of the open innovation projects on a global scale. NFI employs around ten people (with less than one million euros of turnover), and there is clearly one core service process that it efficiently repeats on the platform in cooperation with HEIs.

Demola facilitates a fairly complex student project, while usually the on-line-to-off-line platforms provide simple and single service practices (e.g., Uber's taxi services). As a (transaction) platform [*Evans, Gawer,* 2016], it connects mainly two groups of users: university students (and researchers as well) and local firms (or other organizations). The global network also provides data to be analyzed in order to develop the organizational innovation management capabilities of the platform company. This may be seen as an investment in the intangible innovation infrastructure. However, it may be claimed that the full value creation potential of the global network has not yet been utilized, from the customer's (companies and HEIs) point of view. It seems that innovation projects are taking place mostly at the local level around each individual Demola location, rather than among the global network. Therefore, global networks and digitalization do not solve the problem of distance in innovation as such, and international innovation projects do not emerge simply due to global network of orchestrators and platform owners. The active role of HEIs themselves as well as other orchestrators are required for further developments. In sum, Demola, as a co-orchestrator of OIPs, may be labelled a '*Global innovation platform service*'.

Campus Arena: Physical and Digital OIPs to Revitalize the Local Innovation Ecosystem

The Campus Arena is a building on the TUT campus, which is owned by SYK. Even though it accommodates some of the basic services for the university (e.g., a library), its profile is strongly built upon a new kind of university and industry collaboration activities. It is marketed as a 'meeting place for science, research, and technology'. Compared to Demola or Mediapolis, the Campus Arena more clearly serves the KT activities of one institution (TUT), as it is located in a central place on the campus and is a new landmark of the TUT (which opened in September 2015). Consequently, over the course of the study at hand, many of its KT-related practices were still evolving.

The premises are owned by the SYK, a fairly new actor in the real-estate business and was established in 2009 to maintain virtually all the premises hosting Finnish HEIs (excluding Aalto University and the University of Helsinki), and it has been actively searching for new and innovative solutions (e.g., a learning campus and co-creation) to increase the value of the premises.

The Campus Arena was developed by the SYK and the TUT by engaging companies, students and university personnel to search for feasible collaboration models as well as spatial solutions. Partly this was due to a need to renew the business cooperation models, as its long-term partner Nokia had closed its major research and development facilities next to the campus of TUT. In the selection of tenant companies, the TUT holds the right to veto in order to ensure that they fit into the research and educational goals of the university. The largest single client of the Campus Arena is also TUT.

The physical office spaces were planned to support collaboration (e.g., co-working spaces, big rooms, etc.) and services were planned to foster opportunities for actors to move 'across the borders in their value creation process'. This may be seen as an attempt to move from networking and interaction towards more 'organized collisions' to support the innovation activities or co-creation between the actors. Specifically, for the Campus Arena, with an emphasis on co-creation and co-working, opportunities were developed in the Campus Club by the SYK, whereby the premises are not rented to the companies, but they may buy a membership in the club for three years. The club offers flexible spaces for long-term, face-to-face collaboration. Compared to many 'cluster-based' projects in which teams may work apart from each other, and the most interactive link between the companies is the project steering group, this model emphasizes more direct interaction among the key individuals and the self-organization of members.

Campus Arena hosts companies offering innovation-supporting services; the building itself includes sensors that enable its use for various analyses, and TUT may organize workshops (e.g., those with students and companies) or use laboratories on the campus. It is worth noting that specialized entities provide various services and support activities for companies in order to organize innovation activities with the university or with other companies. For example, DIMECC (Digital, Internet, Materials & Engineering Co-Creation) which is owned by several HEIs, knowledge intensive companies, and other stakeholders labels itself as a 'leading breakthrough-oriented co-creation ecosystem that speeds up time to market' whose innovation platform offers both digital and process services. These include digitalized innovation services like the 'Demobuuster' service that is for sale for the companies who seeks 'to speed up the commercialization of their software demos'. Such a process is not very different from the Demola process as such, but it should be noted that practical implementation rather than conceptual definition explains the success or failures of these services. Another example is SMACC (Smart Machines and Manufacturing Competence Centre), owned by the University of Technology and Technical Research Centre of Finland (VTT), offering a one-desk service to manufacturing companies for research and innovation services. In sum, DIMECC and SMACC are entities owned by the business and research communities that aim to foster innovativeness in their respective fields, to benefit the community and ecosystem at large.

Thus, the Campus Arena offers a physical platform for various independent service providers and their real-life innovation services to foster the interactions between the university and industry. Tenants (i.e. businesses) of the arena are aligned with the objectives of research and education at TUT. The model resembles an 'innovation service shopping mall', where complementary services make it more attractive for the users (e.g., companies, university researchers, students) to deploy operations there. As an OIP orchestration model, Campus Arena is aligned with the strong research orientation and strategy of TUT with many specialized innovation supporting services and may be labelled an '*innovation ecosystem hub*'.

Mediapolis: A Physical OIP for the Local Business Ecosystem

Mediapolis gathers together over 700 employees and 600 students in Tampere at a renovated campus, which was built around the old studio complex of the national television Channel 2 and national broadcasting company (YLE) outside the established university campuses. Mediapolis aims to develop an internationally recognized center of excellence and business in the field of media, especially by fostering collaboration between the ICT and creative industries. The motivation for local stakeholders is their involvement in strengthening the media business in the Tampere region, as it has become increasingly concentrated in the capital city region of Helsinki. In fact, one of the key triggers was the organizational restructuring of YLE and plans to move activities from the Tampere studio complex to the capital city. YLE is the largest content provider in Finland.

The idea of Mediapolis was born in 2011, when YLE was seeking more cooperation with its partners to support the vitality of the creative business in the region. In 2012, the YLE sold the studio complex to Technopolis, of which the core business is the management of the business premises in several locations in six countries. The YLE and the University of Applied Sciences of Tampere (TAMK) made 20-year contracts with Technopolis and the firms moved into the premises in 2013, students of arts and media (TAMK) and media assistant students from the vocational training school (Tredu) became involved in 2014. In 2016, there were more than 30 media, ICT, and expert service companies on the campus. For the students, the campus offers the opportunity to benefit from the audio-visual equipment and studios of both companies and educational institutions, as well as cooperation opportunities with the

[4] Available at: https://www.dimecc.com/, accessed 09.05.2018.

companies (e.g., studio premises, design services, and wardrobes), and the assignments offer students opportunities to network with businesses.

Vocational training, civic engagement, and links to urban development suggest that experience-based learning and innovation play an important role. Mediapolis, with its studio facilities, offers a technological development platform for various innovative projects. For example, companies and educational institutions have co-produced a trans-media storytelling project that cross-fertilizes different media and research fields (including universities, vocational training schools, Microsoft, Apex Games, etc.) with a contract; according to which, each actor maintains their IPR on everything they provided for the project. Clearly various knowledge bases, from symbolic to analytical, were integrated (e.g., virtual reality, acting, theatre, gaming, etc.). Mediapolis is also linked to urban development in the close by neighborhood of Tesoma, solving social problems that have accumulated there.

The ultimate goal for Mediapolis was to not only to increase the flow of innovations from the campus to industry, but also to provide benefits for other platform users. Due to the nature of the business, where the keystone company was buying and orchestrating major productions, the external innovation platform services could focus on new technological solutions, for example, those involving augmented reality, artificial intelligence, or virtual reality. The key actors of Mediapolis agreed that there is a need for a co-creation platform (i.e., one that facilitates cooperation among the small companies and another for the big players), but it should be noted that in the media business, many small companies engage in co-productions, frequently led by a major company in the field. Thus, in other words, a model where 'strategically minded keystone companies shape and coordinate the ecosystem, largely by the dissemination of platforms that form a foundation for ecosystem innovation and operations' [*Iansiti, Levien,* 2004], may be recognized here. YLE is a key buyer and organizer of productions involving several companies, but it has not been eager to set up a platform to further enhance the innovativeness of the ecosystem. Instead, public sector actors have been funding the emergence of these platform type of activities at Mediapolis. For example, a private media-focused accelerator service was bought to offer services and a venture capital fund for the creative industries was established (i.e., an IPR VC fund for creative industries). At Mediapolis, the service development is based upon regional development funds and projects rather than more established innovation services, although the IPR VC fund has a private base.

Mediapolis may be seen as platform with multiple technological environments, YLE as a 'keystone' company (along with couple of other larger companies), smaller companies, and start-ups as members of the ecosystem, as well as a practically oriented HEI that brings these actors within the vicinity of one another and thus to some extent fosters their interactions and innovation activities. Due to the given business- and practice-oriented set up and the lack of a strong commitment from research institutions, Mediapolis may be considered a '*business ecosystem hub*', in terms its role as an OIP.

Discussion and Conclusions: Towards Inclusive Innovation Policy Design

The production of new knowledge within the platform framework occurs on the basis of the integration of its various actors [*Asheim et al.,* 2011] and the interactions between them [*Boschma*, 2005]. The question is how to organize these processes efficiently among the 'ecosystems' that the platforms serve. Digitalized (intangible) and physical (tangible) innovation platforms foster interactions among the actors of the ecosystem. There are, however, differences in how sufficient proximities (e.g., physical, cognitive, social, or institutional) are sought and how innovation processes are organized among the actors on the platforms [*Nooteboom et al.,* 2007].

The societal impact of OIPs is related to spill-overs and the serendipity that they foster. Many of the effects are intangible and relates to learning or ecosystem developments. These are very difficult to measure and visualize, and when the knowledge triangle is expanded to further solve social problems and urban development challenges, an even further revision of the measurements and indicators that are used to orchestrate the OIPs and related KT strategies are required. Thus, OIPs offer potential tools for leveraging the societal impact of KT activities. However, in the orchestration of platforms and regional innovation policies, at least three questions emerge: (1) How does the ownership of the intangible and tangible assets on the platform impact the orchestration and its focus? (2) How can one create network effects by utilizing the platform model? (3) How does one foster inclusive qualities in OIPs, especially when the approach is transferred to urban development and more active citizen engagement? In the following section we aim to answer these three questions tentatively, and to formulate further questions to be discussed in forthcoming studies and in the context of policy design processes.

Firstly, it should be further explored how the roles of the companies partnering with HEIs — as key orchestrators and owners of the platforms — impact the development of innovation processes and services on the platforms. How does one combine the functions of physical and digitalized platforms in an appropriate way to ensure that one maximizes the benefits for the users and ecosystem development? In our examples, two of the partnering orchestrators, Technopolis and SYK, both hold physical premises valued at more than one billion euros and they have annual turnover of between 100 and 150 million euros. Their business revenues are strongly linked to these tangible assets. In the case of NFI, it mostly relies upon intangible assets (e.g., concepts, software, training, etc.) for its clients (with turnover of less than 1 million euros). The Mediapolis platform is built around one key-stone company, and the Campus Arena is mostly built around TUT and is revitalizing its KT interface with local businesses in a way that supports its research and educational goals. NFI serves the HEIs and companies with one specific innovation service concept on a global basis. The following four questions may be considered important: (1) What are the core incentives for co-orchestrators and platform owners who invest tangible or intangible assets in the KT context? (2) Why was the platform created? (3) What are the expected outcomes? (4) How do the platform owners define the returns that they seek from these activities in the first place?

As we know, intangible and tangible investments have several different qualities, including the fact that the value of an intangible asset depends on its successful performance. Further, distinctive features that provide serious competitive advantages are often much more likely to be organizational (intangible) than physical (tangible) and include elements such as management, processes, software, trust, and so on [*Haskel, Westlake,* 2017]. Further, in the case of sufficiently digitalized platforms, the 'perfect, instant, and free' provision of the service makes them more scalable than physical investments. However, on on-line-to-off-line platforms, the physical world creates constraints that may seriously limit the scalability of the on-line services [*Brynjolfsson, McAfee,* 2017]. There are crucial questions that remain in the orchestration of OIPs that combine tangible and intangible platform models to foster KT strategies: (1) Do actors seek returns from intangible or tangible investments? (2) Do they consider private returns or social returns more critical?

Secondly, key competences include the ability to *create network effects*. Incentives and carefully built feedback loops, rewards, and value capture processes, including IPR management practices, are crucial. For example, the lack of funding or career-related incentives at HEIs may hinder the participation of academics, or poorly executed IPR agreements may hinder the participation of companies. Therefore, the benefits and incentives that different actors provide to one another should be carefully considered, not only at the operational level but also at a more strategic level. Furthermore, a global platform management company points out that crossing the geographical distances in knowledge deployment — innovation processes — does not occur simply by linking universities and companies to the same network, but further activities must be implemented to enhance the innovative interactions globally.

For platform management, the revenue logics, facilitation and curation, value creation, and capture among the members of a multilateral platform and the ability to create a network effects are crucial competences [*Gawer,* 2009; *Hagiu,* 2014]. These should be sufficiently developed in order to benefit all the users and owners of the platform in physical and digital environments.

The development of management capabilities, both on a strategic and operational level, also includes a conceptual understanding of the tangible and intangible OIP approaches, tools to measure the outcomes (including intangible spill-overs and investments in learning), recognizable service profiles, and comprehensive and compatible service offerings for the target groups in regionally relevant innovation ecosystems. The HEIs, in partnership with co-orchestrators, have to consider these capabilities and various complementary services and assets to build the appropriate entity to foster societal impacts while benefitting research and education.

Thus, this paper was able to provide only a partial answer to the questions posed earlier: Global platform management services and physical innovation hubs have different characteristics in the orchestration of HEIs' KT strategies. While there is some common ground, the role of intangible and tangible assets and returns should be well recognized when developing the OIP processes. What is the most appropriate combination of orchestrators in each case requires tailor-made solutions, as is usual in the provision of local or regional innovation policy measures.

Finally, in the context of the Six Cities Strategy, further challenges in the provision of network effects are likely to emerge, as even wider civic engagement (e.g., citizens and the unemployed) is sought after. Public procurement and open data, as a new source for innovative business, offer various opportunities to use OIPs, but the questions above should be considered. The value creation with users should not be based only upon volunteers or ostensible rewards for the 'lab rats', but upon the real benefits for

the 'external parties'. It is furthermore important to monitor and ensure that the activities and their outcomes are societally responsible in the long run.

The OIP approach may be seen as an inclusive innovation policy for developed economies, which suggests that the inclusive processes engaging more people in innovation activities may also offer more benefits to a wider group of people. This may take place through their roles as innovators or as the users of the end-products, services, or both. Thus, the policy design is parallel to those that are suggested for many developing countries [OECD, 2014, 2015], promoting the idea that not only innovations as such are important, but also the inclusive processes and well-designed value capturing protocols.

The assumption is that people, for example, receive returns from the use of their knowledge and may create networks or learn how to engage with and benefit from the surrounding innovation ecosystem. Benefits are acquired, not only from the innovative outcomes but also from participating in the process (e.g., when solving the societal grand challenges).

Therefore, OIPs should be framed in the wider policy characterized by the inclusive innovation approach. This is not only a question of justice but also most likely a crucial part of the sustainable economic structure of societies, according to recent studies [*Mazzucato,* 2016; *Piketty,* 2014]. Therefore, developing new modes of deploying the knowledge of society — including HEIs — and the responsible qualities in both processes and outcomes should be secured in terms of equity and sustainable economic growth.

The inclusive approach is parallel to the user-driven or open innovation approaches, but it has a different point of departure. In open and user-driven approaches, as well as in creativity discussions more generally, the innovation process is believed to benefit from the wider engagement of users, various stakeholders, or professionals as providers of useful knowledge and insights into the process.

The platform approach, with users providing value to each other, the facilitation of network effects, and the combinations of digital solutions and physical innovation hubs should be considered carefully as a significant part of the solution to contemporary challenges in both KT policies and regional knowledge-based development policies. This all suggests that novel management and policy design capabilities are required to orchestrate increasingly intangible assets and complex processes.

References

Asheim B., Boschma R., Cooke P. (2011) Constructing regional advantage: Platform policies based on related variety and differentiated knowledge bases. *Regional Studies*, vol. 45, no 6, pp. 1–22.

Boschma R. (2005) Proximity and Innovation: A Critical Assessment. *Regional Studies*, vol. 39, no 1, pp. 61–74.

Boudreau K., Hagiu A. (2009) Platform Rules: Multi-Sided Platforms as Regulators. *Platforms, Markets and Innovation* (ed. A. Gawer), London: Edward Elgar, pp. 163–191.

Brynjolfsson E., McAfee A. (2017) *Machine, Platform, Crowd: Harnessing Our Digital Future*, New York: W.W. Norton and Company.

Castells M. (1996). *The Rise of the Network Society: The Information Age: Economy, Society, and Culture*, vol. I, Oxford: Blackwell Publishers.

Chesbrough H. (2003) *Open Innovation: The New Imperative for Creating and Profiting from Technology, Boston, MA: HBS Press*.

Choudary S.P. (2013) *Platform power. Secrets of billion-dollar internet startups*. Available at: http://platfromed.info, accessed 15.02.2016.

City of Tampere (2013) *Tampere, Working Together for a Bright Future. Tampere City Strategy 2025*, Tampere: City of Tampere. Available at: https://www.tampere.fi/tiedostot/k/P1IFwM6AI/Tampere_City_Strategy.pdf, accessed 16.11.2017.

Cooke P., de Laurentis C. (2010a) The matrix: Evolving policies for platform knowledge flows. *Platforms of Innovation: Dynamics of New Industrial Knowledge Flows* (eds. P. Cooke, C. de Laurentis, S. MacNeill, C. Collinge), London: Edward Elgar Publishing, pp. 311–360.

Cooke P., de Laurentis C. (2010b) Platforms of innovation: Some examples. *Platforms of Innovation: Dynamics of New Industrial Knowledge Flows* (eds. P. Cooke, C. de Laurentis, S. MacNeill, C. Collinge), London: Edward Elgar Publishing, pp. 271–310.

DeLyser D., Sui D. (2013) Crossing the qualitative–quantitative divide II: Inventive approaches to big data,mobile methods, and rhythmanalysis. *Progress in Human Geography*, vol. 37, pp. 293–305.

Etzkowitz H. (1993) Enterprises from Science: The Origins of Science-based Regional Economic Development. *Minerva,* vol. 31, no 3, pp. 326–360.

Evans P.C., Gawer A. (2016) *The Rise of the Platform Enterprise. A Global Survey* (The Emerging Platform Economy Series Report no 1), New York: The Center of Global Enterpise.

Finnish Government (2009) *Evaluation of Finnish National Innovation System (Full report)*, Helsinki: Ministry of Education, Ministry of Employment and the Economy. Available at: https://www.etla.fi/wp-content/uploads/InnoEvalFi_FULL_Report_28-Oct-2009.pdf, accessed 18.04.2017.

Gawer A. (2009) (ed.) *Platforms, Markets and Innovation*, New York: Edward Elgar.

Gawer A., Cusumano M. (2002) *Platform Leadership: How Intel, Microsoft and Cisco Drive Industry Innovation*, Boston, MA: Harvard Business School Press.

Gawer A., Cusumano M. (2008) How companies become platform leaders. *MIT Sloan Management Review*, vol. 49, no 2, pp. 28–35.

Hagiu A. (2014) Strategic decisions for multisided platforms. *MIT Sloan Management Review*, vol. 55, no 2, pp. 71–80.
Hallerstede S.H. (2013) *Managing the Lifecycle of Open Innovation Platforms*, Wiesbaden: Springer Gabler. DOI 10.1007/978-3-658-02508-3.
Harmaakorpi V., Tura T., Melkas H. (2011) Regional innovation platforms. *Handbook of Regional Innovation and Growth* (eds. P. Cooke, B. Asheim, R. Boschma, R. Martin, D. Schwartz, F. Todtling), Cheltenham: Edward Elgar, pp. 556–572.
Haskel J., Westlake S. (2017) *Capitalism without Capital. The Rise of the Intangible Economy*, Princeton, NJ: Princeton University Press.
Howells J. (2006) Intermediation and the role of intermediaries in innovation. *Research Policy*, vol. 35, pp. 715–728.
Huhtamaki J., Rubens N. (2016) Exploring Innovation Ecosystems as Networks: Four European Cases. *Proceedings of the 49th Hawaii International Conference on System Sciences (HICSS),* Koloa, HI, USA, 2016, pp. 4505–4514. DOI:10.1109/HICSS.2016.560.
Hyytinen K., Kivisaari S., Lehtoranta O., Toivanen M., Loikkanen T., Lyytinen T., Oksanen J., Rilla N., van der Have R. (2012) *Funder*, *Activator*, *Networker, Investor... Exploring Roles of Tekes in Fuelling Finnish Innovation* (*Tekes* Review no 289/2012). Helsinki: Tekes.
Iansiti M., Levien R. (2004) *The Keystone Advantage: What the New Dynamics of Business Ecosystems Mean for Strategy, Innovation, and Sustainability*, Boston, MA: Harvard University Press.
Katzy B., Turgut E., Holzmann T., Sailer K. (2013) Innovation intermediaries: A process view on open innovation coordination. *Technology Analysis & Strategic Management*, vol. 25, no 3, pp. 295–309. Available at: http://dx.doi.org/10.1080/09537325.2013.764982, accessed 17.03.2018.
Kautonen M., Pugh R., Raunio M. (2016) Transformation of regional innovation policies: From "traditional" to "next generation" models of incubation. *European Planning Studies*, vol. 25, no 4, pp. 620–637. DOI: 10.1080/09654313.2017.1281228.
Kavonius V. (2013) *Innovation Policies in Finland,* Helsinki: Ministry of Employment and the Economy. Available at: https://www.bothnianarc.net/-en/wp-content/uploads/2013/02/Innovation-Policies-in-Finland-Vexi-Oulu-19.2.2013.pdf, accessed 13.04.2018.
Ladkin D. (2004) Action research. *Qualitative Research Practice* (eds. C. Searle, F.G. Gobo, J.F. Gubrium, D. Silverman), London: SAGE, pp. 536–548.
Lehenkari J., Pelkonen A., Oksanen J. (2015) *Innovaatioalustat 2015* [Innovation platforms 2015] (Policy brief. MEE reports 45/2015), Helsinki: Ministry of Employment and the Economy (in Finnish).
Leminen S. (2015) *LivingLabs as Open Innovation Networks: Networks, Roles and Innovation Outcomes* (PhD Thesis), Aalto: Aalto University. Available at: https://aaltodoc.aalto.fi/bitstream/handle/123456789/17899/isbn9789526063751.pdf?sequence=1&isAllowed=y, accessed 23.02.2017.
Markkula M. (2013) The knowledge triangle renewing the university culture. *The Knowledge Triangle: Re-inventing the Future* (eds. P. Lappalainen, M. Markkula), Helsinki: SEFI, Aalto University, Valencia University, pp. 11–32.
Mazzucato M. (2016) From Market Fixing to Market Creating: A New Framework for Innovation Policy. *Industry and Innovation*, vol. 23, no 2, pp. 140–156.
Moore J. (1993) Predators and Prey: A New Ecology of Competition. Harward Business Review (May–June issue), pp. 75–86. Available at: http://blogs.harvard.edu/jim/files/2010/04/Predators-and-Prey.pdf, accessed 17.02.2018.
Nooteboom B., van Haverbeke W.P.M., Duijsters G.M., Gilsing V.A., van der Oord A. (2007) Optimal cognitive distance and absorptive capacity. *Research Policy*, vol. 36, pp. 1016–1034.
OECD (2014) *All on board. Making inclusive growth happen*, Paris: OECD.
OECD (2015) *Innovation policies for inclusive growth*, Paris: OECD.
Pelkonen A., Nieminen M. (2015) *Korkeakoulujen ja tutkimuslaitosten yhteistyö ja yhteistyön esteet* [Collaboration and co-operation between higher education and research institutions]. Helsinki: Ministry of Education and Culture (in Finnish).
Piketty T. (2014) *Capital in the Twenty-First Century*, Cambridge, MA: Harvard University Press.
Raunio M., Saarinen J., Kautonen M. (2013) *Models for International Innovation Policy: Transnational Channels and Regional Platforms: Fostering Globalizing Innovation Communities in Finland and Abroad* (TaSTI Working Paper no 9), Tampere: University of Tampere.
Research.Fi (n.d.) *Research Information Hub*. Available at: https://research.fi/, accessed 19.04.2018.
Ries E. (2011) *The Lean Startup. How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses*, New York: Crown Business.
Sawhney M.S. (1998) Leveraged high-variety strategies: From portfolio thinking to platform thinking. *Journal of the Academy of Marketing Science*, vol. 26, no 1, pp. 54–61.
Six Cities Strategy Office (2016) *Six Finnish cities join forces to become better and smarter*. Available at: http://6aika.fi/in-english, accessed 22.01.2018.
Statistics Finland (2016) *Science, Technology and Information Society*. Available at: www.stat.fi, accessed 19.01.2018.
Sundararajan A. (2016) *The Sharing Economy: The End of Employment and the Rise of Crowd-Based Capitalism*, Cambridge, MA: MIT Press.
Susman G.I. (1983) Action Research: A Sociotechnical Systems Perspective. *Beyond Method: Strategies for Social Research* (ed. G. Morgan), London: Sage Publications, pp. 95–113.
Tekes (2013) *INKA – Innovative Cities. New Policy Programme for Promoting World-class Innovation Hubs (2014–2020)*, Helsinki: Tekes. Available at: https://tapahtumat.tekes.fi/uploads/8bf12378/INKA-6506.pdf, accessed 13.04.2018.
Thiel P. (2014) *Zero to One. Notes on Startups, or How to Build the Future*, New York: Crown Business. Available at: http://gsl.mit.edu/media/programs/south-africa-summer-2015/materials/0to1.pdf, accessed 26.08.2017.
Thomas L., Autio E., Gann D.M. (2014) Architectural leverage: Putting platforms in context. *Academy of Management Perspective*, vol. 28, no 2, pp. 198–219.
Turunen I. (2010) *Open (Information and Open) Innovation Strategies in Finland — Paving the Way for Open Science*. Paper presented at the FinnOA symposium «Open access to research results», 3rd May 2010. Available at: http://www.finnoa.fi/wp-content/uploads/2010/05/turunen.pdf, accessed 13.04.2018.
Vipunen.Fi (n.d.) *Education Statistics Finland*. Available at: https://vipunen.fi/en-gb/, accessed 19.01.2018.
von Hippel E.A. (2005) *Democratizing Innovation*, Cambridge, MA: MIT Press.
Wallin J., Laxell P. (2013) *Alueet globaaleissa ekosysteemeissä. Osaamiskeskusohjelman loppuarviointi. Työ- ja elinkeinoministeriön julkaisuja, Innovaatio* [Regions in Global Ecosystems - Final Evaluation of the Center for Expertise Program. Publications of the Ministry of Employment and the Economy, Innovation], Helsinki: Ministry of Employment and Economy. Available at: https://tem.fi/documents/1410877/2864661/Alueet+globaaleissa+ekosysteemeiss%C3%A4+04062013.pdf, accessed 17.04.2018 (in Finnish).

The Psychological Aspects of Corporate Foresight

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Abstract

The article considers the psychological mechanisms of collective foresight activities. Corporate foresight is considered a collective relection, an open strategic dialogue about group objectives and joint actions that helps group members construct a collective image of the future and adapt to future challenges. The results of expert panel revealed several organizational and psychological barriers that hinder corporate foresight effectiveness in Russia: distrust toward long-term forecasting, the avoidance of responsibility for one's own future, a poor focus on the future, and low levels of social cooperation. Special attention is paid to overcoming the cognitive biases and socio-psychological effects during foresight sessions that hinder group reflection, including: the effects of overconfidence, the desirability effect, framing, future anxiety, neglect of the scope of risk, future stereotyping, uncertainty of outcome, availability heuristic, the generalization of fictional evidence, the visualization effect, hindsight bias, future discounting, cognitive dissonance, regression to the mean, planning fallacy, explanation effect, common knowledge and polarization effects, technophile's bias, and self-fulfilling prophecies. Directions of future psychological research in the field of foresight studies are proposed.

Keywords: corporate foresight; collective image of the future; social forecasting; time perspective; leadership vision; group identity; group reflexivity; cognitive biases; social psychology of foresight.

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The increasingly high rate of change and complex, ambiguous global economic prospects prompt Russian company managers to systematically analyze weak signals of emerging change [PWC, 2014]. In the innovation and strategic management domain, Foresight tools are now commonly used for these purposes. Essentially this methodology involves regularly collecting data about change, stakeholders taking a position about the most likely future, forging a desirable vision of the future, and making decisions regarding steps to be jointly taken in the present. In a broader sense, corporate Foresight can be seen as a system of procedures, organizational processes, structures, values, and norms supporting the company's (or the professional community's) ability to foresee and anticipate change as well as adapt its behavior and activities in line with the trend analysis and future development scenarios [*Sokolov,* 2007; *Gracht et al.,* 2010; *Rohrbeck,* 2011; *Portaleoni et al.,* 2013; *Meissner et al.,* 2013; *Vishnevskiy, Karasev,* 2016]. The application of Foresight techniques by Russian companies encounters opposition due not only to economic, political, and cultural preconditions, but also due to psychological reasons.

Cognitive mechanisms of corporate and industry-level Foresight studies in the technology and innovation sphere command the growing interest of researchers [*MacKay, McKiernan,* 2004; *Meissner, Wulf,* 2012; *Boe-Lillegravena, Monterdeb,* 2015; *Warnke, Schirrmeister,* 2016]. However, no systemic reviews of cognitive and socio-psychological factors affecting Foresight studies' productivity have yet been conducted, those that take into account the various effects emerging over the course of experts' joint work in developing possible future scenarios. This paper fills this gap on the basis of Russian and international socio-psychological studies.

Organizational and Socio-Psychological Factors Affecting Foresight Studies at Russian Companies

Corporate Foresight studies are expected to help companies meet the challenges hindering their abilities to foresee the future [*Rohrbeck,* 2011]. Firstly, these challenges include the accelerated rate of change: shorter product life cycles, the speedier creation and dissemination of innovations increase uncertainty and make long-term planning more difficult. In industries where the rate of change is particularly high (such as the production of computers and semiconductors, the movie industry, etc.) strategic flexibility, i.e., sensitivity to change, and management teams' ability to think in a variable, scenario-based way become key success factors [*Nadkarni, Narayanani,* 2007]. Secondly, companies' lack of response to evidence of change hinders the ability to perceive future trends because in most cases their planning cycle matches the financial year and is not designed to take long-term trends into account. Top managers are unable to cope with the flow of information and therefore cannot set priorities while signals of change frequently simply do not reach the executive floors because they are filtered out by mid-level managers who try to protect the interests of their units and departments [*Ilmola, Kuusi,* 2006]. A good example of such lack of sensitivity is provided by Kodak, whose engineers developed the digital photography technology as early as 1975. However, in the 1980s the top management ignored the "weak signals" of the forthcoming market revolution and failed to persuade heads of independent divisions to change their priorities [*Lucas, Goh,* 2009; *Barabba,* 2011]. Finally, due to the inertial nature of their development, companies fail to react in time even to the changes they do notice; a possible explanation is the complex multilevel (divisional or product) organizational structures that comprise wide networks of subcontractors and strategic partners and an unwillingness to abandon the customary technologies and product lines that remain profitable in favor of investing in new products and services.

Typical barriers hindering corporate Foresight studies include the inadequate perception of long-term forecasts' practical value by the management; complex hierarchies that slow down decision-making; performance assessment and motivation systems focused on short-term objectives; and a high turnover rate on management teams. At small companies, the relevant problems mostly involve a lack of resources, managers' excessive concentration on current activities, and a lack of incentives for the staff to try and foresee the future [*Vishnevskiy et al.,* 2015].

Group reflection is the key corporate Foresight mechanism, i.e., team members' open discussions about their common goals and ways to accomplish them by changing internal and external environments [*West,* 1996; *Zhuravlev, Nestik,* 2012]. Without using the term, numerous researchers call "reflection" a basic Foresight mechanism. One of group reflection's strengths is its potential to support "strategic dialogue" as a precondition of productive scenario planning [*Schwartz,* 1996; *van der Heijden,* 2005; *Mack,* 2013]. Another major principle of the Foresight methodology is discussing competing visions of the future [*Berkhout,* 2006; *Durand,* 2009], comparing alternative interpretations of the present [*Ogilvy,* 2002], and forging a common basic vision of tomorrow [*Blackman, Henderson,* 2004].

Shell's long experience in scenario planning indicates that the main objective of this technique is not supporting management decision-making but maintaining a strategic dialogue between company

executives about the future [*Wilkinson, Kupers,* 2013]. One of the paradoxes of conventional forecasting (i.e., the extrapolation of observed trends into the future) is that the accuracy of short-term forecasts does not depend at all upon an understanding of the reasons behind forthcoming events. Authors of present-day futures studies increasingly often urge one to promote group dialogues, various forms of reflection, and the contemplation of current processes and emerging trends [*Nelson,* 2010; *Treyer,* 2011; *Mack,* 2013].

Our previous empirical studies of Russian companies and their managers' behavior allowed us to identify three main socio-psychological mechanisms which affect management teams' attitudes towards the future: 1) group reflection of a common future; 2) group identification, based upon a positive vision of the common future forged by the management (leaders' vision); and 3) collective anxiety and protective mechanisms launched by a perceived threat to the group's continued existence [*Nestik,* 2013; *Nestik,* 2014b].

If group reflection increases the management team's ability to adapt to changing conditions (strategic flexibility), group identification based on a positive vision of the future performs a quite different function: it increases loyalty to common goals despite changing conditions for joint activities. The vision of the future forged by the leaders motivates the team and brings it closer together, while at the same time "blinding" individual team members and strengthening peer pressure and risk proneness effects. On the contrary, group reflection promotes greater openness to information which contradicts basic group convictions.

Despite their different directions, these processes are closely linked to each other: group reflection of the long-term future can only be possible if a positive group identity and trust are in place. Looking ahead, company managers face a paradox: the delusions of being able to control the future and excessive optimism negatively affect the quality of strategic decisions, however, they are necessary to support the management team's focus on long-term goals [*Rosenzweig,* 2014]. The corporate Foresight methodology is expected to deal with this psychological controversy through a strategic dialogue about the future based upon reliable information.

More than 30 various quantitative and qualitative data collection, analysis, and interpretation techniques are available for corporate Foresight studies [*Popper,* 2008], which can be divided into several groups: 1) techniques based upon making use of participants' knowledge and experience (such as Delphi, roadmaps, critical technologies); 2) methods mobilizing participants' creativity (wild cards, science fiction, game modelling); 3) methods oriented towards obtaining evidence (bibliometric and patent analysis, mathematical modelling, benchmarking, etc.); 4) techniques based upon participants' interactions (such as brainstorming sessions, conferences, scenario building workshops, stakeholder analysis, etc.).

The summarized data about 1,794 Foresight sessions reveals that four methods seem to be particularly popular: expert panels, literature reviews, trend analysis, and scenario analysis. Meanwhile in Asia and Latin America, anonymous surveys appear to be the preferred choice (i.e., Delphi), while the US and Europe typically favor Foresight sessions, i.e., face-to-face forums for expert group discussions [European Commission, 2009]. In Russia, Foresight sessions became a common practice at development institutes and medium-sized high-tech companies.

Experts and Foresight studies' organizers taking part in group discussions face numerous organizational and psychological barriers. The expert poll we conducted in 2014, covering the organizers and moderators of corporate Foresight sessions from the Strategic Initiatives Agency (SIA), the Moscow School of Management Skolkovo, and experts from the HSE Foresight Centre allowed us to identify

Table 1. **Barriers Affecting the Practical Application of Foresight Studies' Results (average scores on a 5-point scale, N=42)**

Barriers	Effect
1. Lack of long-term future analysis and planning culture in Russia	4.4
2. Decision makers' poor interest in Foresight studies' results due to the remoteness of the projected future	4.3
3. Poor awareness of Foresight studies' potential among the general public	3.9
4. Customers' inclination to use Foresight studies to justify previously made decisions	3.8
5. Decision-making at organizations commissioning Foresight studies lags behind the dynamics of the innovative processes	3.8
6. Inefficient horizontal communications between project participants	3.6
7. No plans for the application of Foresight studies' results are typically made before the study commences	3.6
8. Insufficiently regular meetings between the project group and external stakeholders	3.5

Source: composed by the author based upon expert polling.

Table 2. **The Distribution of the Experts' Answers to the Open Question "In your opinion, what are the main barriers hindering projects aimed at foresight in Russia?" (N=42)**

Answer options	The option's share in the total number of answers (%)	Number of experts who selected this option*
Low awareness of Foresight techniques among managers: the lack of a culture for conducting such studies in Russia; a lack of trust in the methodology; an inadequate understanding of its application and functionality; the lack of relevant habits; wider society does not believe the challenges the country is going to face in the future can be met with the help of Foresight methods; insufficient knowledge about the methodology; an insufficient understanding of its nature and potential as a tool for increasing the productivity of the economy.	14	27
Insufficient focus on the future: a focus on dealing with current issues using conventional tools; a focus on short-term results; a short planning horizon; one does not believe it is even possible to make accurate forecasts; customers' fear of the future; top managers' reduced strategic planning horizon and range of vision; an inadequate culture for assessing the future of the country, the business, and one's own, alike.	11	22
Immature Foresight studies market: the application of administrative resources to promote one's particular (own) methods and approaches among the more important players; the lack of a competitive market for Foresight studies; inadequately adapted, undeveloped Russian methods and techniques; the insufficient application of scenario analysis; the lack of necessary skills and competences; the lack of professional teams; the lack of a commonly accepted methodology.	10	19
Weak connections between society and the state: undeveloped feedback mechanisms; deep corruption; a lack of interest from officials; the state's unwillingness to fully implement roadmaps;	9	16
The lack of competent clients; no competent demand: low demand; exceedingly high importance assigned to finances; the economic backwardness of regions; insufficiently developed professional communities; etc.	9	16
Managers' unwillingness to take responsibility for the future: passing responsibility for the future onto external authorities; people who make forecasts should be responsible for their coming true; it is easier and safer to live in chaos and uncertainty; the unwillingness to actually plan; customers lacking political and managerial will to implement Foresight studies' results.	9	16
The low level of social trust and lack of a cooperation culture: diminishing social trust; a focus on competition, not cooperation; generally low level of trust in the country; a lack of a communication culture among stakeholders; inter-agency barriers; "manual control" habits.	7	14
Using Foresight studies as a manipulation tool: the mismatch between the true and formally declared objectives; declarations not matching actual actions; a gap between customers' real and declared goals; etc.	7	14
The short-term orientation of the public administration system: legal limitations on long-term planning; less-than-perfect budgetary mechanisms; one- to three-year planning horizon; inter-budgetary imbalances; certain specific features of public authorities' operations; short horizons of decision-making systems at all levels.	7	14
Fatalism and learned helplessness: the lack of trust in change; people have learned to expect to fail in their undertakings; low ambition of individuals and companies alike	4	8
Lack of connections between Foresight studies' results and the subsequent action plans: the inability of Foresight studies' organizers to explain the meaning of and ways to apply the results; the uncertain prospects for subsequent projects; a "cosmos" of creative results.	4	8
The low level of experts: inadequate competences of experts; the snobbishness of participants; the devaluation of the methodology in the eyes of experts.	4	8
Constantly changing "rules of the game" in the country's political and economic domains: inadequate political mechanisms, unstable "rules of the game"; politics; high levels of economic uncertainty.	3	5
Other factors	2	2

* The experts were allowed to choose several options.

Source: composed by the author based on expert polling.

the following particularly important socio-psychological barriers hindering the practical application of Foresight studies' results: a biased attitude towards long-term planning and forecasting and management teams' unwillingness to assume responsibility for the strategic future (Table 1) [*Nestik,* 2016a].

Answering an open question about the problems encountered while trying to foresee the future in Russia, along with the above barriers, the experts also noted managers' insufficient focus on the future and the public administration system being primarily interested in accomplishing short-term objectives (22 and 14% of the experts, respectively); an insufficiently transparent market for Foresight studies (19%); weak connections between the public authorities and society (16%); the low level of social trust and the lack of a cooperation culture (14%), etc. The above barriers predominantly have institutional and psychological characteristics (Table 2).

Table 3. **Common Mistakes Associated with Group Attempts to Foresee the Future in the Scope of Corporate Foresight Studies (average scores on a 5-point scale, N=42)**

Type of mistake	Score
Events in the distant future were perceived by participants as less important than the current or forthcoming events.	4.0
Experts tend to describe the future on the basis of information that caught their attention in the media and on social networks;	4.0
Experts tend to underestimate the probability of events with which they have no personal experience (or similar ones);	3.9
The amount of time required to implement the planned action is usually underestimated.	3.8
Conclusions about future phenomena and people tend to be unreasonably generalized and assessed in line with present-day stereotypes (age-, gender-, ethnic-related, etc.).	3.6
Experts tend to disregard the facts and information sources that do not match the position they have taken from the start.	3.4
Over the course of group discussions, initial suppositions about the future tend to turn into absolutes that cannot possibly be doubted.	3.2
Experts tend to place negative events far into the distant future.	3.1

Source: composed by the author based on expert polling.

The more common mistakes associated with group attempts to foresee the future have turned out to be of a psychological nature because: 1) events in the distant future were perceived by participants as less important than the current or forthcoming ones; 2) participants described the future on the basis of information that has caught their attention in the media and on social networks; and 3) experts tend to underestimate the probability of events with which they have no personal experience (or similar ones) (Table 3).

How can the aforementioned motivational and cognitive biases as well as the impact of the group dynamics on the results of corporate Foresight sessions be reduced? Studies show that training experts on the use of special techniques designed to diminish such negative effects increases the accuracy of the forecasts [*Mellers et al.,* 2014]. Let us take a closer look at the psychological pitfalls encountered by moderators and participants in Foresight sessions and suggest more detailed recommendations on how to be aware of them and avoid them over the course of group expert discussions. A common feature of such cognitive traps is that they hinder group reflection and reduce sensitivity to alternative visions of the future.

Psychological Barriers Hindering Corporate Foresight Sessions

Over the course of a well-known study presented in [*Tetlock,* 2005], 284 international experts proposed about 80,000 predictive estimates of several countries' future development. The next 20 years showed that these forecasts had not been particularly accurate. The approaches to forecasting that the experts use can be notionally linked with one of two strategies, those of foxes' or hedgehogs', to use the terms that philosopher Isaiah Berlin borrowed from the ancient Greek poet Archilochus: "The fox knows a lot, while the hedgehog knows one thing only – but it's the important one" [*Berlin,* 1953]. The least accurate forecasts were produced by the "hedgehog" experts who extrapolated a certain pattern observed in an area they knew well, into other areas of life. Predictive estimates made by "fox" experts, who used various data sources and alternative analysis models have turned out to be more accurate [*Tetlock,* 2005]. The laymen's forecast produced within the scope of the *Good Judgment Project* study confirmed this pattern: in the short term, people who are open to all things new, who are capable of reflection and self-criticism, and more importantly, are willing to discuss their insights and listen to other people's opinions, tend to be more successful at predicting the future [*Tetlock, Gardner,* 2015].

Indeed, a typical barrier frequently encountered during Foresight sessions aimed at developing corporate strategies is the *overconfidence effect*, i.e., the experts' insensitivity to other people's opinions and to information that contradicts their already taken positions [*Tetlock, Gardner,* 2015]. Taking special steps before the Foresight session begins to help the participants temporarily abandon their "hedgehog" roles in favor of becoming "foxes", which allows one to reduce this factor along with encouraging (or even forcing) the participants to listen to other people's views (e.g., by using techniques such as focus groups, "Idealogue"[1], brainwriting [*Rohrbach,* 1969], etc.). For example, session participants can be divided into groups, each of which is asked to interview the other groups on a certain topic and then summarize the collected opinions. During a brainwriting session, participants silently write down

[1] See http://caramboli.ru/?p=233 for more; last accessed on 18.01.2018.

their ideas on cards for five minutes, and then pass the cards around the table so other people could add their own contribution.

The *social desirability bias*, or *excessive optimism*, is manifested in the propensity of experts to forecast the future in order to increase the probability of desirable events while reducing that of the undesirable ones (compared with neutral events) [*Ecken et al.,* 2011]. On the whole, we tend to underestimate the probability of negative scenarios [*McKenna,* 1993]. The *scenario matrix* technique allows one to reduce this effect (as opposed to contrasting pessimistic and optimistic scenarios). In such a matrix, the more important (and more uncertain) factors affecting future developments serve as the axes. For example, analyzing the possible development of the healthcare sector, experts can use the axes of "passing on the responsibility for healthcare from the state to citizens", and "moving on to personalized and preventive medicine". Various combinations of these factors produce four scenarios that allow one to avoid simplistic binary logic. Techniques such as *black swans* and *wild cards* (i.e., events with a low probability of happening, but with the potential to radically change the relevant industry) can also help reduce social desirability bias [*Taleb,* 2007; *Mendonça et al.,* 2004]). Analyzing the positive and negative consequences of each scenario and applying a "desirability" scale in addition to the "probability" one to produce expert assessments are productive approaches too.

The *framing effect* occurs when given a negatively formulated objective ("how to avoid something"), participants tend to strongly adhere to the initial position and strive to preserve (sustain) what they have already achieved [*Tversky, Kahneman,* 1992]. In Foresight sessions this cognitive bias is closely related to *collective anxiety over the future*, manifested in the participants' inclination to shorten the planning horizon *[Nestik, 2014c]*; their thinking becomes more stereotyped [*Kelly et al.,* 2001; *Friedman, Foerster,* 2005], while the ability to take into account possible action by other players diminishes *[Leder et al., 2015]*. Our studies show that discussions about the group future at Russian companies in most cases are inspired by anxiety about changes that have already occurred or potentially possible negative changes, rather than by the need to maintain stability or become aware of new opportunities [*Nestik,* 2014b, 2014c]. Collective anxiety as a reaction to perceived threats to the team's continued existence can increase the staff's interest in the future. At the same time, anxiety over the future suppresses the group members' creativity and concentration when they try to make decisions and makes them more critical of one another [*Rhee,* 2007]. As a survey of 169 Russian executives revealed [*Nestik,* 2014b], they intentionally build up anxiety to mobilize the staff and increase their concern about the short-term future. However, the alarmism they provoke launches the mechanisms of positive group identity protection: the group turns towards the more positive common past and starts seeing the future in a predominantly gloomy light.

In Russian corporate and industry-level Foresight studies, the above effect manifests itself in the problems experts encounter when they try to forge a positive vision of the future: the focus of their attention shifts from opportunities to threats and ways to deal with the latter. Experts' trying to protect their positive identity – be it a corporate, professional, or national – produces the framing effect, increases adherence to previously made decisions and customary concepts. Such protective psychological effects arising over the course of pondering the future are particularly common for public companies and research and educational organizations whose staff have experienced a significant decline in their socioeconomic status and the prestige of their profession over the past 20 years. However, the "protecting positive identity" effect may emerge at more successful companies as well. Studies of social psychology of risks indicate that analyzing possible futures, experts tend to underestimate the probability of and overestimate the remoteness of events that threaten a positive assessment of their group, i.e., hurt their patriotic feelings, negatively affect pride in their company, profession, etc. [*Joffe,* 2003].

Discussing participants' shared history and values before starting to ponder the future can help reduce the "protecting positive identity" effect and strengthen the participants' self-assessment. Also, gaming techniques can be quite helpful in analyzing trends and scenarios, this is when participants try to play the roles of various parties interacting on the market [*Schwarz,* 2011]. Foresight session moderators can reduce the collective anxiety over the future by allaying experts' alarmism, avoiding excessively serious formats, introducing elements of (self-)irony, and putting the participants in a positive mood. The framing effect can be diminished by using a positive wording to set brainstorming objectives ("challenges" instead of "risks", "create" instead of "avoid", "can" instead of "have to"). Conceptual schemes are also applied to reduce this effect: before making a decision, managers graphically present the cause-and-effect links between relevant facts [*Hodgkinson et al.,* 1999, 2002]. Visualizing the interaction between trends on a timeline can serve as an analogue of such a conceptual scheme for a Foresight session.

Another protective mechanism that can be triggered over the course of analyzing future threats is called the *scope/extension neglect effect* and the "*callousness*" effect, which emerges when negative consequences are assessed. Essentially it means that people tend to be more willing to empathize with a specific person in the photograph rather than with an abstract statistical community of several million people [*Slovic,*

2013]. To diminish its impact when major risks are assessed, it is important to analyze their consequences for specific individuals (e.g., for one of the company's clients), as opposed to confining the analysis to measuring the consequences for faceless social groups.

The depersonalization of future events over the course of their assessment is related to another cognitive barrier – *future stereotyping*. Studies in the scope of the mental construction theory indicate that remote (in temporal terms) events are perceived in a highly abstract way, using general categories and customary stereotypes [*Trope, Lieberman,* 2010]. Accordingly, abstractly presented events are perceived as more remote and less likely to happen. On the other hand, a detailed description makes even remote events appear more probable [*Bilgin, Brenner,* 2008]. To compensate for this cognitive barrier over the course of a Foresight session, future events may be linked to specific, familiar places; prototyping and role playing games may be used, which help to more deeply imerse the participants in a future situation. Building scenarios and assessing possible consequences of the trends for specific individuals ("a person in the picture") also helps. For example, for the purposes of its Foresight study, a European company has actually built replicas of the residential and office premises in line with various ideas on how work places would look by 2020. These "premises from the future" were used to hold board meetings and other conferences in order to make the changes that would affect managers' work in the coming decades as realistic as possible [*Rohrbeck,* 2011].

The abstract and uncertain nature of events in the remote future also hinders risk analysis. If we treat a future event as one that has already happened – as if we already know how it ended – we take into account approximately 30% more possible reasons than if those same events were treated as distant possibilities [*Mitchell et al.,* 1989]. To overcome this *uncertainty of outcome* effect, participants of Foresight sessions can be asked to imagine themselves on a specific future date; relevant positive and negative events should be described to them as actual facts and the participants could be asked to identify their reasons. This approach is commonly applied in facilitation techniques Pre Mortem [*Klein,* 2007], Future Search [*Weisbord, Janoff,* 2010], and Appreciative Inquiry [*Lewis et al.,* 2008].

Stereotyping of the future is closely connected with two other psychological effects: *availability heuristics* and the underestimation of events never encountered personally. Availability heuristics amount to pondering the future on the basis of the most readily available information [*Tversky, Kahneman,* 1974]. In other words, experts tend to construct the future on the basis of the trends actively discussed in the media and on social networks. This frequently produces a *generalization of fictional evidence* effect, when experts rely on their "memory of the future" created by visually impressive and memorable Hollywood stories and computer games [*Yudkowsky,* 2008]. Memory of the future is supported by the modern multimedia culture and *visualization effects*: it turns out that future scenarios presented in the computer animation and video clip formats are perceived by viewers as more probable and predictable than those presented as texts with diagrams [*Roese, Vohs,* 2010]. To help session participants understand the effect news media have on their thinking, the *hype cycle* technique can be applied to assess and analyze the development of trends and technologies, suggested in 1995 by the Gartner research and analysis company [*Fenn,* 1995]. This method allows one to identify technologies actively discussed in the media and by the professional community thus overshadowing other important changes – barely emerging innovations or those that have failed to live up to expectations. It would also help one to consider how well the trends under consideration are represented in various sources of information (including social media) and to present quantitative data to session participants such as statistical indicators of the relevant markets, bibliometric analysis, etc.

The same brain structures are responsible for remembering the past and constructing the future in our imagination. In particular, this occurs in the zones located in the parietal and temporal lobes of the brain, the retrospinal cortex, and the cortex of the posterior part of the cingulate gyrus [*Gaidos,* 2008; *Spreng,* 2009]. The hippocampus (which is responsible for memory) also plays an important role in forecasting [*Buckner,* 2010]. Hippocampus dysfunctions and the loss of one's ability to associate events of the past stored in our memory with one another undermine one's ability to imagine one's future [*Kwan et al.,* 2010]. Underestimating the probability of events, the likes of which we have never personally experienced, becomes a natural limitation hindering our analysis of the future. People tend to rule out those events they cannot model because the required images are lacking in their personal autobiographical memory [*Arnold et al.,* 2011].

The opposite of this pattern is the *extrapolation of the past into the future* [*MacKay, McKiernan,* 2004]. Knowing the outcomes of events, we tend to overestimate the predetermination and predictability of the past (the *hindsight bias*), which leads to overconfidence and simplification when forecasting the future (the *foresight bias*) [*Fischhoff,* 1975]. To stir up the participants' imagination and help them to see beyond the customary limits, Foresight sessions may include an analysis of alternative versions of the company's past,

unlikely scenarios of the future (black swans, wild cards), and projection and metaphorical techniques (knowledge reactor[2], photo collage, prototyping, Lego Serious Play[3], etc.).

Generally, participants of Foresight sessions find it easier to build short-term future scenarios, while constructing medium- and long-term prospects usually turns out to be a much more difficult task. The reason is not just the objectively higher rate of change and uncertainty, which hinders planning for horizons of more than ten years long, but also various subjective factors such as *perceived goal value depending on its distance in time* [*Gjesme,* 1981] and the well-known *discounted future* effect. The essence of the latter is very well reflected in the saying "a bird in the hand is worth two in the bush": people go for real benefits in favor of possible future advantages [*Berns et al.,* 2007]. For example, given a choice between getting $100 now or $120 in a month's time, people would irrationally opt for immediate remuneration. However, given a choice between $100 in 12 months' time and $120 in 13 months, most people would go for the second option. Thus, the impossibility opting for the "here and now" prompts one to make more sensible decisions. Over the course of Foresight sessions, discounting the future leads not only to making inaccurate estimates of when events might occur, but to using a narrower strategic goal setting horizon and to the devaluation of long-term forecasts. Increasing the subjective importance of events under consideration would help one to compensate for these effects (at a certain stage of the session the participants should be asked to describe their personal goals and come up with ways to achieve them in the context of the trends and scenarios being discussed). "Time travel" may also turn out to be useful, asking the participants to imagine themselves in the past or the future to put aside the choices available "here and now".

An unwillingness to look into medium-term and remote future can also be explained by *cognitive dissonance*: we usually tend to underestimate the likelihood of events we cannot influence [*Festinger,* 1957; *Nestik,* 2016b]. Therefore, it may be useful to ask the participants to consider how they could speed up the arrival of the events under consideration, for example: "What can we do to increase the chances of this event happening, even by as little as 1%?"; "How can the "butterfly effect" occur in the scenario we're discussing?" Experiments showed that often we do not just overestimate our ability to influence events, but underestimate it too [*Gino et al.,* 2011].

An assessment of specific events' probability can be biased due to *regression to the mean*. When we try to predict the development of a trend, we compare possible outcomes with the intuitive norm: for example, after a period of high or low oil prices, we expect them to come closer to the average. We tend to believe that people with outstanding abilities would have clever children, while mediocre parents' offspring would surpass them with their achievements [*Kahneman,* 2011]. That is why when we assess the prospects of particular technologies, it is quite important to consider the mutual overlaying of trends over the course of a *cross impact analysis* [*Gordon,* 1994] using quantitative data, and, along with the drivers of change, also keep in mind limiting factors (e.g., with the help of the *force-field analysis* technique) [*Schwering,* 2003]).

At the project preparation stage, participants of Foresight (and strategy development) sessions may be affected by *planning fallacy*. This is the tendency to underestimate the time required to implement the plan [*Kahneman, Tversky*, 1979]. Such super-optimism turned out to be a universal pattern, practically regardless of the nature of the task or participants' personal traits (such as optimism or the propensity to procrastinate). This is particularly common when the session is focused on the future or on assessing long-term projects [*Buehler, Griffin,* 2003; *Min, Arkes,* 2011]. Planning mistakes may be due to a lack of experience in carrying out specific tasks or the inability to make good use of it. When, before making a plan, we analyze similar situations on the basis of objective data, the probability of making mistakes diminishes [*Roy et al.,* 2008]. Another interpretation of this kind of mistakes is that we tend to overestimate the likelihood of events we have explained. This *explanation effect* occurs after we have carefully considered a sequence of steps leading to the desired goal [*Hirt et al.,* 2004]. And, since it is easier to mentally go back to the just-completed plan than to find information about other projects, we tend to believe our project has better chances of being realized than alternative scenarios. It turns out that in group discussions, optimism regarding project completion time is higher than when projects are assessed individually since a group tends to first discuss ways to achieve success, not problems that can hinder the work [*Buehler et al.,* 2005]. We can diminish the explanation effect and planning fallacy by analyzing several alternative scenarios, developing a pessimistic scenario, and the decomposition of strategic projects' objectives in a more discrete way [*Min, Arkes,* 2011].

[2] See http://znatech.ru/ for more; last accessed on 18.01.2018.

[3] See https://www.lego.com/en-us/seriousplay/the-method for more; last accessed on 18.01.2018.

Group dynamics can increase individual cognitive biases that occur when people ponder the future. *Common knowledge* and *belief polarization* effects tend to emerge over the course of a Foresight session. The first essentially amounts to discussing information about the future that is known to most of the experts while disregarding the facts available only to some of the participants [*Gigone, Hastie,* 1993; *Straus et al.,* 2011]. Techniques designed to reduce peer pressure could help overcome this barrier, such as silent individual brainstorm sessions (when participants write down their ideas on cards); the nominal groups technique; brainwriting; debates; checking alternative hypotheses; microgroup discussions (comprising of two or three participants); adding "originality" criterion when ranking ideas; providing additional time to discuss relevant matters, etc.

The *belief polarization* effect essentially increases the negative consequences of experts' overconfidence: when analyzing possible development scenarios, groups tend to shift towards extreme estimates or towards the opinion that prevailed among the experts from the start. This effect usually happens to be more pronounced in homogeneous groups [*Sunstein,* 2009]: the shifting of expert assessments in such groups is further encouraged by their shared values. The so-called *technophile's bias* often emerges over the course of technology or corporate Foresight studies: experts oriented towards the future tend to overestimate the inevitability of changes and try to see trends even where there are not any [*Mack,* 2013]. Such "professional deformation" of futurists affects their forecasts especially strongly in "youth Foresight" sessions aimed at promoting innovative and high-technology entrepreneurship. To prevent belief polarization and technophile's bias of this kind, discussion groups should be diverse (in terms of the experts' specialization and experience); techniques such as "devil's advocate", and role allocation to analyze the future from different perspectives and points of views can also help.

The diversity of participants is a necessary condition of Foresight sessions' productivity. Involving representatives of various professional communities and partner organizations in shaping a desirable future not only helps to comprehensively analyze the changes but produces a positive *Medici effect* – the emergence of a long-term network for exchanging ideas, which facilitates innovation [*Johansson,* 2006; *Paliokaite,* 2010]. An example of such a community is IBM's HorizonWatch network comprising more than 1,900 managers and professionals from all company divisions and regional offices [*Chamberlin,* 2011]. To forecast the future, companies increasingly often employ "crowd wisdom" – they use crowdsourcing mechanisms to involve not just the company's clients and partners but also a broad range of persons not directly associated with it [*Gast, Zanini,* 2012]. Crowdsourcing allows to use diversity to one's advantage, but it is vulnerable to social influence. Crowdsourcing participants' knowledge of each other's opinions and judgements creates several negative effects: the diversity of ideas significantly diminishes if no adjustment is made to compensate for group assessment errors; accurate forecasts get pushed out to the periphery of the group discussion, which undermines external observers' and new participants' trust in the crowd; finally, when opinions and assessments voiced by the community are summarized and averaged out, the participants become more confident that the group decision is correct – though in reality it may not be so [*Lorenz et al.,* 2011; *Zhuravlev, Nestik,* 2016]. To minimize the impact of these effects on forecasting results, the participants of a crowdsourcing project can be divided into diverse discussion groups each comprising five to seven people, with access to averaged out assessments made by other groups but without a possibility of influencing their members. That is how an international Foresight project on the social consequences of technological development was organized on the Synmind virtual platform [Council for the Environment and Infrastructure, 2015].

Finally, over the course of Foresight sessions and afterwards, the group *self-fulfilling prophecies* effect can emerge. Essentially it means that publicly made predictions become a part of the situation whose development is being predicted and affect future developments [*Merton,* 1948]. Observing each other's statements and actions, the group members increasingly find confirmations of their expectations, and thus increasingly rely on them when they make decisions. This effect is further strengthened by social networks and readily available information about statements made and actions taken by participants and customers of the Foresight study as well as and stakeholders in the corporate future. In our opinion this effect should be purposefully used by involving decision makers in the expert groups and giving the participants a chance to forge a common vision of the future and steps to be jointly taken to make it happen.

Conclusions

Companies' increasingly common use of group forums for forecasting (such as Foresight sessions, prediction markets, crowdsourcing projects, etc.) determines the need to study socio-psychological mechanisms for constructing visions of the future. Several areas seem to be particularly promising in terms of the further analysis of socio-psychological factors affecting the productivity of corporate Foresight studies.

Firstly, specific features of group forecasting in various situations and areas of activity are worthy of attention. It seems that Foresight projects devoted to various crises, global or industry-specific risks on the one hand, and those focused on analyzing new markets or prospective technologies on the other, produce different psychological effects.

Secondly, corporate communities, norms, and rituals that are supposed to help Foresight studies' participants stay focused on the company's future and implement the obtained results, require further analysis. The issue of developing a future-oriented corporate culture that would encourage and increase sensitivity to weak signals of change cannot be successfully addressed without taking into account the socio-psychological mechanisms that shape groups' attitude towards the future and the way employees exchange knowledge [*Nestik,* 2014a].

Thirdly, psychological factors affecting the construction of the future in social networks and forums should also be studied, since Foresight projects are increasingly often implemented in the crowdsourcing or virtual expert group formats. International social network-based Foresight communities are actively developing, whose participants exchange information about signals of emerging radical changes (e.g., the European Foresight Platform[4], Strategic Foresight[5], Forecasting Net[6], The Futures Strategy Group[7], etc.). How do asynchronous communications, partial anonymity, disinhibition, low cohesion, diverse and variable compositions, blurred limits, gamification, and other specific features of virtual communities affect group forecasting? What effects does social media have on the participants of Foresight sessions? How should organizers and moderators take the emerging psychological effects into account?

Fourthly, we still know very little about the role collective memory plays in shaping visions of the future, while the effect the past has on forecasts was studied only at the individual level. Meanwhile, our studies show that employees' assessments of the corporate past do affect their attitude towards their common future [*Nestik,* 2014c]. Exactly how do specific aspects of corporate history manifest themselves over the course of Foresight studies, and how do they affect their results? How could one help participants consciously reconstruct their common past based on the results of their joint effort to analyze the future?

Fifthly, the objective of matching visions of the future that Foresight sessions' participants construct over different time horizons remains extremely relevant [*Das,* 2003], as does that of producing synergies between corporate and professional communities with different cultural and group norms (which affect their attitude towards the future).

Finally, developing socio-psychological techniques for managing the time perspective of group activities becomes increasingly relevant from theoretical and practical points of view alike, including changing the temporal orientation of Foresight sessions' participants depending on the current objective and balancing their common past, present, and future.

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References

Arnold K.M., McDermott K.B., Szpunar K.K. (2011) Imagining the near and far future: The role of location familiarity. *Memory and Cognition*, vol. 39, no 6, pp. 954–967.

Barabba V. (2011) *The Decision Loom: A Design for Interactive Decision-Making in Organizations*, Axminster (UK): Triarchy Press.

Berkhout F.G.H. (2006) Normative Expectations in Systems Innovation. *Technology Analysis & Strategic Management*, vol. 18, no 3–4, pp. 299–311.

Berlin I. (1953) *The Hedgehog and the Fox: An Essay on Tolstoy's View of History*, New York: Simon and Schuster.

Berns G.S, Laibson D., Loewenstein G. (2007) Intertemporal choice – Toward an integrative framework. *Trends in Cognitive Sciences*, no 11(11), pp. 482–488.

Bilgin B., Brenner L. (2008) Temporal distance moderates description dependence of subjective probability. *Journal of Experimental Social Psychology*, vol. 44, no 3, pp. 890–895.

Blackman D., Henderson S. (2004) How Foresight Creates Unforeseen Futures: The Role of Doubting. *Futures*, vol. 36, no 2, pp. 253–266.

Boe-Lillegravena S., Monterdeb S. (2015) Exploring the cognitive value of technology foresight: The case of the Cisco Technology Radar. *Technological Forecasting and Social Change*, vol. 101, pp. 62–82.

[4] See http://www.foresight-platform.eu/ for more; last accessed on 18.01.2018.

[5] See http://www.strategicforesight.com/ for more; last accessed on 18.01.2018.

[6] See http://www.forecastingnet.com/ for more; last accessed on 18.01.2018.

[7] See https://www.futuresstrategygroup.com/ for more; last accessed on 18.01.2018.

Buckner R.L. (2010) The role of the hippocampus in prediction and imagination. *Annual Review of Psychology*, vol. 61, pp. 27–48.

Buehler R., Griffin D. (2003) Planning, personality, and prediction: The role of future focus in optimistic time predictions. *Organizational Behavior and Human Decision Processes*, vol. 92, pp. 80–90.

Buehler R., Messervey D., Griffin D. (2005) Collaborative planning and prediction: Does group discussion affect optimistic biases in time estimation? *Organizational Behavior and Human Decision Processes*, vol. 97, pp. 47–63.

Chamberlin B. (2011) HorizonWatching: How IBM Develops Views of the Potential Futures (online presentation). Available at: https://www.slideshare.net/HorizonWatching/horizonwatching-how-ibm-develops-views-of-the-potential-futures, accessed 17.06.2017.

Council for the Environment and Infrastructure (2015) Survey of technological innovations in the living environment. Hague: Council for the Environment and Infrastructure (Rli). Available at: http://www.rli.nl/sites/default/files/survey-technological-innovations-english-version.pdf, accessed 25.09.2017.

Das T.K. (2004) Strategy and time: Really recognizing the future. *Managing the future: Strategic foresight in the knowledge economy* (eds. H. Tsoukas, J. Shepherd), Oxford: Blackwell Publishing Ltd., pp. 58–74.

Durand T. (2009) Scenarios as knowledge transformed into strategic "re-presentations": The use of foresight studies to help shape and implement strategy. *Handbook of Research on Strategy and Foresight* (eds. L.A. Costanzo, R.B. MacKay), Cheltenham, UK: Edward Elgar, pp. 128–143.

Ecken Ph., Gnatzy T., von der Gracht H.A. (2011) Desirability bias in foresight: Consequences for decision quality based on Delphi results. *Technological Forecasting and Social Change*, vol. 78, no 9, p. 1654–1670.

European Commission (2009) *Mapping Foresight: Revealing how Europe and other world regions navigate into the future* (Report EUR 24041 EN), Brussels: European Commission. DOI: 10.2777/47203. Available at: http://www.forschungsnetzwerk.at/downloadpub/2009_efmn_mappingForesight_EU.pdf, accessed 15.11.2016.

Fenn J. (1995) *When to Leap on the Hype Cycle*, Stamford, CT: Gartner Inc.

Festinger L. (1957) *A theory of cognitive dissonance*, Stanford, CA: Stanford University Press.

Fischhoff B. (1975) Hindsight is not Equal to Foresight. *Journal of Experimental Psychology, Human Perception and Performance*, vol. 1, no 3, pp. 288–299.

Friedman R.S., Foerster J. (2005) Effects of Motivational Cues on Perceptual Asymmetry: Implications for Creativity and Analytical Problem Solving. *Journal of Personality and Social Psychology*, vol. 88, no 2, pp. 263–275.

Gaidos S. (2008) Thanks for the future memories. *Science News*, vol. 173, no 19, pp. 26–29.

Gast A., Zanini M. (2012) The social side of strategy. *McKinsey Quarterly*, no 2, pp. 82–93.

Gigone D., Hastie R. (1993) The common knowledge effect: Information sharing and group judgment. *Journal of Personality and Social Psychology*, vol. 65, no 5, pp. 959–974.

Gino F., Zachariah Sh., Moore D.A. (2011) Keeping the Illusion of Control Under Control: Ceilings, Floors, and Imperfect Calibration. *Organizational Behavior and Human Decision Processes*, vol. 114, no 2, pp. 104–114.

Gjesme T. (1981) Some Factors Influencing Perceived Goal Distance in Time: A Preliminary Check. *Perceptual Motor Skills*, vol. 53, pp. 175–182.

Gordon T.J. (1994) *Cross Impact Method* (United Nation University Millennium Project, Futures Research Methodology), Vienna: United Nations.

Gracht H.A., Vennemann C.R., Darcow I.-L. (2010) Corporate foresight and innovation management: A portfolio-approach in evaluating organizational development. *Futures*, vol. 42, pp. 380–393.

Hirt E.R., Kardes F.R., Markman K.D. (2004) Activating a mental simulation mind-set through generation of alternatives: Implications for debiasing in related and unrelated domains. *Journal of Experimental Social Psychology*, vol. 40, pp. 374–383.

Hodgkinson G., Bown N., Maule A. (1999) Breaking the frame: An analysis of strategic cognition and decision making under uncertainty. *Strategic Management Journal*, vol. 20, no 10, pp. 977–985.

Hodgkinson G., Maule A., Bown N. (2002) Further Reflections on the Elimination of Framing Bias in Strategic Decision Making. *Strategic Management Journal,* vol. 23, no 11, pp. 1069–1076.

Ilmola L., Kuusi O. (2006) Filters of weak signals hinder foresight: Monitoring weak signals efficiently in corporate decision-making. *Futures*, vol. 38, no 8, pp. 908–924.

Joffe H. (2003) Risk: From perception to social representation. *British Journal of Social Psychology*, vol. 42, pp. 55–73.

Johansson F. (2006) *The Medici Effect: What Elephants and Epidemics Can Teach Us About Innovation*, Boston, MA: Harvard Business School Press.

Kahneman D. (2011) *Thinking Fast and Slow*, New York: Farrar, Straus and Giroux.

Kahneman D., Tversky A. (1979) Intuitive prediction: Biases and corrective procedures. *TIMS Studies in Management Science*, vol. 12, pp. 313–327.

Kelly J.R., Barsade S.G. (2001) Mood and Emotions in Small Groups and Work Teams. *Organizational Behavior and Human Decision Processes*, vol. 86, no 1, pp. 99–130.

Klein G. (2007) Performing a Project Premortem. *Harvard Business Review*, vol. 85, no 9, pp. 18–19.

Kwan D., Carson N., Addis D.R., Rosenbaum R.S. (2010) Deficits in past remembering extend to future imagining in a case of developmental amnesia. *Neuropsychologia*, vol. 48, no 11, pp. 3179–3186.

Leder J., Häusser J.A., Mojzisch A. (2015) Exploring the underpinnings of impaired strategic decision-making under stress. *Journal of Economic Psychology*, vol. 49, pp. 133–140.

Lewis S., Passmore J., Cantore S. (2008) *The Appreciative Inquiry Approach to Change Management*, London: Kogan Paul.

Lorenz J., Rauhut H., Schweitzer F., Helbing D. (2011) How social influence can undermine the wisdom of crowd effect. *Proceedings of the National Academy of Sciences of the USA*, vol. 108, no 22, pp. 9020–9025.

Lucas H.C., Goh J.M. (2009) Disruptive technology: How Kodak missed the digital photography revolution. *Journal of Strategic Information Systems*, vol. 18, no 1, pp. 46–55.

Mack T.C. (2013) Foresight as Dialogue. *Futurist*, vol. 47, no 2, pp. 46–50.

MacKay R.B., McKiernan P. (2004) The role of hindsight in foresight: Refining strategic reasoning. *Futures*, vol. 36, pp. 161–179.

McKenna F.P. (1993) It won't happen to me: Unrealistic optimism or illusion of control? *British Journal of Psychology*, vol. 84, pp. 39–50.

Meissner D., Gokhberg L., Sokolov A. (eds.) (2013) *Science, Technology and Innovation Policy for the Future: Potentials and Limits of Foresight Studies*, Heidelberg; New York; Dordrecht; London: Springer.

Meissner P., Wulf T. (2012) Cognitive benefits of scenario planning: Its impact on biases and decision quality. *Technological Forecasting and Social Change*, vol. 80, pp. 801–814.

Mellers B., Ungar L., Baron J., Ramos J., Gurcay B., Fincher K., Scott S.E., Moore D., Atanasov P., Swift S.A., Murray T., Stone E., Tetlock P.E. (2014) Psychological Strategies for Winning a Geopolitical Forecasting Tournament. *Psychological Science*, vol. 25, no 5, pp. 1106–1115.

Mendonça S., Cunha M.P., Kaivo-oja Jari, Ruff F. (2004) Wild Cards, Weak Signals and Organisational Improvisation. *Futures. The Journal of Forecasting, Planning and Policy*, vol. 36, no 2, pp. 201–218.

Merton R. (1948) The Self-Fulfilling Prophecy. *The Antioch Review*, vol. 8, no 2, pp. 193–210. Available at: http://dx.doi.org/10.2307/4609267, accessed 15.11.2016.

Min K.S., Arkes H. R. (2012) When Is Difficult Planning Good Planning? The Effects of Scenario-Based Planning on Optimistic Prediction Bias. *Journal of Applied Social Psychology*, vol. 42, no 11, pp. 2701–2729.

Mitchell D.J., Russo J.E., Pennington N. (1989) Back to the future: Temporal perspective in the explanation of events. *Journal of Behavioral Decision Making*, vol. 2, no 1, pp. 25–38.

Nadkarni S., Narayanani V.K. (2007) Strategic schemas, strategic flexibility, and firm performance: The moderating role of industry clockspeed. *Strategic Management Journal*, vol. 28, no 3, pp. 243–270.

Nelson R. (2010) Extending Foresight: The Case for and Nature of Foresight 2.0. *Futures*, vol. 42, pp. 282–294.

Nestik T. (2013) Kollektivnyi obraz budushchego: sotsial'no-psikhologicheskii analiz [Collective image of the future: Socio-psychological analysis]. *Psikhologicheskie issledovaniya problem sovremennogo rossiiskogo obshchestva* [Psychological research problems of modern Russian society] / Eds. A. Zhuravlev, E. Sergienko, Moscow: Institute of Psychology RAS, pp. 32–53 (in Russian).

Nestik T. (2014a) Sotsial'naya psikhologiya upravleniya znaniyami: osnovnye napravleniya i perspektivy issledovaniya [Social psychology of knowledge management: main directions and prospects of research]. *Chelovecheskii faktor: problemy psikhologii i ergonomiki* [Human factor: Problems of psychology and ergonomics], no 4 (71), pp. 4–10 (in Russian).

Nestik T. (2014b) Sotsial'no-psikhologicheskie bar'ery pri prognozirovanii budushchego v rossiiskikh kompaniyakh [Socio-psychological barriers in forecasting the future in Russian companies]. *Prikladnaya yuridicheskaya psikhologiya* [Applied Legal Psychology], no 2, pp. 124–135 (in Russian).

Nestik T. (2014c) Sotsial'naya psikhologiya vremeni [Social psychology of time], Moscow: Institute of Psychology RAS (in Russian).

Nestik T. (2016a) Sotsial'no-psikhologicheskie mekhanizmy dolgosrochnoi orientatsii [Socio-psychological mechanisms of long-term orientation]. Sotsial'naya i ekonomicheskaya psikhologiya [Social and Economic Psychology], vol. 1, no 4, pp. 16–60 (in Russian).

Nestik T.A. (2016b) Global'nye riski kak psikhologicheskii fenomen [Global Risks as a Psychological Phenomenon]. *Puti k miru i bezopasnosti* [Pathways to Peace and Security], no 1 (50), pp. 24–38 (in Russian).

Nestik T.A. (2016c) Sotsial'no-psikhologicheskie metody fasilitatsii sovmestnogo analiza opyta i obmena znaniyami [Socio-psychological methods of facilitation of joint analysis of experience and knowledge sharing]. *Sotsial'naya psikhologiya znaniya* [Social Psychology of Knowledge] (ed. A.L. Zhuravlev, D.V. Ushakov), Moscow: Institute of Psychology RAS, pp. 357–377 (in Russian).

Ogilvy J. (2002) *Creating Better Futures*, New York: Oxford University Press.

Paliokaite A. (2010) *Networking as a Route for Corporate Foresight in SMEs* (IET Working Paper WPS010/2010), Monte de Caparica: IET.

Popper R. (2008) Foresight Methodology. *The Handbook of Technology Foresight. Concepts and Practice* (eds. L. Georghiou, J.C. Harper, M. Keenan, I. Miles, R. Popper), Cheltenham: Edward Elgar Publishing, pp. 44–88.

Portaleoni G.C., Marinova S., Ul-Haq R., Marinov M. (2013) *Corporate Foresight and Strategic Decisions: Lessons from a European Bank,* London: Palgrave Macmillan.

PWC (2014) *Megatendentsii na povestke dnya. Opros chlenov sovetov direktorov rossiiskikh kompanii* [Megatendencies on the agenda. Interrogation of members of the boards of directors of Russian companies], Moscow: PricewaterhouseCoopers. Available at: https://www.pwc.ru/en/governance-risk-compliance/assets/russian_boards_survey2014_rus.pdf, accessed 01.10.2014 (in Russian).

Rhee S.-E. (2007) Group emotions and group outcomes: The role of group-member interactions // Affect and Groups. *Research on Managing Groups and Teams* (eds. E.A. Mannix, M.A. Neale, C.P. Anderson), vol. 10, Oxford: Elsevier Ltd., pp. 65–95.

Roese N.J.E., Vohs K.D. (2011) The visualization trap. *Harvard Business Review*, vol. 88, no 5, p. 26.

Rohrbach B. (1969) Kreativ nach Regeln – Methode 635, eine neue Technik zum Losen von Problemen [Creative by rules – Method 635, a new technique for solving problems]. *Absatzwirtschaft*, vol. 12, pp. 73–75 (in German).

Rohrbeck R. (2011) *Corporate Foresight. Towards a Maturity Model for the Future Orientation of a Firm*, Heidelberg; New York; Dordrecht; London: Springer.

Rosenzweig Ph. (2014) *Left Brain, Right Stuff: How Leaders Make Winning Decisions*, New York: Public Affairs.

Roy M.M., Mitten S.T., Christenfeld N.J.S. (2008) Correcting memory improves accuracy of predicted task duration. *Journal of Experimental Psychology: Applied*, vol. 14, pp. 266–275.

Schwartz P. (1996) *The Art of the Long View: Planning for the Future in an Uncertain World*, New York; London; Toronto; Sydney; Oakland: Currency Doubleday.

Schwarz J.O. (2011) Business wargaming: Developing foresight within a strategic simulation. *Foresight for Dynamic Organisations in Unstable Environments: A Search for New Frameworks* (eds. S. Mendonça, B. Sapio), London; New York: Taylor and Francis, pp. 5–20.

Schwering R.E. (2003) Focusing leadership through force field analysis: New variations on a venerable planning tool. *Leadership and Organization Development Journal*, vol. 24, no 7, pp. 361–370. DOI:10.1108/01437730310498587.

Slovic P., Västfjäll D. (2013) The More Who Die, the Less We Care. *Imagining Human Rights* (eds. S. Kaul, D. Kim), Berlin: De Gruyter, pp. 55–68.

Sokolov A. (2007) Forsait: vzglyad v budushchee [Foresight: A Look into the Future]. *Foresight-Russia*, vol. 1, no 1, pp. 8–15 (in Russian).

Spreng R.N., Mar R.A., Kim A.S.N. (2009) The Common Neural Basis of Autobiographical Memory, Prospection, Navigation, Theory of Mind, and the Default Mode: A Quantitative Meta-analysis. *Journal of Cognitive Neuroscience*, vol. 21, no 3, pp. 489–510.

Straus S., Parker A., Bruce J. (2011) The group matters: A review of processes and outcomes in intelligence analysis. *Group Dynamics: Theory, Research, and Practice*, vol. 15, pp. 128–146.

Sunstein C.R. (2009) *Going to extremes: How like minds unite and divide*, Oxford: Oxford University Press.

Taleb N.N. (2007) *The Black Swan: The Impact of the Highly Improbable*, New York: Random House.

Tetlock P., Gardner D. (2015) *Superforecasting: The Art and Science of Prediction*, N.Y.: Random House.

Tetlock P.E. (2005) *Expert political judgment — How good is it? How can we know?,* Princeton: Princeton University Press.

Treyer S. (2011) Changing perspectives on foresight and strategy: From foresight project management to the management of change in collective strategic elaboration processes. *Foresight for Dynamic Organisations in Unstable Environments: A Search for New Frameworks* (eds. S. Mendonça, B. Sapio), London; New York: Taylor and Francis, pp. 67–76.

Trope Y., Lieberman N. (2010) Construal-Level Theory of Psychological Distance. *Psychological Review*, vol. 117, no 2, pp. 440–463.

Tversky A., Kahneman D. (1974) Judgment under Uncertainty: Heuristics and Biases. *Science*, no 185 (4157), pp. 1124–1131.

Tversky A., Kahneman D. (1992) Advances in Prospect Theory: Cumulative Representation of Uncertainty. *Journal of Risk and Uncertainty*, vol. 5, no 4, pp. 297–323.

van der Heijden K. (2005) *Scenarios. The Art of Strategic Conversation* (2nd ed.), Chichester, West Sussex: John Wiley and Sons Ltd.

Vishnevskiy K., Karasev O. (2016) Challenges and Opportunities for Corporate Foresight. *Deploying Foresight for Policy and Strategy Makers: Creating Opportunities Through Public Policies and Corporate Strategies in Science, Technology and Innovation* (eds. L. Gokhberg, D. Meissner, A. Sokolov), Heidelberg; New York; Dordrecht; London: Springer, pp. 65–79.

Vishnevskiy K., Meissner D., Egorova O. (2015) *Foresight for SMEs: How to overcome the limitations in small firms* (HSE WP BRP 45/STI), Moscow: HSE, pp. 1–18.

Warnke Ph., Schirrmeister E. (2016) Small seeds for grand challenges — Exploring disregarded seeds of change in a foresight process for RTI policy. *Futures*, vol. 77, pp. 1–10.

Weisbord M., Janoff S. (2010) *Future Search: Getting the Whole System in the Room for Vision, Commitment, and Action* (3rd. ed.), San Francisco, CA: Berrett-Koehler Publishers.

West M.A. (1996) Reflexivity and work group effectiveness: A conceptual integration. *Handbook of Work Group Psychology* (ed. M.A. West), Chichester: Wiley, pp. 555–579.

Wilkinson A., Kupers R. (2013) Living in the futures. *Harvard Business Review*, vol. 91, no 5, pp. 118–127.

Yudkowsky E. (2008) Cognitive biases potentially affecting judgement of global risks. *Global Catastrophic Risks* (eds. N. Bostrom, M.M. Cirkovic), London; New York: Oxford University Press, pp. 91–119.

Zhuravlev A., Nestik T. (2012) Gruppovaya refleksivnost': osnovnye podkhody i perspektivy issledovanii [Group Reflexivity: Basic Approaches and Prospects for Research] // *Psikhologicheskii zhurnal* [Psychological Journal], vol. 33, no 4, pp. 27–37 (in Russian).

Zhuravlev A., Nestik T. (2016) Psikhologicheskie osobennosti kollektivnogo tvorchestva v setevykh soobshchestvakh [Psychological features of collective creativity in networked communities]. *Psikhologicheskii zhurnal* [Psychological Journal], vol. 37, no 2, pp. 19–28 (in Russian).

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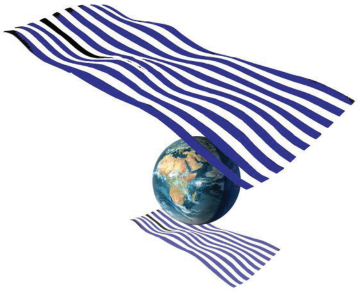

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