

Private Sector Participation in Research, Development and Innovation Policy: A Technology perspective

Rauno Mäekivi¹, Erkki Karo² and Veiko Lember³

Abstract

The cooperation between economic and political actors in policy making has been a subject of active academic debate among the innovation and industrial policy scholars. However, it is rarely elaborated on how these processes exactly take place. Participation is often viewed as a universal principle which should be used as much as possible regardless of the policy context or the politico-economic structure of the country. This paper sets out to develop a deeper understanding of how country-level politico-economic context and technological context influence the cooperation processes. For the theoretical framework, the varieties of capitalism and discursive institutionalism literatures are combined with the evolutionary theory on technological trajectories. Energy technology, ICT and biotechnology sectors are chosen for the detailed analysis due to their policy relevance and different levels of technological maturity, which help outline their various policy-needs. The empirical analysis concentrates on the Estonian research, development and innovation policy and more specifically on national technology programs. Two research questions are posed: How do the economic, political and technological factors shape private sector participation processes?; What is the key driver of participation: country or sectoral level political economy? The results show that the Estonian politico-economic structure is not flexible in coping with the demands of the technological sectors. Country-level political economy seems to play the dominant role in setting the private sector participation processes as there are only minor variations in participation processes between technology sectors.

Keywords: Estonia, public-private sector cooperation, participatory policy making, varieties of capitalism, discursive institutionalism, technological trajectories, energy technology, ICT, biotechnology

¹ Rauno Mäekivi (rauno.maekivi@ttu.ee) is a doctoral student at Ragnar Nurkse School of Innovation and Governance, Tallinn University of Technology.

² Erkki Karo (erkki.karo@ttu.ee) is a senior research fellow at Ragnar Nurkse School of Innovation and Governance, Tallinn University of Technology.

³ Veiko Lember (veiko.lember@ttu.ee) is a senior research fellow at Ragnar Nurkse School of Innovation and Governance, Tallinn University of Technology.

Introduction

During the recent decade there has been an sharp increase in the industrial policy literature expressing the need for more cooperation between the state and the economic actors (e.g. see Rodrik 2008; OECD 2014). This has also been echoed by the systems of innovation literature, which puts the emphasis on interactions between multiple actors such as research institutions, private sector and the state (see Edquist & Chaminade 2006; Edquist & Hommen 2008). However, even if the necessity of participation in policy making is stated, the specific processes behind it are often left unelaborated. Participation is often viewed simplistically as „the more the merrier“, while neglecting the economic and political structures that shape and limit these processes. In addition, the differences in technology regimes and how participation relates to varying needs of different technologies tends to be overlooked as well. More importantly, however, as the country-level politico-economic structures shape general policy-making and participation processes, then the questions arises how well can these structures cope with the needs of various technological sectors. It remains still quite unclear how flexible the country-level politico-economic structures are in responding to the various demands and needs arising from technological sectors.

The current paper will set out to tackle these issues by analyzing private sector participation in Estonian RDI policies as a case study. Estonia proves here to be an interesting case as it is typically regarded as liberal market economy with a centralised government and decision-making power, however, the RDI policy measures seem to have state interventionist, high participation/consensus-based policy-making logic written in them. This contradiction can be used to gain insight into how flexible the country-level politico-economic structures actually are in allowing sectoral variability.

The analysis will take into account the politico-economic characteristics of Estonia as well as analyze the differences of participation dynamics accross different technologies: energy technologies, ICT and biotechnology. As energy, ICT and biotechnology have been set as some of the key focus sectors (or growth areas) for the Estonian research, development and innovation system and smart specialization strategy (Eesti Arengufond 2013, 5) and as these technologies vary in their levels of maturity and wider contextual characteritics (and thus in their needs for policy interventions), they prove to be both policy relevant as well as academically interesting cases to analyse. More specifically, the national technology programs – key policy efforts to

target the specific needs and economic potential of these technologies via targeted policy coordination and public-private cooperation – in the respective areas will serve as a unit of analysis. This will allow to discover and analyse bottlenecks in the RDI policy and technology development as well as give some insight to the origin of these problems.

The following research questions are central to this study:

1. How do the economic, political and technological factors shape private sector participation processes?
2. What is the key driver of participation: country or sectoral level political economy?

The paper will first construct a framework for analysing different participation processes. For the theoretical framework, a combination of theoretical viewpoints will be used. Firstly, the varieties of capitalism (VoC) literature will be discussed. This will contribute to the discussion by allowing to distinguish between different types of market economies, which in turn show different interactions between the state and the private sector as well as the impact on policies. Secondly, another important dimension will be added to the discussion through the literature on discursive institutionalism, which will allow to differentiate between polity contexts and thus show the variation of discourse (or dialogue) between the state and stakeholders in different polity setups. If the VoC framework allows to analyze the macro-level institutions that influence policy making processes in a specific country, then the discursive institutionalism enables to get in-depth insights into the macro-level processes of policy evolution. In section 2., the participation processes will be explained in the context of technologies. By discussing the literature on the evolutionary theory of technological trajectories, a crucial dimension to the research question – the description of different technology sectors and the implications they present when it comes to interests, coordination and interactions with the state – will be added. In section 3 the private sector participation in Estonian RDI policy-making will be analysed first on a general level. After this the private sector participation in specific national technology programs will be analysed, in order to outline the flexibility of the politico-economic structures of the country.

1. Macro-level political economy

The varieties of capitalism literature distinguishes between ideal types of political economies. The main distinction, brought out by Hall & Soskice (2001) and used by several other authors (e.g. Buchen 2004; Feldmann 2006), recognizes two ideal types of political economy: liberal economies and coordinated economies.

The VoC literature explains institutions as the result of economic actors (as rational strategic calculators) trying to solve problems of coordination. Thus, the institutions are created to advance actors' self-interests (Hall & Taylor 1996, 12-13; Hall & Soskice 2001, 6; Schmidt 2009, 519; Campbell 2007, 2). In more liberal economies the private actors coordinate interactions by market-based relationships (market-transactions, competition, formal contracts) while coordinated economies rely on non-market relationships (cross- and inter-sectoral networks such as unions and associations) (Feldmann 2006, 835-836; Hall & Soskice 2001, 9-10). Thus in liberal economies it can be expected that due to the reliance of market-mechanisms for coordination, then the demand is for policies which sharpen market competition (improve the functioning of markets) (Hall & Soskice 2001, 46). This results in the state taking upon itself the role of setting rules and settling conflicts (preserving the market), while the administration of those rules is left to self-regulating bodies or regulatory agencies (Schmidt 2009, 521).

On the contrary in coordinated economies the demand is for policies, which reinforce the capacities of actors for non-market coordination, such as improving the competencies of firms (e.g. technology, skills) on a more precise sectoral/firm level (Hall & Soskice 2001, 46-49). Here the state takes actions not only to resolve conflicts or set rules in the market, but also to facilitate actions between economic actors. Thus, the rules are often set and administered jointly among the businesses, labor organisations and the state, where the latter acts as a (more-or-less) equal partner. (Schmidt 2009, 521-522)

It has to be briefly mentioned here, that VoC debate has been controversial. Hall & Soskice (2001) initial binary distribution of countries has been well discussed and debated. Several authors also provide more than two varieties of capitalisms (see Amable 2003; Schmidt 2009; Myant & Drahokoupil 2010). The distribution of states (aside from creating more types of capitalism) has been holding up quite well (see Schneider & Paunescu 2012). The current paper uses liberal economies – coordinated economies as two radical types to establish an initial framework. It is fully understood, that there are types of capitalisms which fall in between or are

even more mixed. However for current analysis mapping out the extremes is a good starting point.

VoC does well to understand the differences in economic structures between countries, however falls short on explaining how these structural specifics translate into policy-making processes. In VoC literature the main emphasis is set on the private actors (firms, associations) and state is seen basically as a support actor to the private actors. The state however does more than that, it constitutes the political institutions, the arenas where these interactions between private-public sector actors take place, which in turn frame the interactions between political as well as economic actors (Schmidt 2009, 517). Thus it would be far too simplistic to assume, that the state plays little role in these interactions. Here discursive institutionalism (DI) can be used to elaborate more on the policy-making processes and to explain how the political institutional context can influence policy reform differently, even in the same variety of capitalism (Schmidt 2009, 525).

Discursive institutionalism allows to distinguish between coordinative and communicative discourse and thus also between two governance systems: simple polities and compound polities. Communicative discourse is dominant in simple polities and consists of political actors (individuals and groups), who are involved in persuading the public through discussion and deliberation that the policies (developed in coordinative discourse) are necessary and appropriate (Schmidt 2002; Schmidt 2009). Thus communicative discourse tends to be informative and take place in the later stages of the policy cycle, when the policy solutions (except for implementation) are already decided. While the communicative discourse holds more importance as a policy legitimization or informing process, then coordinative discourse takes place earlier in the policy cycle. In coordinative discourse, which is dominant in compound polities, the policy consists of a multitude of ideas from several different (but important) policy actors. Thus, the main discussion and debate takes place with the constituents (interest groups, businesses, stakeholders). Here cooperation becomes the key issue, as the intent of these interactions is not to inform constituents, but moreso to reach a compromise and consensus. (Schmidt 2002, 243-245) The various dimensions and differences between governance systems and discourse are brought out in the following table.

Table 1: Dimensions of governance systems

<i>Governance system</i>	Simple polities (single-actor authority system)	Compound polities (multiple-actor authority system)
<i>Elements of institutional set-up</i>	Strong cabinet; restrained judiciary; centralised neutral bureaucracy;	Strong separation of powers; diffused authority; weak party organisations; decentralised bureaucracy;
<i>Interest groups</i>	Centralized and party-aligned	Fragmented and nonpartisan
<i>Decision-making authority</i>	Centralised (state retains decision-making authority)	Dispersed (veto-points; corporatist structures)
<i>Coordinative discourse</i>	Thin	Elaborate
<i>Communicative discourse</i>	Elaborate	Thin
<i>Timing regarding the policy-cycle</i>	Late stages	Early stages
<i>Main actors</i>	Political actors	Policy actors
<i>Participants in dialogue</i>	Public and state actors	Various policy actors (incl. state, interest groups, associations etc)
<i>Generator of ideas</i>	Epistemic community, discourse coalition, advocacy coalition, policy entrepreneur	Policy actors
<i>Purpose of discourse</i>	Communicate to public, provide orienting and legitimizing information	Construct policy programme, come to agreement
<i>Form of discourse</i>	Translate programme into accessible language for public discussion and deliberation	Provide language and framework for policy actors' discussion and deliberation

Source: Based on Schmidt (2002; 2009); Gerring et. al (2005) modified by authors

As can be seen from Table 1, the institutional setup and thus the discourse can vary to a great extent. Comparing the DI literature by Schmidt and the traditional participation/empowerment model literature first written by Arnstein (1969) and developed by several others (e.g. Davidson 1998), then several visible contact points can be noticed. As the communicative discourse is aimed towards informing the public and legitimizing decisions, then it essentially entails lower

levels of involvement. As the various policy actors (ie interest groups) are less involved, have fairly low decision-making power and are involved into the policy making at the later stages of the policy cycle (when most decisions are done) then communicative discourse can range anywhere from non-participation, informative and (to a certain extent even) consultative levels of participation (see Table 2). Meanwhile as the higher levels of participation (consultative; decisional levels) place a much higher emphasis on the empowerment of policy actors and consensus-building in the early stages of policy-cycle and thus resembling more to coordinative discourse (see Table 2).

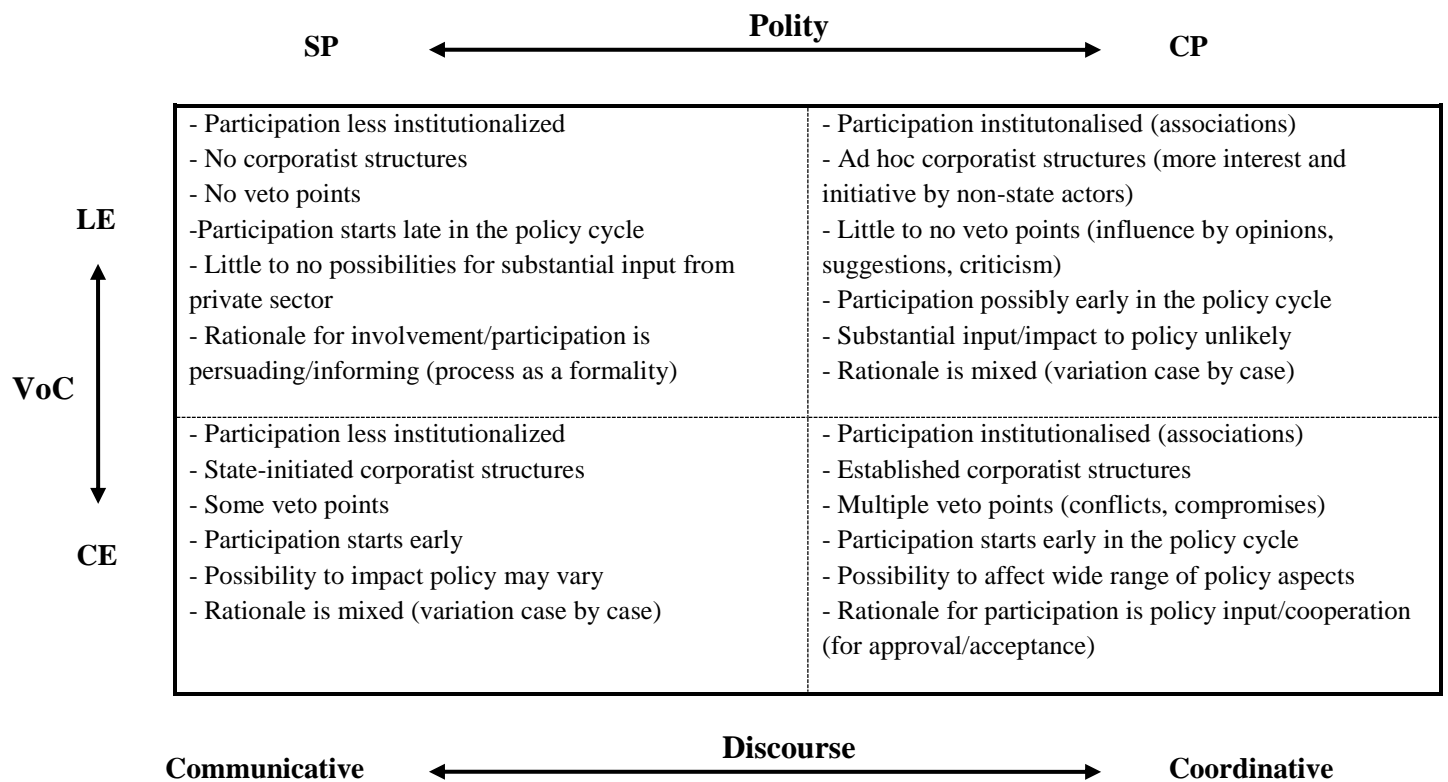
Table 2: Level of involvement and discourse

Simple polities					Compound polities			
Communicative discourse					Coordinative discourse			
Level of involvement	Non-participation		Informative	Consultative		Decisional		
	Manipulation	Therapy	Informing	Consultation	Placation	Partnership	Delegated power	Stakeholder control
Participant side	Participants are „cured“ and „educated“ by policy-makers		Participants may be heard, but lack influence to enforce decisions	Participants are asked for their input (no decision power)	Participants as continous advisors (no decision power)	Participants engage in trade-offs with powerholders	Participants have majority of deciding votes or full decision power	
Policy-maker side	Giving information to participants based on what the policy-maker wants to tell them (neglecting what participants want to hear); given information can be general (lack of details)		Providing information based on what the participant requests/needs	Providing information in a limited manner with the onus often placed on the participants to respond	Inviting participants to draw up proposals for the policy-maker to consider	Solving problems in partnership with participants	Delegating limited decision-making powers in a particular area or project	Obligated to provide a service but choosing to do so by facilitating participant groups to provide that service on their behalf

Source: Based on Arnstein (1969); Davidson (1998); Green & Hunton-Clarke (2003) modified by author

The discussion on VoC, discourse and participation can be combined to understand the country-level political economy of participatory policy making. This is best described through a matrix, which distinguishes between different ideal types of participation (see Figure 2). As the VoC and polity literatures distinguish between two ideal types of politico-economic structures, thus the four different ways of participation can also be regarded only as ideal (radical) types. In practice the lines between these types of participation might certainly not be very clear. In the following subsections, the different types of participation will be explained in detail. Two pure models will be distinguished – where polity and market characteristics reinforce each other – and two potential mixed models where there seems to be a potential contradiction between the polity and market.

Figure 1. Participation within the varieties of capitalism (liberal economies (LE); coordinated economies (CE)), polities (SP; CP) and discourse literature.



Source: Structure based on Schmidt (2009), modified by author based on theoretical discussion

1.1. Compound polity and coordinated economy model

In systems characterized by compound polity and coordinated economy traits, the participation of the private sector in policy processes is rather strong and takes place already in the coordinative discourse and is organized, institutionalized in the forms of corporatist structures (e.g. tripartite agreements between multiple actors). This model gives much more power (veto-points) to the economic actors during policy discussion/negotiation, which in turn can create conflicts, but also force the state to settle for a compromise.

Due to the dominance of coordinative discourse, the participation is expected to be much more substantial. In the sense, that economic actors, not only are treated as more-or-less equal partners in the discussion with the government, but are also involved with the policy formulation early on (in regards to the policy cycle) and thus have a say in a wide range of policy aspects (e.g. in the very rationale/idea of the policy). In addition, due to the coordinative discourse in the compound polity the rationale for participation/involvement is shifted towards getting policy input from economic actors early in and throughout the process in order for the policy to be accepted (and implemented) later on. In extreme cases this can mean that the participation can be characterised as a cooperation, extremely lengthy process, due to the government and private sector being more-or-less equal in negotiations. In the end, the policy can either fail to succeed (as common ground is not obtained) or the policy is a product of cooperation between the public and private sectors. Schmidt (2009) for example places Germany into this institutional category (Schmidt 2009, 527).

1.2. Simple polity and liberal economy model

The simple polity and a liberal economy is the exact opposite of previous. As the interactions between businesses in liberal economies are coordinated using market mechanisms (e.g. competition and contracts), the participation in policy making is less (or not at all) institutionalised. Due to the emphasis placed on communicative discourse instead of coordinative discourse, the policy input from the economic actors will be less substantial and the participation will occur rather in the later stages of the policy (formulation) cycle.

Due to the centralised decision-making authority and low institutionalisation of the private sector in this model, the influence of the private sector (to impact the policy discussion and its detailed formulation) will be low. In this model, policies do not necessarily need broad-based agreements

or compromises to be implemented. Thus, the rationale for having private sector participation is shifted towards justification and legitimization of the policy in order to persuade the overall public that the policy is needed and appropriate. In extreme cases this can mean that the participation process is taken as a formality (in order to state that formally the process happened), meaning that the participants give no real input into policy formulation policy making and the discussion resembles more the one-sided informing communication, rather than dialogue. This is especially the case when the participation takes place during the later stages of policy formulation, when the substance of the policy has already been set in stone. Thus, any proposals for changes from participants at that stage will be difficult to implement regardless of the willingness of the policy makers.

Schmidt (2009) places for example the United Kingdom into this category (Schmidt 2009, 527). Estonia has also generally been placed into this category (e.g. see Hope & Raudla 2012; Kattel & Raudla 2013; Thorhallsson & Kattel 2013; Feldmann 2006; Karo & Looga 2014).

1.3. Mixed cases

This framework offers also two mixed models: – a simple polity and coordinated economy models and a compound polity liberal economy model. While the two cases discussed above are easy to distinguish and are theoretically holistic, the mixed cases have no clear outlines and seem to exhibit theoretical and conceptual contradictions in terms of the expectations set by the characteristics of the polity and economic structures. Thus, if these models exist, they may also be treated as policy or institutional design failures.

For example, it can be argued that, the EU's integration and policy processes have been changing the aforementioned and more coherent models, especially in the newer member states and economies influenced by the recent economic crisis. In other words, the responses to economic crisis have changed policy processes and coordination patterns and some of the coordinated economies (e.g. Slovenia) are moving closer to the liberal economy models (Stanojevic 2012; Karo & Looga 2014). The variation and vagueness of these types makes finding any clear-cut examples of countries difficult as well. However, these mixed versions shall still at least be discussed here.

A simple polity and a coordinated economy model would have institutionalized private sector interest formulation and representation (due to coordinated economy characteristics) in the form

of e.g. industry and employer associations. These structures would however have fairly weak power and access pathways to influence policies (as the decision-making authority in simple polities is centralised). This would mean that in extreme cases, the private sector could have specific interests in the early stages of policy formulation; however, the state would have no need to formally take it into account. Thus, the veto-points would be non-existent and the institutionalised participation would possibly be based on the private sector being able to state opinions and suggestions with no real (formal or informal) power to have them implemented. Here, the rationale for allowing participation/involvement from the side of the political and policy actors would be mainly to justify the policy or persuade the public. However, there would still exist a higher chance to have some input/impact from the private sector implemented (than in a simple polity with liberal economies). This is due to having the institutionalised setup to at least provide criticism, which would give the private sector more possibilities for input than in simple polities with a liberal economy. However, this would largely depend on the specific cases.

In compound polity liberal economy model, the power-interest relations would be reversed. The polity actors would be interested and open to business participation in policy processes (the key discourse would be coordinative), but the market actors would lack institutionalized forms of interest formulation and representation. This could lead either to specific lobbying interests of single actors or generic critique of the role of the state on coordinating the economy. Schmidt (2009) places USA for example into the compound polity with a liberal economy category (Schmidt 2009, 527).

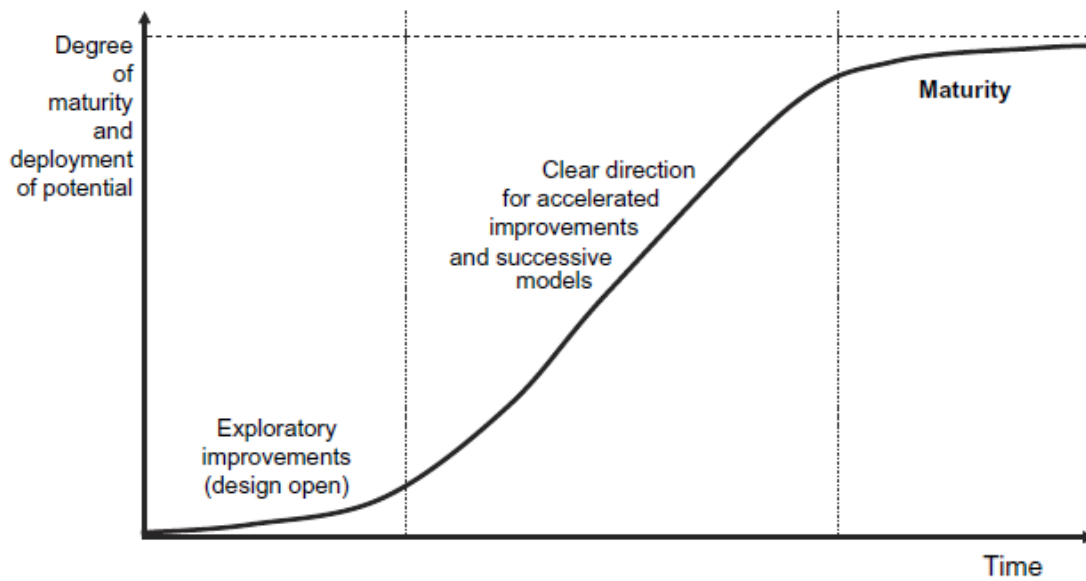
This framework provides also a suitable basis in order to analyze the issues within different technology sectors as potential cases where the ideal-type models and also mixed cases may appear. Thus, in the following chapter the theoretical framework will be further enhanced and combined with the evolutionary theory on technological change. This will allow to connect the aforementioned participation processes with context-specific technology needs and issues. This will provide a useful theoretical framework for analyzing the participation processes in the energy technology, ICT and biotechnology sectors of Estonia.

2. Micro-level political economy

VoC and DI literature provide a general understanding of political economy of private sector participation on a country-level. This is important to understand in case of technologies, since they are developed through complex interactions between economic motivation (cost saving, search for new profit sources) together with institutional factors from both the private sector (interest groups, structure) and public sector (effects of government policies) (Dosi 1982, 157). However according to evolutionary theory of technological change, technologies also go through different phases as they develop and eventually mature. This means the structure of a technological sector (and its policy-needs) change as it develops along the trajectory. The question here becomes how do these changing structures within a technology sector (micro-level political economy) resonate with the fairly stagnant difficult-to-change country-level political economy (macro-level political economy). In order to better understand this, the micro-level political economy must be elaborated on.

In principal, the trajectory of a technology starts with intense innovation and optimization, which is to a certain extent exploratory (with high risk of failure) as the dominant design is yet to be defined. Market interactions later on lead to defining the successful business model of the industry. This opens up a period of growth as incremental innovations are implemented to the product and processes, with innovations mostly directed towards diffusion to other sectors/areas. This culminates with technology reaching maturity and due to existing dominant structures (incumbents) and high entry costs, the new innovators have a hard time entering the competition (Perez 2001; 2009; Dosi 1982). Figure 1 can be used to illustrate the development of a technology.

Figure 2. Technological trajectories



Source: Perez (2009)

This means, that the policy needs may vary between technology sectors based on their maturity. Thus the country-level political economy may be supportive or unsupportive of the development of a particular technology. It can be argued, that in a relatively immature technology sector, the state should be cautious of high involvement of private actors into policy-making as the interests are still relatively unclear. Also due to lack of a successful business model, the state might be cautious of 'backing the wrong horse' and thus lock-ins (Arthur 1989). Meanwhile in mature technology sectors the interests are quite clear and dominant design has led to the emerging of incumbents, which together with high entry barriers fend off newcomers. Here on the contrary the state has to essentially play a balancing act in order to balance the interests of incumbents and newcomers. To explain this more, the specific policy-needs of the technology sectors will be further discussed down below.

The technological sectors (energy, ICT and biotechnology), which this paper analyses vary in their levels of maturity. Energy as a complex, established legacy sector (will be explained later) with clear conflicting interests and networks is the most mature. Meanwhile ICT can be considered as a maturing/converging sector, with clear interests and networks already formed. Last, biotechnology is the least mature of these three, with a lack of coherent private sector interests, except for scientific interests. The sectors and their specific contexts will be further elaborated on in the following paragraphs.

2.1. Energy technology

The energy technology sector is usually referred to as a legacy sector (or as a complex, established legacy sector). Weiss & Bonvillian (2009) characterise energy as a sector, where the processes of both technology push and market pull are inhibited by the preferences for „legacy technologies“ (technologies based on fossil fuels). These legacy technologies are heavily subsidized and deeply embedded in the political and economic systems and in public expectations. As a result, new prevalent technologies have less chance of being developed and being successful. (Weiss & Bonvillian 2009, 32)

This obviously hinders the technological development in the sector and thus poses a serious problem. Essentially what can be seen the causes⁴ for this problem is a variation of market failures and conflicts of interest. The public interest is divided between broad environmental friendly goals (mainly represented by the specific interest groups) and cheap, convenient energy. Meanwhile the existing „legacy“ technologies have vested interests to continue their current business models and dispose of threats to their position. Over time, these legacy technologies have been able to penetrate and gain relevant power in the political arena. Furthermore this has helped them gain a competitive advantage when it comes to governmental subsidies, institutional and infrastructure support, but also for human resources and knowledge. The situation is not helped by imperfect market conditions in the energy sector, which require large initial investments and are dominated by network economies. (Weiss & Bonvillian 2009; 2013; Negro *et al.* 2012)

Negro *et al.* (2012) propose four policy recommendations to alleviate these problems: (1) states must form policies that match the phase of the specific technology (match the different needs of different innovation systems/technology sectors); (2) policies should be consistent and long term (with possibilities to impose changes as the needs of economic actors change); (3) in order to avoid incumbents proposing their own agenda, the state needs to closely listen to a variety of

⁴ Weiss & Bonvillian (2013) bring out six causes: (1) Existing subsidies and price structures favor existing (legacy) technologies; (2) Government institutional architecture and infrastructure has been structured to accommodate the needs of existing technologies; (3) Existing well established and powerful interests resist technologies that threaten their business models; (4) Imperfect market favors existing technologies; (5) Public interest is conflicted - cheap and convenient energy vs. environmental goals; (6) Existing human resource structures and knowledge has adapted to the needs of existing technologies.

economic actors (including new smaller actors) and take their different interests in account; (4) state needs to put pressure on the incumbents in order to reduce the locked-in situation (creating better conditions for new technologies to strive) (Negro *et al.* 2012, 3844-3845).

An argument can also be made, that renewable energy technologies can be seen as creating the shift towards the next techno-economic paradigm together with ICT (which the current paradigm is based on). This means combining ICT solutions into the energy sectors (e.g. to the electric power grid, to electric vehicle technologies). However, in order to facilitate this shift it is also stressed that the state should take an active role in balancing out the conflicting interests (i.e. to balance out the resistance from the incumbents/legacy sectors). (Mathews 2012, 19-20) Thus, the government should not dictate and the private sector follow, instead there should be a collaboration between the two in order to roadmap the difficulties and obstacles and then set the plan to overcome them (Weiss & Bonvillian 2009, 41).

Returning back to the framework of political economy of participation, in the case of the current developments of the energy sector, a compound polity and a coordinated economy model of participation would suit best for the sectors' needs and for solving the aforementioned issues. Due to energy being a fairly mature technology with a variety of different interests and stakeholders (which are gathered into associations/unions), participation should be conducted at the association/union level. This would allow to involve a wide range of stakeholders. As there are incumbents, who try to resist technology change, then the participants (especially the non-legacy sectors) should have several veto points. This way the government could cooperate with various stakeholders in order balance different interests and ensure the development of energy technologies.

2.2. ICT

When the energy technology sector can be described as a complex legacy-sector, ICT can be currently described as an application-oriented (or diffusion-oriented) sector. ICT is thus described (both academically, but also increasingly in the policy discussions) as a horizontal and key enabling technology, meaning that ICT solutions can be applied in a wide variety of different fields and sectors. ICTs form the basic infrastructure for innovation and growth in all sectors, and, thus it is reasonable to develop ICT in connection with the enhancement of other industries and fields (Perez 2012, 216).

For example, in the manufacturing industry there is nearly no working place without ICT support and ICT (along with nanotechnology and material technology) provides almost endless possibilities to develop new products, speed up manufacturing or add new functionalities to pre-existing products. Thus ICT has become an enabling technology and a driver of innovation in manufacturing. (Bessey *et. al* 2009, 92-115) The same applies to many other fields, including education (e.g. see Fu 2013) and healthcare (e.g. see Lang & Mertes 2011; Löhr *et. al* 2010).

In the European Union (EU) policy discourse this notion is described in the context of key-enabling technologies (KETs). ICT is regarded as a key-enabling technology in the EU policy discourse (see for example Commission of the European Communities 2009a; 2009b; 2012). Thus, it is suggested that the research, development and innovation policies should help other policies (e.g. energy, health, transport) to innovate faster in the vertical markets and thus respond to societal challenges via greater utilization of ICTs (Commission of the European Communities 2009a, 9). This shows how the discussion over R&D in the ICT sector has moved from basic research towards application-oriented research. Further, it is also a sector with a „booming“ competitive market, which can be clearly seen within the „killer apps“ segment⁵.

In sum, ICT is a maturing industry, but not as mature as for example energy (discussed in chapter 2.1.), and as a key enabling technology its borders are much more fluid in terms of what sectors, segments and interests are involved in the development of the sector. While the ICT companies are networked to an extent, the interests however are still fairly clear and not as conflicting as in the case of energy technology. Thus, from the perspective of policy and participation processes, it is important to involve both the ICT industry and the other industries/areas (where ICT can be applied) in to the policy making. The participation should be conducted on the association/union level in order to involve various stakeholders. In order to diffuse and integrate ICT solutions, various stakeholders from the ICT and other industries should be involved in a cooperation with the government. To achieve cooperation, the compound polity and a coordinated economy model of participation may be the most suitable the ICT sector. Yet, currently most ICT progress (especially in the killer app segment) is driven by LME economies such as the USA.

⁵ E.g. Uber is anticipated as the highest grossing IPO of 2015 with the value of ~36 billion euros, while at the same time its market share is threatened by Lyft and Sidecar (Nasdaq 2015a). Whatsapp was acquired by Facebook for ~16 billion euros (Forbes 2014). Also there are other highly valued (app-based) ICT companies on the market (that are anticipated to go public): Dropbox, Pinterest, Spotify, Snapchat and Airbnb (Nasdaq 2015b).

2.3. Biotechnology

Biotechnology can be characterized as a science-based sector. This means the whole biotech industry is not only dependent on science, but it is also actively involved in the process of creating or advancing science itself and thus relies heavily on collaboration and cooperation⁶ with universities and other research institutes (Bartholomew 1997; Pisano 2006a, 2). Biotechnology, being driven mainly by science-push and having yet to develop clear business models, can clearly be seen as the less mature of the three technologies discussed by this paper. Indeed, most of the business models in the biotechnology sector are borrowed from the ICT-related industries, which however are unable to serve the needs of the basic science and the needs of the firms at the same time. Due to these reasons, biotechnology is unable to attract the necessary talent and investments. (Pisano 2006b, 2)

Due to biotechnology being a science-based sector, the lines between research organisations (read universities) and firms are often blurred. Most of biotech enterprises are founded based on new advancements/technologies developed by certain researchers/scientists at universities. Usually, the founders also retain an equity stake in the company as well as their post in the university. Thus, these businesses and universities develop a close relationship. (Pisano 2006b, 2) Due to this notion, it is difficult to separate business interests from the researchers interests in the biotechnology sector. Biotechnology has also been recognized as a key-enabling technology by the EU (see for example Commission of the European Communities 2009b), thus supporting the application-oriented research is also important. Yet, the critical perspectives argue that the horizontal application potential is still rather vague and years ahead.

Thus, it can be even argued that in the biotechnology sector the government should be careful when involving economic actors during policy making. The economic actors may be interested in lobbying for establishing their products and business models as industry standards. Further, as the line between researchers and the private sector is blurred, then the companies' interests could be non-existent and dominated by researchers interests. These interests however might not necessarily be the same. Researchers could have less interest in finding application for biotechnology than doing basic research. Thus, it might be useful to not involve economic actors from the biotechnology at all. In that sense, it can be argued that there is certain logic in biotechnology being driven (at its early phases characterized by strong uncertainty) by simple

⁶ For the purposes of transferring knowledge and technology

polity liberal economy models or by mixed model of compound polity and liberal economy where business (and academic) interest are not either allowed or capable to influence policy processes. At the same time, the government can still involve more closely representatives from other industries (where biotechnology research outcomes could be used already now) in order to define the demand and direction for biotechnology policy in short- and mid-range. However, in order for the government to be able to determine these needs, a close cooperation must be achieved with these industries.

2.4. Summary of technological discussion

Based on the theoretic discussion in chapters 1 and 2, several conjectures can be made.

- Keeping in mind, that Estonia is generally characterised in regards to the politico-economic structures a simple polity and a liberal economy, there are several technology specific issues that might prove difficult to solve. For example, balancing the interests of incumbents and new entrants (but also various other stakeholders) in the energy technology sector seem to require a compound polity and a coordinated economy approach. Here the simple polity and a liberal economy type of participation might not prove to be sufficient enough to provide the necessary involvement of multiple stakeholders in a cooperative manner.
- In the case of ICT, the Estonian politico-economic structures might be suitable for narrow ICT specific progress (as in the „killer apps segment“ referred to in chapter 2.2.). However, these structures will probably be unable to fully facilitate the needed ICT diffusion (or application-oriented R&D) to other sectors/areas. This is again due to the simple polity and liberal economy structures being unable to participate enough of a wide variety of stakeholders and due to the lack of coordinative discourse.
- In the case of the biotechnology sector, a differentiation must be made between the economic actors of the biotechnology sector and the economic actors from other sectors (similarly as in ICT). Estonian politico-economic structures might be suitable for decreasing the possible harmful impact from the self-interested biotechnology economic actors. However, for involving actors from other industries and sectors, the simple polity and liberal economy structures might restrain from achieving the necessary levels of participation.

3. Empirical analysis

The empirical analysis will consist of a study of private sector participation in the general RDI policy making in Estonia and of the analysis of specific national technology program management structures. Estonia has generally been placed into the simple polity category (e.g. see Hope & Raudla 2012; Kattel & Raudla 2013; Thorhallsson & Kattel 2013) and also generally into the liberal economy category (e.g. see Feldmann 2006; Buchen 2004; Reslinger 2013; Karo & Looga 2014). Estonia fits quite well into the macro-level political economy literature and also into the micro-level political economy as the three chosen technology sectors all hold high relevance in the Estonian economy.

Meanwhile however the RDI policy design in Estonia seems to not resemble to the archetypical simple polity liberal economy rhetoric. The logic and aim of the RDI measure designs seems to be state interventionist and seems to be intended to promote cooperation between various sectors. This can be somewhat attributed to Estonia's dependence on EU structural funding to design innovation measures as EU funding comes with strict guidelines (Karo & Looga 2014; Kattel & Suurna 2010; Karo & Kattel 2009). This means, that besides country-level and sectoral-level political economies, there can also be distinguished a „supranational“ level of political economy, mainly in sense of EU policy influence on (new) member states. However this requires further research and is far beyond the reach of the current paper.

To bring forth an example of Estonian RDI policy-making the paper will analyze the participation processes (1) generally in Estonian RDI policy-making and (2) look into specific national technology programs, which follow the previously discussed state interventionist/consensus based policy-making logic. These programs were essentially divided into two types: Key-enabling technology R&D programs (ICT; biotechnology; material technologies programs) and socio-economic R&D programs (energy technology; environmental protection and technology; health technology programs). Achieving the active participation of the private sector was set as one of the priorities. (Eesti teadus- ja arendustegevuse ning innovatsiooni strateegia 2007–2013; Riigikontroll 2012). All of the programs had well defined tasks, strictly regulated steering committees, advisory committees and a program manager. Members of these committees varied between policy makers, sectoral associations, enterprises, academia and other interest groups. Thus the participation was quite institutionalised and technology programs were designed almost as for corporatist decision-making, which is more

usual for compound polities and coordinative economies. This however seems rather unusual for Estonia (a simple polity; liberal economy). The following programs will be discussed in detail: (1) „the Estonian Energy technology program“ (ETP); „the Estonian info- and communication technology higher education and R&D program 2011-2015“ (ICTP); and „the Estonian biotechnology program“ (BTP). Next to technological differences, these three programs represent very different policy contexts. Energy technology in Estonian is due to geo-political reasons politically one of the most sensitive sectors. Biotechnology represents an attempt to create new market capabilities through science push ideas. And ICT, being the most horizontal among the three technologies, has become the most influential in policy discourses and thinking.

3.1. Participation in Estonian RDI policies

The participation of private sector generally varies between ministries. Here examples can be brought from the two ministries, which together are responsible for policy making in research, development and innovation field. Ministry of Economic Affairs and Communications involves mostly the private sector in the way of umbrella organizations and professional associations (Interview E). However as the capacities (of these representative organisations) to provide input and represent the interests of their members often vary (Interview B; C; E; F), then there are instances where businesses are contacted directly (Interview B). On the contrary Ministry of Education and Research does not see the private sector as stakeholders who should necessarily be involved in their policy making. The participants of Ministry of Education and Research can mostly be seen as schools, universities and research institutions. (Response B; Interview C) This of course is somewhat explained as the Ministry of Economic Affairs and Communications is more responsible for private sector support measures and thus sees its main stakeholders as the private sector. Meanwhile the Ministry of Education and Research is more in charge of R&D policy making and thus the primary target group of the Ministry of Education and Science are the universities and research institutions. This is also because most of their policy measures have been involved with purchasing/gathering machines and equipment for researchers (Interview C). However the reasoning for participation completely varies.

It can be said, that there are two conflicting rationales put forth by the two ministries responsible for RDI policy in Estonia. Ministry of Economic Affairs and Communications sees the need for participation to gather expert knowledge as the ministries themselves lack the detailed knowledge on specific matters (Interview B). Here the technological sectors are seen as too

intricate and complex for bureaucrats to really design effective policies. In this sense the discourse could seem to resemble more to coordinative than communicative. However generally the process is informal (no pre existing corporatist/institutionalised structures) and conducted with specific pre-existing contacts (Interview B; F). Also there exists a general fear of self-interests from the participants. For example when it comes to funding decisions, then it is feared that the economic actors might want to influence the funding to maximize their own profits (Interview B, C). Thus while it is acknowledged, that the policy-maker lacks knowledge on complex matters, then the participation is not institutionalised. Also there exists a mistrust and suspicion of conflict of interests due to which participants' decision-making power is constrained.

Meanwhile however Ministry of Education and Research argues, that policies are often actually not complicated enough to require gathering expert knowledge from outside the public sector. The major reason for participation in this case becomes legitimizing and explaining the policy and thus developing a common understanding on specific matters (Interview F). Thus the discourse in participation varies from (somewhat constrained notion of) coordinative discourse and (fairly clear case of) communicative discourse.

3.2. Biotechnology

In the case for both ministries, there are variations regarding different technology sectors. According to the interview (B), the biotechnology sector is deemed fairly easy to grasp, as there appears to be a small number of companies which revolve around even fewer key people (as discussed before). Also these key people are deemed generally strong personalities, who make themselves „visible“ and show initiative for participation. As these same people have been involved with numerous programs and are familiar through competence centers, then reaching out and communicating with them is deemed a relatively simple task. (Interview B) In the case of biotechnology most of the contacts for Ministry of Education and Research are scientists/researchers, as the private sector here revolves around these key people. (Interview F, but see also Suurna 2011)

In regards to the Estonian Biotechnology Program. The government actors formed the steering committee, meanwhile all other policy stakeholders were taken into account as advisors (through the advisory board). As established before, then the biotechnology sector does not have a strong

private sector and the main mechanism for innovation here is (instead of market pull) science push. What can be witnessed in the case of BTP is strong horizontal coordination between different government entities, which is of course important as biotech is a large sector with many possible applications in different fields. According to the interview (B) in the case of BTP the participants were mostly from the research community and professional associations where biotechnology could find application. This is largely due to the biotechnology private sector being centred around scientists themselves.

Instead of informal participation, a corporatist structure can be seen with a fairly clear management structure (with certain rules and regulated procedures). This however applies to all of the technology programs. Also here, a variety of different economic actors can be seen to be involved with similar possibilities to impact the policies. This includes economic actors from the biotechnology industry, but also the associations of industries where biotechnology could be applied. This presents a twofold issue.

First, the representative associations from other industries/sectors being involved is a welcoming sight for finding applications and diffusion pathways for biotechnology. However, their participation seems not strong enough for generating any sort of cooperation as they are involved as only advisors. In addition, the advisory board is dominated by academics/researchers which leads to the second issue. This leads back to the discussion on the differences between basic and applied research. Limited involvement and participation of industries where biotechnology could be applied and strong involvement of academic/research staff may result in a lack of support for applied research. Thus, the biotechnology program presents an interesting issue of participation being too strong and too weak – or not sufficiently balanced by counterweighting powers – at the same time.

There are however some noticeable differences in participation between the general RDI policy and the biotechnology program. While the general participation in the biotechnology sectors is conducted generally through informal communication with long-time contacts, then BTP had more institutionalised participation. However, leaving these inherent differences to the side, the issues (in the case of the program and the general participation in the sector) are relatively similar. In both cases the involvement is dominated by certain key actors, who have very specific business models and interests, which limit the applicability of biotechnology and the overall development in the sector.

3.3. ICT

In the ICT sector selecting participants is also regarded fairly simple in general, since Estonian Association of Information Technology and Telecommunications (ITL) is generally seen as a fairly strong representative network of the ICT industry interests (Interview B). The energy sector is regarded as more complicated. As there exists a variety of different associations and a multitude of interests, then it is generally regarded as not so easily understandable as the biotechnology sector. Here the interests are not as clear and further consultation might be needed. (Interview B)

Ministry of Education and Research does not involve private sector much in general (as discussed above), however when it comes to ICT, then here ITL can almost be regarded as a strategic partner. However the ICT industry's interest is mostly centred on the development of human capital and less on research and science policies. Thus here the substance in their involvement is limited when it comes to R&D measures. When the measure is not accompanied by no real (for example monetary) commitments on behalf of the ICT industry, then their input has been noted as less substantial.

In regards to the Estonian Info- and Communication Technology Higher Education and R&D Program. Here the decision-making power was more dispersed than in other programs. Half of the steering committee consisted of ICT sector representatives and the other half of policy makers. Even the chairman in this case was actually ITL and not the government as in the case of ETP and BTP. As for the decisions, a 2/3 majority vote was needed („Eesti info- ja kommunikatsioonitehnoloogia kõrghariduse ning teadus- ja arendustegevuse programm 2011-2015“, 26), so the private sector could be seen to have had some type of veto-points. Of course this is somewhat hindered by the rule that if a ministry (from the same field as the underlying motion) objects, then the 2/3 majority vote would get overruled and the motion automatically rejected. This seemed to be a type of „safety measure“ for the government to decrease the possibility of the ICT sector being able to push through proposals that the government (as a whole) does not agree on.

However from the three technology programs, that are discussed in this paper, ICTP had the strongest involvement of industry actors (Interview F). ITL had a major influence during the writing of the program, even to the extent where the distribution of funding was changed as ITL

requested more funds to be aimed towards the support of education. This strong participation made the formulation process longer to the extent that the program was implemented several years later than other technology programs. (Interview C) ITL has been actively contributing ideas and input on the higher education topics and for promotional events (Interview A).

However the ICTP program has several shortcomings. Firstly, the program involves only the ICT industry and the government while it fails to include actors from other sectors into the management structure. Involving actors from different industries (e.g. manufacturing) and from different policy areas (e.g. energy, healthcare, education) is crucial in order for ICT to diffuse to other sectors/areas as discussed before. Thus, there is a conflict between the participation and the goal of the program to improve the application-oriented R&D in the ICT sector.

Secondly, there is also a lack of coordination with other ministries, who are in charge of different policy areas (e.g. Ministry of Social Affairs, Ministry of Environment). No other ministries (except MKM) are included in the management structures of the program. This stems from the different structure and funding of the program. While ETP and BTP were coordinative programs jointly funded by different ministries, then IKTP was fully funded by HTM. However in the sense of diffusing ICT (and applied-oriented R&D), the program could have benefited from being coordinative, rather than in isolation from other ministries and thus policy areas. Thus, both a lack of sufficient participation as well as a lack of horizontal coordination between ministries can be seen. Due to this issue, the program fails to establish coordination with other sectors (such as healthcare, energy, traditional industries) and other policy areas, which in return sets restraints on the diffusion of ICT and on enhancing the cooperation.

Third, the implementation (and management) of R&D policy to be extremely messy or even absent, even though it is stated in the program. The program in general is managed by HITSA, however HITSA claims to be actively in charge of only the activities, which develop human capital, whereas the R&D side is supposedly set to be managed by the Archimedes Foundation (Interview A). Archimedes Foundation however recognizes itself only as an implementing agency, which deals with forming reports, processing cost documents and mediating funding from the EU structural funds. They have no role in the design of the policy content nor in the participation of enterprises in the planning or implementation stages of the program. (Response A) The lead ministry for this program (HTM), itself describes the program ending up as being

almost solely oriented towards developing human capital (Interview F). Thus, several crucial goals⁷ of the IKTP program have been ill-managed.

3.4. Energy

When it comes to the energy sector, then Ministry of Education and Research has some contacts with specific enterprises (such as Viru Keemia Grupp AS regarding the science policy and Eesti Energia AS regarding the education policy), however this is rather the exception than the norm. The reasoning here is, that the science policy of the public sector in the energy sector has been generally absent and the science and R&D is usually left to be conducted/supported directly by the enterprises themselves. (Interview F) This is potentially problematic here as it might work (to an extent) for large corporations with the capacity to self-support science and R&D (Interview C), however developing this competence is too complicated and costly for most enterprises (Interview D). Also there is the risk, that these enterprises move R&D outside the country, to a more suitable (supporting) environment, which can already be seen to happen (Interview C; D).

In the case of Estonian Energy Technology Program the private sector actors were only part of the advisory body. The steering committee however existed purely of policy makers. The private sector here was represented mostly by various associations and unions, however the two larger energy corporations (Viru Keemia Grupp AS and Eesti Energia AS) had separate seats. Based on the interview (B), the basic logic behind the program was, to develop technologies in the way that the private sector would give demand and then universities/research institutes would try to fulfill those demands through research. The private sector generally was not able to define its technological needs aside from biofuels and (oil-shale) mining, which resulted evidently in weaker involvement of the private sector. Overall this communication happened between the state and private sector enterprises as the technology needs were enterprise specific. Here the professional associations were not involved. (Interview B) The energy sector is characterized by the policy-makers as a difficult and not-as-clear when it comes to choosing who to involve. Here the participation is to a certain extent lower in the RDI policies, as the state generally takes a *laissez faire* attitude towards R&D in the energy sector. Returning to the theoretical discussion in chapter 2.1., Eesti Energia AS can be seen as an incumbent (or as a lead actor of the legacy sector) since it dominates the whole energy sector and has vested interests in oil-shale (fossil fuel

⁷ These include: (1) Raising the competitiveness of R&D in the ICT sector of Estonia; (2) Improving the application-oriented R&D in the ICT field („Eesti info- ja kommunikatsioonitehnoloogia kõrghariduse ning teadus- ja arendustegevuse programm 2011-2015“, 11)

resource) (for more see Tõnurist 2015, 5-10). What makes it interesting is that Eesti Energia AS is a state owned enterprise, thus it would be generally expected to be in close coordination with the government. However, it is quite the opposite as while Eesti Energia AS does innovative investments, there is a lack of policy coordination and acknowledgement from the state (Tõnurist 2015, 10).

In the case of the ETP there are also multiple issues present. One of the many goals stated for this program was to increase the cooperation between the state and the energy sector. However, as the energy sector actors have only the role of advisers in the program with no veto points, the the program management structure partly hinders the possibilities of the program being able to establish any real cooperation between the state and the sector.

Furthermore, this is also reflected in the way the priority directions for development⁸ were set. Here again the group with deciding power consisted of government actors, universities, parliament's environmental commission, Estonian Association of Engineers and Estonian Employers' Confederation. Thus, in the decision-making group the energy sector's interests can mainly be seen represented by the two latter organisations. However, these two organisations are broad multi-sectoral institutions, which have been characterised as relatively limited in their demands and viewpoints on technology specific topics (Interview B). The energy interest groups were involved only in working groups and discussions.

Further, various associations from the energy sector can be seen to have been represented in the advisory body. Thus, different interests were indeed represented. However, when looking at the incumbents (e.g. Viru Keemia Grupp and Eesti Energia), they seem to have a small over-representation here, as they had separate chairs from associations. During the design of the program the enterprises were contacted directly in order to map out their specific technology needs. Here the incumbent enterprises, were more capable in stating their needs than the other economic actors. Thus, the incumbents can be seen to have a bigger influence on the program, which can derive from the difference in capacities within associations and economic actors.

⁸ ETP priority directions of development: (1) oil shale technologies, (2) new technologies based on renewable energy sources and the optimisation of the energy system based on those technologies, (3) nuclear energy („Eesti energiatehnoloogia programm“, 9).

4. Discussion

In broad terms the participation processes seem to be similar for both the general policy-making and specific national technology programs. While the national technology programs aimed to increase participation of the private sector by institutionalizing the participation process, then the empowerment of private sector actors remained still rather weak. The minor variance here exists only in the institutionalisation of the participation, as in general the enterprises/associations are involved in the policy-making processes quite informally. This variance might be attributed to the guidelines set by European Commission for the funding schemes, however it needs further research to be understood better.

Current analysis seems to show, that in the case of Estonia the country-level political economy seems to emerge as the dominant factor in the case of participation processes. Even as the specific programs were aimed and somewhat also designed to facilitate greater levels of participation than regular Estonian RDI policy-making, then the actual participation processes remained still quite similar to regular RDI policy-making. Here seems to be the case, that a liberal economy, with relatively low level of private sector empowerment (communicative discourse being dominant), is unable to facilitate the more intricate type of discourse and participation, which the programmes were designed to do.

Another interesting notion is, that while the technology programs were designed sector-specific in the sense of responding to the sectoral needs, then they remained still quite similar to each other. Theory would suggest, that the rationale for participation would differ between technology sectors: in energy it would be important to balance the interests (balance the incumbents and newcomers); in ICT a wide participation of various sectors to diffuse ICT solutions into other sectors/areas; in biotechnology limiting the academic interests and involving possible application sectors for diffusion. However this did not seem to be the case with the three technology programs chosen.

The technology programs failed to capture the sectoral context and problems at hand. For example in the case of energy, the incumbents were given an additional voice as they were represented in addition to association-level also separately on the enterprise-level, while other alternative energy enterprises were represented only on association/union levels. In the case of biotechnology, the academia heavily dominated the committee. In the case of ICT, the core ICT association had indeed very strong involvement in the program, even to the extent of having

veto-powers. However aside from the ICT association no other sectors were involved, which does little in supporting ICT diffusion.

The ICT program suffered perhaps already in the program design, as the two other programs were financed by multiple ministries (through EU funding schemes) and thus had coordination between ministries and a larger multi-sector base of participants. Meanwhile the ICT program was solely financed by Ministry of Education and Research (through EU funding schemes). This is also reflected in the activities of the program as the emphasis is on educational (human capital oriented) activities and goals, where ICT association and the ministry in charge has more historical management competence than in R&D. On the contrary, the responsibility of managing the R&D side of activities, which was also one of the goals of program, was in reality rather unclear. Energy Technology Program and Biotechnology Program were national coordinative programs, thus the basic logic was that ministries (from various fields) work together in order to recognize bottlenecks in the specific technology fields and to find solutions. (Interview B) Also Energy Technology Program was basically oriented towards achieving energy policy goals (not necessarily RDI policy goals) through supporting science. Biotechnology Program was however geared towards developing key enabling technologies. ICT Program was also originally oriented towards developing key enabling technologies, however it focused more on the human resource side. (Interview F) Taking into account the differences in the orientation of the programs, then it is particularly interesting, that the participation was relatively similar between all three programs.

The main takeaway from this analysis is, that the political economy of the country does not seem to leave enough room for implementing policies, which do not correspond to the political economy of the country, successfully. Thus responding to various sectoral needs is difficult unless the state and private sector structures do not match with the specific needs. For example if the country is in general a liberal economy with a centralised authority and quite weak state intervention practices, then it is rather unlikely that the state can execute well an interventionist, sectoral cooperation measures. Here a certain path dependency effect might be seen, as the structures developed in a country will limit the future policy-tools which are available to the policy-makers to (successfully) use.

However this will definitely need further research and empirical studies to draw any clear conclusions. Also the question here arises whether and how the political economy of a country evolves and changes and what effect do supranational institutions (e.g. EU policy initiative and

funding schemes) play on the country-level political economy. These are however topics, which must be tackled by further research.

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APPENDIX A: List of interviews and responses

List of interviews conducted by the author specifically for this paper:

Interview A. Employee of the Information Technology Foundation for Education. Audio recording. 27.04.2015.

Interview B. Employee (1) of the Ministry of Economic Affairs and Communications. Audio recording. 28.04.2015.

Interview C. Employee (1) of the Ministry of Education and Research. Audio recording. 29.04.2015.

Interview D. Employee of the Union of Electricity Industry of Estonia. Audio recording. 30.04.2015.

Interview E. Employee (2) of the Ministry of Economic Affairs and Science. Audio recording. 05.05.2015.

Interview F. Employee (2) of the Ministry of Education and Research. Audio Recording. 07.05.2015.

List of responses used in this paper⁹:

Response A. Employee of the Archimedes Foundation. E-mail response. 30.04.2015

Response B. Employee (3) of the Ministry of Education and Science. E-mail response. 21.04.2015

⁹ These include electronic letters that were written as responses to the author's requests for an interview. However these responses contained details and explanations, which are empirically relevant for this paper and thus are used in the analysis.