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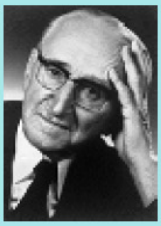



Dorel Tamm

System failures in public sector innovation support measures: The case of Estonian innovation system and dairy industry[1]

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Abstract

The external and internal context of the firms is influenced by governmental interventions. For a long time the discussion over government interventions to the market processes and economic environment has taken place. It is accepted by different researchers including supporters of social market economy that some interventions are necessary to create general framework for and achieve desirable outcomes of economic processes through laws, regulations etc. There are different approaches discussing whether and how strongly government should intervene. Reasons for and circumstances in what public sector should intervene and weather the intervention itself creates additional failures or not have mainly been rested on two concepts: market and system failures (Edler, Georghiou 2007: 952).

Keywords:

Innovation Molkereiindustrie, Estland

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System failures in public sector innovation support measures: The case of Estonian innovation system and dairy industry

The aim of the article is to bring out the system failures existing in implementation of innovation policy measures in Estonia. Analysis will be conducted using the example of Estonian dairy industry, namely dairy processors. There are several reasons for choosing this sector. Milk production and processing has been traditional sectors for Estonian agriculture for a long time and Estonia has had a competitive advantage in dairy products for almost a century. Besides being a sector with long traditions, milk processing industry also represents an interesting case for analysis. Dairy industry is considered to be traditional sector but in Estonia it is rather innovative and many of the producers are closely linked to high-tech sectors like biotech and introducing several product innovations per year. They also use possibilities created by public sector in area of innovation policy.

To analyze the system failure industry case study is used. Case study method is often used to analyse processes taking place within social context including innovation systems (Cutler 2004: 367). In innovation system approach case studies are the main instrument in developing the approach to theory. On the basis of the results of the case studies similarities and common traits are found to draw new contextual statements about the IS approach. (Hommen, Edquist 2008: 443)

Theoretical framework for analysis of system failures

Reasons for and circumstances in what public sector should intervene have been rested on two concepts: market and system failures (Edler, Georghiou 2007: 952). Market failure can be defined as a situation where market is not able to achieve optimality without public sector interventions (Jacobsson, Bergek 2006: 690; Rolfo, Calabrese 2006: 249). Therefore market failures base on neo-classical theory and according to neo-classical theory the existence of market failures should bring along the interventions from public sector (Frenkel 2003: 118). In this framework market failures are linked mainly to under provision of public good because of the uncertainties, externalities (inability to appropriate the positive externalities of knowledge/innovation), imperfect information (lack of information or difficulties linked to accessing the information, special characteristics of scientific knowledge), inability to invest because of the lack of private sector interests, and missing markets (Jacobsson, Bergek 2006: 690; Rolfo, Calabrese 2006: 249; Godoe, Nygaard 2006: 1698). Majority of times market failure in innovation area appears through insufficient amount of financial resources for investments into risky and innovative activities (Reid 2009: 13).

At the same time the concept of market failure is not in line with innovation systems' approach which is influenced by interactive learning and evolutionary theory. The quest for optimal solution and equilibrium is just not possible in an environment with uncertainties, imperfect information, evolutionary characteristics, and dynamics (Hommen, Edquist 2008: 458; Jacobsson, Bergek 2006: 690). Optimality is not definable in reality and therefore also the comparison between optimality and society's current situation is not possible. Therefore the concept of market failure should not be the only bases for public sector intervention to country's economic system. (Hommen, Edquist 2008: 458)

More broad set of failures has to be taken into account to explain the conditions for innovation system (IS) to be effective and need to intervene by public policy. (Jacobsson, Bergek 2006: 690) Innovation systems approach encompasses several important functions it has to fulfil effectively.

For example the interactions between actors have to take place, the rules of the game have to be implemented and operating, the evolutionary process has to

function, firms have to have innovation capabilities etc. If these functions are not in place or are ineffective a system failure appears. (Hommen, Edquist 2008: 459)

Therefore the theoretical backgrounds of system failure and market failure concepts are rather different from each other. Latter of them is based on neo-classical theory with focus on optimality and the ways to achieve it, first of those two concepts grows out from evolutionary theory and IS approach and tries to compare different systems and evaluates their efficiency to fulfil IS functions. (Hommen, Edquist 2008: 459) So, even if some of the problems/failures may appear the same according to two concepts (e.g. lack of information exchange, low level of investments into basic research, existence of externalities and uncertainty) their background and rational are different. In market failure framework public sector intervenes if markets cannot achieve the optimality, in system failure framework public sector intervenes when some of the functions are inefficient or non-existent compared to the needs of society, other innovation systems' or the same innovation system in the past.

Different authors have brought out different types of system failures, different areas where the failure might appear. Keith Smith (2000) brings out four areas of systemic failure and therefore the need for intervention is necessary. These areas are (Keith 2000: 94):

- Creation of infrastructure,
- "Transition failures",
- Lock-in failures,
- Institutional failures.

For enterprises internal physical infrastructure is very important, but it is also important to have external science-technology infrastructure encompassing research institutions, databases, and regulatory institutions and functioning ministries.

Usually private institutions do not want to invest into science-technology infrastructure because of the problems with investment appraisal, lack of appropriability of benefits, and the existing public good's characteristics. Besides physical infrastructure, also institutional infrastructure has to be in place. Institutional infrastructure includes implementation of regulations, standards, health and safety rules, increase in innovation awareness etc which has been a primary task of countries. Therefore these areas need public sector attention and interventions if

necessary. (Smith 2000: 94) In Reid 2009 the concept of framework failures is used instead of failures in institutional infrastructure (Reid 2009: 14). So the failures linked to infrastructural provision and investments into science-technology infrastructure cover the factors influencing all three stages separately and together, and overlapping areas of innovation process according to the model employed in this thesis.

“Transition failures” are linked to firms’ inability to interpret the knowledge and opportunities existing in their environment because of the path dependency and low capability. It brings along three problems. First, firms fail to solve the problems outside of their existing capabilities. Second, they may not notice the changes in demands creating new areas in markets and technologies. Third, firms may not notice and/or recognize the major changes in technology regimes or paradigms. (Smith 2000: 95) Some authors use the term “capabilities’ failure” describing rather similar situation as “transition failure”. Capabilities- failure is defined as firm’s inability to learn, lack of flexibility inside the firm and/or resources enabling them to adapt to the changes (Woolthuis *et al* 2005: 610, 614). In other words companies and also countries are unable to act in the way which is the most beneficial to them (Reid 2009: 13). In some ways capabilities’ failure may be considered as a cause for “transition failure” to appear (Woolthuis *et al* 2005: 612). Therefore these types of failures are linked to the factors influencing the first, second, third and all overlapping stages of the innovation process.

Although different researchers describe the capabilities’ failure at the level of enterprises, similar situation may occur at the national level. If this appears on national level the lock-in failures exists.

Technologies are not only linked to firms’ production processes; they are also embedded into social and economic environment of specific country. Therefore new technologies do not have to compete only with existing technologies but also with environment where the existing technologies are based. Because of the path-dependency some nations may fail to absorb the change in technology paradigms and be locked-in to a particular development stage. (Smith 2000: 95–96) Another type of capability failure at national level has existed in EU. In many EU member states there has been a growing need to support innovations through financial support. One possibility to do that has been created by structural funds. At the same

time many countries have not been capable to absorb financial support coming from EU. (Reid 2009: 27) Previous is closely linked to government failure described below.

Institutional setting of the country (public and private institutions, regulations, policy and economic system, social institutions) may also experience failure and therefore hinder the development of the firms and country. (Smith 2000: 96, Woolthuis *et al* 2005: 610) Institutional failure can exist due to the inefficient or non-existent coordination between different kind of institutions and organizations as an outcome of wrongly chosen governance style. For example there might exists a mismatch between the aims and needs of public sector policy measures, created institutions and organisations etc. While implementing different policy tools/instruments/measures it has to kept in mind that different measures should complement each other and not to substitute and/or work against each other. (Hommen, Edquist 2008: 469)

Institutional failure is sometimes defined as governance failure. Governance may be understood as managing collective actions. These collective actions may take place in firms, public sector organisations, etc. Governance can be organised through markets, hierarchies (corporate and political hierarchies), and network. (Yoruk, von Tunzelmann 2002: 4) Therefore also failures in those areas can exist. Hierarchies failures can be described as failures in institutions in Reid 2009 i.e. inability of IS actors to act in their own best interests. Failures in political hierarchy can be defined as government or policy failures. Policy failure is linked to problems in public interventions including low level of policy making capacity (Reid 2009: 14).

Network failure can be divided into weak and strong network failures. Weak network failures arise from lack of interactions between different agents of innovation system (Woolthuis *et al* 2005: 610). The lack of interactions may be caused by lack of willingness to exchange the ideas and knowledge and/or contradictory aims of institutions. (Ekboir 2003: 583) At the same time the networking activities are important for innovation process because through this knowledge and ideas are change. If there is no interaction between different institutions the innovation process may be very time consuming and/or non-existent. Strong network failures describe the situation where different institutions are linked together so closely that they do not notice opportunities coming from outside of the network (Woolthuis *et al* 2005: 610). Using this definition strong network failures are closely linked to lock-in failures.

Below all the above mentioned failures are compounded in one figure (see Figure 1). Reader has to keep in mind that the definitions of some of the failures are rather

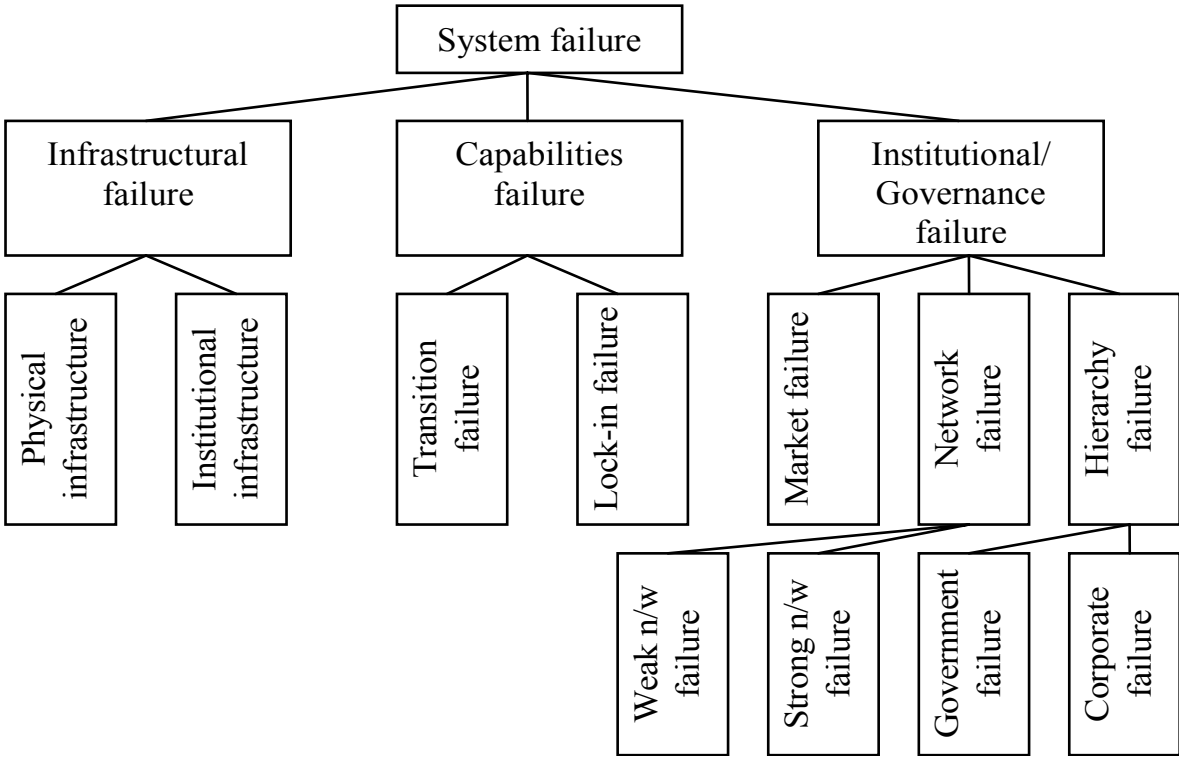

Figure 1. Framework of system failure concept (composed by the author)

similar and there are actually no explicit boarders between those sub-concepts.

For example transition failure may overlap with corporate failure. Also some institutional failures may be linked to transition and lock-in failures etc.

In the past the main problem linked to innovations for policy makers has been lack of finances. Now capabilities and capabilities' failure has moved into the centre of focus. (Reid 2009: 16) But one has to keep in mind that it does not matter which failure exists in the society. The existence of system failure is not sufficient condition for interventions by public sector. Before intervening public sector should be convinced that this failure could not be solved by market forces and/or private organizations, and that public sector is able to solve or mitigate the problem through policy measures. (Edquist *et al* 2004: 430–431; Hommen, Edquist 2008: 458)

It is hard to evaluate the public sector's ability to solve the problem before intervention actually takes place. There is always uncertainty over the ability of public

sector to mitigate the failure but the clearer the aims of the policy easier to evaluate the influence of intervention. If public sector is not able to solve or mitigate the problem there might be several reasons for that. For example the government failure (also called public and political failure) might exist. That means that the state does not have necessary capabilities to solve the problem. The reason might also be that this particular failure cannot be removed through public sector interventions. (Edquist *et al* 2004: 430–431) Therefore to support the innovativeness of the firms through public sector support measures it is important to find the balance between pure market and centrally planned economy. If the system failure exists the intervention possibilities have to be evaluated from the viewpoint of other types of system failures because elimination of one failure might create another one. (Lundvall 1999: 25–26) If the intervention is grounded the proper activities should be chosen. Those activities may be in the form of designing and implementing new policy measures and/or terminating and/or changing already existing measures. (Hommen, Edquist 2008: 459) Termination of or change in already existing measures can be justified if the systemic failure was caused by the malfunctioning of the existing policy measures.

Overview of Estonian dairy industry and its innovativeness

After regaining its independence Estonian economy experienced high growth rates. The main competitive advantage which contributed to this trend was based on cost advantage coming from previous distorted price structure and devaluation of croon after introduction of Estonian own currency. (Tamm 2004). At the same time the value added of manufacturing products was low and the activities could be characterised as subcontracting. The focusing on how to decrease costs and/or be competitive brought along investments into machines and equipment, but not into high value added product development. This behaviour was possible in the environment of low production costs and high economic growth but as a result Estonian enterprises did not have sufficient experiences with product innovations and cooperation activities with the aim to introduce an innovation was almost non-existent (Kalvet 2006: 6–7).

During the last decade cost advantage eroded rapidly it forced enterprises and public sector to look for new ways to compete on world markets and one way to do this is to increase the production of high value-added e.g. functional products through

innovations. Several innovation policy measures were therefore designed and implemented. In this article system failures existing in implementation of innovation policy measures in Estonia are brought out. Analysis is conducted using the example of Estonian dairy industry, namely dairy processors.

In Table 1 a general overview of the dairy industry is presented. Dairy industry is the largest sector in manufacture of food products and beverages in Estonia although it has lost a bit of its prevailing position to manufacture of beverages and production of meat products (Industrial Production by Economic Activity at Current Prices 2009). The number of dairy industry production units has decreased from 42 in 2004 to 39 in 2008. Although the decrease in number of units has not been significant, several of those 39 enterprises actually belong to the same concern (Niinepuu 2009: 1). For example AS Maag Piimatööstus owns factories in Jõhvi, Rakvere and Annikvere (MAAG Piimatööstusest 2009). If the information about ownership is taken into account the number of units decreases to 29 out of which 11 are micro-enterprises (Niinepuu 2009: 1, 13). Therefore the concentration of dairy processors can be observed on Estonian market.

During last 5 years the share of raw milk sold to dairy industry out of total raw milk production has increased from 82% to 88% (Niinepuu 2009: 2).

The reason for that can be found in decrease in number of small farms because smaller farms have not been able to comply with EU's standards (Hein 2006: 51, Hein 2009: 3). Although the number of diary farms and cows has decreased the production per cow has increased. It is influenced by development in pedigree, feeding and technology. (Niinepuu 2009: 2)

Table 1. Overview of dairy industry in Estonia in 2004–2008

	2004	**2005**	**2006**	**2007**	**2008***
Share of dairy industry in total production of manufacturing industry (%)	6,2	5,4	4,9	4,7	4,8
Share of dairy industry in total production of food industry (%)	32,0	30,3	28,2	28,4	27,3

Share of milk products in food export (%)	40,0	35,8	29,9	34,9	31,3
Number of dairy industry production units	42	40	38	37	39
Share of five largest raw milk processing enterprises in purchase of raw milk	N/A	59	62	58	83
Raw milk production in thousand tons	652	670	692	692	702
Raw milk purchase in thousand tons	536	571	606	593	614
Average raw milk purchase price (EEK)	3,83	3,98	3,80	4,20	4,64
Net turnover per employee in thousand croons	1779	1828	1954	2364	2625
Value added per employee in thousand croons	140	181	254	358	305

* preliminary data

Source: Niinepuu 2009: 2, 3, 4, 10, 12; Niinepuu 2008: 5; Niinepuu 2007: 4; Niinepuu 2006: 5, Saron 2009

In Table 2 the overview of production of different milk products in Estonia is presented. As a positive trend the production quantities of butter have decreased during last 5 years. Also the quantity of powders has become smaller simultaneously with increase in cheese production. Production quantities of those three products are interlinked – if powder has higher price the production of it increases and production of cheese and butter decreases and *vice versa* (Saron 2008). At the same time, these three product groups are considered to be bulk products with low value added although production of cheese may actually be both – low and high value added product. To compete on the basis of bulk products is very difficult for Estonian dairy processing industry. The sales of these products are very price sensitive and the competition from developing countries with lower labour and production costs is intense. It is important to be less bulk goods oriented and to find different possibilities for developing products belonging to the high-value added group for milk processors. Therefore the diversification of products would be more advisable and profitable for

Estonian food sector. In this case the competitiveness would be based on quality and uniqueness of the product instead of costs and price. (Toming 2006/2007: 23).

The quantities of products from curd, yoghurt and fresh cream have increased. Usually those products are with higher value added sold mainly at internal market in Estonia (Saron 2008). That is the reason why in monetary terms domestic market is bigger than export market. Although, considering the quantities the situation is opposite. (Kivine 2008).

There is pressure from consumers to processors to produce more products with high value added. Latter is closely linked to the increase of the awareness of consumers to eat healthier and functional food. This has also motivated processors to develop and introduce to markets new higher value added products with specific functionality (Hein 2009: 5). As seen from the Table 1 the productivity and value added per employees in dairy industry has increased during recent years with the exception of 2008 on the basis of value added per employee. Although the production of value added per employee has increased, Estonia still belongs to the second part of EU countries' ranking based on that indicator. By now the positive trend in production and value added indicators may have stopped though because of the economic crises occurred on the global market in 2008 and sequential decrease in prices and demand of dairy products, and scarcity of resources available for innovations. Previous also influences production of dairy products in Estonia. (Niinepuu 2009: 11, 14)

Table 2. Production of milk products in Estonia 2004–2008 in thousand tons

	2004	**2005**	**2006**	**2007**	**2008**
Milk	73,4	79,9	84,6	88,3	80,6
Fresh cream	11,1	12,6	9,7	18,1	15,4
Butter	10,7	8,3	7,3	7,7	6,6
Sour cream	16,8	14,2	15,1	15,7	15,0
Sour milk products	16,3	17,5	18,2	17,0	14,2

Yoghurt	15,8	18,3	19,9	20,6	20,6
Products from curd	13,8	15,9	17,6	17,8	16,8
Powders	33,6	34,7	17,9	20,5	19,4
Cheese	12,8	15,6	20,5	17,3	15,9
Ice cream	9,5	9,9	11,2	10,5	10,0

Source: Production of Food products 2009

The export of milk and milk products has always been higher than import during. In 2008 main export countries for Estonian dairy products were Finland (18,4%), Latvia (17,1%), Germany (12,7%), Russia (12,6%) and Lithuania (9,5%). (Niinepuu 2009: 8) Before Russian economic crises in 1998 Russia was one of the main export countries for Estonian dairy industry. By the year 2000 Russian share in milk products' export was decreased to 7%. (Hein 2002: 24)

At the same time Russian market has remained an important challenge and target market for Estonian dairy processors. Russia is especially important for the export of products with higher value added because with those products it is easier to compete on Russian market than on EU's market. (Saron 2008). Therefore it is positive that export to Russia increased in 2008 compared to 2007 10%. EU's market is dominated by very large enterprises with high financial resources and high economic power and Estonian dairy industry is too small to compete with them. So, on European market Estonian processors do not have remarkable competitive advantage in production of bulk products or other low value added products. Therefore industry has to focus more on R&D activities, increasing awareness of consumers, and increasing the production of healthy and functional products (Saron 2009). Previously described trend towards functional food is also supported by development of technology platform "Food for Life" elaborated by European Commission. The aim of this platform is to increase the awareness about food and its influence to health in Europe. (Saron 2008)

Diary industry is rather innovative in Estonia. According to Community Innovation Survey 2004–2006 (CIS V) the share of innovators among respondents was 91,7% in

dairy industry compared to 72,8% of innovators in manufacturing sector as whole (author's calculations on the bases of database CIS V). Reasons for this may lie in severe competition for market share according to interviewee A but also in increase of competitiveness of the whole value chain. For example milk production per cow has increase from 5140 kg/cow in 2002 to 6765 kg/cow in 2008 i.e. approximately 30% (Niinepuu 2009: 3).

Although share of innovators is high innovations introduced by dairy processing industry have been and still mainly are incremental product innovations. At the same time there are positive trends apparent in innovation activities and movements towards producing higher value added products and diversification of production in Estonian dairy industry. For Example Estonian processors have introduced dairy products packed in handy plastic bottles similar to their foreign competitors. Besides innovations in products and processes also marketing and organizational innovations have been used by dairy processors (Database of Community Innovation Survey 2004–2006). All these innovations show the desire to be competitive on domestic and foreign market.

To develop products with high value added enterprises do not yet have enough internal competences and therefore it requires cooperation with research institutions and support from public sector. Currently research on healthy and functional food is taking place in Estonian University of Life Sciences, University of Tartu and in Bio-Competence Centre of Healthy Dairy Products. To be able to invest into R&D and cooperation with research institutions dairy processors need financial resources. Fortunately, even in this volatile business environment some larger enterprises of Estonian dairy industry have been able to invest into R&D and cooperate either with scientists and/or are partners in Bio-Competence Centre of Healthy Dairy Production (BCCHDP). This trend was mainly induced by the program of Competence Centres first implemented by Enterprise Estonia at the beginning of 2000. First competence centres including BCCHDP were established in 2004. (Riik toetab 2009)

Due to cooperation between enterprises and universities and/or competence centre already some functional dairy products have been introduced to Estonian market The most known and the first radical innovation coming from the cooperation between Estonian dairy enterprise and scientists of University of Tartu was the introduction of probiotic ME3 bacteria into "Hellus" products range in 2003 (Kalvet 2006: 86–87).

After that also other functional dairy products have been brought to market by Estonian dairy processors, some of them due to the cooperation with BCCHDP has had a role. For this trend to be sustainable and continuous strong links with Estonian biotechnology representative organisations which are not based only on research institutions are needed.

On the basis of previously presented data and earlier research the following aspects characterizing Estonian diary industry can be brought out (Kivine 2008, Tammsaar 2008, Kalvet 2006):

- The consolidation process is taking place, most of the raw milk produced in Estonia is bought by 5 companies;
- Low level of R&D activities in SMEs;
- Life-cycle of the products is short and therefore investments into product innovations have to earn incomes fast;
- During last years majority of innovations in dairy industry have been linked to incremental changes in products, and implementing new packaging and new technology;
- Lately more focus have been put on functionality and healthiness of dairy products, and the share of bulk products in production has decreased;
- It is very hard to get a patent on food products which may hamper the development of functional food;
- Production of dairy products is influenced by European Union through common agricultural policy;
- Estonian domestic market is small, therefore it is necessary to find possibilities for export.

To achieve the aim of the article case study method was used. There are some limitations researcher has to be aware of while using case study method though. For example, case study method is very time consuming. The whole process has to be prepared and executed carefully to avoid any biases and find the right number of cases/interviewees to include into the analysis. Also it is considered that results of case studies are not easily generalized. The author of this article was aware of the limitations of case study method during collection of data and analysing it. To tackle

the limitations of case study method several precautions were used during the research. First, to avoid subjectivity several sources of information were used. Public sector representatives were asked to comment innovation process taking place in enterprises in addition to enterprises itself and vice versa – activities of public sector were evaluated by enterprises. Also representatives from industry associations and third sector were included to the list of interviewees to increase the objectivity and decrease subjectivity of the research. Second, interviews were all taped to decrease the bias of observer.

Overview of interviewees is presented in Table 3. People presented in Table 3 were chosen because of their knowledge either about Estonian dairy processors or process of elaborating and implementing innovation policy measures in Estonia.

Table 3. Overview of interviewees' occupation, organization and time of interview

Name	**Occupation**	**Organization**	**Time of the interview**
Dairy industry			
Ülo Kivine	Chairman of the Board	Tere Ltd	7th of Oct 2008
Jaanus Murakas	Chairman of the Management Board	E-Piim	14th of Jan 2009
Valdis Noppel	CEO, Member of the Board	Maag Piimatööstus	27th of Jan 2009
Urmas Sannik	Member of Executive Board	CC of Food and Fermentation Technology	14th of Oct 2008
Tiina Saron	CEO	Estonian Dairy Association	21st of Oct 2008
Ene Tammsaar	CEO	Bio-CC of Healthy Dairy Products	22nd of Oct 2008

Public sector organizations			
Harry Faiman	Coordinator of Technological Development Centre Support Programme	Enterprise Estonia	14th of October
Allar Korjas	Director of Export Division	Enterprise Estonia	13th of Jan 2009
Kitty Kubo	Head of Foresight Division	Estonian Development Fund	10th of Oct 2008
Ilmar Pralla	Director of Innovation Division	Enterprise Estonia	8th of Oct 2008
Mihkel Randrüüt	Head of Technology and Innovation Division	Ministry of Economic Affairs and Communications (MEA&C)	8th of Oct 2008
Lauri Tammiste	Head of Economic Development Dept	MEA&C	15th of Oct 2008
Marek Tiits	Chief Analyst of Monitoring and Analysis Group	Estonian Academy of Sciences	14th of Oct 2008
Piret Treiberg	Head of Enterprise Division	MEA&C	21st of Oct 2008
Oliver Väärtnõu	Adviser of the Strategy Office	State Chancellery	10th of Oct 2008

Source: Composed by the author.

Three dairy processors interviewed by the author purchase 53% of raw milk sold to processors in 2008 (Niinepuu 2009: 4).

All of them are also members of Estonian Dairy Association. In addition to people directly linked to private companies also representatives of associations and organizations connected to this industry were interviewed. Besides dairy industry also people from public sector organizations were interviewed to get comprehensive overview of innovation policy measures designed and implemented, and analyse possible areas of system failure.

In following part of the article existing system failure in Estonian innovation system are analysed. Also suggestions how to remove or mitigate the failure are presented.

System failures existing in implementation of innovation support measures

Several types of system failure exist in Estonian innovation system. Based on Figure 1 and analysis of interviewees following system failures exist in Estonia: failure of institutional infrastructure, transition failure, market failure, weak network failure and government failure. Failure of institutional infrastructure is mainly caused by the lack of use of regulations and standards by policy makers. Use of regulations and standards helps to introduce demand side policy measures into innovation support measures' package. Also problems existing in economic relations between Estonia and Russia may be considered as an example of failure of institutional infrastructure.

Transition failure existing in Estonia is mainly caused by low level of firms' capabilities namely innovation capability linked to the lack of knowledge and skills of human resources. But in addition to previous also some other problems brought out by interviewees can be linked to transition failures.

Last set of failures existing in Estonian innovation system are sub-types of governance failure i.e. market failure, weak network failure, and government failure. In Estonia market failure appears through scarcity of financial and human resources e.g. weak venture capital market, lack of people with necessary experience and skills etc.

Weak network failure is caused by the lack of interactions between different actors and organizations of innovation system. The coordination and information exchange between actors of innovation system should be more efficient and intensive to

decrease the doubling of activities and increase the efficiency of the system. Although Estonia is small barriers in information exchange still exist. Last type of failure existing and causing problems in Estonia is government failure. Previous is mainly linked to problems in public sector intervention including low level of policy making capability.

Below previously mentioned system failures are discussed more thoroughly. Also, several suggestions who to decrease existing system failure of Estonian national innovation system are brought out. Suggestions are grouped into two sets: suggestions relevant for dairy processors and for public sector organizations.

Suggestions relevant for dairy processors are linked to alleviating of transition, market, government failure and failure of institutional infrastructure. As already mentioned transition failure is linked to capabilities of enterprises and innovation awareness. From analysis of factors influencing innovation process several interviewees mentioned factors linked directly to the capabilities and skills of management. For example, lack of risk-taking behaviour, missing willingness to cooperate, lack of long-term innovation strategies, etc. Those factors can be addressed by CEO's of enterprises without additional help from public sector through recognizing the problems and devoting time to lessen their negative effect on innovation process. At the same time, public sector can help enterprises with issues rising from low innovation capability. Training organized by public sector and focused on increasing the innovation capabilities of enterprises are very important in this respect.

Also, need for awareness rising events bringing together traditional and high-tech enterprises was brought out by interviewees. Companies belonging to traditional sectors including dairy processors are not informed about the research conducted in research institutions in area of enabling technologies.

Hence, it is hard to find common interests and opportunities for cooperation with the aim to develop, for example, functional food. Similar problem exists in high-tech enterprises. These enterprises are not open to cooperation with enterprises from traditional sectors. At the same time, if there are no dialogue between enterprises and awareness about each other activities there is no possibility for cooperation activities to appear. So, measures bringing together high-technology enterprises with traditional sector are necessary. One of those measures could be the support to

enterprises from traditional sectors using some kind of high-technology solutions in their production. It is also possible to increase the cooperation between traditional and high-technology enterprises through setting some kind of standards and/or regulations forcing those two groups to work together to meet the standards. It would also introduce demand side policy measures into Estonian National Innovation System and decrease the failure of institutional infrastructure.

Second set of problems is linked to government failure. In Estonia there are several innovation policy measures dealing with innovation process factors. At the same time problems arise not from the lack of innovation policy measures but from set of conditions of specific programs. Previous decreases the possible positive influence of the designed and implemented measures. For dairy industry the main problem is linked to the high share of own financing, high bureaucracy and small amount of grants given to enterprises. Latter issue is closely linked to existing market failure. So, it is necessary to focus more on possibilities to change the conditions of some policy measures/programs. One way to do that is to apply for special conditions from EU. This issue is discussed more thoroughly below.

Major problem for dairy industry is linked to the international relationship between Russia and Estonia i.e. failure of institutional infrastructure. Dairy industry representatives mentioned the need for better economic relations between Estonia and Russia, and better system of export guarantees covering the risks of exporting to Russia. International relations between Estonia and Russia are rather delicate. Every bigger dispute on political level influences severely Estonian enterprises doing business with Russian partners, including dairy processors exporting to Russia. At the same time Russian market is important for Estonian dairy processors because they have competitive advantage there. European market is dominated by large dairy enterprises making entering to and competing at that market very difficult for Estonian dairy enterprises.

In addition to need of improving international relations between Estonia and Russia also better export guarantee system is needed to support dairy processors exporting to Russia. Currently the most suitable export guarantee to fulfil required needs is turnover guarantee offered by KredEx, but the choice of guarantees should be wider and/or some beneficial conditions for dairy enterprises should be introduced. Thus, existing market failure has to be addressed.

Second group of suggestions is linked to the public sector side and the procedures and processes taking place in Estonian National Innovation System. On graphical presentation of Estonian National Innovation System the importance of public sector organizations is emphasized through their position at the top of the figure. Enterprises and research institutions were located at the bottom. Therefore, it seems that enterprises and research institutions are marginal for innovation system, but according to Lundvall (2007) enterprises and research institution should be at the core of the innovation system. All innovation support measures should be directed to those organizations and they should be the final beneficiaries of the support system.

Besides the location of enterprises and research institutions, also the wider context of innovation system is disregarded in Estonian innovation system. Social welfare, and demand side factors are not included into the picture. Prevailing narrow approach to the national innovation system can also be seen on the bases of excluding some important public sector organizations from the figure e.g. Ministry of Agriculture and its sub-organizations.

Change of the innovation system figure may feel like insignificant, but it would help to show graphically to innovation system actors that innovation system is something more than just task and responsibility of limited set of public sector actors and the system should exist for enterprises and research institutions not for public sector organizations. Also inclusion of demand side would remind to policy makers that it is important to use demand side policies e.g. demand subsidies and tax incentives, and public procurement measures while elaborating innovation policy measures' system. Right now no interviewee from public sector brought out the importance of innovation system's functions focused on demand-side policies. Previous also shows the prevailing dominance of technology push innovation process model in public sector.

Next suggestion is linked to the existing network failure in Estonian innovation system. Up until now innovation policy has mainly been considered as a task of two Estonian ministries: Ministry of Economic Affairs and Communication, and Ministry of Education and Research. In addition to those two ministries also Research and Development Council contributes to the policy design and implementation. Although the circle of ministries and organizations (including representatives of private sector) responsible for innovation policy measures should be broader as already mentioned above also attention to information exchange should be paid. Even between just two

ministries the information exchange is not without barriers. The result of miscommunication can be the decrease in efficiency of the innovation policy or doubling the activities and waste of resources. Therefore regular meetings between two ministries could be organized. Currently representative of two ministries do meet but those meeting are not regular.

There also exist problems in design and implementation of innovation policy measures causing additional government failures. First, our policy makers are not yet very experienced in communicating with European Commission and applying for special conditions for Estonian enterprises. The boarders of the EU's regulations are not yet known and therefore regulations and requirements are followed very carefully. At the same time, it is possible to attain some kind of exceptions while implementing innovation and agricultural policy measures, but this requires experiences of working within legal framework of European Union. Right now this experience is scarce in Estonian public sector organizations. To increase experiences of the employees of public sector organizations it is important to lessen the rapid exchange of the workforce in those organizations. So, employees have to be provided with good working conditions, possibilities to make career and receive competitive income. Previous also increases their motivation to work and be more approachable by enterprises.

Second, low level of experiences brings along technical evaluation and surveillance of the applications and supported projects. Several representatives of companies mentioned that it is easier for them not to apply for some support measures than to fill in all the reports and documents needed. Technical evaluation and surveillance of the innovation support measures can be some what decreased through implementation of client based approach already introduced in Enterprise Estonia. In EE all the consultants are accredited and it is required from them to know all the measures provided to enterprises and other organizations through EE. Therefore employees of Enterprise Estonia are moving from being just administrators of specific programs and/or projects towards being partners to and consultants for applicants through helping them to find and apply for measures most necessary to them. At the same time, it does not solve the problems linked to strict requirements and unfavourable conditions of innovation support programs and policy measures.

Many of previously mentioned problems may be explained through short history of Estonian innovation policy. It may be stated that Estonia is still building the bases of the innovation policy and national innovation system. Therefore, the tasks of innovation system's actors are not yet drawn out explicitly, and coordination and communication between actors need to be improved. Also if system and its actors gather more experience new employees of those actors gain experience faster which helps to solve existing problems better and faster. At the same time the, consistency in decision making is not coming from lack of experience. It is linked to changes in politics of the country. Innovation policy design and implementation in Estonia requires more consistency from public sector side starting with development of strategy documents linked to innovation system and implementation of innovation policy measures, and ending with surveillance of achievement of different objectives set up in different policy documents. The harmonization of strategies and decrease in doubling of activities would make Estonian innovation system more efficient. But while developing different innovation support measures, it cannot be forgotten that selection processes taking place at the markets with the result of survival of the strongest cannot be completely replaced by the system supporting enterprises with high capability of writing good application.

Conclusion

There are different reasons for public sector to intervene into markets. In current article interventions are analysed on the basis of system failures approach. Latter is closely linked to innovation systems approach. According to innovation system approach optimality is not achievable in the environment of uncertainties and imperfect information. Therefore market failure is not the only reason for public sector interventions. In this article public sector intervention is justified through system failure exists.

System failures can be divided into three subgroups: infrastructural, capabilities, and institutional failure. These subgroups can be subdivided into smaller ones. Therefore, many different types of system failures are defined describing different situations where innovation system does not fulfil its functions. When system failures appear intervention from public sector might be justified but it may not be the best solutions

to remove existing failures because they may be caused by public sector interference.

In current article system failure were analysed based on Estonian dairy industry's case study in the area of innovation policy and system. Dairy industry was chosen because of its importance to Estonian economy and foreign trade. This industry is also rather innovative and uses existing innovation policy measures to increase and/or fasten their innovativeness.

Almost all sub-types of system failure exist in Estonian National Innovation System. The only types of system failure not causing problems in are physical infrastructure and lock-in failure. To make support system more effective for enterprises public sector employees have to gain more experience in working within the legal framework put forward by EU and find ways to apply for special conditions if it is needed. It is also important to understand that national innovation and innovation support systems have to exist for enterprises and research institutions not for public sector organizations.

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