



Effects of VINNOVA Programs on Small and Medium Sized Enterprises

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Effects of VINNOVA Programs on Small and Medium Sized Enterprises

- the cases of Forska&Väx and VINN NU

Report to VINNOVA

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EXTENDED SUMMARY¹

The aim of VINNOVA's activities is to contribute to higher economic growth through support of development of innovation activities. But productivity and employment increases from innovations often take long time to realize and are rarely visible in firms that have just recently taken part or is still active in an innovation program. The objective of the study is to analyse the extent and direction of effects of two programs launched relatively recently, namely VINNOVA's Forska&Väx and VINN NU programs. These are programs directed towards small and medium sized enterprises. Our main focus is not on economic growth or productivity growth *per se* but rather on how behaviour has changed as a result of program participation, both by type of behaviour and the extent of this change. Some of the questions we address are: To what extent and in what ways does participation in such public support programs affect firms' perspectives to move into new areas resulting in a changed portfolio of R&D projects? In what ways does participation impact the rate at whereby R&D projects are pursued? Do firms collaborate more widely and/or with other types of partners, such as academic ones? Do firms recruit staff in this process within or outside their normal traits? Such changes in firm routines are analysed under the heading *behavioural additionality* in the report.

Method

We have made 34 in-depth interviews with firm R&D executives from both programs to give a portrait of the existence of behavioural additionalities. Firms have been explicitly told that they are anonymous in the report, as they might otherwise answer strategically. Although much fewer than all the firms that have participated in Forska&Väx and VINN NU were selected, we have been careful in our choice of firms, sampling them to be of similar size, active in the same industry, and from regions around the country similar to the general population of firms that have received support from the programs. Firms in the programs are overrepresented in population dense regions such as Stockholm, Gothenburg and Malmo, which is not surprising as these

¹ The following is a summary of the much longer report with the same name. For further information about results and effects and a more elaborated discussion we refer to the main report.

according to official statistics also have a large share of business and university R&D, the two major categories of R&D in Sweden. The interviews were conducted where firms were located. Firms are generally found in the industries “Manufacturing”, “Information and Communication” and “Professional, scientific and technical activities”. Sampling on these characteristics was possible as we had access to register data on the participating firms concerning firm size (employees and sales values), location and firm age. We also investigated whether the identified effects could have been influenced by firm characteristics, the program they participated in and the size of the grant and whether additionality effects correlated with each other. The reader needs, however, be aware that it is a small sample (34 firms) that have been interviewed, and that conclusions stated below about correlations and indeed about the effects in general, should be read as indicative as the small number does not give us permission to draw definitive conclusions. The effects found may furthermore, in some cases, be specific to the interview situation, the firm in question, time elapsed from first taking part in the program, and so on.

Generally speaking, we do find many examples of additionality effects among our interviewed firms. The most visible finding is that the programs strongly help to scale up activities and help the firms to pursue them faster. These are effects that are found in the overwhelming majority of cases. It is not overly surprising as an inflow of resources into a small firm should generate changes, not least because this is stipulated by the agreement between the firm and VINNOVA. Perhaps more interesting is instead the type of effect found, its strength and how it varies by type of program and firms characteristics. There are also clear differences between the programs: Forska&Väx firms, many of which are larger, and more experienced than their VINN NU equivalents, show more tendencies to experience changes in orientation due to the program. For VINN NU firms, it is not uncommon that the program enables them to survive in early stages, which is crucial until they can show definitive progress in their business model.

A typology of additionality effects

In our analysis of the interview material we have characterized additionality effects as either “weak” or “strong” where a strong effect means that the firm implements major changes in their routines. Conversely, a weak effect means that the firm does not implement major changes. Figure A provides a schematic overview of the effects found. The dots indicate how many firms belong to a category and whether that effect is classified as weak or strong.

To facilitate our description, *behavioural additionality* has been divided into *scale*, *acceleration* and *scope*. *Scope* is further divided into *new markets and new products*, *improved network capabilities*, *increased human capital* and *improved innovation management*. While these categories are presented as distinct from each other, they often occur jointly, i.e. observed effects cut across categories.

Scale additionality pertains when the volume of activities is expanded beyond the funding budget. Grants can open for opportunities for firms to dedicate additional man hours into the development of a project. Projects may also expand in activities or into new areas e.g. due to employment of labour with new and different insights on a specific area. *Strong behavioural scale additionality* concerns projects which have been substantially expanded as a result of the grant. This relates both to financial, time and staff commitment and hiring of new competencies. These categories are complementary as more of one will tend to elevate another effect.

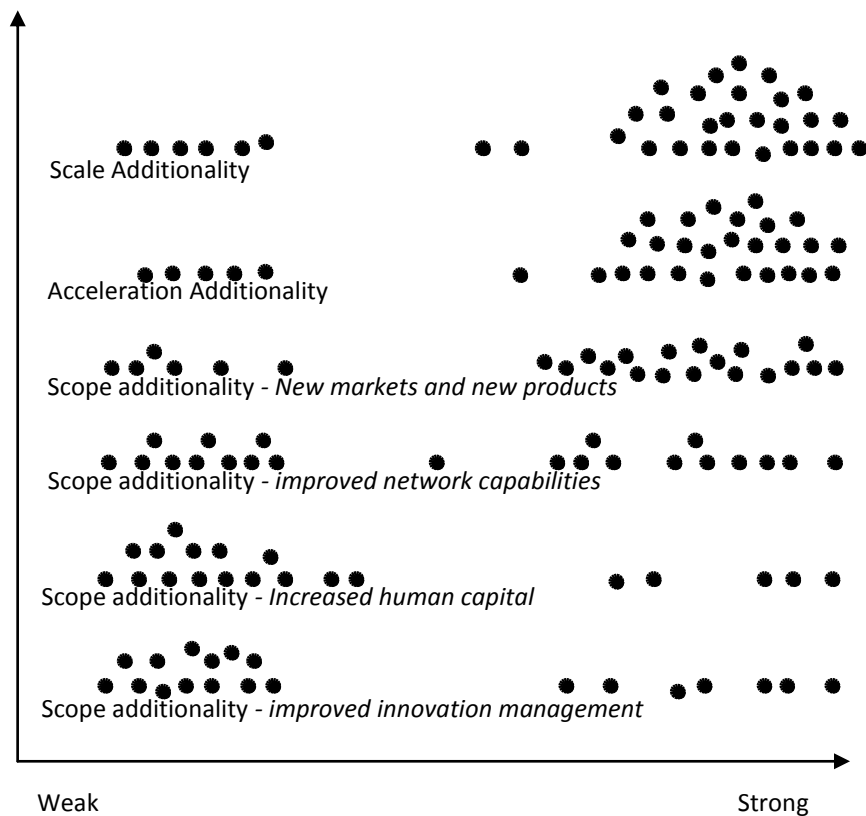


FIGURE A. SCHEMATIC FINDINGS OF BEHAVIORAL ADDITIONALITIES AMONG INTERVIEWED FIRMS

When the Forska&Väx or VINN NU grant has caused the project to grow in time, resources and personnel has been devoted to it, the effect is considered to be strong. In cases where the interviewee does not estimate the grant to be of particular significance for the size of the project, the effect is considered to be weak. As can be seen in Figure A, strong scale additionality has been identified as occurring in the vast majority of cases. Where the firms have been given money from VINN NU, scale additionality is often an important effect, highly valued by the interviewees. Interviewees generally attribute scale additionality effects to the possibilities of focusing and comprehensively plan and carry out projects with designated personnel and project leader. It is argued among several interviewees that without having to squeeze the project into an already strained company activity portfolio, but rather getting the opportunity to pursue the project with separate focus and designated resources and personnel, both the project and the company in general benefit. The project can thus be conducted with greater volume, and thereby become *better* in a very clear sense.

A side effect of scale additionality is the possibility that projects funded through Forska&Väx may be carried out at the desired scale without having a negative impact on the 'ordinary' activities and performance of the firm. Representatives of firms who have participated in the VINN NU program generally express the opinion that the VINN NU grant money is crucial in the startup phase as a 'boost' to their activities. This is possible to conceptualize as a scale additionality effect – especially given the stated ambition to view VINN NU startups as projects and compare them to projects – because it has the immediate effect of increasing the scale of the startup's activities. This has been classified as a *strong* additionality effect for interviewees who explicitly state that the VINN NU grant took their firm several steps from almost only idea stage to real business.

Acceleration additionalities encompass behavioural changes that bring project activities significantly forward in time. Possible outcomes of acceleration additionalities can be that firms enter new fields of knowledge, acquire new information at an earlier point than expected or that development of products is accelerated in order to pursue a window of opportunities existing temporarily on the market. *Strong acceleration additionalities* exist for projects that are pursued much earlier and/or at a higher speed compared to what would have been possible without support. Acceleration is often combined with other types of additionalities, such as scale. Due to shorter product life cycles these effects are important as being first to the market is increasingly urgent for a firm's competitiveness. The effect is also considered strong when the interviewee expresses that the project in question would not have been conducted at all if it had not been for the grant. Weak acceleration additionality effects pertain to cases where the interviewee considers the external funding to be important but not crucial for the implementation of the project. Acceleration additionality effects have emerged as closely coupled with the scale additionality effects discussed in the previous section. Figure A shows that it is common to find strong acceleration effects. Several interviewees stated explicitly that the projects carried out with support from the Forska&Väx program benefited from external funding in the shape and form of accelerating the activities. It is possible to conclude that acceleration additionality effects, although exceptions exist, show primarily on the project level. Related to this, is the matter of *timing*. Several interviewees have argued that the project would have been pursued sooner or later even without external funding, but the grant allowed for it to be started earlier, which is deemed to have had beneficial effects on both project and company as a whole.

A correlation analysis between the effects establishes a strong correlation between scale and acceleration additionality, and the additionalities found are positively correlated with the size of funds provided, but negatively correlated with the size of the firm. In other words, firms that obtained more funds pursued the projects more intensively and faster, but these effects were less important for larger firms.

Behavioural scope additionalities is a broad category of effects describing the qualitative nature of firm behaviour resulting from the programs. Strong behavioural scope additionality results when a firm tries to develop a product or process with little resemblance to earlier methods and/or where we are fairly certain that the public support has led to this result. In the case of scope additionality, a weak effect describes an uncertain or disputable causal relationship between the funding program and the effect in question. Changes in orientation and type of activities, as scope additionalities describe, are often difficult to ascribe to VINN NU firms as these are small or newly started and there is not much that can 'change'. Given the program design scope additionalities have more relevance in describing effects for Forska&Väx firms. More substantially, these analyses show that older firms have a tendency to experience more scope additionalities. The grant may therefore act as a stimulus for the firm to change orientation in relation to established ways.

We also find that the amount funded is positively related to increased human capital and improved innovation management, but not clearly to new markets, new products or improved network capabilities. There are also tendencies that as time elapses from the time the (first) grant was obtained, the effect of the grant is that firms develop more new markets, new products and improve network capabilities.

New markets and new products result if research activity is expanded into other products and markets than would have been possible without government funding. Funding allows the firm to do something new or partly new in addition to their regular activities or allows for significant upgrading of their activities. VINN NU firms had to be excluded in Figure A as the analysis is made relative to past behaviour of the firm. Strong additionality effects are judged to have emerged when a firm has developed a product distinct from the original one with regard to processes and/or knowledge needed to produce it and/or a product that targets a new market. Weak additionality effects on the other hand is defined as a firm developing a product that is similar to existing products which does not require new processes and/or knowledge to be developed. The

effect is considered weak also when the same market is targeted, although the newly developed product is intended for a slightly different market niche.

Among established and comparably large firms it is clear that the Forska&Väx grant can trigger the pursuit to move into an area that is completely new for the firm. The grant can provide an opportunity and/or an incentive to move in the new direction, albeit 'parallel' to the ordinary activities of the company. The grant can be the necessary *trigger* of events that eventually leads to the development of new products and/or the entering into new markets. By the grant they are spurred to 'think anew' and reach for possibilities they would not have thought of in the normal case. This may very well lead to the establishment of entirely new network connections. In addition, a successful project peripheral to the firm's 'ordinary' activity may lead to the creation of a spinoff firm or a subsidiary company separate from the mother company.

Examples of weak additionality effects in the same category also emerge in the material. In one case, the project led to the strengthening of the network of the firm, as new contacts have been established with actors within the new market area.

A strong additionality effect in this category is that existing products are improved or the market for them is expanded by the project funded, through participation in Forska&Väx. This is normally the case for firms that target a rather small market niche and that have a good knowledge about the needs of the customers. For another firm, the grant was crucial for the ability to launch their second product, an improvement on the original one. Yet another firm was able to target a well defined market niche with little competition. In other cases, projects have been identified as leading to a product that differs from the general orientation of the firm in question as it targets a different market or simply that a product has been developed that the interviewee regards more or less unlikely to have been realized without participation in the Forska&Väx program.

Improved network capabilities comprises collaboration and networks between firms as well. Examples of effects include expansion into other projects, new collaborations both within and between organisations. Another example of such scope additionality is when firms search for new strategic partners, e.g. firms, organisations or universities, which can lead to increased quality or provide knowledge stimulus to develop products.

Strong additionality effects on firms with regard to networking and collaboration with external partners is defined as firms developing relationships that in their character and/or purpose differs from the firm's earlier conduct. The effect is also considered strong if the project leads to links with new collaboration partners that are viewed as significant for the future performance of the firm. Weak additionality effects is when the project either does not lead to any collaboration at all, or when collaborations takes place without the firm extending its network with new partners.

Industry-academy relationships as well as other kinds of new collaborations emerge in the material. The industry-academy relationships are important, not least in the case of established and fairly large firms whose new connection with academia actually is said to transform their company – on long term.

VINNOVA has occasionally been identified as the 'door opener' in these matters. Several interviewees have expressed that their contacts with geographically close academic institutions has deepened on basis of the initial connection established as part of the project funded through Forska&Väx and that this is of great benefit for the company in the long term. Examples of contacts include consultants from other sectors such as academia, the hiring of consultants from a research institute. Some cases involved networking with foreign actors. Small, R&D intensive firms may establish contacts with industrial partners as a result of the granted project.

Increased human capital concern investments into new fields of knowledge with the potential to exploit new markets, and also the willingness to let learning experiences from one project benefit other projects.

Scope additionality effects in the category of human capital is defined as strong when the project in question leads to the employment of personnel with key competences. Also the hiring of consultants is considered a strong effect. Weak additionality effects on the other hand leads to no visible effect on recruitment though the project may still contribute to raising the general knowledge level in the firm. As Figure A shows, strong effects with regard to human capital are quite rare. This can, at least in part, be explained by the fact that most firms in the sample are small and R&D intensive and that their business niche is rather narrow.

One of the firms under study hired no less than three persons to take part in the project. It is not unusual that staff 'move over' to the firm in question as a result of the project. Grants are occasionally also used for hiring consultants, or for financing an external study or investigation.

Other examples have been to add credibility of an external (preferably academic) authority in the area, and in one case the firm used the grant to pay for a study done by a research institute, to pay

for an external expert who wrote a scientific report about the product technology of the firm. In this way, the 'academic height' of an activity is perceived to be drastically raised. It should be noted that these cases identify an overlap between the subcategories *human capital* and *improved innovation management*.

Improved innovation management is closely related, but nevertheless discussed as a separate category. It represents behavioral additionality effects in the form of firms' changed modus operandi, that they move into either entirely new, R&D intensive activities, or that they change character of their existing activities to become more R&D intensive. This procedure might be the result of the hiring of additional competences but may also be an effect of the experiences gained from running a specific, well-defined project and in this latter sense we speak of *improved innovation management*.

Strong additionality effects in the category of innovation management results when the firm develops new ways of conduct, for example by increasing contacts with academia so that a more research intensive profile is obtained. Another example of strong effects is when external consultants are hired that contribute not only with specific knowledge of an area but whose impact on the firm's behaviour progresses when the project is completed. The additionality effect is considered weak when the project in question does not mean the firm has to learn to do things in a new way.

Pursuing a development project may also have disciplinary effects that benefit the firm also in the long run. One example of this is given by one interviewee who says the firm has become better at identifying, planning, and carrying out projects from the experience of having a well-defined, externally funded project. Firms organize their activities more in terms of projects than they would have done otherwise. Sometimes they

experience a general elevation of their innovation management competence stemming from increased 'academic height' brought on by the project.

It is common among the firms in the material to have experienced different kinds of changes – allegedly to the better – regarding their general innovation abilities, as effects of their Forska&Väx funded projects. On the project level it is clear that the application and formal procedures of the programs themselves make firms better organized.

Supplementary findings

Several of the interviewees have expressed that the fact that they have been awarded Forska&Väx and/or VINN NU grants acts as a *mark of quality and success* for the firm, on the project level as well as generally for the firm. In one concrete example, it was claimed by the interviewee that participation in the program may be disclosed to customers and other collaborative partners as a sign that the research intensity is high in the firm, i.e. as a direct advertising or marketing tool. This tool may also be used as a resource for attracting other similar funding, for one firm the VINN NU grant became a "quality marker" that gave credibility that was valuable in relation to funders; as well as indirectly leading to the awarding of an 'innovation prize' to the firm. Several interviewees have expressed that 'ordinary' venture capital is extremely hard to get hold on, mainly because venture capitalists, in their opinion, only fund 'safe' projects.

An interesting but "slippery" concept that can be synthesized out of the material is the occurrence of a so called cumulative advantage related to firms' participation in Forska&Väx and VINN NU (and similar) programs in general, and perhaps the above discussed 'soft' marker of quality effects. In concrete terms, cumulative advantage shows generally as reciprocally acting positive factors in firm behavior and performance that collectively or on the basis of each other enhance firm success in any given definition. For example, the participation in a VINNOVA program may, as discussed above, function as a 'mark of quality' for the firm, which in turn yields a benefit on the market, in relation to customers, or in relation to other funding sources. This advantage – for example an increased probability to be awarded a grant – would then have another positive effect on the firm, such as inflow of capital, which may further strengthen the 'mark of quality' or have a

similar, positive, effect that adds to the long term enhancement of firm performance. This advantageous effect is cumulative in the sense that different factors induce, improve and strengthen each other.

Effects of this kind are common in the material. One tangible example, expressed by several interviewees, is the enhanced ability to write proposals and applications that comes from having an application accepted, which significantly improves the possibility of getting the next application through. Some interviewees have raised the possibility that a receiver of VINN NU support may be more inclined to apply for Forska&Väx support because of the positive experiences from the VINN NU program.

Summary of main results

There is no question that additionality effects stemming from the support appear in the studied firms. In many of the cases the identified effects are classified as strong. There are however large differences within the categories. Many concrete examples of strong additionality effects in scale and acceleration are identified (i.e. despite the fact that these, in principle, belong to the “weak” category). One should also keep in mind that context matters. Scale and acceleration effects are conditioned by the size of support, the type of program and the size of the firm. Unsurprisingly, the volume of public funds has an effect on the speed and volume of activities (i.e. acceleration and scale additionalities). Small firms experience strong scale and acceleration additionality more frequently than large firms. For them, this may be the major discernible effect; a small firm has not yet had time to diversify its business model into several products and therefore increasing volume and speed regarding their existing activities (or perhaps activity) may be the most visible type of effect in these firms. In accordance with this reasoning, firms receiving support from VINN NU (which are recently established) tend to scale up activities more than firms receiving support from Forska&Väx. The grant is thus relatively more influential for small and recently established firms.

Scope additionality is almost by definition only relevant for firms with already ongoing activities. Therefore such effects are primarily analysed for the firms supported by Forska&Väx. An important result from the present study is that strong scope additionalities with respect to new products and new markets are common. Also this observation is strongly contextual. The longer the time since a firm got its first support grant, the more likely it is to develop new products or enter new markets. This signifies that such effects are likely to be

long term. Moreover, the older the firm, the more scope additionalities appear as a result of the support grant. The reason for this is that older firms have established routines, infrastructure and organization. The support grant enables them to shift focus onto a new area. Such shift of focus is a strong effect and is evidence of a pronounced difference in effects between new vs. established firms.

Among the other scope additionality categories (networks, human capital and innovation management), there are less indications of strong effects among the studied firms. These results are probably influenced by the classification of the effects. There is no question that there are inherent differences within these groups in terms of long term effects and tangibility. Human capital, improved networks and improved innovation management are 'softer', less well defined by nature. Firms may consider these as more or less important and their long term effects may vary. Effects within these are further difficult specify. New products and new markets are on the other hand very substantial and easy to specify. So are their potential long term effects.

An effect that we did not look for, as our focus was set on additionality, was that the public agency (VINNOVA) is perceived as a mediator of quality, both among the supported firms and by other actors in their surroundings. This "quality assurance" which stems from the received support from VINNOVA influences the firms' market potential and makes them able to attract additional (venture) capital.

The support contributes mainly to reducing the risk at the stages of business formation and reorientation and to information signalling. It is clear though that many of the effects identified in this study vary systematically, are contextually bound, and differ a lot both between and across firms and type of programs.

Suggestions for future studies

The study has identified many examples of additionality. However, we have not been able to analyse links to long-term productivity effects. An interesting future study could be carried out in the following step-wise manner. First, a survey is sent to all firms taking part in the two programs inquiring about additionality effects. The survey results could be linked to the firms that have been interviewed in this study to examine whether perceived additionality effects are stable over time. This would give indications whether additionality effects found early on are similar over time. This inquiry would further be linked to quantitative data regarding firms'

productivity, attempting to assess whether participation is connected with higher productivity. Such a study would have to be carefully designed as there are several statistical facets to acknowledge, such as selection mechanisms at work from the choice of firms in the program by VINNOVA necessitating the use of a control group of firms for comparison, the problem of separating cause from effect as the most able firms tend to be selected to participate in the program.

1 INTRODUCTION AND SCOPE OF THE STUDY

VINNOVA, the Swedish Governmental Agency for Innovation Systems, aims to promote sustainable growth and prosperity throughout Sweden. An important means to reach this goal is to fund needs-driven research. VINNOVA has a number of tools at its disposal to achieve this goal. Some of them target small and medium size enterprises (SMEs). As it is central for VINNOVA to get at least an understanding of the effects of such support in order to improve on their efficiency, this report studies the short to medium term effects of VINNOVAs support programs on SMEs.

There are at least two challenges facing the budding researcher assessing the ultimate effects of innovation support programs. First, there are difficulties *observing* the effects of support. Second, the *causality* from input to effect is generally difficult to establish. Studies indicate that the productive effect of innovation programs take many years. This is both because the data collection into records such as financial accounts or other performance measures are slow processes, and because effects themselves take time to unfold. Researchers are therefore in many cases bounded to study short term effects manifested in less tangible shapes such as changed orientation of firms, new methods and scope of products. Such studies have the potential to give a glimpse of the long-term effects of innovation support.

This study evaluates *additionality* in firms emerging from VINNOVAs innovation support programs. Additionality is in this report defined as changes in firms' routines. The study is not an evaluation of the support programs as such, although evidence of additionalities may influence program design.

The main method for "measuring" additionality has been to interview representatives from a selection of firms subject to support, and to qualitatively assess their answers. The interviews are complemented by quantitative information to give indications of whether factors such as firm size, type of program participated in and the age of the firm impact on additionality as well.

The firms selected for study have received support from VINNOVAs programs VINN NU and Forska&Väx.² We selected firms from those programs for the practical reason that they expressly target small and medium sized firms. We received accounting data concerning number of employees, production value etc, which has been used to complement the qualitative descriptions provided by the interviews. The study was carried out by staff at CIRCLE (Centre for Innovation, Research and Competence in the Learning Economy) at Lund University. Project leader has been Olof Ejermo, CIRCLE.

² Some firms have received support from both programs.

2 PUBLIC SUPPORT TO INNOVATION ACTIVITIES

Why should the public hand out money, seemingly freely, to private firms? A basic answer is that the public should fund activities with high social returns. While an individual firm mainly considers private returns (profits) of its activities, the public should consider social returns which incorporate effects that extend beyond the firm. This means that social returns take into account the full effects for society, discussed further below. Based on literature in economics we distinguish three reasons why activities related to information, knowledge and innovation need public support. All three reasons tend to lower innovation investments if markets are left to themselves.

The *first* explanation that economists mention is lacking appropriability of information goods. A private actor cannot appropriate all the returns to innovation development activities as these commonly can be copied, imitated or otherwise used by other firms.³ Arrow (1962) discusses in a seminal article how public goods tend to be undersupplied by competitive markets. The marginal costs of information reproduction is often low (cf. the Internet), while initial research costs may be significant. If then the information good can be copied by free-riders, there will not be sufficient returns to the original inventor. Knowledge production activities are therefore subject to *spillovers* to other actors. This introduces a *market failure* argument for supporting innovation.

Secondly, innovation is often 'risky' business. Firms and individuals are generally risk averse: most people prefer safe but lower incomes rather than unpredictable, though sometimes high, incomes.⁴ This means that if

³ Similar arguments as discussed below apply to "information" or "knowledge" goods in general. A more elaborate discussion can be found in Foray FORAY, D. (2004) *The Economics of Knowledge*, Cambridge, Ma, MIT Press.

⁴ Lotteries are exceptions. But these are controlled games with limited stakes; most people choose not to gamble with their whole income.

firms have a choice between developing safe, incremental innovations vs. risky but potentially highly rewarding ones, firms will tend to choose the first type more often or refrain from development altogether. From a societal point of view and given that risk assessments can be correctly made by a public supporting agency, it would be desirable raise the level of risk and the number of risky projects going. Although some innovation projects with high risk will inevitably fail, a fair amount of projects is desirable as a larger number would create a higher chance that at least some projects succeed. If this happens, the benefits of succeeding projects supported by society would more than offset the losses incurred by failing projects. Small businesses in particular are in a position where developing new projects is more risky as they normally are less resourceful. Small businesses have fewer capabilities to correct for imperfections within the internal organizations. For instance, large firms can to some extent overcome the difficulties of a small portfolio of risky projects as they can pool several risky projects together. Large firms, in addition, have an established track record which signals reputation and value to financiers.

Often the probabilities of an outcome are *subjective* to an individual and cannot be objectively attached to an innovation. Knight (1921) proposed the labels risk and uncertainty to describe objective and subjective probabilities. An urn with 49 white balls and 51 black balls represents an objective 51 per cent chance that a black ball is picked at random, whereas an urn with an unknown number of each colour represents genuine uncertainty. Characterization of innovations as uncertain is appropriate, especially in the early stages of an innovation process, and connects directly to our third identified cause for public intervention. This report will not further differentiate between risk and uncertainty as it is difficult to apply in our empirical analysis. Rather, 'risk' will therefore refer both to risk and uncertainty.

The *third identified* rationale for public intervention concerns information asymmetries. It may be very difficult to convince outside financiers to support an innovation project early, as these may neither know whether to trust the seemingly subjective probability as communicated by a firm or an inventor, nor correctly value the size of the reward in case the financiers take an ownership stake. Thus for an outsider an innovation project may represent genuine uncertainty, while the firm or the inventor may consider their calculated probability very accurate. There is therefore an issue of trust involved. As discussed in Akerlof (1970a), this information

asymmetry problem is a common one. *Signalling* is the action by which individuals and firms try to communicate the correct value of a good. Because of trust issues, a trust-worthy agent such as a public organization may take on the role of intermediary and provide objective information about a firm. A signal mechanism may be that a firm receives an award or other types of recognition. In the context of innovation programs, public organizations may take on the role of information intermediaries *signalling* value to other financiers. It could also be argued that information asymmetries exist also within firms as enthusiastic inventors may have to convince sceptical financial managers. It is possible that a public agency may mitigate these risk hurdles if inventors can convince a public agency.

2.1 SPILLOVERS FROM INNOVATIONS

An interesting device for discussing private and social returns to innovation and relating them to policy measures is provided by Jaffe (1998).

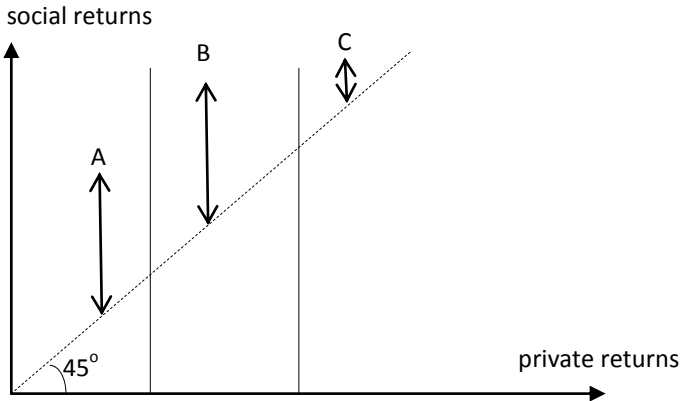


FIGURE 1. PRIVATE AND SOCIAL RATES OF RETURN TO INNOVATION. SOURCE: BASED ON JAFFE (1998)

Assuming the spillover gap, i.e. the difference between private and social returns, to be positive, we can consider three different types of research projects, drawn in Figure 1 as A, B and C. The horizontal axis measures the rate of private return of innovation projects. A 45 degree line links private returns to a vertically drawn axis measuring social returns. Project A in Figure 1 is an unprofitable project from a private point of view. The social returns are on the other hand substantial. Project B has some commercial returns and much scope for spillovers. Project C has large commercial prospect, but exhibit little additional spillover effects. Jaffe

(1998) discusses these projects roughly as follows. Projects with large social returns are of course of interest to policy makers. Projects with large private returns may not be necessary to support, as these are likely to find their ways to the market anyway. On the other hand, projects with very low private returns (Project A) should probably not be supported by the public as they may not be sustained by markets. Therefore, projects like B with intermediate levels of private return are the strongest candidates for policy support. It may be further argued that private and social returns are positively correlated, i.e. projects with some commercial returns are likely to attract followers and lead to more positive spillovers and consequently larger social returns. This means that private and social returns in combination may be an appropriate guiding rule when considering amenable projects for support. It should be noted that the project mainly must fall within the scope of a *market* to be appropriately analyzed in Jaffe's framework. Projects entirely or almost entirely for use within a public sector do not lend themselves easily to this analysis, as "private returns" are not well defined. In this case, A projects may also be relevant support projects. The analysis also presumes that the potential private and social returns can be correctly evaluated to be eligible for public support. Often this is the most difficult and is complicated by the existence of risk (and uncertainty).

A second way of using the diagram is by analyzing the effects of a general instrument to promote innovative activities: general R&D tax incentives comprising e.g. tax credits, cost allowances, depreciation allowances and effects on corporate income tax rates (OECD, 2001).⁵ These mechanisms lower the cost of R&D activities in general, and therefore lower the bar for project to be commercially successful. Assuming that eligible R&D projects can be correctly reimbursed, a movement of all projects will occur to the right in the diagram, as if the private rate of return had increased. The effect of such a policy is to encourage mainly projects with somewhat weaker commercial prospects, as it is mainly projects on the margin that change status from unprofitable to profitable. If these projects are also associated with somewhat lower social returns, as seems likely by the reasoning of Jaffe, R&D tax incentives are unlikely to yield substantial effects. Despite this, R&D tax incentives are used by an increasing number of countries (OECD, 2001). Of course, if incentives can be targeted to specific

⁵ We avoid the term "subsidy" as it might be understood by some as an "R&D program".

types of R&D, e.g. for small firms or more risky types, the effects may be more beneficial than the highly stylized characterization given above. In Sweden and some other OECD countries (e.g. Finland, Germany, OECD, 2001) no general tax incentives are given to R&D.

A large literature has developed that examines spillovers on the firm level using production function estimation techniques. Empirical evidence suggests that they are sizeable and in the order of 50-100% of the magnitude of private returns (Swann, 2009). Wieser (2005) summarizes large parts of the literature and reaches similar conclusions. He also finds that the elasticity of R&D to output increased in the 1980s and 1990s compared to the 1970s.

The Jaffe (1998) model is useful when the end-result is more or less clear, i.e. innovations are on the market and have more of a 'finished' character. A discussion of spillovers is useful in the sense that it focuses on what is relevant for society as opposed to that of the private firm. In another sense it is limiting. Spillovers mainly concern output effects: the ultimate benefits for consumers and producers are mainly what counts, whether accruing in the original firm or in recipient firms.⁶ The process by which this occurs is not under scrutiny. In many cases these conditions do not apply. For instance, innovations diffuse into the economic environment and are constantly improved (Hall, 2005). This means that an innovation is rarely fully developed. The productivity effects of gradual innovations may be substantial when added over time.⁷ For projects where we have limited information about the eventual outcome, this lack of observability becomes disturbing. We instead develop a framework for analysis that is extended to include earlier stages of the innovation processes.

⁶ Spillovers can of course occur also in the development processes, as many (if not most) innovations require high degrees of interaction with other agents for their development. These spillovers may be more controlled by the involved actors (i.e. they are rent spillovers). Spillovers coming from a finished product may be more difficult to control, however.

⁷ The history of the steam engine is a case in point, as is shown by the dramatic improvements in performance over centuries GOMORY, R. (1983) Technology development. *Science*, 220, 576-580..

2.2 INPUT, BEHAVIOUR AND OUTPUT IN INNOVATION PROCESSES

Figure 2 shows a simple description of the innovation process where firms are the main drivers of innovation. The process is modelled as linear from input, through firm organization leading to output. Spillovers are further added as they have a potential of occurring at all stages and accrue outside the firm. This model is an obvious simplification as there are plenty of feedback mechanisms from users to developers, suppliers of intermediate goods to purchasers, from testing, design, marketing, etc (Kline and Rosenberg, 1986, Hippel, 1988). In this sense, information may also “spill in” to the firm from its collaboration. It is difficult to generalize these distinctions and beyond the scope of this report. The type of innovation differs by sector and technological trajectory. Pharmaceutical firms are e.g. product R&D oriented, active in science areas, whereas farming are dependent on supplies of innovative products from firms specializing in providing thereby forming a process-oriented improvements in farming techniques. In other sectors, technological change in the supply of IT reforms service sectors, such as in banking, in telecommunications. These are but a few distinctions that could be made (Pavitt, 1984, Tidd et al., 2005).

Inputs in Figure 2 refer to additions of capital that add on ‘fuel’ to the innovation process(es). Inside the firm reorganization of staff and production development takes place. This may take several forms: e.g. changed types of products, or service contents, changed profile for use of human capital such as recruitment of staff with different competences. The output changes may involve different variants of a base product or change of existing products.

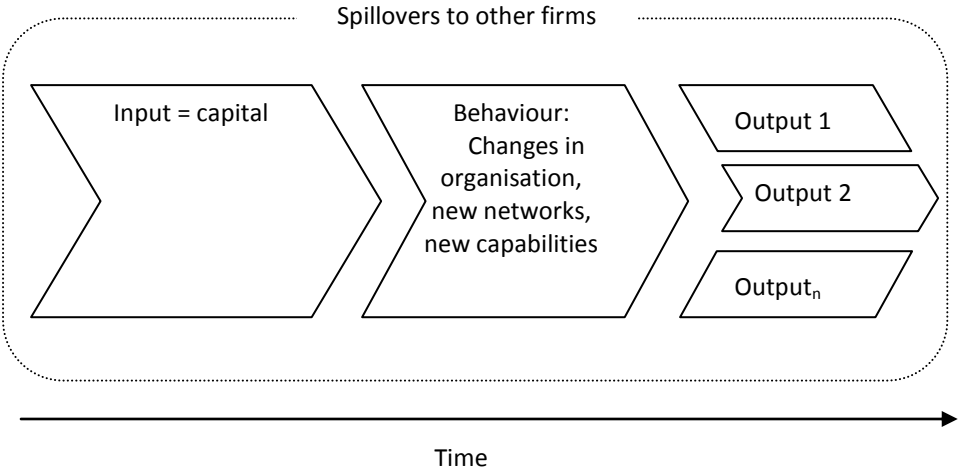


FIGURE 2. AN INPUT-OUTPUT VIEW OF THE INNOVATION PROCESS

2.3 ADDITIONALITY AND THE INNOVATION PROCESS

A central aim for government innovation programs is to realize permanent changes in the innovative processes of firms and organizations (Forsknings- og Innovationsstyrelsen, 2008). These intended results have been labeled *additionality effects*, a class of effects that can be regarded as changes in firms' routines. Georghiou (2002) argues that three categories – *input*, *output* and *behavioural additionality* – are at work. There is a direct correspondence between additionalities and the input-output scheme depicted in Figure 2, and the aims of innovation policy and innovation programs. In the following, we adopt the categorisation of Georghiou (2002) to build an analytical framework in which we analyse the additionality effects of government research funding within which the empirical analysis of the study can take place.

2.3.1 INPUT ADDITIONALITY

Input additionality is concerned with “whether resources provided to a firm are additional, that is to say whether for every Euro provided in subsidy or other assistance, the firm spends at least an additional Euro on the target activity” (Georghiou, 2002, p. 58). Input additionality was the first aspect of additionality that caught the interest from policy makers. The interest in input additionality came from a concern that government funding in R&D should not crowd out private R&D investments (Quintas and Guy, 1995). Rather, such funds should stimulate added input to already planned, or ongoing processes to expand activities.

An input additionality can be that government support opens up for venture capital financing or other types of financial support that increase the opportunities for firms to carry out the activities or projects that they are planning. Most governments build in requirements of co-financing in their innovation support programs. This is one way of ensuring commitment from the supported firms and reducing risks of crowding out.

2.3.2 BEHAVIOURAL ADDITIONALITY

Behavioural additionalities concern firms or individuals that change behaviour as a result of funds granted. *Behavioural additionality* can be divided into *scale*, *scope* and *acceleration*.

Behavioural scale additionality pertains when the volume of activities is expanded beyond the funding budget. Grants can open for opportunities for firms to dedicate additional man hours into the development of a

project. Projects may also expand in activities or into new areas e.g. due to employment of labour with new and different insights on a specific area. In close relation to behavioural scale additionalities we have the sub category of behavioural scope additionalities.

Behavioural scope additionalities result if research activity is expanded into other products and markets than would have been possible without government funding. This category comprises collaboration and networks between firms as well. Scope additionalities concern activities that expand into other projects, new collaborations both within and between organisations. Examples of scope additionalities are the expansion of human capital investments into new fields of knowledge with the potential to exploit new markets but also to let learning experiences from one project benefit other projects. Another example of scope additionality is when firms search for new strategic partners, e.g. firms, organisations or universities, which can lead to increased quality or provide knowledge stimulus to develop products. Also firms can witness that management in general is improving due to deadlines, demands for documentation appointments with partnering firms and organisations or due to restrictions and demands that follow a grant. Moreover, grants can raise the competences and skills within a firm through employment of personnel. An increase in and a variety of skills has the potential not only to benefit a single project but the whole organisation, both in the short and the long run. This leaves us with four types of behavioural scope additionalities: markets and products, new networks, new types of human capital, and improved innovation management.

Finally, *behavioural acceleration additionalities* encompass behavioural changes that bring project activities significantly forward in time. Possible outcomes of such acceleration additionalities can be that firms enter new fields of knowledge, acquire new information at an earlier point than expected or that development of products is accelerated in order to pursue a window of opportunity existing temporarily on the market.

While the above presentation of the theoretical framework presents the categories as distinct from each other, such clarity is probably rare to observe in practice. Several effects categories are likely to be observed conjointly, a caveat to bear in mind in the analysis.

2.3.3 OUTPUT ADDITIONALITY

Output additionality measures output that would not have taken place without funding. Output additionalities concern foremost products, market shares and profitability, but also new inventions or patents developed within the funded project. These characteristics can in principle be observed in quantitative data, such as counts of patents, increase of sales and new products in the pipeline. More difficult to quantify is the opening of new markets, which would nevertheless count as an output additionality. Compared to private returns, output additionality is a broader concept and the type of output is often specified.

A fictitious example illustrates all the additionalities discussed above. Consider a small biotech company specializing in development of antibody-based drugs for cancer cell treatment that has been granted support from VINNOVA. The grant is on 5 MSEK. This enables the hiring of three scientists. In addition, the firm invests another 5 MSEK that is used to hire three more scientists. These additional 5 MSEK represent an input additionality. The hiring of three additional scientists represents a behavioural scale additionality. The recruitment of scientists adds new dimensions to the competence portfolio of the firm. The firm finds that it is now competent to enter into research on multiple sclerosis (MS), which is a new niche of research for the firm. This new activity is an example of a behavioural scope additionality stemming from the grant. The recruited scientists provided new connections with universities and other firms representing another type of behavioural scope additionalities: networking. Due to synergies between these two fields of research the firm solved a bottleneck research problem they had struggled with for a long time. As a result, a new cancer drug was developed much faster. This represents a behavioural acceleration additionality. The new cancer drug is an ordinary output effect, not an additionality as it would have been developed sooner or later, also without the support from VINNOVA. The MS research, however, led to a patent defining a new drug candidate which later materialized as a new product. This created possibilities for treatment of an entirely new group of patients, i.e. it opened a new market. The patent, the product and the new market are all examples of output additionalities as they would never have been realized without the support.

Table 1 provides an overview of the type of additionalities dealt with in this study.

TABLE 1. CATEGORISATION AND DEFINITION OF ADDITIONALITIES

Type of additionality	Sub-categories	Definition
Input additionality		Financial resources invested in a project in addition to the support funds
Behavioural additionality	Scale	Volume of activities expanded beyond the funding budget
	Scope	Activities expanded into new areas
	Acceleration	Activities significantly brought forward in time
Output additionality		More output due to financial support

2.4 INNOVATION PROCESSES AND WEAK AND STRONG ADDITIONALITY

Risk aversion as a decision factor enters especially in the preliminary stages of innovation processes. Firms choosing between two projects with the same expected return will tend to choose the less risky one. This would favour R&D projects associated with safer, more process-oriented outcome and disfavour risky long-term R&D projects with large commercial potential. For an individual firm it makes sense to avoid risky projects, but for society risky projects failing may be outweighed with high returns on other risky projects that lead to higher economic growth on average. In addition, even if projects ‘fail’ from the perspective of e.g. a product that should have been developed, a firm may acquire useful experiences for the future. Information asymmetry relates to this as outside investors may not be able to correctly gauge the innovation potential of investment projects. Similarly, within firms internal politics may present an objectiveness problem as inventors try to persuade managers to pursue money-draining projects. Public money may therefore help support projects that are considered risky in the preliminary stages.

It is not trivial to arrive at a working definition of behavioural additionality that can be used in practical empirical work.⁸ Behavioural additionality can occur at many levels. *Weak additionality* is used to signify cases which do not imply major changes in routines, i.e. the effects are of low magnitude. *Strong additionality* on the other hand comprises effects that are of strong “magnitude”, i.e. they cause the firms to implement major changes in their routines. We further adapt the concept of weak and strong to sub-categories:

Strong behavioural scope additionality results when a firm tries to develop a product or process with little resemblance to earlier methods and/or where we are fairly certain that the public support has led to this result. In the case of scope additionality, a weak effect describes an uncertain or disputable causal relationship between the funding program and the effect in question. What in the material may appear as effects of the funding program may in principle be due to other factors, further distorted by time lags. These effects may therefore be analytically difficult to distinguish. The use of weak additionality incorporates also these ambiguous cases. New products, creation of new markets and novelty is associated with this category. Similarly, strong behavioural scope additionality also applies where an innovator tries to pursue a new line of research or line of production with vague resemblance to earlier work, and this can be established. In other words, for behavioural scope additionality the concept of strong effects has been used also to describe cases where it is clear that a (relatively small) project has had a major impact on the firm’s behavior.

Strong behavioural scale additionality concerns projects which have been substantially expanded as a result of the grant. This relates both to financial, time and staff commitment and hiring of new competencies. These categories are complementary as more of one will tend to elevate another effect.

⁸ A quote from Clarysse et al. (2006) is illustrative. They state that the field of behavioural additionality “...has remained a rather anecdotal observation, without much academic work to underpin its existence or to explain the mechanism through which it was affected” (p. 1518).

Strong behavioural acceleration additionality. This category comprises projects which are pursued much earlier and/or at a higher speed. We can expect that acceleration is often combined with other types of additionalities, such as scale. These effects are important as being first to the market is increasingly urgent for a firm's competitiveness.

In the cases of scale- and acceleration behavioural additionality we can be fairly certain that there is in fact an additionality taking place as a result of the public support. In those categories, "strong" therefore means both strong and certain.

2.5 INSTRUMENTS FOR INNOVATION SUPPORT⁹

As the causes for market failure differ as outlined above, the actual instruments should be tailored to the failure identified. But in many cases of innovation development the information collection costs are too high to bear for policy makers and more general instruments are in use.

Swann (2009) adopts a three-tiered categorization of policies designed to support innovation. In the following, we will discuss examples in each of these categories.

First, *tax incentives* may be given to innovative activities associated with positive externalities.¹⁰ Tax incentives have been discussed briefly under 2.1, where some of the problems of a generalized version of this instrument

⁹ In this brief discussion, we are by no means intending to fully catalogue all types of public support to innovation. Examples of omissions include support to business formation, standards setting. Scotchmer (2004) provides a more systematic discussion of e.g. the history of innovation incentives, with specific attention to IP rights and the role of prizes.

¹⁰ Swann (2009) actually uses the term subsidies. We use the term tax incentives for consistency with 2.1.

were highlighted. Under certain circumstances, where subsidies can be tailored they may be effective, for instance if they can be targeted to specific areas or specific actors.¹¹

Second, *institutions* which enforce property rights to limit, or altogether stop spillovers to third parties, raise the level of appropriability and provide an incentive to invent. Intellectual property rights including copyright, trademarks, design and utility patents, belong here. For space reasons we limit the discussion here to so-called utility patents, usually prominent in discussions about intellectual property rights.¹² Patents have been and continue to be an important incentive mechanism directed towards inventive activity.¹³ Patents can be observed to have two basic functions: 1. inventions need to be documented so that they can be reproduced by someone skilled in the art, 2. the inventor is in turn rewarded with a monopoly, often lasting 20 years. An advantage of the patent mechanism is that the problem formulation, i.e. what is to be invented, is decentralized so that inventors decide about the new ideas themselves. Furthermore, the value to patentees of their inventions (the monopoly) is related to the social value and the size of the market that becomes the result of the invention. There are also several disadvantages. Patenting is common mainly in fields where inventions can successfully be protected by law, where sufficient financial muscle is available and where investors can discern commercial potential; other fields tend to rely on other protection mechanisms (Levin et al., 1987).

Other types of institutions affect education and supply of skills. *Monasteries* were historically important institutions specializing in research *and* documentation of inventions. *Universities*, also with origin in medieval times, raise the level of education, initially for the elite, nowadays for broader parts of society. Raised levels of

¹¹ An example: The Swedish home-PC program 1998-2006, by allowing gross income deductions of PC costs in return for evidence of undergone computer skill education, arguably raised the levels of computer skills for a substantial share of employees.

¹² This is the type of patents one normally thinks about.

¹³ For example, Lamoreaux and Sokoloff (2007) point to a sharp increase in patenting in the wake of the radically reformed patent law of the United States in 1836.

education affect both demand and supply of innovation. On the supply side skilled employees raise the quality of innovations and provide research input. On the demand side tastes for goods change with education. It is e.g. inconceivable to have large demand for computers unless the population is literate. Universities as research institutions is a complex area for research, as prospects for turning new knowledge into useful goods for society depends on incentives and culture among researchers, businesses and how this competes with the educating role of universities.

Third, *government expenditure or procurement* aiming to directly support certain activities which do not naturally develop on the market. Historically, systems of patronage for philosophers, mathematicians and scientists have played an important role. A different incentive mechanism which also affects demand are *prizes to innovation* (Scotchmer, 2004). Prizes are awarded to solvers of problems specified in advance and have played a role in history. In France, development of the tin can was awarded a prize by Napoleon as it preserved the food for his armies. Lyon's weavers were also awarded prizes. The machines developed were precursors of modern computers. The main advantage of prizes is that targeted problems can be addressed. If society sees the need for innovation development of a desired innovation, say environmental or health, it can award a prize. A difficulty with prizes is how to set the prize level, and whether performance (*blue sky prizes*) or achieving a pre-determined level (*target prizes*) should be rewarded. Related to prizes is public procurement. The main difference as compared with prizes seems to be that in procurement, sales to government is the reward possibly combined with a prize for developing the innovation. In procurement, the provider of the good needs competence both in production and innovation.

3 VINNOVA PROGRAMS FOR SMALL AND MEDIUM SIZED ENTERPRISES

As indicated in the previous section, innovation support to small and medium sized enterprises (SMEs) is indeed much more than allocation of financial resources from the public. Financial resources are nevertheless necessary components for any type of innovation support and the most common tangible instrument for the public sector to intervene in firms' activities and priorities.

A basic question to address before going into a discussion on the outcomes of policy support (i.e. additionalities) is what type of concrete activities that can be promoted with policy intervention. In other words: what can be done in terms of innovation policy support and who can do it? Figure 2 (previous chapter) provides a rough overview of at which stages of the innovation process various types of activities (broadly defined) normally take place, from input of resources in the initial stage to output of innovation in the end. This model is however a highly stylized illustration. In reality the process is non-linear and iterative. Input of capital (financing) takes place throughout the process, not only at the outset of firm or project formation. In an attempt to qualify our understanding of input of capital through means provided by the public sector, its connection to behaviour in firm organization, and eventually (although indirectly) its influence on output in terms of new innovations, the following section presents a simple classification of such support activities administered by the public sector. The classification takes specific account of the underlying rationale for policy intervention within respective program, and the forms in which the support is materialized. Distinctions are made both with regard to the target level of support (i.e. to whom the support is provided) and the form and focus of support activities (i.e. through which means the support is channeled). Support for small and medium sized enterprises from VINNOVA is put in perspective through comparison with other public support organizations in Sweden. The section ends with detailed descriptions of the two innovation support programs specifically dealt with in the remainder of this report: Forska&Väx and VINN NU.

One of the main arguments put forward in the innovation systems literature, indeed very influential for the formation of VINNOVA and the orientation of their activities in support of innovation, is that competitive markets do not provide sufficient stimulus for the development of strong innovation systems. An aim of the Swedish innovation support programs is to strengthen innovation capabilities in Sweden and in Europe. Investment in R&D and innovation projects, where SMEs are drivers is considered to strengthen capabilities not only in the participating companies but also among cooperating partners.

Three important theoretical motives for public intervention were highlighted in chapter 2. The examples of public instruments, or mediators, to stimulate innovation presented in the previous section are broad categories representing different levels of abstraction and providing different possibilities for impact

assessment. They are also examples of instruments managed by society as a whole rather than by specific organizations (or consortiums) representing the support structure of innovation systems. General and more supply oriented instruments (e.g. tax incentives and institutions) provide more or less omnipresent framework conditions, in principle applicable to any innovating firm. Demand oriented specific instruments (e.g. governmental expenditures and procurement) are more exclusive by nature. Innovation systems policy presupposes the existence of instruments as outlined in 2.5. Tax incentives and institutions provide general framework conditions affecting the behaviour of all actors in the system by raising incentives and reducing risks (in the innovation systems literature these instruments are usually seen as defining the “institutional framework” of the system), while government expenditure and procurement are examples of concrete activities carried out by actors representing the subsystem which the innovation systems literature usually refers to as the “support structure” of the system. Some instruments may though be more critical than others, depending on the specific context.

This report is primarily dealing with direct and specific types of policy support instruments, in the previous section specified in terms of governmental expenditures or procurement. To reach an understanding of the effects of various forms of specific innovation support on behavioural additionality among the receivers, it is necessary to go beyond those broad categories specified in the previous section towards more concrete support activities. Before going into details with the support activities initiated by VINNOVA through the Forska&Väx and VINN NU programs a short introduction to various types of innovation support offered by the public sector and various public-private constellations representing the support structure of the Swedish innovation system and its various regional subsystems is provided.

The innovation systems literature identifies a range of innovation support activities, initiated by or involving actors from the public sector (e.g. Asheim et al., 2006, Nauwelaers and Wintjes, 2002, Edquist, 2008). A first distinction can be made with regard to the target level (unit) of support, specifying activities focusing directly on the level of individual firms and activities focusing on more general framework conditions on the level of systems. This distinction separates activities providing *direct* support to single organizations from activities providing support to *groups* of actors (e.g. in specific regions or sectors). While a large share of activities

initiated by VINNOVA targets the system level (examples are given below), the two instruments dealt with in this study are more oriented towards individual firms. A second distinction can be made with regard to the form and focus of support, specifying activities aiming for redistribution of input resources and activities aiming for behavioral change in organizations (or systems) receiving support. Like most instruments initiated by VINNOVA the focus of VINN NU and Forska&Väx is to achieve behavioral additionality, however input resources are used as means for achieving this. Table 2 provides a classification of instruments along these two dimensions and examples of activities representing each category.

TABLE 2. CLASSIFICATION TEMPLATE FOR INNOVATION SUPPORT WITH ILLUSTRATIVE EXAMPLES FROM SWEDEN

	Input resources	Behavioral change
Firm level	<i>ALMI</i>	<i>The Swedish Trade Council</i>
System level	<i>The Innovation Bridge</i>	<i>VINNOVA</i>

VINNOVA is certainly not the only public sector organization providing support for SMEs. They are however one of few national actors primarily targeting the system level (even if the two programs studied in this report are more firm oriented) and they are one of few organizations specifically focusing on support for innovation. While many regional actors initiate activities targeting the regional system level with ultimate focus on behavioral additionality, most national initiatives are primarily oriented at input resources on a firm level. Among the most influential national actors providing financial support to SMEs is ALMI Företagspartner AB, a non-profit limited company (aktiebolag) fully owned by the Swedish state. ALMI has 19 regional offices (subsidiaries) in Sweden. These are owned to 51% by the Swedish state and to 49% by regional public authorities. Main focus of ALMIs activities is finance (mainly through loans) and business advice. They clearly target the firm level and most of their programs are oriented towards activities in which regular venture capital usually not invests. ALMI is thus a schoolbook example of an actor in the upper left box in Table 2. As regards the risk dimension discussed in chapter 2 of this report, most of ALMIs support activities are oriented towards a

low-risk strategy.¹⁴ Relatively small loans with short payback horizons presuppose development of innovations close to market. Linking this to the previous discussion on the trade-off between social and private returns, illustrated in Figure 1 (previous chapter) one could argue that main focus is put on private returns in this type of policy support. Those should be well defined and within reach for the applicant to be eligible for support. As regards behavioural additionality, these activities mainly target scale and acceleration. Other well known examples of the same category are Industrifonden (“The Industry Fund”)¹⁵ and the Swedish Agency for Economic and Regional Growth (TillväxtVerket, formerly NUTEK).

The Swedish Trade Council (Exportrådet) is another national actor providing support to SMEs. Just like ALMI, their activities mainly target the firm level, through information, strategic advice and hands on support for firms entering foreign markets. They however do not provide financial support (other than “in kind” resources by providing their services for free or strongly subsidized). They are thus a good example of an actor in the upper right box in Table 2. As regards risk, also Exportrådet follows a low-risk strategy when it comes to innovation since their support activities do not target renewal but further exploitation of existing strengths. Also those activities thus primarily target scale. Therefore the most likely outcome is what we in this report define as weak additionality. Main focus is put on private returns, even though social returns, of course, also are expected as outcomes of the support activities.

The Innovation Bridge Foundation (Innovationsbron) is just like ALMI mainly oriented towards young firms (or even firms not yet established). It is a state-owned limited company with seven regional offices (in Luleå, Umeå, Uppsala, Stockholm, Linköping, Gothenburg and Lund). The Innovation Bridge Foundation has five subsidiaries, two of them fully owned by the mother company, and three with other public agencies as

¹⁴ Low-risk vs. high-risk strategy here and in the following refer to the risk level of targeted firms.

¹⁵ Industrifonden is an independent foundation founded by the Swedish state. The foundation offers venture capital, management and judicial advice and a network of contacts to small and medium-sized companies that want to grow.

minority shareholders. The main aim of their activities is to promote commercialization of research and innovation. This is done both through provision of venture capital through their investment subsidiaries (Teknoseed AB, Uppsala Seed Capital and Innovationsbron Rendera S addkapital AB) and through advice and help with research-based firm formation and development through the mother company and their technology transfer subsidiaries (Teknopol AB and Forskarpatent i Syd AB). As opposed to ALMI and the Swedish Agency for Economic and Regional Growth, The Innovation Bridge Foundation has a clear focus on innovation, and in addition to provision of capital and direct support targeting individual firms, a large part of their activities is oriented towards business incubators. They are therefore a prime case of an actor in the lower left box of Table 2. As regards the risk dimension, the Innovation Bridge Foundation follows a high-risk strategy through an explicit focus on new, previously non-existent technologies. Their activities thus mainly target scope additionality, but also to some extent scale and acceleration. As regards private returns, these (or the potential of such) are usually not fully identified in this type of projects. The underlying rationale for the support as such is expectations on high social returns. Another example of this category is the Knowledge Foundation (KK-stiftelsen) who provides resources to stimulate university-industry relations and research within specific prioritized thematic areas.

As already touched upon, VINNOVA is a good example of an organization primarily oriented towards the lower right box of Table 2. Most of their activities target the system level rather than individual firms, where the underlying rationale is to stimulate behavioural change towards innovation. One of VINNOVA's flagships, which clearly illustrates this point, is the VINNV AXT program aiming to support the formation and performance of regional innovation systems. VINNV AXT, and most other instruments provided by VINNOVA, presupposes active engagement from firms, universities and public sector organizations (triple helix). VINNOVA's activities generally follow a high-risk strategy, not least since almost all their support programs explicitly state that support is only given for activities that without such support would not been initiated at all, or at least on a significantly smaller scale. In similarity with the Innovation Bridge Foundation, both high social and private returns are expected to result from projects supported by VINNOVA, but the private returns are usually very hard to predict. This is also the underlying rationale for the support as such – to increase incentives for firms taking risks through engaging in R&D despite uncertainty as regards private returns of the activities.

However, as mentioned above, the two programs specifically analyzed in this study, are more oriented towards the firm level than what is commonly associated with VINNOVA. Nevertheless, since both programs have an explicit aim of stimulating innovation (as opposed to general business support) the criteria for evaluation can be said to also cover the system level because most innovation processes, particularly those carried out by SMEs, involve also other actors in the innovation system (e.g. other firms, universities, users etc). Classifying the programs in line with the template presented above, we would thus place them somewhere in between the upper and lower left boxes of Table 2. With similar arguments, they would both also tend to transcend the left column through their explicit focus on innovation (i.e. behavioural additionality).

*Forska&Väx*¹⁶ is by far the largest and most influential initiative in support of SMEs in VINNOVA's portfolio. The program was launched in 2006 with an annual budget of 120 MSEK. Although research is highlighted in the title of the program, the main criterion for evaluation of applications to this program is the growth potential of firms. Yet, the growth potential should be rooted in R&D activities. The program is primarily targeting established firms which have an ambition of strengthening their R&D activities. The programs are attractive from the firm's perspective as they lack the financial stability necessary for dealing with the costs and high risks associated with R&D operations. Target groups of this support program are both firms with limited experience in R&D but with intentions to strengthen this dimension, and firms largely based on R&D activities with an ambition to scale up such activities. The program is structured as three different project types: (A) full scale R&D projects – up to 5 MSEK, (B) small scale R&D projects – up to 0.5 MSEK, (C) needs analysis – up to 0.1 MSEK. The program covers in principle all sectors of the economy, but in practice there is a dominance of typical high-technology sectors like ICT, biotechnology, medical technology and other niches of the life sciences. Priority is given to projects with environmental and energy focus, and a fairly large share of supported projects comes from the transport sector. Support is not provided to already ongoing activities; the applicants must convince evaluators that the R&D activity suggested in the application would not have been carried out without support, at least not at the same speed and volume. The supported projects are in other words

¹⁶ Could be translated roughly as 'Research to Grow'.

relatively far from concrete market applications. Other potential sources of funding are therefore strictly limited. Additionality is thus a central rationale for this program.

*VINN NU*¹⁷ was launched in 2002 as a joint program between VINNOVA and the Swedish Agency for Economic and Regional Growth (formerly NUTEK). Since 2006 it is a joint effort between VINNOVA and the Swedish Energy Agency (Energimyndigheten). The program has an annual budget of 6 MSEK, to be equally distributed between 20 receiving firms/projects. In contrast to Forska&Väx, which mainly targets established firms, VINN NU explicitly aims to support new firm formation. The main rationale is to provide conditions for survival in the earliest phase of establishment, making it possible for the firms to refine their business models and approach the market. In similarity with Forska&Väx, VINN NU in principle covers all sectors of the economy. However, in the call for applications VINNOVA defines specific thematic areas. The vast majority of firms receiving support from VINN NU are based on research carried out at universities or other types of research institutes (e.g. they are spin-offs from universities or research institutes). While the main rationale for Forska&Väx was to promote R&D activities that would not have been carried out without the support, VINN NU grants are supposed to primarily cover costs of developing business models for commercialization. This means that while Forska&Väx could be seen as seeking to promote high social returns through stimulating R&D activities, VINN NU is more oriented towards stimulating private returns through supporting commercialization of already ongoing research. Thus, while aspects of additionality from Forska&Väx can be measured through new investments in R&D and outcomes in terms of research based innovations, VINN NU starts from the opposite perspective. Additionality from VINN NU can be measured through spin-off formation and survival, and through outcomes in terms of the new firms' success in attraction of private venture capital. At least 50% of the grant from VINN NU should be used for activities targeting commercialization and attraction of private investments. Also, this program pursues a high-risk strategy.

An important difference between these two programs, apart from different focus (R&D vs. commercialization), is their target groups. VINN NU is eligible only for firms younger than one year. Firms can hardly receive VINN

¹⁷ Could be translated roughly as 'Win Now'.

NU grants more than once, while they can in principle be awarded a Forska&Väx grant more than once. It is therefore not possible to evaluate learning effects as regards VINN NU applicants' skills or inclination to apply for grants within this program. There are, however, quite a few firms that have applied for, and received, support from VINN NU that in a later stage also apply for funding from Forska&Väx. This illustrates 'complementarities' of support programs provided by the same organization (e.g. a company receives support from VINN NU in the stage of firm formation, and additional support from Forska&Väx in a later stage of expanding its R&D activities).

4 EMPIRICAL EVIDENCE ON ADDITIONALITIES

A growing body of literature discusses different aspects of additionality effects of public support of R&D. In the following we review the literature and highlight the most interesting findings as regards the types of additionality introduced in chapter 2.

4.1 INPUT ADDITIONALITY

A primary reason why research on additionality effects of government funded R&D was initiated was a wish for documentation of effects of funding on the one hand and an assurance that government funding would not crowd out venture capital and other forms of private investments, on the other. Reviewing European studies reveals no evidence of crowding out effects on private R&D from public funding (see e.g. Johnson et al., 2008, Ali-Yrkkö, 2004, Falk, 2006, Aerts and Schmidt, 2008, Quintas and Guy, 1995). Johnson et al. (2008) interviewed Swedish firms who had received seed capital funding from VINNOVA and NUTEK and found that the majority of the funded R&D projects would not have been undertaken without the public support. Similar results were found by the Research and Innovation Agency in Denmark who found that 44% of firms that were funded with strategic research grants would not have had activities equal to its present scale if they had not received funding. Only 6% would *not* have started any activities at all if not funded (Forskings- og Innovationsstyrelsen, 2008p. 66). Related findings are reported by Hsu et al. (2009) in Taiwan who found that 7.1% of the studied projects would *not* have taken place without external government funding. However, in

Ireland, Görg and Strobl (2007) find a crowding out effect if the grant is large (above €55,000)¹⁸ but not otherwise. Accordingly, studies show that input additionalities such as research funding from the government supplement ongoing research rather than give the initial impetus to it, but as emphasised by Görg and Strobl (2007), if grants exceed a certain amount crowding out effects may occur.

All in all, this leaves the impression that public funding leads to input additionality in terms of higher investments in R&D both within individual projects and also in the organisation in general. But although, the literature tends to agree that government funding of private R&D does not crowd out private investments – at least to a certain point - there is less agreement on where the input additionality effects are the largest. Ali-Yrkkö (2004) finds the strongest additionality effects for large firms, whereas Lööf and Heshmati (2005) find that additionality only prevails among small firms. Such conflicting reports are condensed by Buisseret et al. (1995) who argue that larger firms have the resources to continue projects without subsidies from the government and thus logically contribute less input additionality than smaller firms do. This view is supported by Shipp et al. (2006) who, based on research in the US, also find that small firms have the highest gains from funding, among other things due to the more fragile economy in smaller firms. According to this study public funding can help to stabilise the economy of young and/or small firms in periods of unsecure and risk related investments in R&D. Consequently, an input additionality of public funding can also be regarded as a risk lowering process that encourages especially smaller firms to engage in R&D.

4.2 OUTPUT ADDITIONALITY

Georghiou (2002) defines output additionality as the extent to which the outcome of a project differs due to funding, or as Hyvärinen and Rautianen (2007) put it: would the same output have been obtained without a policy action? Output additionalities can increase a firm's stock of knowledge resulting from an R&D funded project and bring an increase in capabilities which will influence R&D productivity and profit in a longer perspective, e.g. through patents (Hsu et al., 2009).

¹⁸ This corresponds to the above 66.6 percentile of the entire distribution of R&D grant payments.

The success of identifying output additionalities is mixed. Using employment growth as a proxy for output additionality, Johnson et al. (2008) and Ebersberger (2004) report a positive effect from public funding whereas Piekkola (2007) and Norrman and Bager-Sjögren (2008) do not find any evidence of output additionality and Bager-Sjögren and Löf (2005) actually suggest a negative effect on employment. But employment growth may be a poor proxy for output additionality as R&D can easily result in rationalization and increased efficiency which from a firm's point of view can be a rather positive effect. Bager-Sjögren and Löf (2005) also find a negative effect from public funding on output in terms of sales, productivity and solidity. But the authors point out that they have a rather small sample of funded firms and that it could be that the firms in the comparison group do not undertake the same kind of risky technological projects.

Studies also report evidence of positive output additionalities. Johnson et al. (2008) find that government support has helped firms develop prototypes of their products which in turn enabled them to find external funding. Hence, output additionality can lead to input additionality. Furthermore, Ebersberger (2004) finds that funded firms have higher innovative output in terms of patent applications than non-funded firms. Hsu et al. (2009) argue that there is a time aspect to output additionality in the sense that additionalities may first show late in a project phase or even some time after a project is finalised. They also find supporting evidence to this claim among Taiwanese R&D funding. Similar findings are reported by Forsknings- of Innovationsstyrelsen (2008) who in an evaluation of additionality outcome of strategic research funds in Denmark finds that output additionalities are hard to identify in the short run. While arguing that output additionalities have to be seen in a long term perspective, the Danish study finds that only 7% of the firms that received grants had not seen any output effect at all. The identified additionalities comprise a wide range of effects including speeding up of development processes, increased knowledge about markets and customers and new R&D hardware.

Moreover, Hsu et al. (2009) find that output additionalities vary considerably between industries depending on their level of research intensity, on whether the industry is new and emerging or older and established. They also find that the machinery and equipment industry exhibits significantly higher patent rates than the biotech and pharmacy sector and conclude that the evaluation of output additionalities is highly complex and difficult to operationalize. The bottom line is that additionalities assessed in terms of output has to take account of a

time dimension, but should also be observant about the role of industry specific influences and the type of program that firms have received grants from.

4.3 BEHAVIOURAL ADDITIONALITY

Behavioural additionalities are defined as changes in how firms behave due to public funding. Behavioural additionality is sometimes also referred to as second-order additionalities (Autio et al., 2008) and is according to Clarysse et al. (2009) poorly empirically tested and rather anecdotally studied. As mentioned in chapter 2, behavioural additionality can be classified in three subcategories: *scale*, *scope* and *acceleration* additionalities. *Scale* refers to an increasing volume of activities, *scope* refers to activities expanded into other products and markets and *acceleration* to increased speed of activities (Georgehiou, 2002). According to Clarysse et al. (2009) behavioural additionalities are introduced in order to capture processes where input and output additionalities had been unsuccessfully measured. Whereas input- and output additionalities most often are measured by hard facts and analysed by quantitative methods, behavioural additionality is measured and explored through more qualitative means. Studies of behavioural additionality tend to highlight effects in terms of increased scale of project, acceleration of project, improved innovation management, improved networking capabilities and increased use of human capital (See Hyvärinen, 2006, Quintas and Guy, 1995, Malik et al., 2006, Falk, 2006, Fier et al., 2006). From many aspects, behavioural additionality can be regarded as the learning process that a firm undergoes while carrying out a R&D program and thus impacts both the project, but also the organisation in a wider sense. Clarysse et al. (2009) argue that organizational learning theory is a useful point of entry to understand and explain the mechanisms through which behavioural additionality is obtained and is a field that needs to be unpacked.

Norrman and Klofsten (2009) have studied firms in Sweden that were funded by VINN NU grants in 2002-2004. They found that after three years, a majority of firms had improved their knowledge of the market and their relations with external investors. Furthermore, by interviewing key personnel in funded technology based SMEs in the UK, Malik et al. (2006) found that accumulated skills and recruited personnel during a funded project was useful also for subsequent projects. This illustrates that behavioural additionalities may not particularly benefit the funded project but rather the organisation more generally. This is also the essence of a study on R&D

managers from New Zealand; Davenport et al. (1998) find that the most significant behavioural additionality was disciplinary effects on the organisation. Also in line with this, Hsu et al. (2009) identify behavioural additionalities within managerial areas. They specify the behavioural additionalities that they identify as strategy formulation, project enlargements, cost-effectiveness and commercialisation. This, they argue, can be expected to have a positive effect on the firms in both a long and a shorter perspective.

An interesting observation by Clarysse et al. (2009) is that the financial characteristics, most often used to divide between eligible and non-eligible projects, are unusable when it comes to behavioural additionalities. According to Clarysse et al. (2009) some of the characteristics such as networking between firms have positive impact on behavioural additionality while it has a negative impact on output additionality. This result complicates the evaluation process of additionality effects of public funding and highlights the risk of misinterpreting the analytical outcome of empirical studies.

4.4 TIME

An aspect that is only slightly touched upon in the literature is time. This is however a very important parameter when discussing effects of different kind, and thus also when discussing effects of R&D funding. The time dimension is especially important for behaviour additionalities because these represent processes that take time before they materialise and become visible. Behavioural additionality may first show several years after a specific program has been finalised. This makes them difficult to identify and it is particularly difficult to trace changing behaviour as an outcome to a specific research grant. Consequently, evaluation of additionality effects of e.g. public R&D funding should take time into consideration and evaluate projects over a period of time e.g. 1-2 years after a project is finalised and maybe again 4-6 years after. This of course increases the difficulties of pointing to behavioural additionalities of a single project but also increases the possibilities of identifying lasting effects – not least making it possible to distinguish between additionalities that have had weak vs. strong effects on the organisation.

4.5 RISKS

Besides the above mentioned aspect of time for analysing additionality effects of public R&D funding the level of risk is also important for evaluation processes. This is also an issue seemingly overlooked in the literature but highly relevant for the interpretation of additionality. Hyvärinen and Rautianen (2007) argue that one of the goals of public R&D funding is that it “encourages companies to launch R&D projects of higher degree of risk.” (p. 209). If public funding of R&D is targeted towards high risk taking projects then it is logical to expect that the learning from such projects will have a higher impact on the organisation and thus to increase the behavioural additionality – at least if compared to low risk projects. The impact on the organisation will be larger and the output additionality presumable larger too. Based on this argument additionality effects can be expected to increase with a higher level of risk.

5 METHOD

Additionality, discussed in the previous chapter, is a broad concept difficult to operationalize. While certain aspects of firm performance and behavior lend themselves straightforwardly to quantitative description, others are less quantifiable and refer the researcher to qualitative analysis and in-depth case study. This seems to be especially applicable for *behavioral* traits of firms, defined in the previous chapter as belonging to the category of *behavioral additionality* which is a central aim of this study to detect, classify and analyze. Therefore, a complementary methodology has been used, and quantitative and qualitative methods have been deployed in parallel with the ambition to let them cross-fertilize each other. In short, statistical methods have been used to achieve a representative sample of firms, who then have been approached for interviews. Once interviews have been made, quantitative methods have been deployed again to validate findings and to achieve as broad a spectrum of interpretations and results as possible.

5.1 DESCRIPTIVE STATISTICS AND SELECTION OF FIRMS

VINNOVA provided data on 278 different firms that had received 308 grants to projects in the Forska&Väx program, and 118 firms each given one grant in the VINN NU program. There are 28 firms that have been

granted funds twice and one firm that has been granted funds three times. Of these, there are 18 firms that have received funds both from the Forska&Väx program and the VINN NU program.

The firms belonging to the Forska&Väx program have been granted funds in the period 2006-2008 whereas the firms belonging to the VINN NU program have been granted funds in the period 2002-2008. The dataset contains information on the projects and on the firms that applied for funding. Concerning the granted projects there is information on their names, their time period and the size of the grants. Concerning the firms supported there is data on their location, industry affiliation and annual accounts information.

When selecting firms for interviews, we mainly aimed for a representative sample. 80 firms (53 from Forska&Väx and 27 from VINN NU) were selected, sampled on their characteristics concerning region, industry, sales and number of employees.¹⁹ In addition, 20 firms that were extreme in some sense (more than one granted application, large²⁰ increase in sales or employees, many employees or large turnover) were added to the sample.

Due to lack of responses more firms are later added to the sample²¹ and at this stage some of the requirements for representativeness had to be overlooked. In total 119 firms were contacted and in the end 34 interviews were conducted. Of these, 23 firms have been granted funds in Forska&Väx and 14 in VINN NU. This sums to 37 firms because three firms have funded projects both from Forska&Väx and from VINN NU, one of these also

¹⁹ Firms without data on sales or on employment are excluded because their representativeness cannot be validated, as well as firms with zero sales since this figure does not seem reliable. Also, only firms with one granted application are considered.

²⁰ Large is specified as being at least two standard deviations above the mean.

²¹ 30 Forska&Väx firms from the counties of Skåne, Jönköping and Västerbotten and 7 VINN NU firms from Skåne are added.

have two funded projects from Forska&Väx. In addition, there is one firm that has two granted projects in Forska&Väx.

Table 3 and Table 4 show descriptive statistics for all supported firms and all interviewed firms in Forska&Väx and in VINN NU. It should be noted that the sales and employment figures cover the period 2004/2005-2007/2008²², and that this period is the same for all firms irrespective of the year they got an application granted.

TABLE 3. DESCRIPTIVE STATISTICS FOR ALL FIRMS WITH FUNDED PROJECTS IN FORSKA&VÄX AND FOR THE INTERVIEWED FORSKA&VÄX FIRMS

	All funded firms			Interviewed firms		
	N	Mean	Median	N	Mean	Median
Sales (Swedish kronor) ^a	267	27,221,050	5,834,534	23	27,473,960	4,075,403
Growth in sales (%) ^b	196	22.05	12.36	18	31.73	18.06
Number of employees ^a	266	15.85	6.71	23	19.44	7.00
Growth in number of employees (%) ^b	189	10.53	6.37	18	14.60	10.96
Number of applications ^c	278	1.88	2.00	23	2.00	2.00
Number of granted applications ^c	278	1.11	1.00	23	1.09	1.00
Funds paid out	278	728,555	399,000	23	1,066,087	500,000

NOTES: A general note is that there could be measurement errors in the data. Specifically, the data could in rare cases cover the company group rather than the firm.

^a Mean sales and mean employment are calculated in a two step procedure. First each firm's individual mean over the period 2004/2005-2007/2008 is calculated, then the mean across firms. Mean sales are in 2008 prices, SEK.

^b Growth is the average annual growth rate (2004/2005 to 2007/2008) for firms with data for whole period.

^c Number of applications and grants within the program per firm.

Table 3 shows that the growth figures for the interviewed Forska&Väx firms are higher than for the average Forska&Väx firm. This is mainly driven by one of the interviewed firms that has very high growth rates both for

²² The dataset covers four accounting periods, where data on firms following calendar years cover the period 2004-2007, and where data on firms with the first available fiscal year starting in the second half of 2004 cover the period 2004/2005-2007/2008. For firms started later than 2004 the available data are used.

sales and employment. The interviewed firms are also somewhat larger than the other firms in terms of employment, but if one of the firms (having more than 200 employees) is excluded, the interviewed firms are actually somewhat smaller than the other funded firms. The interviewed firms have also, in general, been granted more funds than the other firms. The overall impression is, however, that the interviewed firms are rather similar to the other firms.

TABLE 4. DESCRIPTIVE STATISTICS FOR ALL FIRMS WITH FUNDED PROJECTS IN VINN NU AND FOR THE INTERVIEWED VINN NU FIRMS.

	All funded firms			Interviewed firms		
	N	Mean	Median	N	Mean	Median
Sales (Swedish kronor) ^a	99	834,762	222,680	14	1,131,787	766,745
Growth in sales (%) ^b	27	49.27	25.62		n.a.	n.a.
Number of employees ^a	98	2.44	2.00	14	2.34	2.00
Growth in number of employees (%) ^b	25	8.90	13.62		n.a.	n.a.
Number of applications ^c	118	1.11	1.00	14	1.07	1.00
Number of granted applications ^c	118	1.00	1.00	14	1.00	1.00
Funds paid out	118	290,739	300,000	14	289,286	300,000

See notes to Table 3.

Table 4 shows that the interviewed VINN NU firms are somewhat larger than the rest of the VINN NU firms in terms of sales, but the differences in terms of other variables are small.

A general note to both preceding tables concerns the growth figures which are very high for all funded firms. As can be observed, not all firms are covered in the calculations, especially not VINN NU firms. This is because we only use data on those firms where we have sales and employment data for the whole period. In the dataset there are many newly started firms, especially for VINN NU, as well as some firms that have closed down their activity, hence the growth figures are for established and successful firms. The figures also indicate that firms receiving funds from VINNOVA are in general growing firms. Besides, since most firms are relatively small, even small changes in absolute terms can have large effects in percentage terms.

Comparing Table 3 and Table 4, it can be seen that there is, in general, a large difference between the firms in the Forska&Väx program and the firms in the VINN NU program. The Forska&Väx firms are, on average, larger in terms of both sales and employment. The amounts of funding are also larger in the Forska&Väx program. Firms that have been granted funds in the Forska&Väx program have also generally submitted more applications than the VINN NU firms, a consequence of the fact that a firm only is eligible for VINN NU grants when it is very young. The latter also suggests that the age distribution among firms might differ between the two programs. Unfortunately, this information is only available for the interviewed firms preventing a representativeness check in this aspect. However, Figure 3 displays the age distribution among the interviewed firms. For these firms the age distribution of the Forska&Väx firms is more dispersed than that of the VINN NU firms.

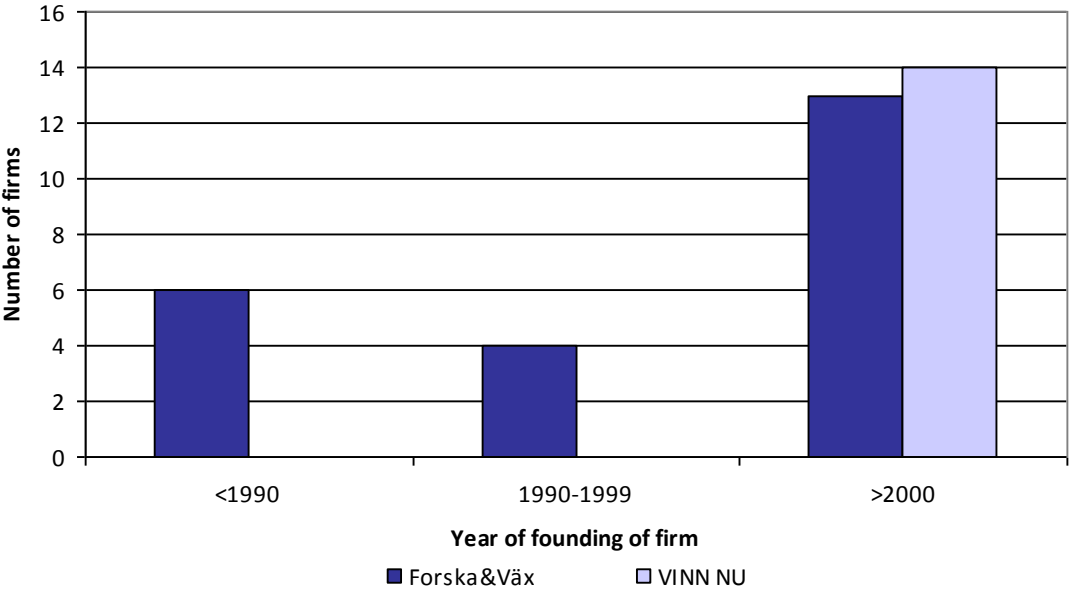


FIGURE 3. AGE DISTRIBUTION OF THE INTERVIEWED FIRMS

The size distribution of the firms reveals large differences between the Forska&Väx firms and the VINN NU firms. Almost all firms that have been granted funds in the VINN NU program are micro firms (0-9 employees). Here, also the largest share of firms in the Forska&Väx program is found but there is also a large proportion of firms in the size group of 10-49 employees, as well as a few firms in the largest size group (50-249 employees). Figure 4 shows this distribution.

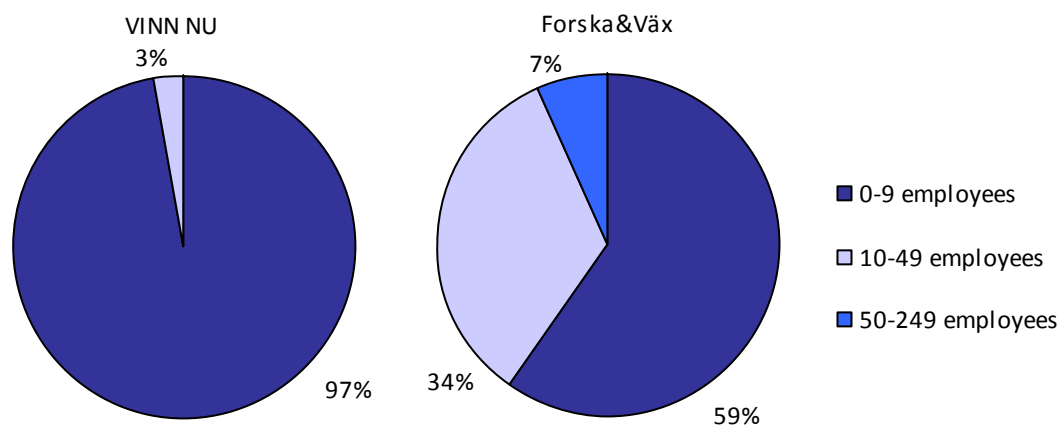


FIGURE 4. PERCENTAGE OF FIRMS IN DIFFERENT SIZE (EMPLOYMENT) GROUPS. 98 OF 118 VINN NU FIRMS ARE SHOWN AND 266 OF 278 FORSKA&VÄX FIRMS

Due to the concentration of VINN NU firms in the smallest size group, all the interviewed VINN NU firms are sampled to have less than 10 employees. Concerning the interviewed Forska&Väx firms, the size distribution is similar to the general structure (57 % with 0-9 employees, 39 % with 10-49 employees and 4 % with 50-249 employees).

The funded firms in Forska&Väx and in VINN NU are mainly located in the three major urban areas Stockholm, Gothenburg and Malmö, as can be seen in Figure 5. Gustafsson et al. (2009) show in their report on the Forska&Väx firms that most applications to VINNOVA are from these counties. This is not surprising as the vast majority of R&D takes place in these counties.²³ It should also be pointed out that the work location of the firm could be somewhere else than the address stated in the dataset, hence the figure can be misleading.

²³ In 2005, 33 % of firm R&D were spent in Stockholm, 30 % in Västra Götaland and 14 % in Skåne STATISTISKA CENTRALBYRÅN (2006) Statistiska Meddelanden, UF14SM0601, Forskning och utveckling inom företagssektorn 2005. *Statistiska Meddelanden*. Kjell Jansson, SCB..

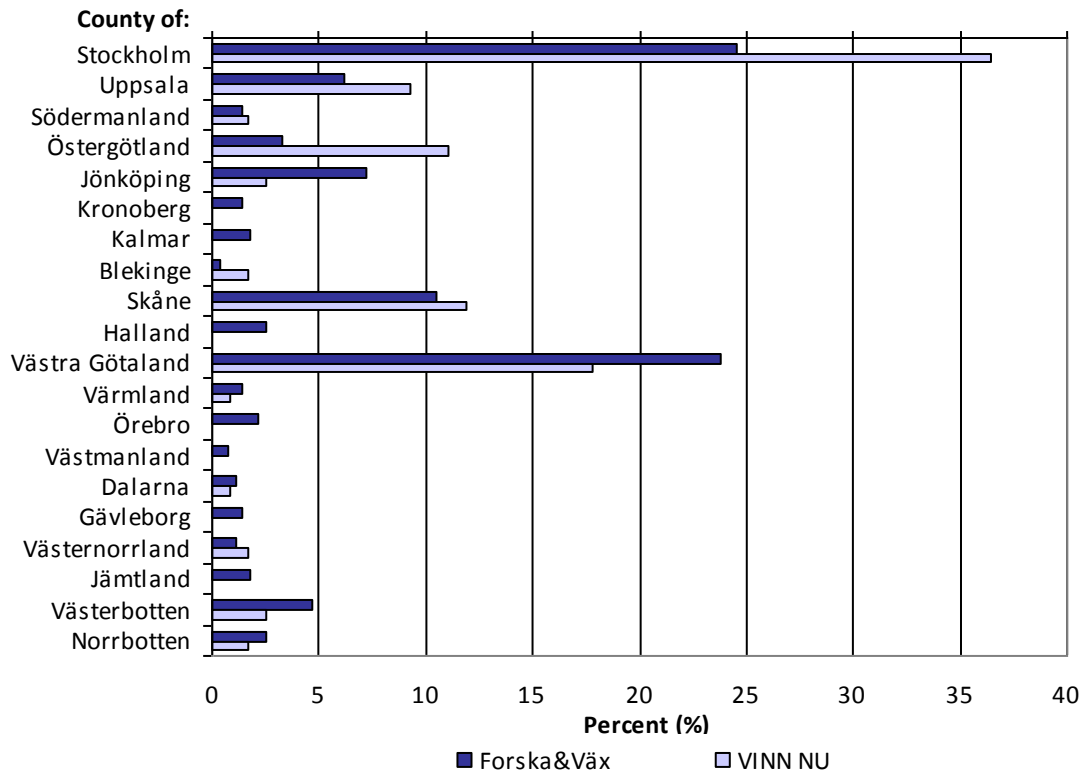


FIGURE 5. GEOGRAPHICAL DISTRIBUTION OF FUNDED FIRMS. 277 OF 278 FORSKA&VÄX FIRMS ARE SHOWN AND ALL 118 VINN NU FIRMS

Because of the concentration of firms to a few counties, only firms from Stockholm, Uppsala, Östergötland, Jönköping (only Forska&Väx), Skåne, Västra Götaland and Västerbotten were contacted. However, the geographical distribution of the interviewed firms deviates somewhat from the general structure. For the Forska&Väx firms, the counties of Uppsala and Östergötland are overrepresented whereas there are too few firms from Västra Götaland, and for the VINN NU firms there are too many firms from Skåne while too few from Stockholm, Uppsala and Västra Götaland. The main reason for this skewed geographical distribution among the interviewed firms is response rate differences between the regions, which is further discussed in section 5.2.2.

As explained in section 3, the Forska&Väx program supports three different types of projects. The most common type to receive funding for is, among the firms in the data set, (A) full scale R&D projects (41 %), but the other two support types are almost as frequent (33 % and 26 % for (B) small scale R&D projects and (C) “needs analysis” respectively). The VINN NU program consists of five sub programs, but here the different

programs do not imply that the size of the funding differs. Firms are sampled following the distribution over the different sub programs and in the end the interviewed firms represent this distribution well.

The firms in the Forska&Väx program are more spread over different industry classes than the firms in the VINN NU program. However, most firms, in both programs, can be found in the industry classes of manufacturing, ICT and professional, scientific and technical activities (following the main groups in the SNI2007). However, it is quite possible that the projects that have been granted support should be more appropriately classified to a different industry class than the industry code the firm is classified to. Figure 6 shows the distribution of firms by industry class for the Forska&Väx firms as well as for the VINN NU firms. The interviewed firms are sampled from the most common industry classes.

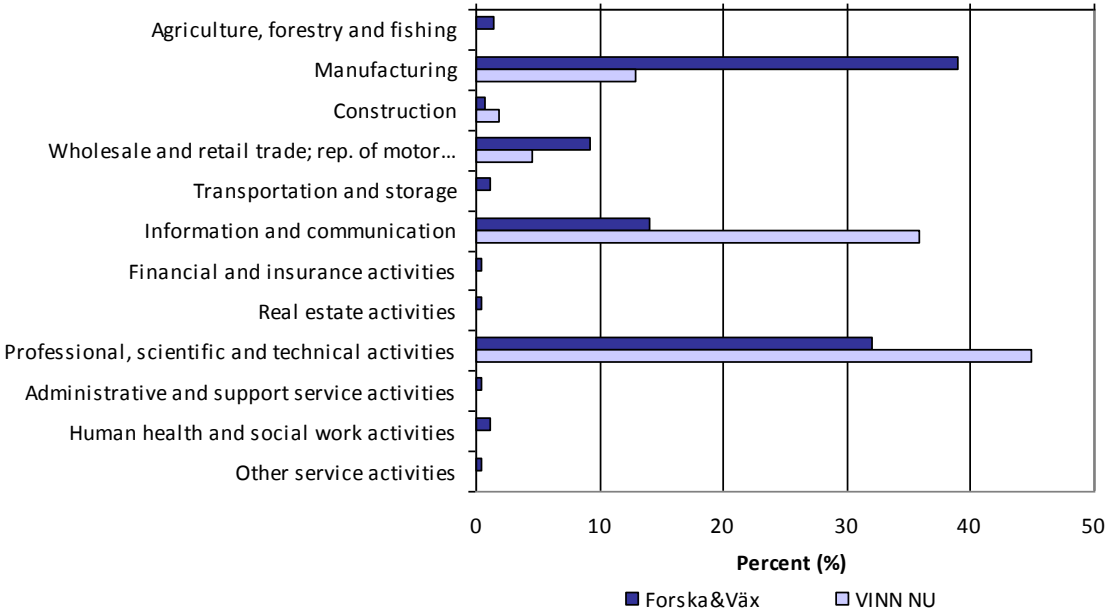


FIGURE 6. DISTRIBUTION OF FIRMS BY INDUSTRY CLASS. NOTE: 272 OUT OF 278 FIRMS FROM FORSKA&VÄX ARE REPRESENTED IN THE FIGURE, AND 109 OUT OF 118 VINN NU FIRMS. SNI2007 MAIN GROUPS ARE USED

To conclude, the 34 interviewed firms are, in the perspectives of size, funding, geographical distribution and industry class, representative of all the firms that have been funded by VINNOVA in the programs of Forska&Väx and VINN NU.²⁴

5.2 INTERVIEWS

5.2.1 METHODOLOGICAL FOUNDATION

Behavioral additionality is typically not detectable through examination of traditional quantitative indicators for changes in company activity, because behavioral additionality typically is either *under way* (and thus has not started to show in quantitative measures) or refers to something that is not quantifiable at all (e.g. Falk, 2007). The category of behavioral additionality includes *experienced* and in some sense *constructed* events and phenomena, which require deliberate and conscious analysis to be conceptualized, normally by the person experiencing it and the person studying it, in collaboration. Therefore, to detect and indicate behavioral additionality, interactive study and iterative synthesis is necessary. The research method used for this purpose is the *focused, semi-structured interview*. Such interviews provide the researcher with a source of information that is potentially in direct touch with the *experiences* of an actor *involved* in the events and phenomena that indicate behavioral additionality. The interviews are *focused* in that they are designed to retrieve information on a specific subject and on specific themes. They are *semi-structured* because they are centered on open-ended questions and are designed to allow for freedom for both interviewee and interviewer to choose to elaborate on issues as they emerge in the discussion {May, 2001/1993 #780; Patton, 2002 #781; Silverman, 2001 #783 see further below }. This corresponds to the simultaneously *deductive* and *explorative* character of

²⁴ To validate the representativeness further, the firms that were contacted but not interviewed are also analyzed. These firms do not differ from the interviewed firms or from the rest of the funded firms in a statistically significant way, except for the geographical distribution, but this is due to more firms being added to the sample where the response rates were low.

the present study; although the point of departure is the identification of the category (behavioral) additionality and the study is based on a demarcated theory body and therefore is focused, there are obviously variations among the study objects (the firms) and their incarnations of behavioral additionality, variations that make an explorative approach and open-ended research questions, i.e. a semi-structured approach, a preferred method.

Narratology or *narrative analysis* provides a methodological base for interview methods (Kohler Riessmann, 1993, Patton, 2002). Interviews are used to retrieve and record creative, non-fictional, recounted stories of human experiences over time, i.e. narratives. Information of this kind has a partial overlap of *content* and *performativity*, in the sense that *meaning* is created by the very act of discussing the issues, and the information is partly shaped by the momentous choices (conscious or subconscious) of interviewee and interviewer. *Meaning*, *context* and *relevance* of the information is therefore (in part) created in all instances; as the framework for the study is developed, as the interview guide is designed and the specific questions are formulated, as they are posed, as the informant answers them or speaks to the issues, as the transcription is done, as the information is processed and synthesized, as it is presented in print, and finally as it is read. Since meaning is added in each of these instances, meaning is fluid and contextual, and so a narrated testimony will never be unequivocal with respect to meaning (Kohler Riessmann, 1993). This obviously has implications for validity and reliability, and practical issues in relation to this are discussed below. However, these apparent drawbacks or flaws are intrinsic to qualitative study. They are unavoidable but methodologically problematic, and the use of qualitative methods therefore requires careful and conscious procedures and continuous reflection, to as far as possible avoid potential traps.

5.2.2 INTERVIEWS AND CHOICE OF INTERVIEWEES

As noted above, the sample of firms interviewed does fairly well represent the whole group of firms in the programs under study. In total, 34 interviews were done during a period of little more than three months.²⁵ All interviews were done in person, except one done on telephone (see below).

The interviews were planned on basis of the selection of the sample discussed in section 5.1, i.e. by compilation of lists of possible and desirable firms to interview. These 'desirable' firms were contacted by email with interview requests. In general, a 'first round' of requests were sent out for each geographic region, consisting of approximately double the number of firms desired. While it is a methodological necessity to keep the sample as representative as possible, there is also a contingency factor built into the planning and scheduling of interviews with more or less available persons on remote locations. Practical issues therefore always potentially compromise the degree of representativeness. In addition, interviewees in the present study accepted to participate completely on voluntary (and, one could say, charity) basis. This made email the preferred form of initial contact, because it presents the potential interviewee with a freer choice than the more confrontational phone call. The drawback is that comparably 'anonymous' email requests may drown in inboxes or reach unintended recipients, who may not have the same inclination to forward the email to the preferable addressee as if it was a person put on hold on the phone. However, two additional specific circumstances of this study made email the preferred way of contact. First, email contacts are more efficient as a large number of potential respondents had to be contacted. The desired number of interviews (30-40) was about a third of the eventual number of contacted firms (119) and a tenth of the number of potential interviewees (378), which made the issue of 'losing' emails less serious. Second, the people targeted, mainly executive officers in SMEs, were expected to have demanding schedules and could thus be repelled by an ill-timed phone call but may on the other hand respond favorably if they were to consider the interview request in an email at a time of their choice. Hence, email requests were sent to representatives of the firms in the sample; R&D managers where appropriate, otherwise CEOs, and in the cases where no personal email

²⁵ The first interview was done on May 28, 2009 and the last on September 2, 2009. See further below.

addresses could be retrieved, a general company address. In total, 119 firms were contacted, in 'rounds' as detailed scheduling proceeded and with careful monitoring of how the representativeness developed within the body of actually conducted interviews.

The importance of *timing* shall not be underestimated. The response rate went down considerably in August compared to May and June, probably as a result of the general vacation period in July during which seemingly (and amazingly) almost no firm executive in Sweden is available even for email correspondence. Timing is also important in the compromise between scheduling issues and the desire to keep the sample representative, when interviews are arranged at remote locations. Interviews were done in 11 'rounds' corresponding to geographical location and time period. They are, in order: Stockholm (May, 2 firms); Lund (June, 1); Linköping (June, 4); Stockholm (June, 7); Malmö/Lund (June, 2); Malmö/Lund (June, 1); Malmö/Lund (August, 4); Umeå (August, 3); Gothenburg (August, 5); Uppsala/Stockholm (August, 4); Jönköping (August, 1, on telephone). Two main deviations from statistical representativeness is the low representation of firms in the Gothenburg region and the Jönköping region, compared to the total sample of firms. This underrepresentation resulted mainly from the mentioned scheduling difficulty associated with the Swedish general vacation period in the month of July.

It has to be noted that these discussed general disadvantages and scheduling difficulties in the end had limited damaging impact upon the study; as discussed in section 5.1 the final collection of interviewed firms shows fair representativeness of the total body of firms within the Forska&Väx and VINN NU programs. However, this statistically defined limitation of method-related disadvantages – that the sample has fair representativeness – does not entirely rule out the general imperfection of qualitative methods that stem from the fundamental fact that any chosen sample of a population by definition excludes some individuals and thus some perspectives or experiences on behalf of firms who have taken part in Forska&Väx and VINN NU will be neglected by the study and invisible in this report.

5.2.3 CONDUCT OF INTERVIEWS AND PROCESSING OF INFORMATION

Focused and *semi-structured interviews* are, as previously mentioned, designed to retrieve information in a given, well-defined, subject area but simultaneously allow for some improvisation and creative utilization of

the dynamics of dialogue and the *narrative*. Since qualitative information is (partly) unpredictable and framing of the subject by the interviewees often provides the richest source of information, the interviewee is typically invited to talk freely to the subject rather than given direct and predefined questions. The interview guide (see Appendix: Interview guide) therefore contains a range of general themes rather than a number of questions. Significant parts of the interviews were devoted to the interviewee's own story about the firm and his/her participation in a VINNOVA program, told freely by the interviewee and only occasionally interrupted by requests for clarifications. Issues raised by the interviewee were then carefully and creatively combined with follow-up questions to frame the issues that can be categorized as changes in firm behavior and ultimately as *behavioral additionality* effects. As far as possible, these issues have been identified and then iteratively discussed in the interview situation to clarify every possible interpretative angle of the experienced behavioral trait, changes of it, and reading of its reasons.

This strategy entails creative improvisation on behalf of the interviewer, as well as undisturbed focus on the message delivered by the interviewee, and therefore the interviews were recorded and subsequently transcribed, in most cases verbatim. Recording and verbatim transcription minimizes the risk of losing information and reduces ambiguity and uncertainty, as direct quotes can be migrated through the analysis and into the final report. Only one issue complicates matters slightly, namely the fact that all interviews were conducted in Swedish whereas the final report is written in English. The report shall therefore be read with the knowledge that direct quotes have been translated.

A more serious problem in connection with interviews and narratology is the practical issue of *stakeholders' messages*. Interviews with people who are stakeholders in the phenomena or events under study always entails a risk that excess rhetoric, political agendas, and deliberate or accidental misinformation shines through in the final report. Part of the material obtained and thus the findings may be skewed or politically tainted, and interviewees may withhold some information. Perhaps most obvious is the risk that representatives of firms let their 'salesperson' identity shine through. This is natural, since it is part and parcel of company representatives to 'sell' their firm. Closely connected with this is the risk of interviewees answering 'strategically' to questions, which might take two shapes. Either (1) they want to present an excessively positive image of the VINNOVA

program in order to increase their chances to receive funding in the future, or (2) they might try to downplay the importance of the program and the grant because they are reluctant to admit that external input has influenced the company and their ability or productivity. The fact that interviewees have been made anonymous in the final report, and that they were informed about this before the interviews started, may however lessen the risk of 'strategic' answers because the answers given will not be directly associated with the interviewee in the final text which makes their 'strategic' care superfluous. This does, however, not completely rule out the risk, since both 'salesperson' identity and inclination to answer 'strategically' may be a (partially) subconscious phenomena.

The existence and usage of rhetoric, 'sales pitches', 'strategic' answers, personal preferences and the like cannot – and should probably not – be neither prevented nor denied. As discussed above, the personal traits of the interview and the narrative of an interviewee are supposed to be constructively deployed rather than pretentiously hidden. Informed by narratology, we can conclude that by deploying a “modest skepticism” towards interviewees and their disclosed stories (Marshall and Rossman, 2006, p 119), nuance and credibility can be retained.

5.3 THE CHALLENGES OF ASSESSING ADDITIONALITIES

In the foregoing we have discussed the potential and limitations of interview methods. We have also established a set of concepts and terms for analysing additionality effects on R&D funding. There are, however, further issues that call for clarification when additionality effects are studied. It is quite possible that the “emergence” of additionality depends on the size of the grant and the number of times a firm has received a grant (Falk, 2007). For example, firms that have received multiple grants may be more willing to engage in riskier projects or to create new collaborations than firms that have “only” been funded once. This is of particular importance for the two programs that this study addresses. If the findings of Falk (2007) are valid also in the Swedish context, we can expect the additionality effects from the two programs Forska&Väx and VINN NU to be different. We can further expect the effects from firms that have been given grants more than once to be different from firms that have received them only once.

The second issue which has been touched upon when discussing behavioural additionalities, is that effects from one specific program can be very difficult to isolate. Davenport et al. (1998) remark that the whole idea of measuring additionality of a single project is highly problematic as additionalities may first show up several years after a project has been finalized. It then becomes difficult to discern whether additionality stems from a specific project or has emerged from participating in several projects. Moreover, to decide whether additionality has a positive or a negative effect can be very difficult. What in the short term might have a negative effect may later on prove to be an advantage. Consequently, it is important to attach a time perspective to the measurement of additionality.

A third dimension to bear in mind is whether additionalities show at the firm or the project level. At the project level, additional financing, strategic partnerships and improved quality can be identified as effects which foremost benefit a single project. However, additionality effects can also be identified on the firm level. Here strategic changes such as the location of R&D activities, changed patent strategies, improved innovation management, as well as improvements of the organization and fostering human resource development are examples of additionalities that can be expected to be found. This illustrates the multi-dimensional complexity of measuring additionalities.

Finally, an issue that should be considered when evaluating additionality is if the research call in itself can affect firms. Firms may not apply for high risk projects which do not lend themselves easily to description. This has two potential consequences. First, it can explain why firms often claim that projects would have taken place even without funding. Second, getting R&D funding to an already scheduled and well planned project may release resources for allocation to other more risky projects. Therefore additionality effects may result from research funding but not necessarily from the funded project. This illustrates how additionalities are complex and cannot always be divided into the three above used categories but rather crosses them. Some of the issues raised here can be studied and will be addressed in the next chapter. There are also issues that are not easily dealt with at all, and can merely be recognized as a limitation of these types of studies.

We have in 5.1 described the firms with respect to their size, either measured as number of employees or sales value, the age of the firm and amount of funds granted among several characteristics. In the following chapter,

interview material will be analyzed for the existence of additionalities. If an additionality is found to be “strong” it is coded as value 1 in a (dummy) variable denoting the strength of the additionality.

This procedure is somewhat problematic since a “strong” effect always gets the value 1 regardless of the extent of the effect. The pairwise correlation between these additionality variables and the just mentioned firm characteristics will be carried out to give further evidence, and background information on the nature of additionalities. That is, is there an indication that the additionality effect relates to firm characteristics, or that additionalities are related to each other? We choose not to present these tables as we think it would lead our reader astray. Although firm characteristics are readily quantifiable, the number of interviewed firms is small (34) and therefore correlation analysis is somewhat dubious from statistical laws demanding “large numbers”.

More seriously, qualitative interpretations are imprecise. Presenting “data” on additionalities, and their corresponding correlations, might deceive a careless reader that our identified additionalities are more accurately represented than they are. The emphasis of these correlations, that will be discussed, should therefore really be on *indicative* of associations. Table 5 lists the characteristics and additionalities used for the correlations.

TABLE 5. QUANTIFIABLE FIRM CHARACTERISTICS AND ADDITIONALITY EFFECTS USED TO STUDY ROUGH ‘CORRELATIONS’

<i>Firm characteristic</i>	<i>Additionality</i>
Age of firms	Scale
Mean sales	Acceleration
Mean employment	New markets, new products
First year of funding	Improved network capability
Total funding	Increased human capital
Program Forska&Väx	Improved innovation management

Despite the mentioned caveats, the correlations are valuable as they can to some extent be used to address questions raised above. The existence of lag effects is addressed by reporting on the correlation of the variable “First year of funding” with the additionalities. Unfortunately, as this variable has low variance it might be difficult to draw conclusions from it.

Whether the type of program affects the occurrence of different additionalities is addressed by the variable “Program Forska&Väx” which takes the value 1 for Forska&Väx firms and 0 for VINN NU firms.²⁶ “Total funding” elaborates on the possibility that the size of funds matter. “Age of firms”, “Mean sales” and “Mean employment” consider if the time the firm has been in existence and whether its size conditions the type of additionality effect found.

6 EMPIRICAL FINDINGS

6.1 INTRODUCTORY REMARKS

This chapter is devoted to the report and analysis of the findings of 34 chosen firms in Forska&Väx and VINN NU described in 5.1. The analysis focuses on behavioral additionality and the interviews are analyzed in accordance with the framework and operationalization of the concept “additionality” laid out for this report in chapter 2. Some complementary notes on behavioral additionality are made at the end of this introductory section after a few remarks of contextual and conceptual interest for the analysis.

As noted in 5.3, the distinction between ‘startup firm’ and ‘project’ is not always clear-cut. Startup firms receiving VINN NU support may very well in organization, scope and scale, resemble a project granted Forska&Väx support, rather than being comparable to an established firm. Therefore, ‘project’ may in this context very well apply to a whole firm in its early stages of existence, i.e. the phase when it is eligible for VINN NU support. Therefore, in the following, findings from firms who have received VINN NU support are occasionally utilized to compare with findings from Forska&Väx-funded projects.

The interviewees’ perceptions of the support programs are sometimes of significance for the analysis. Several of the firms express that although the Forska&Väx grants may not provide opportunities that wouldn’t be given

²⁶ Three firms that have received funding from both Forska&Väx and VINN NU are excluded when calculating correlations with this variable.

by any other money, it is important for them that the grant is perceived as unrestrained in comparison with other available means of funding. “We don’t want to lose control over the company” (Firm 26), which they fear will happen if investors are let in. Several interviewees also express that the Forska&Väx program suited their project very well, that “no alternative means of funding it were available” (Firm 14), mainly because investments from other sources are coupled with terms and conditions, while Forska&Väx allows for exactly the risk-taking and commitment to new things that the firms in question expressed that they needed to pursue the project (see also section 6.5). According to one interviewee, the Forska&Väx program is in fact the only source of funding for the kind of projects the firm has pursued with its aid; in the opinion of the interviewee, the two other main alternatives for funding are venture capital and an external customer buying into the project at an early stage. These would however shift the balance of influence over the company and the technology they develop unfavorably, and therefore owners choose to participate in the Forska&Väx program to retain control of the firm and to remain sole owners of their innovations (Firm 21).

The question of project risk level is also important. One particularly challenging dimension when analyzing support for specific firm projects is the character of their projects with regard to the risk involved and the firms’ perceived need for external support to manage and commit to a project. On the one hand, it is reasonable to expect that a certain amount of risk is involved, since an elevated risk is an obvious rationale for searching for government support. If there was no ‘risk elevation’ and the venture would yield secure profit, the market itself would be capable of realizing and funding the project (cf. 2.4). On the other hand, it is unreasonable to expect that firms suddenly engage in very risky projects just because there are good prospects to obtain funding; projects are most certainly already adapted to the competences and capabilities of the firm and part of their plans. At least one interviewee expressed that “you do not apply for a grant for a project that you wouldn’t want to do”. Most, if not all of the firms have a mix of motives between not having the financial capability to fund the project themselves, concurrently being determined that it is important for the company and well in line with their core activities. In most cases they retrospectively and probably rightfully make the judgement that the project in question was ‘successful’ on long or short term (cf. the discussion in chapter 4). Important to remember in this context is the points of the previous paragraph, that VINNOVA support may be preferable for

firms due to the restrictions of the alternatives; i.e. they may apply for VINNOVA support for other reasons than elevated risk.

The causal relationships between funding programs, applications, and the projects within firms are also important to consider. Several interviewees have expressed the firm belief that the VINNOVA support has been an explicit incentive for projects to be pursued at all. The importance of this cannot be underestimated, because it is a fact that in these cases, all possible additionality effects are induced at project level. That is, they would not have appeared unless the project had been pursued. This is discernable in Forska&Väx firms, where the grant is given to well-defined projects, which invokes a pattern of firms actually moving into a new sector or activity on direct basis of the grant. For VINN NU firms, a similar effect has been discerned, but on a different level – it is possible in at least five cases to conclude that the firm would in fact not have existed without the grant. This is a debatable assertion, not least since it contains counterfactual speculation, but the evidence in the material is overwhelming enough – several interviewees clearly indicate this state of affairs.

The concept behavioral additionality has been thoroughly discussed in chapter 2. In accordance with the terminology established in that chapter, the following analysis treats behavioral additionality as *changes in a firm's routines* and conceptualizes it as either *scale*, *scope* or *acceleration* additionality. Behavioral additionality in these forms are identified at the project level, due to the fact that support within the concerned programs is given to demarcated projects. As discussed earlier, since most firms in the study are small in size, newly established and/or R&D intensive, the project will inevitably influence the firm at large and the additionality effects may be difficult to assign to a specific project or participation in a particular program (cf Davenport et al., 1998, chapter 4). Furthermore, effects on a firm classified as *behavioral* do, almost by definition, not limit themselves to a project, but will affect the firm more broadly (cf Norrman and Klofsten, 2009, chapter 4). Thus, the detection of behavioural additionality starts by specific projects but leads to conclusions regarding the overall behavior of the firm. Important to take into account is also the possibility of *time lag*, i.e. that effects show up years after a program or project has been concluded (cf Hsu et al., 2009, chapter 4), causing us in this study to broaden the perspective to report and discuss also *signs* of behavioral additionality effects *under way*.

In the analysis, attention is also given to the concepts of *weak* and *strong* additionality effects generally describing the ‘strength’ of the effect found. For the categories embodied in *scope*, additionality is more difficult to analytically distinguish from ordinary effects. For *scope* therefore, weak and strong also weigh in the certainty ascribed to the effect (a precise definition of weak and strong among the different effects has been given in 2.4). These are not all that clear-cut categories but rather fluid analytical concepts. The distinction between weak and strong additionality and their “distribution” among the firms will be illustrated in connection to each category of behavioural additionality. As already stressed in chapter 2, behavioral additionality is not an unambiguous concept, and neither is the distinction between weak and strong which has been used as an analytical tool for approaching, analyzing and discussing additionality effects. In the interview material it shows as a variety of very specific behavioral traits on the firm level. The material reflects the *form*, *character* and *quality* of projects and short and long term effects they may have on overall firm performance and behavior. The variations are great as every firm has unique experiences of how the support affects their projects. The categories established in chapter 4 and used in the analysis below, as well as the concepts of *weak* and *strong* additionality, are therefore not clear-cut and should be read with the caveat that exceptions exist, that occasionally particular firm behavior may be best described as moving across or between categories, and that some behavioral traits intuitively identified as behavioral additionality or stemming from participation in the programs under study may not at all sort itself into the stipulated categories. Nonetheless, in almost all cases the framework has proven useful and the following text is therefore structured according to the categories of *scale*, *scope* and *acceleration* additionality, with subcategories where appropriate.

The figures introducing each section are schematic overviews of additionality effects, based on qualitative ‘appreciative’ data rather than solid quantitative data. The dots represent firms and the behavior in the figures are placed on the basis of an evaluation of each individual firm’s performance rather than a comparison between firms or firm behavior according to specific criteria or measures. This is also the reason for the variation of number of dots in each figure, not all firms have been possible to evaluate with respect to all additionality types. The figures can be used to gain a schematic understanding of the occurrences of weak and strong behavioral additionality effects in the different categories of additionality used in the analysis, but should not be used comparatively or as substitute for diagrams showing quantitative data.

Despite the largely unquantifiable nature of these effects, we have nevertheless made an attempt to link strong effects to the background characteristics presented in Table 4. This is described in 5.4. Again, the interpretations of these findings should be thought of as ‘rough correlations’. We will only report on those links of two variables where there is a reasonable level of correlation.

6.2 SCALE ADDITIONALITY

Figure 7 illustrates the existence of scale additionality among the firms in the sample, ranging from ‘weak’ to ‘strong’.

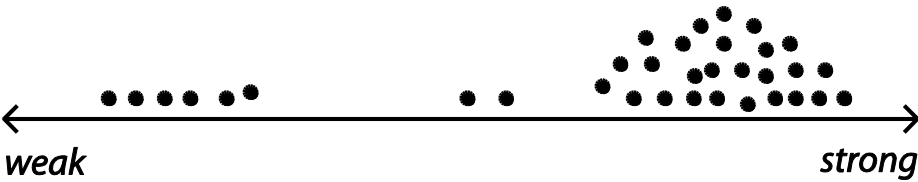


FIGURE 7. SCHEMATIC FINDINGS OF WEAK AND STRONG SCALE ADDITIONALITY

When the Forska&Väx or VINN NU grant has caused the project to grow in time, resources and personnel has been devoted to it, the effect is considered to be strong. In cases where the interviewee does not estimate the grant to be of particular significance for the size of the project, the effect is considered to be weak. As can be seen in Figure 7, strong scale additionality has been identified as occurring in the vast majority of cases. Where the firms have been given money from the VINN NU, program scale additionality is often an important effect, highly valued by the interviewees. Interviewees generally attribute scale additionality effects to the possibilities of focusing and comprehensively plan and carry out projects with designated personnel and project leader. It is argued among several interviewees that without having to squeeze the project into an already strained company activity portfolio, but rather getting the opportunity to pursue the project with separate focus and designated resources and personnel, both the project and the company in general benefit, and the project can be conducted with greater volume, and thereby become *better* in a very clear sense. The examples are many.

In the case of Firm 3, who used the Forska&Väx grant to develop a specific product, scale is the most visible additionality effect. The product in question had been identified in advance and it is now deemed to be a

significant part of the company's activities and strategically very important. What was needed to realize it was dedicated investment funds to allow for a targeted and comprehensive effort:

"This was an area that we wanted to enter, but it was very resource-demanding to enter into it. We knew that we had the competence to do it but we needed financial help, especially to devote time to the initial phase."

The interviewee makes the case that although the project in question would most likely have been carried out also without external funding, the grant allowed for a stronger effort right from the start. Since the participation in the Forska&Väx program in this specific case led to the development, manufacturing and market introduction of a specific product, the scale additionality effect is in this case classified as *strong*.

A similar result is detected in the case of Firm 8 for which the grant allowed for time and energy to be invested in the project to an extent that would not have been possible otherwise:

"We would not have been able to commit to planning and carrying out such a development program if it wouldn't have been for the support. These firms have a very tight budget framework, but this made it possible to run a development program parallel with the ordinary activities."

Weak scale additionality effects may also operate on general firm level, as the 'added value' of particular projects affect the firm at large. In the case of Firm 21, the interviewee clearly expresses that the time and resources obtained from the Forska&Väx program allowed the firm to commit to the project in question and long term effects on general firm performance, mainly because the success of the project gave the firm credibility and a marker of capability to comprehensively carry out demanding projects. Another interviewee indicates that the scale of projects may by default be raised when funded through the Forska&Väx program, simply because of the large momentous inflow of money it carries. This clearly gives a weak scale additionality effect since the firm thereby commits a little more to the project than they would otherwise have done (Firm 23).

A side effect of scale additionality of the type discussed above is the possibility that projects funded through Forska&Väx may be carried out at the desired scale without having a negative impact on the 'ordinary' activities and performance of the firm. In the case of Firm 8, the Forska&Väx grant money was spent on the development program while other investments were made in a parallel project already underway. In effect, the project could be carried out without negative side-effects on the regular activities.

Representatives of firms who have participated in the VINN NU program generally express the opinion that the VINN NU grant money is crucial in the startup phase as a 'boost' to their activities. This is possible to conceptualize as a scale additionality effect – especially given the stated ambition to view VINN NU startups as projects and compare them to projects – because it has the immediate effect of increasing the scale of the startup's activities. This is to be classified as a *strong* additionality effect because of the overwhelming number of interviewees who explicitly state that the VINN NU grant took their firm several steps from almost only idea stage to real business:

"The VINN NU money was very important to get the company started" (Firm 2)

"VINN NU meant a lot at the start" (Firm 1)

"It was worth everything right there at the beginning." (Firm 24)

It should be recognized that the VINN NU grant – despite its modest size of 300,000 SEK – may provide a significant contribution to an almost non-existing budget of a startup firm, as in the case of Firm 32. Despite the fact that the company earned millions later, the interviewee is clear on the point that the 300,000 in the first phase was extremely valuable:

"We were two persons who took this from a diploma work to a product, so to speak, and there are only a couple of months for you to make that happen" (Firm 32)

"300,000 is infinitely much money, compared to zero, and the alternative is in fact zero. You could say: 'let's get a venture capitalist in', but it is not that simple, you just don't call someone up and say 'hi, could you give me half a million?' [...] It shouldn't be underestimated, because it's not that easy to get money in." (Firm 5)

6.3 ACCELERATION ADDITIONALITY

Figure 8 illustrates the occurrence of acceleration additionality among all the firms in the sample.

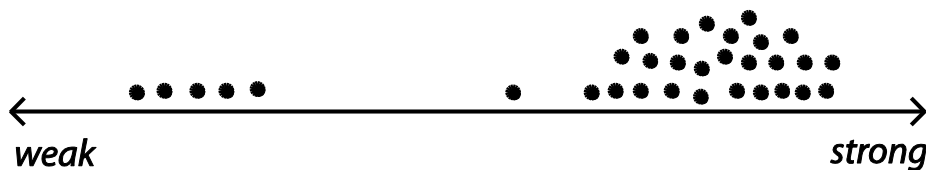


FIGURE 8. SCHEMATIC FINDINGS OF WEAK AND STRONG ACCELERATION ADDITIONALITY

The effect is considered to be strong when the interviewee expresses that the project in question would not have been conducted at all if it had not been for the grant, or if the project would have been carried out much slower without it. Weak acceleration additionality effects pertain to cases where the interviewee considers the external funding to be important but not crucial for the implementation of the project. Acceleration additionality effects have emerged as closely coupled with the scale additionality effects discussed in the previous section. Further corroborating this is that quantified, strong scale and strong acceleration additionality effects correlate strongly. Acceleration additionality is about bringing project activities forward in time and/or accelerating the development time of products or other activities of importance for a firm or a specific project. Two cases reported in the previous section where strong and weak scale additionality was explicitly identified, Firm 3 and 8 also showed clear acceleration additionality effects as part of the same process. As time and effort was devoted, the projects were pursued faster. For Firm 3, the acceleration additionality effect should be categorized as *strong* since, as noted, it contributed to the creation and marketing of a specific product, whereas in the case of Firm 8, participation in the Forska&Väx program accelerated the general performance and activities of the firm, and the acceleration additionality effect should therefore be classified as *weak*.

Several interviewees stated explicitly that the projects carried out with support from the Forska&Väx program benefited from external funding in the shape and form of accelerating the activities (Firm 3, 16, 21, 26, 33). Therefore, it is possible to conclude that acceleration additionality effects, although exceptions exist, show primarily on the project level. The ability to carry out a project in a timely manner is a very tangible effect that shows up frequently in the material, for example:

“We would have waited a couple of years before we tried this if it had not been for VINNOVA” (Firm 33).

Related to this, although it is not an additionality effect in the strict sense, is the matter of *timing*. Several interviewees have argued that the project would have been pursued sooner or later even without external funding, but the grant allowed for it to be started earlier, which is deemed to have had beneficial effects on both project and company as a whole (e.g. Firm 13).

The correlation analysis in addition to establishing the strong correlation between scale and acceleration additionality, further shows that the two additionalities are positively correlated with the size of funds provided, but negatively with the size of the firm. In other words, firms that obtained more funds pursued the projects more intensively and faster. Figure 9 shows the frequency of interviewed firms by fund size. For smaller firms, the effects are also more pronounced.

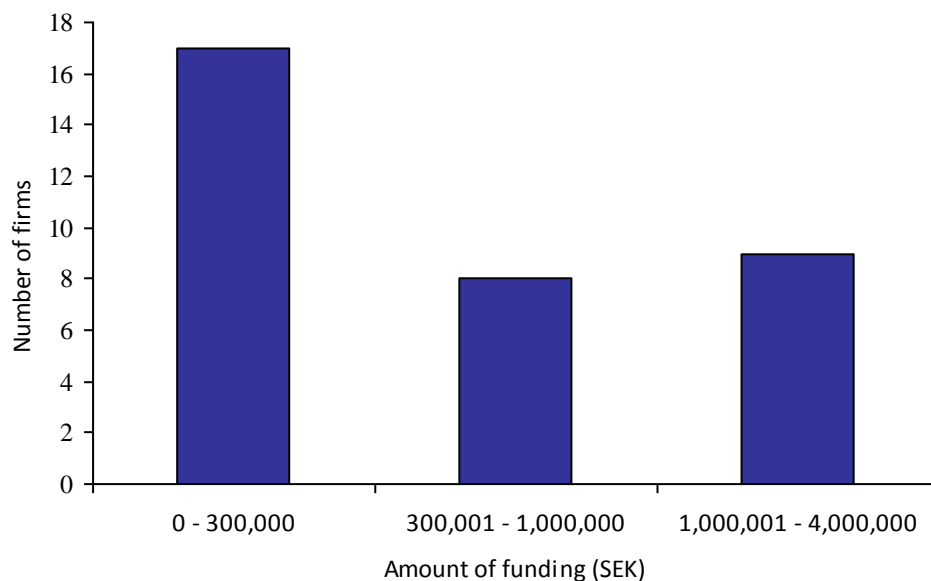


FIGURE 9. FREQUENCY OF FUNDING BY FUND SIZE OVER INTERVIEW FIRMS

6.4 SCOPE ADDITIONALITY

The broadest category of additionality effects is *scope additionality*, which is further divided into subcategories in turn classified as weak or strong effects. A common theme among the interviewed firms is that the project

which the Forska&Väx grant helps funding allows the firm to do something new or partly new in addition to their regular activities or significant upgrading of their activities. This is identified as *new markets and new products* and treated under a separate heading below. In relation to the concepts weak and strong additionality, both effects are *strong* additionality effects, because they are long term and have lasting consequences for the firm that go beyond the specific project.

New or partially new activities may provide opportunity or necessitate the establishment of contacts with external actors and the creation of collaborations, with actors within academia or with new business partners. Such collaboration may give rise to synergies with long term effects, such as knowledge exchange or other business partnerships. It may also enable or require recruitments, thereby adding to the general competence level in the firm on a long term basis. In some cases such hiring has been preceded by the engagement of a consultant that is later hired. These effects are examples of *improved networking capabilities* and *increased human capital* as identified in chapter 2, and will be discussed under separate headings below.

Closely related, but nevertheless discussed as a separate category, is *improved innovation management*, which represents behavioral additionality effects in the form of firms' changed modus operandi, that they move into either entirely new, R&D intensive activities, or that they change character of their existing activities to become more R&D intensive. This procedure might be the result of the hiring of additional competences but may also be an effect of the experiences gained from running a specific, well-defined project and in this latter sense we speak of *improved innovation management*.

Our correlation analyses of firm characteristics and additionality effects, trivially shows that participation in Forska&Väx as compared to participation in VINN NU is positively associated with scope additionality effects. This is because, by construction, most such effects cannot be detected in newly established VINN NU firms. More substantially, these analyses show that older firms have a tendency to experience more scope additionalities. The grant may therefore act as a stimulus for the firm to change orientation in relation to established ways. Furthermore, it was earlier reported that the amount of funding correlated positively with scale and acceleration. We also find that the amount funded is positively related to increased human capital and improved innovation management (but not clearly to new markets, new products or improved network

capabilities). There are also tendencies that as time elapses from the time the (first) grant was obtained, the effect of the grant is that firms develop more new markets, new products and improve network capabilities.

6.4.1 NEW MARKETS, NEW PRODUCTS

Figure 10 illustrates the occurrence of scope additionality regarding new markets and new products among firms that have participated in the Forska&Väx program.

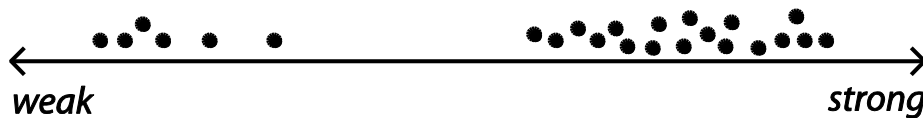


FIGURE 10. SCHEMATIC FINDINGS OF WEAK AND STRONG SCOPE ADDITIONALITY CONCERNING NEW MARKETS AND NEW PRODUCTS

VINN NU firms are excluded from the figure because the analysis is made relative to past behaviour of the firm. Strong additionality effects are judged to have emerged when a firm has developed a product distinct from the original one with regards to processes and/or knowledge needed to produce it and/or a product that targets a new market. Weak additionality effects on the other hand is defined as a firm developing a product that is similar to existing products which does not require new processes and/or knowledge to be developed. The effect is considered weak also when the same market is targeted, although the newly developed product is intended for a slightly different market niche.

“Today we have a product that we sell and that’s a result of us putting in a little extra effort there” (Firm 17)

In the category of established and comparably large firms (e.g. Firm 6, 18, 19, 27, 34) it is clear that the Forska&Väx grant can trigger the pursuit to move into an area that is completely new for the firm. In these cases, two things are important. First, the firms in question would most likely have been able to afford to pursue the project without the Forska&Väx grant, but would likely not do so since they have their market position, established ways and means, and so forth and therefore need not ‘gamble’ with risky projects. Here the Forska&Väx grant (or similar) can provide an opportunity and/or an incentive to move in the new direction, albeit ‘parallel’ to the ordinary activities of the company. There may be slight resistance in the company, among employees, owners or board members, and an external grant may provide opportunity to go against

such resistance in a constructive manner because it provides funding for the project that does not compete with the ordinary activities of the firm. In such cases, the grant can be the necessary *trigger* of events that eventually leads to the development of new products and/or the entering into new markets. Second, a well-established company may lack the competence, skills or know-how to move into the new area, and they would possibly not normally have sought external competence but by the grant they are spurred to 'think anew' and reach for possibilities they would not have thought of in the normal case. This may very well lead to the establishment of entirely new network connections, not least, as we have seen in the material, between established firms and academia.

In one case, the transition from ordinary service firm to a future as a development firm, has been under way for some time and is clearly traceable back to the project funded by Forska&Väx (Firm 29). This points in the direction of Forska&Väx being the trigger of innovative activities in firms with an otherwise 'non-innovative' activity profile or portfolio.

In another case (Firm 14) the Forska&Väx grant was what made it possible to pursue a particular project that had initially been put aside in a strategic decision by the board of the company, despite its alleged great potential. The Forska&Väx grant however made it possible to pursue the project in parallel to its ordinary activities, and it eventually turned out to be beneficial for the long-term performance of the firm. In another case (Firm 10), the interviewee claims that the firm would not have gone into the project in question at all without the Forska&Väx grant. The project was judged to be peripheral from a product perspective, although the case could be made that it fitted well with the in-house competence of the firm. Another interviewee (Firm 15) similarly states that the project would not have been pursued without the grant and hence that the product that was developed would not have been realized.

Speculation on behalf of interviewees sometimes holds that a successful project peripheral to the firm's 'ordinary' activity may lead to the creation of a spinoff firm. Firm 17 was originally the result of a project conducted in another company; basically the same technology is utilized as by the parent company, however targeting a completely different market. Hence, Firm 17 is the result of a project within the parent firm, made possible in part by the VINN NU grant:

“The grant allowed us to enter a new market, to make a survey of it and to develop a more attractive product”

This is a clear example of a strong additionality effect in the category of new markets and new products. Another case in the same category, though evidently in an earlier phase and thus somewhat more speculative, is Firm 22 for which the granted project is similar to the ordinary activities in terms of technology. However, it is a complex product that according to the interviewee may well develop into a separate company. Also for Firm 19 the interviewee holds that the project funded through Forska&Väx may lead to the creation of a subsidiary company that will engage in production, separately from the mother company which is a downright service firm. In this case, the granted project triggered the firm to pursue the development of a product prototype that if proven to be successful, will require the company to take a whole new direction. In this case it clearly provides another example of a strong additionality effect.

Examples of weak additionality effects in the same category also emerge in the material. In one case (Firm 11) the grant was used to make a survey of a new market area interesting for the firm, and it was by and large the project that allowed entering into this area. In this case, the project also led to the strengthening of the network of the firm, as new contacts have been established with actors within the new market area:

“We have continued to participate in different conferences and such, but now we use our own money to do so”

In another case (Firm 25), the firm benefited “unexpectedly” by the project in question, because the product originally developed in the granted project opened up a whole new market for the firm that the interviewee claims is now deemed the future for the firm.

Another strong additionality effect in this category, however on another level of detail, is the possibility that existing products are improved, or the market for them is expanded, by the project funded through participation in Forska&Väx. This is normally the case for firms that target a rather small market niche and that have a good knowledge about the needs of the customers. In one case (Firm 33) for instance, the grant was

used to develop an existing product, and the interviewee claims this precedent may have very positive effects on the firm in the future. Another interviewee (Firm 2) claims that the grant was crucial for the ability to launch their second product, an improvement on the original one. The interviewee holds that it would not have been possible for the firm to attract other types of external funding being in a very early state of the development process (cf. also the discussion in the introductory section). Another firm (Firm 28) identifies themselves as targeting a well defined market niche with little competition. Thanks to the project, the interviewee argues, a new product could be developed for the same market, thus strengthening the firm's position. In other cases, projects have been identified as leading to a product that differs from the general orientation of the firm in question as it targets a different market (Firm 10) or simply that a product has been developed that the interviewee regards more or less unlikely to have been realized without participation in the Forska&Väx program (Firm 3, see previous section).

Related to this is the claim of one interviewee (Firm 18) that the area entered through the Forska&Väx project "will be the future for the company", that the firm in fact needed to change direction a bit and the project was the exact right trigger for that. In the interpretation of the interviewee, it has largely been a matter of chain reactions and serendipity:

"This has led to us buying machines we wouldn't have bought otherwise, which has given us customers we wouldn't have gotten otherwise."

In this particular case, the firm has started to think and plan in new directions. A major breakthrough, according to the interviewee, is the increased acceptance among employees for hiring external experts (see also next section), something that was deemed necessary but problematic since the firm in question is old, comparably large, and has established practices among the employees in production.

6.4.2 IMPROVED NETWORKING CAPABILITIES

Figure 11 illustrates scope additionality effects with regard to improved networking among firms that have participated in the Forska&Väx program.

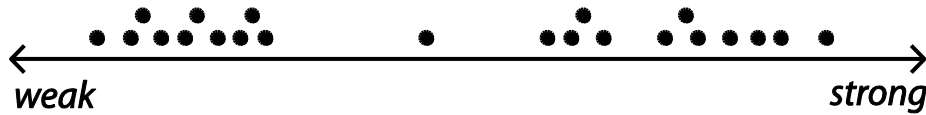


FIGURE 11. SCHEMATIC FINDINGS OF WEAK AND STRONG SCOPE ADDITIONALITY CONCERNING IMPROVED NETWORKING CAPABILITIES

Strong additionality effects on firms with regards to networking and collaboration with external partners is defined as firms developing relationships that in their character and/or purpose differs from the firm's earlier conduct. The effect is also considered strong if the project leads to links with new collaboration partners that are deemed to be significant for the future performance of the firm. Weak additionality effects is when the project either does not lead to any collaboration at all, or when collaborations takes place without the firm extending its network with new partners.

"We have gotten at least two new customers, or collaboration partners" (Firm 12).

Several forms of industry-academy relationships as well as other kinds of new collaborations emerge in the material. The industry-academy relationships are important, not least in the case of established and fairly large firms whose new connection with academia actually is said to transform their company – on long term. It is common among the interviewees to identify this transformation as either very successful, or crucial for the firm's survival in the long term, or both. However, this claim shall be viewed and evaluated with the knowledge that they are discussing comparably 'successful' projects.

VINNOVA has occasionally been identified as the 'door opener' in these matters. Several interviewees (Firm 18, 29, 34) have expressed that their contacts with geographically close academic institutions has deepened on basis of the initial connection established as part of the project funded through Forska&Väx and that this is of great benefit for the company in the long term. The role of Forska&Väx funding is regarded as crucial, since it allows firms to spend money on consultants from other sectors, such as academia. In one such case (Firm 18),

the grant money was used to hire consultants from a research institute and even though the R&D process was located external to the firm, the contacts are considered very valuable by the interviewee.

Several networking effects are visible in the material. One firm (Firm 3) started to work closer with local industry in the development of prototypes. Another (Firm 26) made contact with a German hospital as part of the Forska&Väx-sponsored project, a contact that is maintained for consultancy and specific problem-solving associated with their product. The interviewee regards the connection with this partner as very valuable for the company as a whole, also for the longer term and beyond the specific project. In a similar case (Firm 8), a contact was established between the firm and a specialist laboratory in England, a contact that will be utilized again, "because the lab is very good in this area and it's an interesting area for us to enter in the future". Another firm (Firm 25) involved a major Swedish food company, Arla Foods, in the project funded through Forska&Väx, as well as deepened their contacts with foodtech groups at Lund University. Both of these connections are considered to have rendered long-term advantages. Similarly, another interviewee (Firm 17) claims that their VINN NU grant gave the opportunity to bring in suppliers and consultants with whom the firm is still working. Another firm (Firm 9) has established collaborations with Stockholm University, The Royal Institute of technology, Karolinska Institute and other universities, and claims that participation in the Forska&Väx program in their case particularly has supported network-building:

"VINNOVA wants to have it clearly stated in applications who you collaborate with, and that is a positive thing, it adds structure. When you write an application, this gives you time to think about who you really want to collaborate with. It becomes concrete in a way."

Small, R&D intensive firms may establish contacts with industrial partners as a result of the granted project. One interviewee (Firm 10) maintains the importance of collaborating with customers in the development projects they conduct, and their Forska&Väx project resulted in partnership with two large firms. In similar cases (Firm 24 and Firm 9) the projects have included developing products to become attractive to external industrial partners with the aim of starting commercial production.

On a concrete level, granted projects may result in new relationships also because it allows the firm to spend time and money on maintaining the contacts. In one case (Firm 4), the grant was used to “get a market survey done, travel around to conferences and exhibitions and establish contacts”. This is especially visible in the cases of newly established firms and those who have received the VINN NU grant. Several of these interviewees expresses that the grant allowed them to make initial contacts with possible partners and/or customers and to travel to conferences, fairs to visit customers abroad (Firm 4, 16). Although the project did in this case not lead to first hand collaboration, the networking activities are perceived as very important for the future of the company by the interviewee. One example of the importance of networking is Firm 14, where an effect of the Forska&Väx project was that a connection with a partner in the US was established that later led to applications and grants from the National Institute of Health (NIH):

“If we wouldn’t have had the Forska&Väx, we wouldn’t have come far enough to establish links with this partner in the US and then we wouldn’t have received funding from the NIH.”

Another common theme among the firms is that the Forska&Väx project has contributed to deepen and strengthen already existing contacts with partners. In one case (Firm 7), it is asserted by the interviewee that the project leads to “a natural extension of the contacts that was beneficial”. According to another interviewee (Firm 33), an important part of the project was about maintaining and strengthening the already existing relationship with a research institute in computer science.

6.4.3 INCREASED HUMAN CAPITAL

Figure 12 illustrates the occurrence of increased human capital among firms that have participated in the Forska&Väx program.

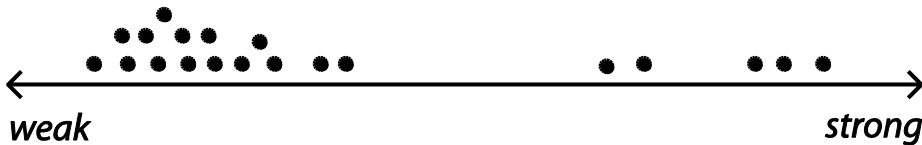


FIGURE 12. SCHEMATIC FINDINGS OF WEAK AND STRONG SCOPE ADDITIONALITY CONCERNING INCREASED HUMAN CAPITAL

Scope additionality effects in the category of human capital is defined as strong when the project in question leads to the employment of personnel with key competences. Also the hiring of consultants is considered a strong effect. Weak additionality effects on the other hand leads to no visible effect on recruitment though the project may still contribute to raising the general knowledge level in the firm. As Figure 12 shows, strong effects with regards to human capital is quite rare. This can, at least in part, be explained by the fact that most firms in the sample are small and R&D intensive and that their business niche is rather narrow.

The general competence level of a firm can be elevated in several ways: by hiring new employees, by hiring consultants, and by developing the skills and knowledge of existing personnel. All of these may be induced or catalyzed by the pursuit of a Forska&Väx funded project, and examples of all three are present in the material. Direct hiring of new employees should probably be regarded as a *strong* additionality effect, whereas improved competence stemming from the temporary hiring of a consultant is to be regarded less strong and developing of skills and knowledge among existing personnel is considered a weak effect. One of the firms under study (Firm 3) hired no less than three persons to take part in the project. All three are now regular employees and are said to have contributed to the long-term competence building of the company. This is seen in several cases (Firm 2, Firm 14 and Firm 10). In one case (Firm 2), employees of collaboration partners have “moved over” and started working with the firm in question instead:

“The first Forska&Väx we got was done in collaboration with a research institute, but the guy there who would do it, he jumped over to us instead, and was employed here. The next Forska&Väx project was done together with a large consulting firm and the person who worked on the project there, he also sits here now”

Grants are occasionally also used for hiring consultants, or for financing an external study or investigation. One firm (Firm 6), a well-established company who wanted to go in a direction where they did not have the competence and wanted to add the credibility of an external (preferably academic) authority in the area, used the grant to pay for a study done by a research institute. Similarly, another firm (Firm 29) used the grant to pay for an external expert who wrote a scientific report about the product technology of the firm. In this way, the ‘academic height’ of an activity is perceived to be drastically raised. It should be noted that these cases identify an overlap between the subcategories *human capital* and *improved innovation management*. In one case (Firm

19), a consultant was hired to participate in the project, however not funded by the grant money but on the firm’s regular budget, which indicates an overlap between the behavioral additionality effect discussed here and an input additionality effect.

In the VINN NU cases, the grant of SEK 300,000 can actually mean the difference of hiring a person or the ability to pay the founder a salary in the initial phase, which should be regarded a major difference. This point is raised by several interviewees in applicable cases (e.g. Firm 24, Firm 1). Other effects of this may be that founders are able to increase their competence and devote time and energy in the venture in the important early stage. In one case (Firm 9), for example, an external CEO was hired with help from the VINN NU grant, and this increased drastically the market knowledge in the startup phase.

6.4.4 IMPROVED INNOVATION MANAGEMENT

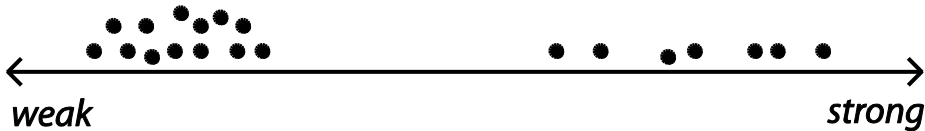


FIGURE 13. SCHEMATIC FINDINGS OF WEAK AND STRONG SCOPE ADDITIONALITY CONCERNING IMPROVED INNOVATION MANAGEMENT

Figure 13 illustrates the occurrence of scope additionality with regards to improved innovation management among firms that have participated in the Forska&Väx program. Strong additionality effects in the category of innovation management results when the firm develops new ways of conduct, for example by increasing contacts with academia so that a more research intensive profile is obtained. Another example of strong effects is when external consultants are hired that contribute not only with specific knowledge of an area but whose impact on the firm’s behaviour progresses when the project is completed. The additionality effect is considered weak when the project in question does not mean the firm has to learn to do things in a new way.

Effects closely connected to networking and the establishment of connections with academia is to make firms better informed, than they would otherwise have been. This can be said to constitute an increased academic ‘height’ or a general competence – or capacity-building effect.

One case (Firm 18) provides an illustrative example. The project in question was already under way in the company before the application to Forska&Väx. An external research institute, known to the firm, was engaged

to aid the project as a consultant. It was on the basis of a recommendation from this consultant that the application to Forska&Väx was made. The project led to the deepening of this collaboration and also to contacts with local academia, a “big step” for the company in question as they had been in the same business for over 50 years and “never worked with external actors before”. The general experience from establishing the ties with this research institute and later academia would probably not have been as good without it being subject to an externally funded project, and the external funding would probably not have been obtained without these contacts.

In a similar case (Firm 34), the firm had an idea that they wanted to develop further but realized that they lacked the ‘academic’ competence to go further. A contact was established with scientists at Chalmers Institute of Technology, who suggested that an application should be written for a Forska&Väx grant. The grant allowed for a deepening of the relations with the Chalmers researchers. Not the least could the Chalmers researchers add “academic height” to the project. In the long run, the interviewee regards this deepening of the relations as competence developing and capacity building for the firm.

Another thing that is important for the general success of projects, as well as for the overall performance of the firm is the time and opportunity for increased R&D efforts. One interviewee (Firm 2) argues that to conduct research to the extent that this firm has been able to do within the Forska&Väx funded projects is otherwise hard or even impossible in a small firm. Business angels and similar funders may not finance pure R&D because they want to “smell the money” but the Forska&Väx grant allowed the firm to go into R&D to a degree they would not have been able to do otherwise.

Pursuing a development project may also, as noted by Davenport et al. (1998) have disciplinary effects that benefit the firm also in the long run. One example of this is given by one interviewee (Firm 9) who says the firm has become better at identifying, planning, and carrying out projects from the experience of having a well-defined, externally funded project:

“We have become somewhat more critical in choosing what projects and collaborations we go on with.”

Another interviewee (Firm 14) explains that the grant has made the firm organize more in terms of projects than they would have otherwise. Another firm (Firm 34), who deepened their relations with Chalmers scientists as part of the Forska&Väx project (see above), have experienced a general elevation of their innovation management competence stemming from the increased 'academic height' brought on by the project; the firm is now planning to start a development department and hire a project leader. This is, according to the interviewee, an effect of the academic collaboration with Chalmers, where they learned the basic idea of 'real' R&D. The company had thus far worked more hands-on, building things and using a trial-and-error approach. With this experience, the door was opened to a different way of doing things.

It is very common among the firms in the material to have experienced different kinds of changes – allegedly to the better – regarding their general innovation abilities, as effects of their Forska&Väx funded projects. In concrete terms, these might for example be employment-related or organizational, like the eventual hiring of a project leader or a person responsible for development, or the rearrangement of tasks and work descriptions depending on organizational changes and slight shifts in company activities:

“With this grant, it became a real project to which we could allocate resources and people could devote time to it and you could set demands and set goals and targets for it in a manner that we couldn't have done if we did the project on 'spare time' so to say. It became a real project with a dedicated project leader and dedicated personnel and then it becomes more focused.” (Firm 21)

On the project level it is clear that the application and formal procedures make firms better organized. One interviewee (Firm 14) explains that “you have to sit down and write the application, get a project together, and when you get the money to have a clear budget and everything in order”. This helps in carrying out a project successfully, and it heightens the innovation capabilities of the firm in the long term. In some cases the project, because it is funded by an external actor, becomes more 'serious' than it would have been otherwise. It has been claimed by interviewees that the efforts to pursue a successful project are greater when they have an external part to take into account:

“It's a push forward, let's do it and let's do it well” (Firm 5)

6.5 SUPPLEMENTARY FINDINGS

As noted in chapter 2 and the introductory remarks to this chapter, there are a few notable features of behavioral additionality as an analytical concept that complicates the study of it. First, there is the *time lag* possibility, i.e. that behavioral additionality effects may not be visible until several years after the project or program is finished (cf Hsu et al., 2009, chapter 4). Second, there is a distinction between *project* and overall *firm*, i.e. that behavioral additionality effects may not be limited to the project carried out with support from the studied program but may very well be detectable in other projects or in the firm at large (cf Norrman and Klofsten, 2009, chapter 4). Third, effects may not be possible to refer back to a specific program or grant but may be the result of participation in multiple programs (cf Davenport et al., 1998, chapter 4) or partly induced by other, external or internal, factors such as location at a business incubator or the specifics of a business plan or strategy. These points of deviation from the ordinary pattern of behavioral additionality effects as deployed in the above analysis may serve as a tool in the attempts to synthesize empirical findings that are seemingly outside the categories *scale*, *scope*, and *additionality* effects. It can be summarized as factors either (1) *possibly* and/or *indirectly* leading to additionality effects, (2) being induced by additionality effects, or (3) correlating with additionality effects to create an allegedly favorable effect on project or firm. The empirical material presented in the following section is beset with ambiguities and should therefore be seen as slightly more suggestive and speculative than the previously presented findings. We have, however, reported correlations between the time lapsed from the first time the firm has received a grant and the extent to which we find the scope additionalities new markets and new products and improved networking capabilities. This indeed indicates that time lags are important, but the full extent of these lags remains to be explored in future work.

Several of the interviewees have expressed that the fact that they have been awarded Forska&Väx and/or VINN NU grants is a *mark of quality and success* for the firm, on project level as well as on general firm level. One concrete example of this is Firm 10, for which it is claimed by the interviewee that participation in the program may be disclosed to customers and other collaborative partners as a sign that the research intensity is high in the firm, i.e. as a direct advertising or marketing tool. This tool may also be used as a resource for attracting other similar funding, as in the case of Firm 4 where the VINN NU grant became a “quality marker”

that gave credibility that was valuable in relation to funders; as well as indirectly leading to the awarding of an 'innovation prize' to the firm. These effects are as ubiquitous in the material as they are subtle, and they correspond well to the discussion about information asymmetry and signalling in chapter 2. It is clear that the information asymmetry problem is perceived as less severe in the relationship between VINNOVA and the firms than in the firms' contacts with other potential funders. As mentioned, several interviewees have expressed that 'ordinary' venture capital is extremely hard to get hold on, mainly because venture capitalists, in their opinion, only fund 'safe' projects. VINNOVA, on the other hand, has a stated purpose of funding projects that are subject to the 'market failure' problem, in an aggregated sense, and the conclusion, not seldom expressed explicitly by the interviewee, is that VINNOVA has a clear 'market niche' here. As a public organization with a politically rather than economically motivated mission of providing funding to innovative projects in small and medium-sized enterprises, VINNOVA does by definition mitigate the information asymmetry problem. In a transferred sense, VINNOVA can also be said to take on the 'signalling' role (Akerlof, 1970b, see chapter 2) as intermediary and provide legitimacy to firms, a phenomenon that is ample in the material. Described by many interviewees as a 'quality marker', the credibility obtained by participating in a VINNOVA program, regardless of how it is put to practical use, is often coupled with very intangible phenomena like self-esteem and similar psychological effects.

"The money makes you dare to try a new project" (Firm 14)

"This is something extra, it strengthens the firm. An order is an order, that's something we need to survive, but this strengthens us [on another level], it's a 'vitamin injection'." (Firm 21)

"It wasn't that much money, but you know, we got emails from people who said 'good for you' ... things started to happen, and you know, that means a lot." (Firm 17)

As mentioned, the practical utilization of the 'quality marker' varies:

"All investors are 'herd animals' and if you are 'blessed' by VINNOVA, that means another investor will have a kind of excuse if it goes wrong. If an investor decides to invest and it doesn't go very well, he can say that it wasn't only he who believed in this, also VINNOVA did and so it was purely bad luck. [...] If you are externally assessed and publicly blessed, that has great value." (Firm 26)

“The grant was crucial for us in order to go through with the project, but it was also a mark of quality, that we were right in our thinking and acting.” (Firm 8)

“You don’t have to go further than to the board of the company, to be able to show them that someone external has assessed the project and approves or backs it up. That gives the investors already in the company strength, I think.” (Firm 8)

An interesting but slippery concept that can be synthesized out of the material is the occurrence of a so called cumulative advantage related to firms’ participation in Forska&Väx and VINN NU (and similar) programs in general, and perhaps the above discussed ‘soft’ marker of quality effects. In concrete terms, cumulative advantage shows generally as reciprocally acting positive factors in firm behavior and performance that collectively or on the basis of each other enhance firm success in any given definition. For example, the participation in a VINNOVA program may, as discussed above, function as a ‘mark of quality’ for the firm, which in turn yields a benefit on the market, in relation to customers, or in relation to other funding sources. This advantage – for example an increased probability to be awarded a grant – would then have another positive effect on the firm, such as inflow of capital, which may further strengthen the ‘mark of quality’ or have a similar, positive, effect that adds to the long term enhancement of firm performance. This advantageous effect is cumulative in the sense that different factors induce, improve and strengthen each other.

Effects of this kind are common in the material. One tangible example, expressed by several interviewees, is the enhanced ability to write proposals and applications that comes from having an application accepted, which significantly improves the possibility of getting the next application through:

“Money often generates more money. When you get a result out, it is easier to apply for more money.” (Firm 14)

There is also an interesting tendency that this cumulative advantage may make a firm a ‘better receiver’ of funding (e.g. Firm 23), i.e. that the firm learns to carry out projects of the type eligible for Forska&Väx support and therefore will use the grant more efficiently, an effect that is clearly also related to other enhancing effects on firm behavior that may be subject to cumulative advantage. There are, however, also signs of ‘unhealthy’

adaptation – one interviewee identified the risk that firms may adapt their activities to areas or activities that have a greater likelihood of getting Forska&Väx (or similar) funding:

“If we see that we can choose to run a project a little earlier and reformulate it so that it fits into an application, of course we will do that.” (Firm 26)

Finally, it shall be mentioned that some interviewees have raised the possibility that a receiver of VINN NU support may be more inclined to apply for Forska&Väx support because of the positive experiences from the VINN NU program.

7 CONCLUSIONS

The present study has analyzed effects of public innovation support in a selection of small and medium sized firms which have received support from VINNOVA through the programs Forska&Väx and VINN NU. The main focus has been on effects in terms of *behavioural change* within supported firms. Such behavioural change is conceptualized as *behavioural additionality* further classified into the subcategories *scale*, *acceleration* and *scope* additionalities. On more detailed level, *behavioural scope additionality* has been specified into the categories *new products and markets*, *improved networks*, *increased human capital*, and *improved innovation management*.

There are by default differences in the “strength” of effects arising from these different types of behavioural additionalities, not least because they affect entirely different dimensions of the firms’ activities. New products and markets have for instance more thorough and direct impact on the long term renewal of firms’ commercial activities than improved networks and innovation management, even if the latter types may have an *indirect* effect also on products and markets. Nevertheless, concrete case observations also reveal differences in strength of effects also within each of these categories. To nuance the general comparison between different types of additionalities, the additionality effects specifically observed are further classified as either weak or strong, *within* respective category. This means that behavioural scope additionalities of the type new products and markets do not necessarily have stronger impact on the firms’ overall orientation and performance than

behavioural scope or acceleration additionalities, even though the former in principle, though not always in practice, implies stronger effects. This nuanced cross-category comparison is one of the main strengths of the in-depth case study approach applied in this study.

There is no question that additionality effects stemming from the support appear in the studied firms. In many of the cases the identified effects are classified as strong. There are however large differences within the categories. Many concrete examples of strong additionality effects in scale and acceleration are identified (i.e. despite the fact that these, in principle, belong to the “weak” category). One should also keep in mind that context matters. Scale and acceleration effects are conditioned by the size of support, the type of program and the size of the firm. Unsurprisingly, the volume of public funds has an effect on the speed and volume of activities (i.e. acceleration and scale additionalities). Small firms experience strong scale and acceleration additionality more frequently than large firms. For them, this may be the major discernible effect; a small firm has not yet had to time to diversify its business model into several products and therefore increasing volume and speed regarding their existing activities (or perhaps activity) may be the most visible type of effect in these firms. In accordance with this reasoning, firms receiving support from VINN NU (which are recently established) tend to scale up activities more than firms receiving support from Forska&Väx. The grant is thus relatively more influential for small and recently established firms.

Scope additionality is almost by definition only relevant for firms with already ongoing activities. Therefore such effects are primarily analyzed for the firms supported by Forska&Väx. An important result from the present study is that strong scope additionalities with respect to new products and new markets are common. Also this observation is strongly contextual. The longer the time since a firm got its first support grant, the more likely it is to develop new products or enter new markets. This signifies that such effects are likely to be long term. Moreover, the older the firm, the more scope additionalities appear as a result of the support grant. The reason for this is that older firms have established routines, infrastructure and organization. The support grant enables them to shift focus onto a new area. Such shift of focus is a strong effect and is evidence of a pronounced difference in effects between new vs. established firms.

Among the other scope additionality categories (networks, human capital and innovation management), there is less evidence of strong effects among the studied firms. These results are probably influenced by the classification of the effects. There is no question that there are inherent differences within these groups in terms of long term effects and tangibility. Human capital, improved networks and improved innovation management are 'softer', less well defined by nature. Firms may consider these as more or less important and their long term effects may vary. Effects within these are further difficult specify. New products and new markets are on the other hand very substantial and easy to specify. So are their potential long term effects.

An effect that we did not look for, as our focus was set on additionality, was that the public agency (VINNOVA) is perceived as a mediator of quality, both among the supported firms and by other actors in their surroundings. This "quality assurance" which stems from the received support from VINNOVA influences the firms' market potential and makes them able to attract additional (venture) capital. This observation connects directly to theory developed in chapter 2 regarding the role of risk and uncertainty, which predicts that a public agency can act as a signal instrument, as an independent information broker clarifying commercial potential of firms that are nascent and re-orienting towards new areas.

To sum up, the findings presented in this study provide concrete illustrations to many of the theoretical statements on the role of public support for innovation performance among small and medium sized firms. The support contributes mainly to reducing the risk at the stages of business formation and reorientation and to information signalling. It is clear though that many of the effects identified in this study vary systematically, are contextually bound, and differ a lot both between and across firms and type of programs. Hopefully this report has shed light on some of these effects and conditions.

APPENDIX: INTERVIEW GUIDE

About the firm

Open-ended question: *Tell us about your firm...*

Specific issues to cover: Founded (year), founder, main activity, approximate turnover, university-spinoff?, number of employees, owners, original idea or product/service, recruiting base, main customers

About participation in the VINNOVA program

Open-ended question: *How and why did you end up applying for and receiving support from VINNOVA?*

Specific issues to cover: How did you come across the program?, 'Motives' to apply, whose idea, contact with VINNOVA, previous knowledge and relation to VINNOVA, influence from VINNOVA, *general comments about the program*, internal 'preparations' for the program, other external support (comparison and relation), administration of the support internally (who)

About the project

Open-ended question: *Tell us about the project that was funded...*

Specific issues to cover: Large/small, central/peripheral (to firm activities), importance of the support (would the project have been pursued anyway), alterations in how the project was conducted as a result of external support, acceleration, scope, scale, other markets, new actors, alternative funding?, alternative projects not pursued

About changes on the firm level

Open-ended question: *In what way do you think/experience that the firm has changed as a result of participating in the program?*

Specific issues to cover: Positive/negative/no difference, 'worth it'? (additionality could be negative), 'unique effects', factors for 'success' of the support, increased incentives to apply for support?, applying for more external funding now?, organizational changes (new recruitments, human resource management), attitudes among employees toward the support, effects on localization, patent strategy, motivation and focus, ambition, risk, new products, new markets, customers, context, competitors, venture capital relations, investors, networks, collaborations, the support as marketing resource, 'quality marker', increased knowledge (about market, general climate, support and public support activities), *permanent changes in any of these?, time factors*

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