Promoting innovation, capabilities and impact for smes in traditional industries calls for variety in innovation support

Promoting Innovation, Capabilities and Impact for SMEs in Traditional Industries Calls for Variety in Innovation Support

René Wintjes, Hugo Hollanders

Innovation support measures in the EU have mostly been designed to support R&D for product innovation in R&D intensive sectors. In line with the policy target to increase business R&D expenditures, this dominant form of public support is mainly evaluated for inducing additional R&D input. Because SMEs in traditional industries innovate in another way, this paper takes a broader view by looking at a range of different interventions and different types of innovation, types of innovation capabilities and types of output. To promote the still considerable contribution to regional employment and competitiveness from SMEs in traditional manufacturing industries, a broad innovation (policy) mix seems more appropriate, than a narrow focus on product innovation. Data from a survey of over 300 SMEs from seven regions in Europe is analysed to explain differences in effects for a variety of intervention features. We find that improved capabilities for product-, process-, organisational-, and marketing-innovation matter for innovative sales. Product innovation (and support used for product innovation) is less likely to generate growth, than (support used for) process innovation. Also (support used for) marketing innovations and organisational innovations are of particular importance – together with internationalisation, design and cooperation. These results suggest that policy makers should promote variety in firms innovation efforts and capabilities, rather than steering them all towards the same.

Keywords: Innovation, SMEs, Traditional Sectors, Low-Tech, Policy Evaluation, Manufacturing, Process Innovation
JEL classification: O38; O33; D83; L60; O14; O33; O31; O32

1. INTRODUCTION

This paper builds on the results of a larger research project [1] that addressed the question given by policy makers: Which support measures can help regions based on traditional industries to prosper in the knowledge economy? This policy question is not a good research question, as it includes several units of analysis, and «support», «help» and «prosper» can be de-

René Wintjes (corresponding author), UNU-MERIT, Maastricht University, Maastricht, r.wintjes@maastrichtuniversity.nl
Hugo Hollanders, UNU-MERIT, Maastricht University, Maastricht

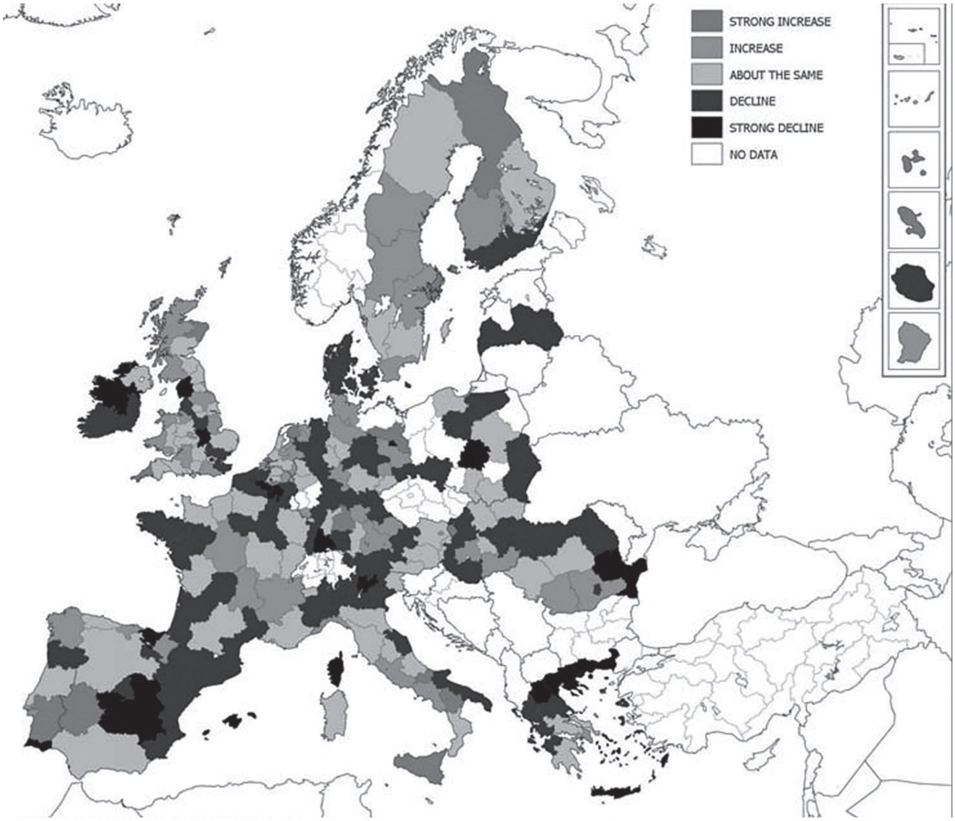
[1] This research benefitted from the European Commission, FP7-SME-2009-1; Grant Number: 245459 (http://business.staffs.ac.uk/gprix/en/index.htm/).

fined in many different ways. In previous papers within this project, econometrics have been applied to assess with statistical rigor if «treatment» in the form of public support to SMEs has worked for innovation (Radicic *et al.*, 2016), and to collaborate (Radicic *et al.*, 2018). It was shown that the support would have had more effect on innovation if it would have been provided randomly, because the support was mostly provided to those SMEs that were more likely to have innovated anyhow. In line with the methodological concerns raised by David *et al.* (2000, p. 509) about endogeneity of R&D subsidies and selection bias in the funding process, the heterogeneity among firms is taken into account more seriously in the literature after 2000. There are other remaining methodological concerns that could explain why there are still quite some studies that do not find innovation input or output additionality, let alone additional economic output, e.g. in terms of employment. On the question if innovation policy works for firms in traditional or low-tech industries the literature is still inconclusive. Instead of aiming to further increase certainty in assessing if support has worked, we take a step back, and widen the perspective. We aim to provide insights in the question why some innovation support seems to work different than others. Such insights should be useful for improving policy interventions, and future evaluations. With less statistical rigor this paper looks at heterogeneity among innovation support measures: Which kind of support is associated with which kind of innovation and which kind of outcome. By looking at the support process we also question some mainstream assumptions and consider some evolutionary ideas.

The literature will be reviewed for insights on the following: how do firms in traditional industries innovate?; how are these firms supported?; does innovation policy work?; how does innovation policy work? The review tells us that SMEs in traditional industries innovate in a different way. R&D subsidies for product innovation (as the dominant form of firm oriented innovation support in Europe) should be less relevant for them. The results from evaluations are inconclusive. Some author's suggest alternative ideas on why and how innovation policy could work, and work differently. The suggestion to have a closer look at the «treatment» brought us to questions such as: for which kind of innovation did SMEs use the support? Could innovation and economic outcomes perhaps not only be based on realised innovations, but also on innovation capabilities developed during the same period?

The analyses involves survey data collected among SMEs in traditional manufacturing industries across 7 regions in different European countries: Sachsen-Anhalt (Germany); Noord-Brabant (Netherlands); West Midlands (UK); Limousin (France); Emilia-Romagna (Italy); Comunidad Valencia (Spain); and Norte and Centro (Portugal). Six traditional industries have been selected that together still considerably contribute to manufacturing

FIG. 1. *Change in European regions' employment share of traditional industries*



Note: Map created with Region Map Generator.

Source: EUROSTAT. Data for 2009 and 1995. The groups were identified using hierarchical clustering and Ward's method. Own calculation.

employment in these regions (food products and beverages; textiles and textile products; leather and leather products; ceramics or other non-metallic mineral products; mechanical/metallurgy or basic metals and fabricated metal products; and motor vehicles, trailers and semi-trailers). Our composition of traditional manufacturing sector is only slightly different from the OECD classification of low-tech industries, which is based on the R&D intensity of the industries. The automotive industry for instance, is generally not regarded as low-tech, but we only included SMEs, and in terms of R&D intensity this subgroup can be regarded as traditional.

While policy makers are most interested in supporting R&D-intensive sectors, traditional manufacturing sectors are still relevant. In about half of all

EU regions the share of traditional industries in manufacturing employment has increased between 1995 and 2009 and in 78 EU regions this increase was more than 4.5 per cent (Figure 1). Although maps of regional innovation performance in Europe often show patterns of core and periphery, the geographic pattern of regions with a declining or increasing share of employment in traditional industries is quite scattered. There are even regions where the traditional sectors appear to be in a state of revival, as they have a low but significantly increasing share of employment in traditional industries. These rather innovative regions are located in Germany, the UK and Nordic Member States. This indicates that firms in «traditional» or «low-tech» industries can demonstrate growth and innovativeness (Tunzelmann, Acha 2005; Kaloudis, Smith 2005). However, the regional economic importance of innovative SMEs in traditional manufacturing sectors is often neglected (Robertson, 2009). Most attention goes to SMEs in research intensive sectors and innovation policy support is focused on supporting the most innovative and R&D intensive firms. Low-tech industries are not synonymous with low growth or low profitability (Maskell, 1998, p. 99). Low-tech industries are not only a forgotten sector in innovation policy (Hirsch-Kreinsen, 2008), but also in the literature on innovation policy evaluation.

More recently the policy interest in modernising SMEs in traditional industries has grown. For instance, as part of environmental policy they are persuaded to use clean technologies, and in «Industry 4.0» strategies they are invited to adopt digital technology and to join emerging value-chains.

Key findings include: SMEs in traditional industries which are supported more frequently are more likely to have taken the innovative steps without public support; improvement of capabilities for all four types of innovations (product, process, organisation, marketing) matter for innovation output; realizing a product innovation, and increased capabilities in product innovation, is less likely to generate growth in turnover or employment; the support is mostly used for product innovations, but impact (in terms of additional innovation input, realized innovations, increased innovation capabilities, and economic output) seems less than could have been achieved if the support would/could have been used for process innovation, organizational innovation or marketing innovation.

2. LITERATURE

2.1. *How do SMEs in traditional industries innovate and grow?*

Studies of innovating firms have revealed that the sources of knowledge creation, learning and innovation have become broader and more complex, regardless of the R&D intensiveness of their industry. Innovation surveys show that R&D is indeed not the sole source of innovation for firms (Arundel *et al.*, 2008; Mairesse, Mohnen 2010). Potters (2009, p. 13) shows that this is especially the case for companies in «low-tech» sectors, for which: «Important inputs to innovation output – other than R&D – are technology acquisition, organisational and managerial innovation, design and marketing» [2].

As a first taxonomy of modes of innovation we can refer to the distinction between the early and later work of Schumpeter, often referred to as Schumpeter Mode 1 and 2. Mode 1 refers to his work on the individual entrepreneur who sees and tries new opportunities before others do. His later work acknowledges the importance of team work in departments and between departments in large firms, including a research department. Pavitt (1984) showed with his taxonomy of firms in different industries that the sources and purposes of innovation are industry-specific. Science based firms in high-tech industries innovate by performing in-house R&D for product innovation. For small firms in traditional industries like textiles, process innovations coming from suppliers of machinery are typically important. Jensen *et al.* (2007) contrast two modes of innovation: the Science, Technology and Innovation (STI) mode, is based on codified scientific and technical knowledge. The Doing, Using and Interacting (DUI) mode, is based on informal processes of learning and experience-based know-how. They show that firms that combine both modes of innovation are more likely to innovate than firms that rely primarily on one of these modes.

In the taxonomy tradition of Pavitt (1984) others have statistically identified a variety of modes of innovation at the firm-level (Srholec, Verspagen 2012; Verspagen *et al.*, 2016). The identified modes of innovation are often similar to those found in the other taxonomies, and to those of Pavitt at industry level (see the overview by Frenz and Lambert 2012). Based on a large set of firm level data for all manufacturing and service sectors, and all EU countries, Srholec and Verspagen (2012, p. 1237) have labelled their 4 types as: «Research», «External», «Production», and «User». Each of these modes are identified in all sectors. The «Research» mode puts together: strong R&D capabilities, extensive use of information from science, and a tendency to participate in joint innovation projects with other organizations. This mode is similar to the «science-based» mode of Pavitt (1984), which has also been identified by Hollenstein (2003), and Leiponen and Drejer (2007). The other modes of innovation refer to other roles that firms play in other parts of value-chains and innovation chains (Fagerberg, 2000; Pietrobelli, Rabellotti 2011) and innovation systems (Verspagen *et al.*, 2016).

[2] In the Community Innovation Survey (CIS), as well as our survey, these inputs are included in the total expenditures on innovation.

In the study of Laforet and Tann (2006) variables related to learning-by-doing, learning-by-training and learning-by-interacting have the highest impact on the degree of novelty of innovation. The main constraints they found for innovation in manufacturing SMEs concerned a poor learning attitude and poor networking, which they relate to their traditional characteristic of being insular and autonomous. Also Amara *et al.* (2008) point at the importance of learning-by-doing and learning-by-interacting in networks for low- and medium-tech manufacturing SMEs. Grimpe and Sofka (2009) show that, compared to high-tech firms, the search for externally available knowledge of firms in low-tech industries is focused on market knowledge. Santamaría *et al.* (2009) provide evidence for a higher importance of external sources for process innovations in low-tech firms compared to high-tech firms.

Four types of innovation as defined by Schumpeter (product innovation, process innovation, organisational innovation, and market innovation) are still the basis for the distinction made in the Oslo Manual (OECD, 2005) and questions in the Community Innovation Survey on each of these four innovations. However, within combinations of these four types of innovations in an innovation mix of a firm, they are often related and hard to separate from each other. In the terms of Schumpeter (1934) the essence is to come to «new combinations». For low-tech manufacturing industries there are several studies that show that product and process innovation are related. Santamaría *et al.* (2009) for instance show for Spanish firms that non-R&D activities, such as design and the use of advanced machinery, are especially important for low- and medium-tech industries and particularly for achieving product innovations. Raymond and St-Pierre (2010) provide an explanation for the positive impact that process innovation in low-tech industries often have on product innovation. They make an important distinction between two types of process innovations: those used for product development (e.g. computer aided design and manufacturing: CAD or CAD/CAM) and those used for production (e.g. computer numerical control: CNC). They show that «product development process technologies», have an especially strong effect on product innovation for firms in low-tech industries, compared to more high-tech firms. For low-tech manufacturing industries they also found that process R&D has a significant positive effect on product innovation. Product R&D has in low-tech industries the weakest and not significant impact on product innovation, probably because it mostly concerns incremental improvements to existing products.

Not only the importance of R&D, but also the importance of product innovation seems to be lower than is often assumed, especially for SME's in traditional industries. Kirner *et al.* (2009) found that low-tech manufacturing firms in Germany (compared to medium- and high-tech firms) lag behind in terms of product (and service) innovation performance, but not in terms of process innovation. For some aspects of process innovation low-tech firms even perform better. Laforet and Tann (2006) show that developing new ways of working in manufacturing SMEs is more important for innovation than developing new products. In relation to employment output Lachenmaier and Rottmann (2010) conclude that process innovations have a higher positive effect on employment than product innovations. We can conclude that SMEs in traditional manufacturing industries rely less on R&D for product innovation.

2.2. *Why and how are firms supported in innovating?*

According to Soete (2009) the focus on R&D and high-tech SMEs in EU policy (e.g. in the Lisbon agenda and the Barcelona target to spend 3 per cent of GDP on R&D) was rooted in the idea that the lagging EU productivity was caused by a failure in structural change towards R&D intensive high-tech sectors. According to Mason and Brown (2013) policy makers also favour high-tech sectors because they would generate more high-growth firms, but several studies show that high-growth firms are not overrepresented in high-tech sectors (Henrekson, Johansson 2010; Bleda *et al.*, 2013). For instance in the UK high-growth firms are almost equally present in high-tech and low-tech sectors (Nesta, 2009). High-growth firms are not necessarily R&D intensive (Brown *et al.*, 2014).

Data from the Innobarometer 2007 [3] show that a lower share of firms in traditional industries (6 per cent) receive direct support to finance R&D based innovation projects than of firms in other manufacturing industries (10 per cent) or services (8 per cent). This may have two reasons: these firms may less often ask for this support, and/or the policy makers may less often be willing to give it to them. Firms in traditional industries have received more support from the following measures: subsidies for acquiring machinery, equipment or software; attending or participating in trade fairs or trade missions; networking with companies; and information on market needs, market conditions, new regulations, etc.

So, SMEs in traditional sectors might indeed need support that is less focussed on «R&D for product innovation». However, many regional agencies have increasingly adopted a venture capital approach, selecting research and innovation project-proposals, which programme managers believe likely to succeed and thus offer a good «return on investment». This innovation policy strategy might not work for SMEs in traditional industries. At regional level the supply-side (R&D oriented) innovation policy measures are still dominant (Walendowksi *et al.*, 2011). A large share involves public R&D support meas-

[3] http://ec.europa.eu/enterprise/policies/innovation/policy/innobarometer/index_en.htm.

ures, despite efforts to support knowledge transfer, collaboration, and linking the public research base with industry. Many of these schemes also include trajectories with smaller amounts of subsidies for feasibility studies, or for prototyping, and increasingly also to support the development of a marketing plan. These schemes are typically designed to support product innovation in high-tech industries and start-ups. Nauwelaers and Wintjes (2002) therefore argue that the general macro-based argument for R&D policy should be complemented with specific measures targeting business innovation according to the local situation and specific needs of the existing industries and firms.

2.3. *Does public support for innovation work?*

Most academic studies of innovation policy evaluate the effect of R&D subsidies for R&D input additionality and R&D output additionality (Becker, 2015; Dimos, Pugh 2016; Beck *et al.*, 2017). In theory, public support might enhance private investment (additionality), but there is also the possibility of substituting private with public funds (crowding out). In recent years, empirical analysis of the impact of public support on firms' innovative activities has been mainly concerned with providing evidence on additionality versus crowding out. Overviews of the evaluation literature after 2000 show that there are more studies that find additionality, but the effect is small and there are still evaluations that do not find additionality. Specific attention to firms in traditional industries is rare, but concerning the distinction between low-tech and high-tech industries a recent and extensive overview by Beck *et al.* (2017, p. 36) conclude that «generally, consistent empirical evidence in this field is lacking» and they report on some contradicting results. González and Pazó (2008) and Becker and Hall (2013) found positive results for firms in low-tech industries and possible crowding out for firms in high-tech. Czarnitzki and Thorwarth (2012) find additionality for Belgium firms in high-tech industries, but not for firms in low-tech sectors.

Although there are many kinds of additionality, innovation policy literature recognizes three main concepts of additionality (Falk, 2007; Streicher *et al.*, 2004). *Input additionality* refers to the effect of support measures on innovation expenditures. *Output additionality* refers to the impact of subsidies on firm innovation performance (product innovation, process innovation, innovative sales, and economic performance (e.g.: productivity, growth in turnover and/or employment, profitability, export). *Behavioural additionality* refers to changes in firms' innovative behaviour induced by public support measures. Clarysse *et al.* (2009) found behavioural additionality from R&D subsidies. Perhaps more interesting is that they found that these learning effects decreased with the number of subsidized projects that were undertaken by the company. Gök and Edler (2012) show that behavioural additionality is not a clearly defined concept. Moreover, these three concepts of additionality are not mutually exclusive, but are based on different logics of intervention, and the effects often have feed-backs. Arqué-Castells and Mohnen (2015) find for Spain that quite some firms which did not have previous experience in doing R&D could be induced to enter R&D without a need to receive further support after that. This could perhaps be explained by the capabilities developed during this new experience.

2.4. *Why and how does innovation policy work?*

The mainstream market failure rationale for public intervention is to provide funding for an R&D project when the market mechanism is not able to allocate the resources for such investments in innovation due to uncertainties. The result of market failures is that firm R&D investments are below the socially optimal level, as was highlighted by Arrow (1962). The neo-classical notion that innovation is limited by the rate of investment may be useful at the macro-level, but it is not very helpful for an individual firm, industry or policy maker in deciding how much to invest in R&D and what kind of innovation should be pursued.

The innovation systems concept as developed by Freeman (1987) and Lundvall (1992) puts innovation in a broader perspective. Various actors play a different role as producers and users of knowledge. Besides firms with various modes of innovation, also other actors in the innovation system fulfil a role in the creation and diffusion of innovation. The main role for policy makers is in creating the conditions for firms which promote innovative behaviour and interactions, and which enhance capabilities for innovation.

Several authors have discussed alternative ideas on the rationale for innovation policy. According to Metcalfe (2005, p. 443): «the evolutionary policy maker is not an optimizing supplement to the market, correcting for imperfect price signals in such a way as to guide private agents to a better innovation mix». Policy makers are not perfect either and are boundedly rational, so a policy maker does not know what the best innovation mix would be for an SME. This also means that there is no one-size-fits-all, «best practice» or optimal policy (Edquist, Hommen 1999). What may be a good innovation mix (and innovation policy mix) for one individual firm or group of firms (say high-tech) may be less appropriate for others (say low-tech). Also within these groups of firms the uncertainty of both the firm and the policy maker remain. The argument moves away from a narrow focus on market failure arguments which favour public support for R&D, to a broader emphasis on the shortcomings of innovation systems which favour a broader range of innovation support interventions, aiming for a change in behaviour and routines (Nelson, Winter 1982). The uncertainties and risks involved with technological change and innovation, put a premium on learning by doing, learning by using and learning by interacting. This actually applies to both the SME as well as the policy maker. Nauwelaers and Wintjes (2003) therefore distinguish policy instruments along different logics of intervention: those which lower the price of inputs aiming to fund the best innovation projects and those which aim for behavioural additionality by providing firms a learning to innovate experience (see also Asheim *et al.*, 2013). This can be an eye-opening experience, an opportunity to try new things, to increase capabilities, to get to know new partners, to get inspired, to discover export opportunities, etc. Also policy makers learn to improve their interventions from this «interactive learning» between the producers and users of innovation policies (Wintjes, 2016).

In this respect, demand-side innovation policies, such as loans for purchasing new machinery, innovative public procurement or support for internationalisation seem more relevant for SMEs in traditional industries than R&D policies (supply-side innovation policy), since R&D and science do not give the main impulses, but conversely these firms rather react to practical problems and changes in customer demand (Kline, Rosenberg 1986; Mowery, Rosenberg 1979). Practical knowledge includes: user experience of operation, shop floor experience in production, and «rules of thumb» from previous experience in design (Faulkner *et al.*, 1995). Learning-by-doing and learning-by-using are typical ways to develop practical knowledge and dynamic capabilities (Teece, Pisano 1994).

Contrary to the linear view on innovation, innovation and new «value added» can come from many activities and sources. Especially for SME's in traditional sectors innovation may not be based on new technological inventions from internal R&D, but rather on serving market-needs and the application of process technologies developed externally. Rejecting the notion of a single best practice instrument for every type of firm and every type of ambition or need, we rather aim to explain the difference between interventions: which kind of support is good for which kind of innovation and which kind of impact?

3. DATA AND METHODOLOGY

Most of the scientific literature on the impact of innovation policy support focus on a single attribution question: does «treatment» in the form of R&D subsidies make a difference. Since the literature questions the relevance of R&D for product innovation for SMEs in traditional manufacturing industries, and suggests that many other innovative activities matter, we evaluate the various contributions from different interventions. In counterfactual evaluations, many questions concerning why, how and for whom the different interventions work or do not work, are often ignored. For the sake of accountability it might be sufficient when an econometric evaluation can assess to a high level of certainty if policy intervention worked or not, however for improving policy more insights are needed.

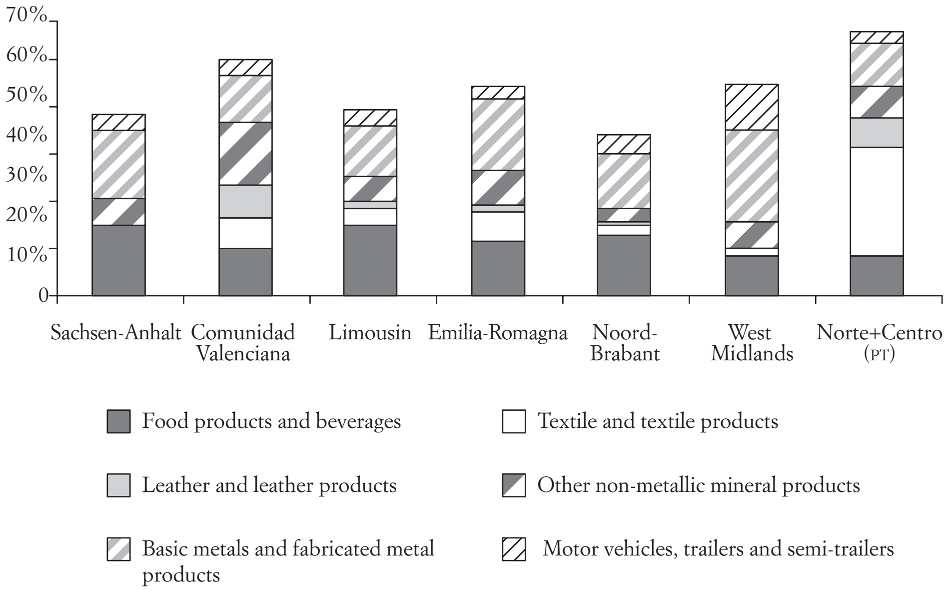
The policy aim is to provide insight on how to improve policy support in regions where a considerable share of manufacturing consist of traditional industries. Seven regions in different European countries have been selected: Sachsen-Anhalt (Germany); Noord-Brabant (Netherlands); West Midlands (UK); Limousin (France); Emilia-Romagna (Italy); Comunidad Valencia (Spain); and Norte and Centro (Portugal). Six traditional industries have been selected that together still considerably contribute to manufacturing employment in these regions (food products and beverages; textiles and textile products; leather and leather products; ceramics or other non-metallic mineral products; mechanical/metallurgy or basic metals and fabricated metal products; and motor vehicles, trailers and semi-trailers). The automotive industry is generally not regarded as low-tech, but we only included SMEs, and in terms of R&D intensity this sub-group can be regarded as traditional. Of the industries categorised as «traditional manufacturing» by the European Commission's European Service Innovation Centre (ESIC) (European Commission, 2015) [4] our selection only omits chemicals.

The distribution of local units in the traditional industries ranges from 43 per cent (of manufacturing in total) in Noord-Brabant and West-Midlands to 62 per cent in Norte and Centro. Basic metals and fabricated metal products is, in the number of local units, the largest traditional industry in Sachsen-Anhalt, Comunidad Valencia, Emilia-Romagna, Noord-Brabant and the West Midlands. Food products and beverages is the largest traditional industry in Limousin with textiles and textile products being the largest traditional industry in Norte and Centro. For employment we observe similar patterns (Figure 2). The share of persons employed in the traditional industries ranges from 41 per cent (of total manufacturing employment) in Noord-Brabant to 68 per cent in Norte and Centro. Although not every single traditional sector is economically important in every region, we can conclude that overall traditional industries still represent reasonably high shares of activity in the regional economic structure of the selected regions, even for a «high-tech» and R&D intensive region such as Noord-Brabant (Netherlands).

The survey sample includes 312 SMEs, comprising 145 firms that have participated in an innovation policy support measure and 167 firms which did not participate in any innovation support measure. In addition 60 inter-

[4] See http://ec.europa.eu/growth/tools-databases/esic/about/ keywords/index_en.htm.

FIG. 2. *Employment in traditional industries in seven selected regions, % persons employed of total manufacturing*



Data source: EUROSTAT, data for 2007, own calculations.

views have been conducted, mainly with responding firms, but also with programme managers. To get a representative sample we used, wherever possible, general firm registration lists, for instance from chambers of commerce. To ensure a sufficient number of firms that participated in support programmes we also approached (with the help of mostly regional programme managers), firms who had applied for support. As a result, firms that are supported are over-represented. Since we did not contact programme managers of EU R&D programmes, firms that participated in those programmes are likely to be under-represented. The firms were approached by e-mail or by post, and in a follow-up by phone. The survey was translated in the languages of the seven regions and SMEs could respond on-line, by e-mail or return-envelope. Data were gathered in 2010 and cover the period from 2005-2009. The sample[5] is well balanced in terms of industry and firm-size (Radicic *et al.*, 2016). The modal firm in the sample has 35 employees.

The first part of the survey largely followed the questions and definitions as used in the Community Innovation Survey, e.g. concerning innova-

[5] Details on how the sample was obtained in different regions are available in: GPrix Deliverable 3.3, p. 20, and Deliverable 1.7, especially pp. 10-14. Deliverable 1.7, pp. 16-54, also reports exhaustive descriptive statistics on the sample.

tion input, output and concerning product innovation, process innovation, organisational innovation and marketing innovation. This implies for instance that significant changes to the aesthetic design or packaging, are reported as marketing innovations, and not as product innovations. This part of the survey (on how firms innovate) was answered by all firms. The second part of the survey addressed public support for innovation. Those who had received support were asked a few questions for a maximum of two support measures: e.g., for which kind of innovation they had used the support, and to rate themselves the importance of 20 predefined, possible impacts from the concerning support. The survey sample has a good balance between participants and non-participants, e.g. with respect to size in terms of the average number of employees and strength of competition.

4. SURVEY ANALYSIS

4.1. *Innovations and improved capabilities in relation to output*

In this paragraph we will first analyse how the total sample of firms innovate and grow. The survey respondents are quite innovative, since 37 per cent of the respondents have spent 1-5 per cent of their turnover on innovation activities, which is standard for most sectors. But a quarter of all responding SMEs spend 6-10 per cent, which is more at the level of research intensive industries. [6] Almost a third spends even more than 10 per cent of their turnover for innovation activities. Nearly 10 per cent do not spend anything on innovation or research. Since these SMEs are in manufacturing industries it may not be surprising that innovation in goods is more important than innovation in services: over 70 per cent of all participants had introduced product innovations in goods in the previous 4 years. More surprising perhaps is that almost 50 per cent of responding firms have realized a service innovation. In terms of sales from new goods and services as a share of turnover (innovation-output), the responding firms are moderately innovative: 14 per cent could reach 25-50 per cent innovative turnover and 17 per cent even realized more than 50 per cent of annual turnover with innovations. For comparison, German research-intensive industrial companies have reported an average of 32 per cent innovative turnover in 2009 (ZEW, 2011).

Respondents have rated capabilities for product innovation as most important. However, when we look at the improvement in the four distin-

[6] In Germany the overall innovation intensity (innovation spending as share of turnover) was 2.74 per cent in 2009, Research intensive industries had an innovation intensity of 8.4 per cent in 2009 (see ZEW 2011, p. 6).

TAB. 1. *Effect of improvement of capabilities and introduced innovations on innovative and economic output*

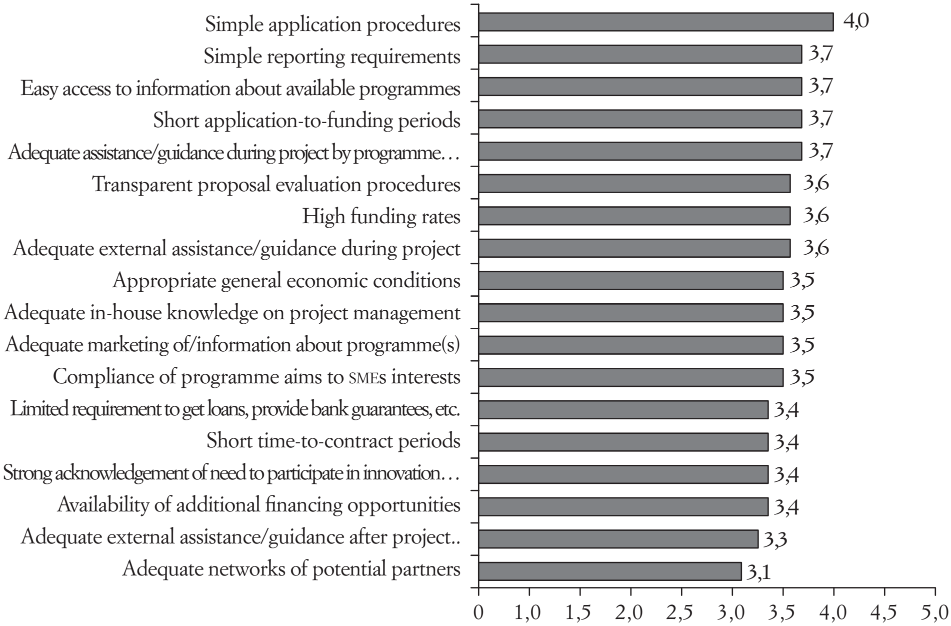
	Share innovative sales (< 6% vs ≥ 6%)	Growth in turnover (≤ 15% vs > 15%)	Growth in employment (≤ 5% vs > 5%)
Improved capabilities[1] relative to industry for:			
product innovation	21.2**		
process innovation	22.4**	6.9*	
organisational innovation	17.6**		
marketing innovation	16.8**	7.9*	
Realized 1 or more[2]:			
product innovation	23.4**		
process innovation			6.9**
organisational innovation	23.3**		20.5**
marketing innovation	18.0**		

Note: Pearson Chi-square is shown; * $p \leq 0.05$, ** $p \leq 0.01$; 1 = improved vs same, or less ($df = 2$); 2 = realized an innovation versus not realized an innovation ($df = 1$).

guished capabilities and the achievement of 1 or more of the four types of innovations we find that the impact on the various outputs suggests otherwise (Table 1). An improvement in the self-rated capabilities for product innovation (relative to their industry, in the previous four years), has a significant positive effect in terms of the share of new products in sales, but this is also true for the other forms of innovation. Also the relation between having realised a new product innovation and share of innovative sales is significant, but so is the relation with having realised an organisational innovation. What we did not find is a significant positive effect of improved product innovation capabilities, or having achieved a product innovation, on growth of turnover or employment. We did find an effect from improved capabilities in process innovation on turn-over growth, and from having achieved a process innovation on employment growth. Also «improved capabilities in marketing innovation» and «having achieved an organisational innovation» has a positive impact on economic output. We can conclude that for all four types of innovations, improved capabilities matter for innovation output, but that product innovation is less likely to generate growth.

A particular feature of innovation by SMEs in traditional manufacturing industries, which was identified in our case studies, is the importance of design, especially that of technical design. Design is one of the intangible aspects that touch on one of the difficulties concerning the definition of the various types of innovation, and it can explain why and how some innovations serve as input to other innovations in a systemic way. E.g., applying new techniques for product development such as Computer Aided Design (and CAD/CAM systems) can be seen as a process technology. Product designers also create additional value with intangible experiences, e.g. aesthetic or user-friendly aspects of goods, but this is often merely captured as marketing in-

FIG. 3. *SMEs needs concerning design and implementation of measures*



Scale: 1 = No importance; 2 = Low importance; 3 = Important; 4 = High importance; 5 = Very High importance

Source: survey; n = 298-308.

novations. Design of new services often involves changing the various interactions with clients (and or suppliers). Service design is therefore to be seen as a means to advance business models (Chesbrough, 2010), and this may transform the organisation in firms and value chains.

4.2. *SME needs regarding programme design and implementation*

Support programme features appear influential on the decision of an SME in traditional sectors to participate in a particular programme (Figure 3). Heavy bureaucratic procedures are a burden to all firms, but this seems especially the case for SMEs in traditional sectors. The survey asked respondents not directly about their own experience of programme participation, but for their view on SME needs in general: «What are the specific needs for SMEs to enable them to participate in innovation support programmes?» The main need identified was procedural simplicity and transparency (according to those responding with «high importance» and «very high importance», which were the extreme categories on a five-point Likert scale). Bureaucratic procedures are a barrier to entry, as they impose a fixed cost on programme participation.

Also highly rated was «short time to contract». Moreover, a common theme was that the need for timeliness can be a source of tension between SMEs and, for example, Universities. Other needs noted as important were «guidance during the project» and «mentoring/coaching». Regular contact with programme managers/case officers combined with mentoring/coaching could increase the effectiveness of support measures.

4.3. *Additionality of intervention and its frequency*

In order to evaluate if the innovations and output in terms of innovative sales can be attributed to the received support, Radicic *et al.* (2016) have analysed (based on the same survey data) the difference between firms that received support and those which have not received support. The support programmes had on average no additionality effect on the innovation of participants, but they would have had a positive effect on randomly selected SMEs. This result is consistent with evidence from interviews with programme managers in all seven regions. The selection procedure adopted by programme managers is typically one of «cream skimming» or «cherry picking». Firms are selected for support on the basis of characteristics that are positively associated with innovation. The selected firms would probably also have innovated without support.

In this article we do not focus on the counterfactual issue by comparing those supported with the not-supported in detail, but the survey included a question which directly asks for the counterfactual situation: «Would you have taken the same or similar steps without this public support?». This question was raised for the 1 or 2 interventions in focus. Of those who have participated in 3 or more support measures, 70 per cent has answered that without the support they would have taken the same or similar steps (Table 2). Of the SMEs which have benefitted from only 1 or 2 support measures 56 per cent has answered that they would have taken the same innovative steps without the concerning support. So, the firms which are supported more frequently are most likely to have taken the innovative steps anyhow, irrespective of programme support. The less frequently supported are more likely to have taken additional innovative steps, steps they would «not at all» have taken without support.

Table 3 describes some differences between firms which are not supported, firms that had less than 3, and those that had 3 or more policy support interventions. A striking difference is in the share of firms cooperating in innovation. Of the non-supported SMEs only 34 per cent cooperate in innova-

TAB. 2. *Difference in additionality between frequently and less frequently supported* SMEs

	Would you have taken the same or similar steps without this public support?			
	Yes – and as quickly	Yes – but more slowly and less effectively	No – not at all	
SMEs with 1 or 2 interventions	11%	45%	44%	100.0% (N = 137)
SMEs with 3 or more interventions	7%	63%	29%	100.0% (N = 82)

Note: Pearson Chi-Square = 6.8, *df* = 2, *p* = .034.

TAB. 3. *Differences between* SMEs *which had no intervention, few interventions and 3 or more interventions*

	Not supported (N = 171) 100%	1 or 2 interventions (N = 101) 100%	3 or more interventions (N = 49) 100%	Pearson Chi-square	*df*
Cooperate in innovation, yes (vs no)	34	79	94	166**	2
Lagging process innovation capabilities relative to industry, 2005 (vs average, above average and leading)	25	22	11	21**	6
Lagging product innovation capabilities, 2005 (vs average, above average and leading)	25	23	11		
≥ 6% of turnover spend on innovation (vs < 6%)	41	65	84	67**	2
Spending more on innovation now than in 2005 (vs same or less)	29	52	51	35**	4
Less than 6% of sales are new products, 2009 (vs ≥ 6%)	55	47	46		
Realised a process innovation, 2005-2009 (vs no process innovation)	79	93	86	20**	2
Realised a product innovation, 2005-2009 (vs no product innovation)	73	92	88	33**	2
Improved capabilities for process innovations (vs same or lower)	29	42	33	13**	4
Improved capabilities for product innovation (vs same or lower)	31	41	35		

Note: ** $p \leq 0.01$; * $p \leq 0.05$.

tion, while of the frequently supported 94 per cent cooperate in innovation. Radicic *et al.* (2018) specified this and found an additionality effect from support on collaboration.

The fact that the product innovation capabilities in 2005 do not differ significantly between firms which had no, few or frequent interventions, suggests that the policy agencies did not simply favour applications on the basis of their innovation capacities. It is more likely that the share of turnover spent on innovation is a characteristic that has served in getting selected, at least for getting selected more than twice (Table 3).

Concerning «increased spending on innovation», «having realised innovations» and «improved capabilities», the lower performance of the frequently supported SMEs supports the above finding that additionality is lower for the frequently supported. For instance, 41 per cent of the firms which received support once or twice has improved their capabilities for product innovation, while for the frequently supported 35 per cent has improved those capabilities, which is actually quite similar to the 31 per cent of the not-supported. This suggests that improvement of capabilities for innovation becomes less likely in case of more than two interventions.

4.4. *Comparing types of innovation support measures on impact*

Based on the survey data we can indicate the extent of impact from participation in various types of schemes, as assessed by the respondents themselves. The responding participants gave a score on the importance of a wide range of possible effects from support. They did this for one or two of the most important programmes they participated in. The impact from Collaborative programmes and especially the support measures concerning Internationalisation seem to be the ones generating relatively high impacts in certain fields. For the largest group of measures: «internal innovation» the impact-scores are often close to average, with less outstanding fields of impact. The high impact-fields are often not very surprising. For example, collaborative schemes generate specifically high impacts on «Formation of new partnerships and networks», and Internationalisation measures specifically score well on «Internationalisation of activities».

In the case studies, many firms reported the need for assistance with marketing. Some lacked the resources to employ a marketing specialist and complained that programmes had a focus on technological innovation. In their view, to promote SME innovation in traditional sectors there should be more emphasis on non-technological innovation, especially design and international marketing.

When asked for which innovative activities they received support, around 10 per cent responded with export promotion. This was an unexpected result, because export promotion was not mentioned in the questionnaire among the guidance notes for respondents on innovation: all the examples of types of innovation followed the Oslo Manual (2005) and the Community Innovation Survey, in which marketing innovation is restricted to varieties of new marketing techniques, but excludes entry into new markets. This perspective is consistent with case study interviews and survey data, both of which suggest that SMEs in traditional manufacturing regard exporting as innovative activity.

TAB. 4. *Factor analysis; four types of self-reported impact and the loading for the main components*

	Impact factors			
	F1: «Access to markets»	F2: «R&D links»	F3: «Strategy organisation & skills»	F4: «Certification»
Access to markets	.796			
Increased profitability	.762			
Increased turnover	.731			
Improved commercial linkages with other organisations	.680			
Enhanced reputation and image	.624			
Internationalisation of activities	.572			
Faster «completion» of innovation project	.529			
Improved R&D linkages with universities/research institutes		.815		
Improved research competences		.723		
Improved R&D linkages with other business organisations		.684		
Facilitated participation in other R&D or innovation programs		.660		
Formation of new partnerships and networks		.517		
Improved business or innovation strategy (e.g. new business model)			.736	
Improved internal organisation			.698	
Improved level of skills of personnel			.650	
Improved marketing competences			.587	
Improved design capabilities			.413	
Impact on quality certification				.851
Impact on safety and environmental certification				.823
Enhanced productivity	.516			.587

Legend: Low factor loadings are not shown. Extraction Method: Principal Component Analysis. Rotation Method: Equamax with Kaiser Normalization. Rotation converged in 10 iterations.

The information captured by the answers on the 20 impact questions have been reduced into four impact factors, with the use of principal component analysis. The main factor (which explains the largest share of the explained variance) consists amongst others of the impacts on: access to markets, increased profitability, increased turnover, commercial linkages and internationalisation. This impact factor has been labeled «access to markets». The second factor includes R&D linkages and improved research competence and is labeled «R&D links». The third factor includes the impact on: business and innovation strategy, improved internal organization, skills and design & marketing capabilities, and has been labeled «Strategy, organization & skills». The fourth factor has been labeled «Certification» (see Table 4).

The first three impact factor scores are significantly different for the various types of support measures (Table 5). Firms that participated in an internationalisation scheme have given on average the highest impact factor score to «access to markets». The participants in collaborative programmes have a

TAB. 5. *Differences in impact and use between types of innovation policy instruments*

	External knowledge (N = 16)	Collaborative (N = 19)	Internal innovation (N = 89)	Internationalisation (N = 19)	Other (N = 55)	
Policy impact factor scores						*F* (ANOVA)
Average Factor 1: «access to markets»	.34	–.11	.03	1.06	–.30	F = 7.9**
Average Factor 2: «R&D links»	–.14	.91	.02	–.49	–.15	F = 5.8**
Average Factor 3: «strategy, organisation & skills»	–.43	.07	–.02	.68	.01	F = 2.9**
Average Factor 4: «certification»	–.32	–.28	.14	–.29	.02	
Used the policy support for:						*Chi-square*
Product innovation (vs no)	69%	70%	80%	10%	60%	36**; *df* = 4;
Process innovation (vs no)	44%	70%	47%	10%	39%	16**; *df* = 4

Note: ** p ≤ 0.01; * p ≤ 0.05.

high score on the impact factor «R&D links», which is much higher than for participants in «Internal innovation» schemes (which to a large extent consists of R&D subsidies). This suggests that collaborative measures are more effective in generating impact related to R&D.

Support from a measure can be used for more than 1 type of innovation. Of the participants in internal innovation measures 80 per cent used the support for product innovation and 47 per cent used it for process innovation. Among the participants in internationalisation schemes only 10 per cent used it for product innovation, and 10 per cent for process innovation. For collaborative schemes the usage for product and process innovation is also equal, but at a higher level of 70 per cent. Overall, the support is most frequently used for product innovation. Since we have recorded for all firms (including the non-supported) that process innovation is the most frequently realized type of innovation in the period 2005-2009, we can conclude that the design of the instruments must have favoured or prescribed the use of the support for product innovation. This was confirmed in several interviews. To get support for innovating your production process is more difficult than for innovating your product.

SMEs that have used the support for product innovation have on average given a higher impact factor score to «R&D links», but this does not seem to have paid off in terms of additional input, innovations, capabilities or output. Support is mostly used for product innovation, but impact in terms of innovation input, realized innovations, increased innovation capacities, and economic output seems less than could have been achieved when the support would have been used for process innovation, organizational innovation or marketing innovation.

Firms which have used the support for process innovation have a high average impact factor score for «Certification». Using support for organiza-

TAB. 6. *Differences in impact between support used for innovation in product, process, organisation and marketing*

	Used support for innovation in:			
	Product (N = 163)	Process (N = 109)	Organisation (N = 37)	Marketing (N = 59)
Self-claimed policy impact factor scores		*Average factor scores*[1]		
Average Factor 1: «access to markets»	–0.07	0.10	0.03	0.32**
Average Factor 2: «R&D links»	0.21**	0.07	0.16	–0.09
Average Factor 3: «strategy, organisation & skills»	–0.06	0.08	0.48**	0.45**
Average Factor 4: «certification»	0.03	0.22**	0.23	–0.04
		Pearson Chi-square		
Innovation input				
Increased innovation expenditure (vs same or lower)		7.2 *		
Innovations realized last five years				
1 or more organisational Innovations ($df = 1$)		4.5*	11.5**	
1 or more marketing innovations ($df = 1$)				8.3**
Improved capabilities relative to industry				
improved product innovation capabilities ($df = 2$)		9.6 **		
improved process innovation capabilities ($df = 2$)		10.7 **		11.8 **
improved organisation innovation capabilities ($df = 2$)	8.1 *			
improved marketing innovation capabilities ($df = 2$)			12.0 **	
Innovative and economic output				
> 15% growth turnover ($df = 1$)			5.8 *	
> 15% innovative sales ($df = 1$)				
Jobs created as result of innovation ($df = 5$)		10.9 *		

Note: the average factor scores are analysed with ANOVA, $df = 1$; ** $p \le 0.01$; * $p \le 0.05$.

tional innovation lead to high impact on «Strategy, organization & skills», and using it for marketing has led to high impact in terms of «Access to markets» and «Strategy, organization & skills». Although the self-reported impact factor-scores are modest for those who have used the support for process innovation, these firms seem to have benefitted from the broadest range of impacts that statistically can be associated with support: ranging from increased innovation expenditures, more organizational innovations, improved innovation capabilities for product, process and organization, as well as jobs created as a result of innovation.

5. DISCUSSION

A first finding for SMEs in traditional manufacturing industries is that those which are supported more frequently are more likely to have taken the same innovative steps without public support. Of the SMEs that have been supported with 3 or more public interventions 70 per cent stated that they would have taken the same steps without support. This self-assessed lack of additionality is in line with the statistical assessment of the counterfactual situation by Radicic *et al.* (2016). Based on the same data they also found limited additionality effect on innovation, but they did not consider the frequency of support. It also seems that improvement of capabilities for innovation becomes less likely in case of more than two interventions. These findings are consistent with those of Clarysse *et al.* (2009) showing that learning effects decrease with the number of subsidized projects. This is probably more likely when these multiple interventions are of the same kind; for example doing the same certification project twice. There are several evaluations (Cunningham, 2013) that find complementarity between different interventions, but we could not analyse this with our data.

Radicic *et al.* (2016) point out that the innovation measures have a limited, or not optimal, impact in terms of additionality. The survey results and interviews suggest this is due to: lack of marketing for innovation support measures to recruit a wide range of potential beneficiaries; restricted programme access and «cherry picking» selection procedures, which means that support goes (and goes more frequently) to firms that are most likely to innovate in any case; and a too narrow focus within support measures on product innovation.

A second finding is that improvement of capabilities for all four types of innovations (product, process, organisation, marketing) matter for innovation output. This finding accords with studies that do not aim to find a single, optimal type or optimal combination that would be «best practice» for all SMEs in traditional industries. It supports the suggestion that there are many ways in which capabilities for these different types of innovations interact in generating impact from innovation. Although we saw in this paper that product innovation may not be the dominant way in which SMEs in traditional industries start innovation processes, this does not imply that they never arrive at product innovations and bringing them to the market. Improvement of capabilities for product innovation does matter, but the process can also start with a new market or production process. The fact that almost 50 per cent of responding firms have realized a service innovation, only reinforces this argument. There are many ways to compete with innovation rather than competing on low costs, since there are several ways to increase added value, but due to uncertainties about the appropriate types of innovation both the entrepreneurs and the policy makers have to invest in learning and discovery. For mature products further away from the technological frontier, ways to increase value added rely less on R&D input for product innovation and more on process innovation, market(ing) innovation and organisational innovation.

As new combinations of their innovation mix firms learn to find new business models with better firm performance (Tavassoli, Bengtsson 2018).

Chesbrough (2010) questioned why it is difficult for companies to innovate their business model. He refers to the insights from Amit and Zott (2001) and Christensen (1997) that in the cost-benefit perception of adjusting the business model, the established technology and business model is disproportionately favoured. This is due to a «dominant logic» build up over time, which makes a company blind for some opportunities that do not fit this «dominant logic». This is why McGrath (2010) claims that adopting a new business model calls for a discovery and experiment driven approach instead of a cost-benefit analysis. This accords with a policy logic that aims at promoting innovation capabilities from experimenting, rather than influencing the rate of investment decisions based on cost reducing subsidies.

A third finding is that realizing a product innovation is less likely to generate economic output in terms of growth. This finding confirms Lachenmaier and Rottmann (2010) who found that process innovations have a higher positive effect on employment than product innovations. Most studies in the innovation policy literature focus on the innovation (input and output) effects, while the effects in terms of economic performance receive less attention. Only a few studies address how combinations of technological (product- and process innovation) and non-technological innovations (marketing- and organisational innovations) work out in terms of economic output, such as employment, or other types of output that address other societal challenges. Edler and Fagerberg (2017) explain why such mission oriented policies are not limited to support for R&D activities, but also for carrying out innovative ideas. For promoting environmental impact it is for instance not enough to only invest in science, but also in the next steps. In one of our interviews this was mentioned as the reason why the SME favoured support from the ministry of environment, since also prototyping and demonstration activities could be supported.

A fourth finding is that the support is mostly used for product innovations, but impact in terms of innovation input, realized innovations, increased innovation capacities, and economic output seems less than could have been achieved when the support would have been used for process innovation, organizational innovation or marketing innovation. This finding accords with Laforet and Tann (2006) who showed that developing new ways of working in manufacturing SMEs is more important for innovation than developing new products. The finding is also supported by the following message that one of the respondents wanted to give to policy makers: «Try to be less prescriptive; do not prescribe how the innovation is to be done». In this respect not only firms have to look beyond the dominant logic, now and then. This also applies to policy makers and policy evaluators.

6. CONCLUSION

6.1. *Policy implications*

There is potential for improving the overall innovation outcomes of innovation support programmes for SMEs in traditional manufacturing industry by selecting firms with the most to gain from support rather than selecting those with the greatest propensity to innovate but the least to gain from support. Moving away from «cream-skimming» also implies the need to remove participation obstacles; in particular, by making application, selection and reporting procedures less bureaucratic and more inclusive. Good practice measures are headed under: cluster policy, value-chain specific schemes, innovation vouchers, coaching schemes, tailored schemes, schemes dedicated to design, to develop new export markets, certification schemes, and pro-active schemes which specifically target to support firms which have not received support before.

The strategic thinking behind existing innovation policy programmes often does not match SME needs in traditional sectors. For example, some R&D tax credit schemes have not helped traditional-sector SMEs with innovation modes based on design and/or marketing. SME respondents explicitly favour demand-led support programmes, such as Innovation Voucher schemes, which can be used to assess innovation potential and to scope/initiate customised projects, and are relatively easy to access. Alternatively, a «one stop shop» can help SMEs to avoid having to navigate the complexity of available support: SMEs take their needs to a single point of contact and are matched with the most appropriate support programme(s).

Policymakers should consider to support a broadened discovery and experimentation processes, rather than a narrow, one-size-fits-all subsidized prescription focussing on R&D for product innovation, which merely steers the outcome of a cost-benefit analysis, incident by incident, towards only this specific type of innovation. In this respect, both the SME and the policy maker should engage in a discovery process. An entrepreneurial process of trying new combination or mix of innovative activities, which goes beyond the «dominant logic» of «scientific discovery» for product innovation. The recent EU research and innovation agenda is more promising in this respect: «innovation will depend on our ability to put together the right mix of policies and instruments» (EC, 2018, p. 3), although «the right mix» is a not a steady state, but a dynamic policy learning process that remains to be fuelled with new evaluations.

Concerning the design features of the programmes it is recommended to allow for customised projects. This implies allowing to use support for different innovation types (product, process, organisation and marketing); wide eligibility of different costs; and flexibility in using the applied budget (internal budget shifts). Moreover, since the additionality of support tends to reduce after the same firm is provided support frequently, pro-active engagement of SMEs which have never received innovation support seems relevant. Besides support aimed to increase the intensity of the same, existing mode of innovation, innovation policy can stimulate firms in developing capabilities in innovation that deviate from their normal innovation mode, and provide the opportunity to experiment and experience new, less familiar ways to innovate (Metcalfe, 1994). Policy makers should not reduce, but enhance the variety of innovation modes.

More recently, the views and policy strategies have adopted a more systemic and holistic perspective. The innovation demand-side (and its complex and systemic interactions with the innovation supply-side) has received increased attention. European, national and regional strategies for industrial transformation and modernisation have been formulated that re-discovered the importance of manufacturing production and the absorption and diffusion of innovation: «to accelerate and improve the uptake of technologies, particularly among SMEs and traditional industries» (EC, 2017, p. 13). Hence the call for: «taking action to facilitate the integration of creativity, design, and non-technological innovations with cutting-edge technology to generate new products, new industrial value chains and revitalise traditional industries (EC, 2017, p. 14). Societal challenges and technological change have called on policy makers to adapt and adopt their policy mix. The interest in modernising SMEs in traditional industries has grown. For instance, as part of environmental policy or other mission-oriented innovation policy (Edler, Fagerberg 2017). SMEs are for instance persuaded to use clean technologies, and in «Industry 4.0» strategies they are invited to adopt digital technology and to join emerging value-chains. This makes it even more important to look beyond product innovation.

6.2. *Limitations*

A limitation of our research is that our composition of traditional manufacturing sector is not exactly the same as the most commonly used OECD classification of low-tech industries, which is based on the R&D intensity of the industries. The results are therefore not fully representative for low-tech industries as classified by the OECD. We can also not claim that the results are representative for all regions in Europe. Only seven regions are covered and the ones selected have a rather high share of SMEs in the 6 selected industries. SMEs in regions with a relatively low share of SMEs in traditional industries might have different characteristics and might have got a different kind of support. To get to a sufficient number of firms that participated in support programmes we had to contact (for some regions) programme managers. Since we did not contact programme managers of EU R&D programmes, or specific national high-tech programmes, SMEs that participated in those programmes might be under-represented.

Since the survey is rather small the variety of topics and support measures have been analysed with rather limited statistical methods. Further research on each of the results is therefore needed. It would especially be needed and interesting to look closer at possible complementarities between types of innovations, and between types of support. More precise information on what happens first and what comes later, would provide relevant additional insights. The same holds for insights in how the development of innovation capacity and the development of innovations are related.

Received: December 4, 2018 | Revised: May 9, 2019 | Accepted: May 13, 2019

References

Amara N., Landry R., Becheikh N., Ouimet M. (2008), *Learning and Novelty of Innovation in Established Manufacturing SMEs*, in «Technovation», 28, 7, pp. 450-463.

Amit R., Zott C. (2001), *Value Creation in e-business*, in «Strategic Management Journal», 22, pp. 493-520.

Arqué-Castells P., Mohnen P. (2015), *Sunk Costs, Extensive R&D Subsidies and Permanent Inducement Effects*, in «The Journal of Industrial Economics», 63, 3, pp. 458-494.

Arrow K. (1962) (eds.), *Economic Welfare and the Allocation of Resources to Invention*, in *The Rate and Direction of Inventive Activity: Economic and Social Factors*, Universities-National Bureau Committee for Economic Research and the Committee on Economic Growth of the Social Science Research Councils, Princeton, NJ, Princeton University Press, pp. 467-492.

Arundel A., Bordoy C., Mohnen P., Smith K. (2008), *Innovation Surveys and Policy: Lessons from the CIS*, in C. Nauwelaers, R. Wintjes (eds.), *Innovation Policy in Europe: Measurement and Strategy*, Cheltenham, UK, Edward Elgar, pp. 3-28.

Asheim B., Bugge M., Coenen L., Herstad S. (2013), *What Does Evolutionary Economic Geography Bring to the Policy Table? Reconceptualising Regional Innovation Systems*. CIRCLE, Lund University, Paper no. 2013/05.

Beck M., Junge M., Kaiser U. (2017), *On the Effects of Research and Development: A Literature Review*, Copenhagen, DEA, pp. 1-94.

Becker B. (2015), *Public R&D Policies and Private R&D Investment: A Survey of the Empirical Evidence*, in «Journal of Economic Surveys», 29, 5, pp. 917-942.

Becker B., Hall S.G. (2013), *Do R&D Strategies in High-Tech Sectors Differ from Those in Low-Tech Sectors? An Alternative Approach to Testing the Pooling Assumption*, in «Econ. Change Restruct», 46, pp. 183-202.

Brown R., Mason C., Mawson S. (2014), *Increasing «The Vital 6 Per cent»: Designing Effective Public Policy to Support High Growth Firms*, NESTA Working Paper No. 14/01.

Chesbrough H. (2010), *Business Model Innovation: Opportunities and Barriers*, in «Long Range Planning», 43, 2-3, April-June, pp. 354-363.
Christensen C. (1997), *The Innovator's Dilemma*, Cambridge, MA, Harvard Business School Press.
Clarysse B., Wright M., Mustar P. (2009), *Behavioural Additionality of R&D Subsidies: A Learning Perspective*, in «Research Policy», 38, 10, pp. 1517-1533.
Cunningham P., Edler J., Flanagan K., Laredo P. (2013), *Innovation Policy Mix and Instrument Interaction: A Review. Compendium of Evidence on the Effectiveness of Innovation Policy Intervention Project*, Manchester, UK, Manchester Institute for Innovation Research, University of Manchester.
Czarnitzki D., Delanote J. (2015), *R&D Policies for Young SMEs: Input and Output Effects*, in «Small Business Economics», 45, 3, pp. 465-485.
Czarnitzki D., Thorwarth S. (2012), *Productivity Effects of Basic Research in Low-Tech and High-Tech Industries*, in «Research Policy», 41, pp. 1555-1564.
Dimos C., Pugh G. (2016), *The Effectiveness of R&D Subsidies: A Meta-Regression Analysis of the Evaluation Literature*, in «Research Policy», 45, pp. 797-815.
Edler J., Fagerberg J. (2017), *Innovation Policy: What, Why, and How*, in «Oxford Review of Economic Policy», 33, 1, 1 January, pp. 2-23.
Edquist C., Hommen L. (1999), *Systems of Innovation: Theory and Policy for the Demand Side*, in «Technology in Society», 21, 1, pp. 63-79.
European Commission (2017), *A Renewed EU Industrial Policy Strategy*, available at: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52017DC0479.
European Commission (2018), *A Renewed European Agenda for Research and Innovation – Europe's Chance to Shape Its Future*, Brussels, 15.5.2018, COM(2018) 306.
Faulkner W., Senker J., Vehlo L. (1995), *Knowledge Frontiers*, Oxford.
Freeman, C. (1987), *Technology Policy and Economic Performance: Lessons from Japan*, London, Pinter.
Fagerberg J. (2000), *Technological Progress, Structural Change And Productivity Growth: A Comparative Study*, in «Structural Change and Economic Dynamics», 11, 4, pp. 393-411.
Frenz M., Lambert R. (2012), *Mixed Modes of Innovation: An Empiric Approach to Capturing Firms' Innovation Behaviour*, OECD Science, Technology and Industry Working Papers, 2012/06, OECD Publishing, http://dx.doi.org/10.1787/5k8x6l0bp3bp-en.
González X., Pazó C. (2008), *Do Public Subsidies Stimulate Private R&D Spending?*, in «Research Policy», 37, 3, pp. 371-389.
Gök A., Edler J. (2012), *The Use of Behavioural Additionality Evaluation in Innovation Policy Making*, in «Research Evaluation», 21, 4, pp. 306-318.
McGrath R. (2010), *Business Models: A Discovery Driven Approach*, in «Long Range Planning», 43, 2-3, April-June, pp. 247-261.
Grimpe C., Sofka W. (2009), *Search Patterns and Absorptive Capacity: Low- and Hightechnology Sectors in European Countries*, in «Research Policy», 38, 3, pp. 495-506.
Henrekson M., Johansson D. (2010) *Gazelles as Job Creators: A Survey and Interpretation of the Evidence*, in «Small Business Economics», 35, 2, pp. 227-244.
Hirsch-Kreinsen H. (2008), *Low-Technology: A Forgotten Sector in Innovation Policy*, in «Journal of Technology Management & Innovation», 3, 3, pp. 11-20.
Hollenstein H. (2003), *Innovation Modes in the Swiss Service Sector: A Cluster Analysis Based on Firm-Level Data*, in «Research Policy», 32, 5, May, pp. 845-863.
Jensen M.B., Johnson B., Lorenz E., Lundvall B.Å. (2007), *Forms of Knowledge and Modes of Innovation*, in «Research Policy», 5, 36, pp. 680-693.

Kaloudis A., Smith K. (2005), *Structural Change, Growth and Innovation: The Roles of Medium and Low Tech Industries, 1980-2002*, in Conference Low-Tech as Misnomer: The Role of Non-Research-Intensive Industries in The Knowledge Economy.
Kirner E., Kinkel S., Jaeger A. (2009), *Innovation Paths and the Innovation Performance of Low-Technology Firms – An Empirical Analysis of German Industry*, in «Research Policy», 38, 3, pp. 447-458.
Kline S.J., Rosenberg N. (1986), *An Overview of Innovation*, in Landau R., Rosenberg N. (eds.), *The Positive Sum Strategy: Harnessing Technology for Economic Growth*, Washington, D.C., National Academy Press, pp. 275-305.
Lachenmaier S., Rottmann H. (2010), *Effects of Innovation on Employment: A Dynamic Panel Analysis*, in «International Journal of Industrial Organization», 29, pp. 210-220.
Laforet S., Tann J. (2006), *Innovative Characteristics of Small Manufacturing Firms*, in «Journal of Small Business and Enterprise Development», 13, 3, pp. 363-380.
Leiponen A., Drejer I. (2007), *What Exactly Are Technological Regimes?: Intra-Industry Heterogeneity in the Organization of Innovation Activities*, in «Research Policy», 36, 8, pp. 1221-1238.
Lundvall B.A. (eds.) (1992), *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*, London, Pinter.
Mairesse J., Mohnen P. (2010) *Using Innovations Surveys for Econometric Analysis*, NBER Working Paper No. 15857, April.
Maskell P. (1998), *Low-Tech Competitive Advantages and the Role of Proximity; The Danish Wooden Furniture Industry,* in «European Urban and Regional Studies», 5, 2, pp. 99-118.
Mason C., Brown R. (2013), *Creating Good Public Policy to Support High-Growth Firms*, in «Small Business Economics», 40, 2, pp. 211-225.
Metcalfe J.S. (1994), *Evolutionary Economics and Technology Policy*, in «The Economic Journal», 104, pp. 931-944.
Metcalfe S., Ramlogan R. (2005), *Innovation Systems and the Competitive Process in Developing Economies*, in «The Quarterly Review of Economics and Finance», 48, 2, pp. 433-446.
Mowery D-C., Rosenberg N. (1979), *The Influence of Market Demand Upon Innovation: A Critical Review of Some Recent Empirical Studies*, in «Research Policy», 8, pp. 102-153.
Nauwelaers C., Wintjes R. (2003), *Towards a New Paradigm For Innovation Policies*?, in B. Asheim, A. Isaksen, C. Nauwelaers, F. Tötdling, *Regional Innovation Policy for Small-Medium Enterprises*, Cheltenham, UK and Lyme, US, Edward Elgar.
Nauwelaers C., Wintjes R. (2002), *Innovating SMEs and Regions: The Need for Policy Intelligence and Interactive Policies*, in «Technology Analysis & Strategic Management», 14, 2, pp. 201-215.
Nelson R. (1981), *Research on Productivity Growth and Productivity Differences: Dead Ends and New Departures*, in «Journal of Economy Literature», 19.
Nelson R., Winter S. (1982), *An Evolutionary Theory of Economic Change*, Cambridge, MA, Harvard University Press, 1982.
Nesta (2009), *The Vital 6 Per Cent: How High-Growth Innovative Businesses Generate Prosperity and Jobs*, National Endowment for Science, Technology and the Arts (NESTA), London.
OECD (2005), *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data, Organisation for Economic Co-Operation and Development/Statistical Office of the European Communities*, Third Edition, Paris, OECD Publishing.
OECD (2005), *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data*, Paris, OECD Publishing.
Pavitt K. (1984), *Sectoral Patterns of Technical Change: Towards a Taxonomy and a Theory*, in «Research Policy», 13, 6, December, pp. 343-373.

Pietrobelli C., Rabellotti R. (2011), *The Global Dimension of Innovation Systems: Linking Innovation Systems and Global Value Chains. Handbook of Innovation Systems and Developing Countries: Building Domestic Capabilities in a Global Setting*, Cheltenham and Northampton, MA, Edward Elgar, pp. 214-240.

Pianta M. (2014), *An Industrial Policy for Europe*, in «Seoul Journal of Economics», 27, pp. 277-305.

Potters L. (2009), *R&D in Low-Tech Sectors*, IPTS Working paper on Corporate R&D and innovation, No. 08/2009.

Raymond L., St-Pierre J. (2010), *R&D as a Determinant of Innovation in Manufacturing SMEs: An Attempt at Empirical Clarification*, in «Technovation», 30, 1, pp. 48-56.

Radicic D., Pugh G., Hollanders H., Wintjes R., Fairburn J. (2016), *The Impact of Innovation Support Programmes on SME Innovation in Traditional Manufacturing Industries: An Evaluation for Seven EU Regions*, in «Environment and Planning C: Government and Policy», 34, 8, pp. 1425-1452.

Radicic D., Pugh G., Douglas D. (2018), *Promoting Cooperation in Innovation Ecosystems: Evidence from European Traditional Manufacturing SMEs*, in «Small Business Economics», pp. 1-27.

Rosenberg N. (1976), *Perspectives on Technology*, Cambridge, Cambridge University Press.

Robertson P., Smith K., Tunzelmann von N. (2009), *Innovation in Low- and Medium Technology Industries*, in «Research Policy», 38, 3, pp. 441-446.

Santamaría L., Nieto M.J., Barge-Gil A. (2009), *Beyond Formal R&D: Taking Advantage of Other Sources of Innovation in Low- and Medium-Technology Industries*, in «Research Policy», 38, 3, pp. 507-517.

Schumpeter J. (1934), *The Theory of Economic Development*, Cambridge, MA, Harvard University Press.

Soete L. *et al.* (2009), *The Role of Community Research Policy in the Knowledge-Based Economy. Report of the Expert Group chaired by Luc Soete*, available at: http://ec.europa.eu/research/era/pdf/community_research_policy_role.pdf.

Srholec M., Verspagen B. (2013), *The Voyage of the Beagle into Innovation: Explorations on Heterogeneity, Selection, and Sectors*, in «Industrial and Corporate Change», 21, pp. 1221-1253.

Tavassoli S., Bengtsson L. (2018), *The Role of Business Model Innovation for Product Innovation Performance*, in «International Journal of Innovation Management», 22, 07, 1850061.

Teece D.J., Pisano G. (1994), *The Dynamic Capabilities of Firms: An Introduction*, in «Industrial and Corporate Change», 3, 3, pp. 537-556.

Thornhill S. (2006), *Knowledge, Innovation and Firm Performance in High- and Low-Technology Regimes*, in «Journal of Business Venturing», 21, 5, pp. 687-703.

Tunzelmann von N., Acha V. (2005), *Innovation in «Low-Tech» Industries*, in Fagerberg J., Mowery D.C., Nelson R.R. (eds.), *The Oxford Handbook of Innovation*, Oxford, Oxford University Press, pp. 407-432.

Verspagen B., Hollanders H., Noben L. (2016), *Conceptualizing the Innovation Systems of the European Innovation Union*, Deliverable 9.1 for the I3U project, Maastricht, UNU-MERIT, available at: http://www.i3u-innovationunion.eu/deliverables/.

Walendowski J., Kroll H., Stahlecker T., Baier E., Wintjes R., Hollanders H. (2011), *Innovation Patterns and Innovation Policy in European Regions – Trends, Challenges and Perspectives*, 2010 Annual Report Regional Innovation Monitor, Brussel, DG Enterprise.

Wintjes R. (2016), *Systems and Modes of ICT Innovation*, JRC Science for Policy Report EUR28005. Brussels: European Commission-Joint Research Centre. http://publications.jrc.ec.europa.eu/repository/handle/JRC102047

ZEW (2011), *2010 German Innovation Survey*, Mannheim, ZEW.