



European
Commission



Policy Brief

Bridging ideas with markets

The impact of training, marketing and design on innovation

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SUMMARY

This Policy Brief presents recent results on the impact of training, marketing and design expenditures on European firms' innovative performance. The new evidence drawn from recent JRC research suggests that these expenditures, in combination with R&D, are crucial drivers of innovation. Drawing on these results, policy implications for the European Research and Innovation Agenda are discussed and additional research questions identified.

¹ The authors acknowledge comments from Pietro Moncada Paternó Castello and Sandro Montresor regarding previous versions of this Policy Brief.

The views expressed are purely those of the author and may not in any circumstances be regarded as stating an official position of the European Commission.

INTRODUCTION

Innovation at firm level (defined as the capacity to turn new ideas into new processes, products and services) is a complex process requiring multiple and interrelated resources. Besides investments in physical assets (such as machinery and laboratories), three main groups of expenditures emerge as relevant for innovation: (1) those related to R&D activities, (2) those that underlie organizational practices, including resources invested in customer satisfaction, product quality, design and brand reputation, and (3) those related to human capital, such as investments in personal skills and training. By spending on these so-called "intangible resources", companies develop a tacit or codified specific knowledge², which is not easily transferable and sustains their competitive advantage³.

A growing body of research, scattered across several disciplines (economics, finance, accounting, organization and management), shows rapid expansion in intangible investments by companies in the US, Japan and Europe, with significant impacts on productivity and, more generally, on firms' performance (OECD, 2011). According to recent estimates, investments in intangibles account for almost 12% of European GDP and for an important part of the productivity growth of the last twenty years.⁴

While research has progressed in the measurement of aggregate business investment in intangibles in the context of growth accounting studies⁵, the empirical evidence about their role as innovation drivers at firm level is still very limited. This Policy Brief presents recent evidence from original research undertaken by the European Commission based on the Community Innovation Survey which looks at intangibles from the point of view of their contribution to the firm's projects for introducing new products or services. Such research analyses the impact that

"innovation driven" expenditures on human capital, marketing and design, in combination with R&D expenditures, have on firm's capacity to introduce new products and services onto the market. The policy implications of these results, relevant in the context of the European research and innovation agenda that recognises the need to pursue a broad concept of innovation⁶, are discussed and main avenues for future research in the area are identified.

TRAINING, DESIGN AND MARKETING: WHY ARE THEY CRUCIAL FOR FIRMS' COMPETITIVENESS?

As innovation is based on the capacity to create, exchange, and exploit knowledge, the education and training of workers is essential. Human capital is not just brought onto a firm by recruiting and selecting highly skilled workers, it is also developed within the firm by investing in it. Several studies have confirmed that a firm capable of generating a human capital advantage is more innovative than the average firm⁷, as skilled people are better at dealing with complexity, innovation, suggestion-making and creativity (Song et al., 2003; Piva and Vivarelli, 2009). If R&D investments are managed by people better trained to develop or introduce innovation, the firm's innovative performance⁸ will also be better.

At the same time, a well-planned product development process helps to differentiate the product (Winter, 1987; Kogut and Zander, 1992; Conner and Prahalad, 1996; Barney et al., 2001), and is part of a firm's innovative effort. Creativity, i.e. R&D efforts, needs to reach the market. All in all, design activities are the bridge between creativity and the market, while the expenditure in marketing represents the effort made by a firm to let the consumer know and appreciate the novelty and characteristics of the product itself. Very often, the greater the R&D content and novelty of

² Polanyi, 1966; Grant, 1996; Lane and Lubatkin, 1998.

³ Penrose, 1959; Wenerfelt, 1984; Rumelt, 1984; Dierickx and Cool, 1989; Peteraf, 1993; Barney, 1996.

⁴ EU *Innodrive* (http://ec.europa.eu/research/social-sciences/projects/407_en.html) and *Coinvest* projects (http://ec.europa.eu/research/social-sciences/projects/359_en.html).

⁵ "Growth accounting ascribes the rate of growth of an economy's output to increases in the amount of factors used –usually capital and labour– and technical change" (OECD, 2012).

⁶ "In a global environment, Europe must also develop its own distinctive approach to innovation (...) by (...): Pursuing a broad concept of innovation, both research-driven innovation and innovation in business models, design, branding and services that add value for users and where Europe has unique talents". Europe 2020 Flagship Initiative Innovation Union, COM(2010) 546 of 6/10/2010.

⁷ Svetlic and Stavrou-Costea, 2007; Lundvall and Nielsen, 2007.

⁸ See also Moncada-Paternò-Castello *et al.*, 2003.

a product, the greater the effort required to "capture" the consumer's interest.

NEW RESEARCH ON INTANGIBLES AT COMPANY LEVEL: FILLING THE KNOWLEDGE GAP

While the existence of the Frascati Manual and an agreed definition of R&D⁹ have facilitated the collection and widespread analysis of R&D statistics, it is difficult to obtain a clear view of the impact of expenditures on intangible activities on a firm's performance due to the lack of both common definitions¹⁰ and data availability. Recent research activities at the European Commission's Joint Research Centre¹¹ aimed to reduce the current lack of international and cross-sector empirical evidence at company level by providing an analysis of the determinants of the training, design and marketing expenditures undertaken by European firms in relation to their innovation activities (i.e. introduction of new products onto the market). In addition, this research has analysed the extent to which these expenditures act as drivers of European firms' product innovation performance (i.e. turnover from new products brought onto the market).¹² Concretely, the research has tried to answer the following questions:

(1) Which factors affect a firm's decision about how much to spend on training/design/marketing?

(2) Do economies of scale influence these choices?

⁹ To avoid confusion, we have provided a few additional definitions. By R&D, we mean the process through which existing technologies (commodities, services and human capital) are used to try to produce a future technology. Since the latter is characterised by knowledge accumulation, it should be distinguished by some kind of recombination of existing knowledge (namely adoption of new techniques or processes), or non-technological improvements of products and processes (such as marketing and design). Finally, by innovation we mean the process through which a new product or process is generated. In other words, intangibles (non-R&D and R&D) are inputs, while innovation is an output.

¹⁰ It is worth mentioning NESTA's (2010) efforts in defining intangibles for statistical purposes.

¹¹ Ciriaci, 2011a and 2011b, Garcia Torres, 2011.

¹² Process innovations were excluded because typically one firm's process innovation is another (upstream) firm's product innovation.

(3) Do these three activities influence a firm's ability to bring new products onto the market?

(4) Are returns on training and design affected by a firm's size?

The analyses are based on the third wave of the Community Innovation Survey (CIS, see Table 1 for a description of the sample and box on methodology in the Appendix). The focus on training, design and marketing (rather than on other categories of non-R&D "intangibles" such as patents or organizational capital) is driven by the objective of exploiting the information available in the "other innovation expenditures" section of the CIS questionnaire. The latter is divided into three parts and provides information about personnel training expenditure aimed specifically at the development of innovations; internal or external marketing activities aimed specifically at the market introduction of a firm's new or significantly improved products; and designs defined as the procedures, choice of elements and technical preparations prior to implementing a new product. The innovative performance of a firm is measured by the amount of sales due to new-to-the-firm products.

Innovative firms (according to the CIS definition of an innovator, see the box on methodology in the Appendix) represent almost 37% of the overall CIS sample of European firms, i.e. 32 583 enterprises out of 87 340 (see Table 1). Of these, 77% are successful product innovators, i.e. firms that have introduced new and significantly improved goods and/or services with respect to their fundamental characteristics, technical specifications, incorporated software or other immaterial components, intended uses, or user-friendliness during the period 1998-2000.

Table 1. The CIS3 sample.

	Number of firms	% in relation to all firms (innovative and non-innovative)	% in relation to innovative firms
Innovative and non-innovative firms in the CIS3 sample	87 340	100%	-
Innovative firms	32 583	37%	100%
Product innovators	25 042	28.7%	77%
with positive internal R&D	14 976	17.1%	46%

Source: Authors' elaboration on CIS3 non anonymised data.

WHAT HAVE WE LEARNT? NEW EMPIRICAL EVIDENCE ON INTANGIBLE EXPENDITURES

In the CIS questionnaire, expenditures on innovation activities are classified into five main categories (intramural R&D, extramural R&D, acquisition of machinery and equipment, acquisition of external knowledge, and training/marketing/design), and refer uniquely to the reference year 2000. Expenditures on training,

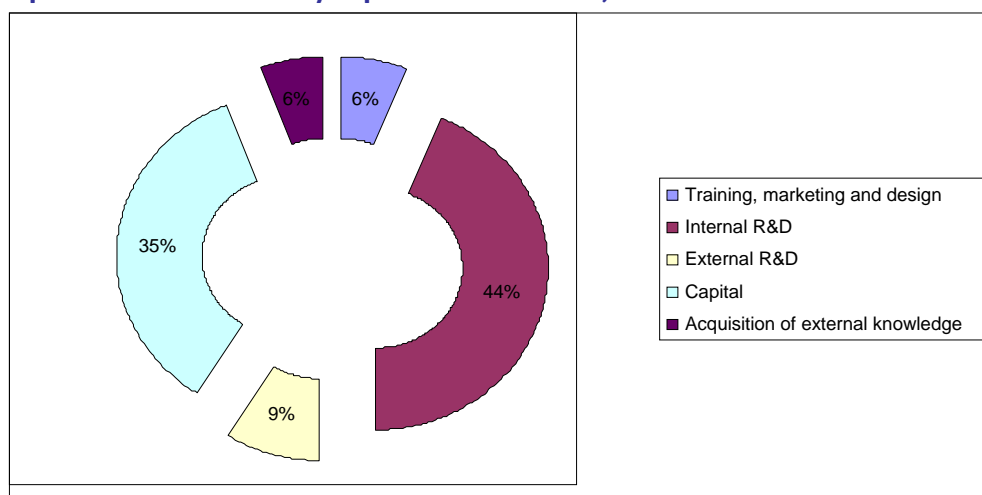
marketing and design represent 6% of overall expenditure on innovation activities of the innovative firms in the sample (see Graph 1). Overall, 13 527 firms engaged in training activities: 41.5% of the innovative firms in the sample and almost 54% of the product innovators (see Table 2). In addition, 7682 stated they had engaged in marketing (28% of the innovative firms and almost 43% of the product innovators) and 9204 in design (slightly more than 28% of the innovative firms and almost 37% of the product innovators).

Table 2. Distribution of innovators with training, marketing and design activities.

	Number of firms	% in relation to innovative firms	% in relation to product innovators
Firms with expenditures on training	13 527	41.5%	54.0%
Firms with expenditures on marketing	10 779	33.1%	43.0%
Firms with expenditures on design	9204	28.2%	36.8%

Source: Authors' elaboration on CIS3 non anonymised data.

Graph 1. Innovation activity expenditure structure, CIS 3.



The impact of training and human capital expenditures

The results confirm the positive impact that “innovation driven” expenditures on training and human capital employed in R&D activities have on firms’ propensity to introduce new products onto the market. Results indicate that a 10% increase in training expenditures increases firms’ innovative sales by almost 1.5% (see Box 1).

These results imply that firms that have learnt how to organize their human resources effectively and train them to use new technology or create new products have an edge over those that do not.

The study also shows that the amount spent on skill development activities increases with the size of the company and also with its R&D intensity. Firms that are part of a group also tend to spend more. *Ceteris paribus*, while there are no significant differences in the returns to training between SME and large firms, returns to R&D personnel are always statistically significantly higher in large than in small and medium-sized firms.¹³

Entrepreneurs appear aware of such potential positive impact. In fact, firms that identified a lack of qualified personnel during the years 1998-2000 as a hampering factor for innovation those who have introduced new management techniques and those that had established networks with universities, appear to spend more on training.

Box 1. Quantifying the impact of a 10% increase in training, design and marketing expenditures on innovative sales

Impact on innovative sales	
Training	+1.5%
Marketing	+7.0%
Design	+3.5%

The impact of expenditures on design and marketing

The new empirical evidence confirms the crucial role of design expenditures for a European firm's average ability to innovate. In this case, the results show that the amount of design

expenditure is not affected by the firm's scale of production or by the R&D intensity of its sector of activity. In addition, returns on these expenditures do not differ between SMEs and larger firms. This evidence suggests that design expenditures can be a very cost-efficient way of innovating for SMEs, more efficient than R&D in the sample analysed¹⁴

Interestingly, the results also show that the level of design expenditure is strongly and positively influenced by the implementation of strategic protection tools (i.e. through patents, registration of design patterns, secrecy, design complexity) by the firm; in doing so, the firm is able to prevent valuable information from reaching other firms.

A 10% increase in design expenditures leads to a 3.5% increase in the sales of new-to-the-firm products (see Box 1). In the case of radical innovations (i.e. products that are new to the firm and to the market) such impact almost doubles this figure.

The positive impact on the firm's propensity to introduce new products also appears in the analysis of marketing expenditures, defined as those directly aimed at the market introduction of an enterprise's new or significantly improved products. Results of the JRC research¹⁵ show that the impact on firms' innovativeness is particularly strong for marketing expenditures and significantly more relevant than that observed for R&D expenditures in this case (the marginal positive impact for marketing is twice the figure for R&D). Overall, a 10% increase in marketing expenditures boosts innovative sales by 7%.

In the case of marketing, the positive impact increases with firm's size, in contrast to that observed for design. The study shows that firms that invest more in marketing are closer to the market, and use for example clients as a source of information. The same occurs with firms that reported having made changes to their marketing strategy or some kind of aesthetic change to their products. All these results indicate that strong marketing efforts are needed to make new products known and desired by consumers (particularly in the case of radical innovations). Not surprisingly, smaller firms face more difficulties than larger ones to undertake the necessary marketing efforts to successfully bring

¹³ Ciriaci, 2011a.

¹⁴ Ciriaci, 2011b.

¹⁵ Garcia Torres, 2011.

new products onto the market and obtain a return in terms of innovative sales.

CONCLUDING REMARKS AND POLICY IMPLICATIONS

The new empirical evidence confirms the importance that training, design and marketing innovation-oriented expenditures can have on firms' capacity to successfully launch and sell new products and services. In addition, results show that, as happens with R&D, economies of scale are crucial for training and marketing expenditures, suggesting that barriers exist for SMEs (particularly if they are financially constrained). However, this result is not observed for design expenditures, the explanation perhaps lying in their lower capital intensity nature and their shorter pay-back period. In addition, the returns on design expenditures (in terms of innovative output) are not affected by the firm's size or level of R&D intensity. All these characteristics make design expenditures a very cost-efficient innovation driver for SMEs, along with training that also shows the same levels of returns regardless of firm size.

In general, the rationale behind public financial support for firms' investments on certain categories of intangibles is based on the evidence that firms are unable to fully internalize the returns and, as a result, the amounts spent are below the optimum. While in the case of R&D and training there is both theoretical and empirical evidence for knowledge spillovers and private under-investment, these market and system failures do not seem to occur for design and marketing expenditures. It is reasonable to argue that most companies have adequate information about the benefits of design and marketing for their business, minimising the argument of asymmetric information and uncertainty. Besides, there is no problem of the appropriation of results, in contrast to what happens with the public knowledge nature of R&D. In other words, the "closeness" of design and marketing activities to the market provides few arguments to justify the provision of direct public financial support.

Does the above mean that there is no room for public intervention to support firms' investments in design and marketing? The answer is no. Public intervention to improve framework conditions may be critical, particularly for certain types of firms. For example, legislation on property rights associated to design and trademarks, accounting practices in relation to expenditures on certain

intangible categories and tax rules can all influence the access to finance of innovative start-ups and young companies investing heavily in intangibles¹⁶. In relation to this, recent evidence shows an increase in the use of intangible assets as collateral for risk financing in the US,¹⁷ showing that intangible assets can indeed increase firm value in credit markets and be used by innovative companies to alleviate their financial constraints. This provides arguments in favour of considering the reform of accounting and disclosure rules on intangibles to extend this practice. Public intervention can also play an important role in improving the matching of human capital skills to the innovation requirements of firms, by supporting training in design and marketing for example.

Given the particular financial constraints of smaller and younger innovators, the case for supporting R&D expenditures of young innovative firms operating in high-R&D intensive sectors appears to be reinforced, based on the new evidence confirming the crucial role that other intangible expenditures play in their capacity to successfully bring to the market and sell the results of their research and development activities. This support for their R&D efforts would allow them to "free-up" internal financial resources which could be profitably directed to new product development and marketing expenditures.¹⁸ In addition, given the specificities of design and their likely positive impact on innovation performance across all types of companies, including low-tech SMEs, public support for general information and training campaigns for small non-innovators might be useful.

In any case, further research is needed to address questions such as: (i) Are R&D investments more effective if preceded by significant new product development efforts, followed by marketing activities than they would be without them? In other words, to what degree do R&D and other intangible resource investments complement each other? (ii) To what extent are training investments more efficient if part of an organizational effort

¹⁶ OECD, 2011.

¹⁷ Loumioti, M (2011) "The use of intangible assets as loan collateral", Harvard Business School

¹⁸ Recent evidence from a sample of more than 700 German firms taken from the CIS sample shows that R&D expenditures and "innovation-driven" marketing expenditures appear to be substitutes in the case of young firms. Bhargava, M. *et al.* 2011.

and/or the result of the implementation of new human resource management techniques? In addition, there are a series of other open issues which deserve more attention, such as the impact of intangible resources on market power and competition, and a more detailed analysis of the kind of policies that are useful for fostering

investments in intangibles. The future European Commission research agenda will try to find an answer to, if not all, some of these questions.

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APPENDIX - DATA AND METHODOLOGY

The three aforementioned JRC-IPTS studies focus on European innovative firms and share the same dataset, i.e. the third wave of the Community Innovation Survey (CIS) innovation survey, representative at the national level and covering 23 EU countries (Belgium, Bulgaria, Czech Republic, Germany, Denmark, Estonia, Finland, France, Greece, Hungary, Iceland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Portugal, Romania, Slovenia, Slovakia, Spain and Sweden) for the period 1998-2000. The reason for using this wave and not one of the more recent ones is data driven: it is the last wave to have enough disaggregated information on the amount of other than-R&D innovation expenditure activities for the aforementioned 23 European Countries.

According to the CIS definition, innovative firms are those that have answered positively to at least one of the following four questions: (1) During the period 1998-2000, has your enterprise brought onto the market any new or substantially improved products?; (2) During the period 1998-2000, has your enterprise introduced any new or substantially improved production processes?; (3) By the end of 2000, did your enterprise have any ongoing innovation activities?; (4) During the period 1998-2000, did your enterprise have any innovation activities that were abandoned?

These studies also share the same methodological approach. Unlike the majority of CIS-based studies, the main variables of interest (training, design and marketing) are continuous variables, i.e. expressed in terms of values, and not binary variables. The determinants of training, design and marketing expenditures and their impact on the amount of sales due to new products (i.e. innovative sales) are determined by estimating a system of three equations, adapting the model of Crepon et al. (1998): the first equation always explains the amount spent by a firm on one of the non-R&D intangible expenditures (i.e. training, marketing and design); the second explains the amount invested in R&D, and the third explains the innovative performance of a firm (i.e. its amount of innovative sales) as the outcome of its effort in R&D and in the intangible activity under study¹⁹, and of other control variables. It is worth noting that given the cross-section structure of the CIS, the causality links between variables are generally thought of as "weak links", although this problem is attenuated by the methodology chosen. In any case, the objective of the aforementioned three studies was to assess the significance and intensity of the correlation relationships between the main variables of interest.

The amount of innovative sales is calculated by multiplying the percentage of sales which a firm declared to be due to new products by the amount of sales in 2000.

As far as the amount of training, marketing and design expenditures is concerned, only two sets of data were available to calculate them. The survey gives information about how much a firm has spent on training, marketing and design, and its overall expenditure on these innovation-related activities (this variable is labelled *rothx* in CIS 3 and is not available for successive CIS waves). Therefore, to be able to correctly identify a firm's expenditure on training, the analysis only considered those firms that stated in the questionnaire that they had invested in training and not in marketing and design (in this case the amount reported as *rothx* coincides with a firm's expenditure on training). The same identification strategy was followed for marketing and design. In the analysis of the impact of marketing (design) expenditure on a firm's innovative performance, we only considered those firms that stated in the questionnaire that they had invested in marketing (design) and not in training and design (marketing).

Finally, the elasticities reported in the text have been calculated following the McDonald-Moffit (1980) procedure. Therefore the Tobit total marginal effects can be interpreted as the elasticities of innovative sales to the independent variables.

¹⁹ This approach makes it possible to tackle both the endogeneity of innovation input expenditures, and the spillovers which they are likely to generate.