

Behavioural Additionality and Organizational Impact of European Policies to Promote Internationalisation of High-growth Innovative SMEs

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Abstract

Many European countries and international financial institutions have tried to address the problems of high transaction costs and risks by creating subsidized credit programmes and/or providing loan guarantees. Such projects have often fostered a culture of non-repayment or failed to reach the target group or achieve financial self-sustainability. Further, it tries to understand what are the main barriers for high-growth innovative Small and Medium-sized Enterprises, with respect to the realisation of their innovative potential and their capacity to improve internal processes by the adoption of innovative manufacturing techniques and a graduated organizational change. They are becoming particularly important for achieving greater productivity, lower operational costs, and higher revenues (usually characterized by reduced access to external finance, unavailability of wider distribution channels, low internationalization, etc.). The purpose of this article at last is to clarify how on-line training on automation and innovation fields can bring economic and organizational benefits. Innovative training contents can improve manufacturing knowledge of managers and employees, especially on industrial automation systems.

Keywords: SMEs, Business organization, Financial incentives, Innovation and automation, E-training, Behavioural additionality

Introduction

To become innovative and competitive manufacturing contractors, Small and Medium-sized Enterprises (SMEs) have to be capable to supply manufacturers with advanced equipment, components, and services for improved manufacturing and engineering operations.

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Besides, despite their foremost numbers and importance in job creation, traditionally SMEs encounter difficulty in obtaining formal credit or equity. Maturities of commercial bank loans extended to SMEs are often limited to a period far too short to pay off any sizeable investment. Finance has been identified in many business surveys as the most important factor determining the survival and growth of SMEs in European countries. Access to finance easily allows SMEs to undertake productive investments to expand their businesses and to acquire the latest technologies, thus ensuring their competitiveness and that of the nation as a whole.

The following three expensive actions can play a crucial role to support investments and innovations in high-growth innovative SMEs:

- Finance and stimulate organisational innovations;
- Support managerial education to boost innovative enterprises;
- Invest and build specific infrastructures for the manufacturing activities.

Poorly functioning financial systems can seriously undermine the microeconomic fundamentals of a country, resulting in lower growth in income and employment. The current economic crisis has weakened the financial health of many small and medium-sized firms (SMEs), especially in industries in which foreign, low-cost producers have entered the market and are threatening the survival of the existing competitors. In addition, new government regulations can change a profitable SME niche business into an enterprise disaster in just a few weeks or months. There have been significant debates about the impact of innovative manufacturing techniques on economic performance (John & Senbet, 1983) and competitiveness in general (Fontana & Lorenzoni, 2004), and on productivity, efficiency, and innovation in particular. The diffusion of automation can produce new opportunities for SMEs. It overcomes the concept of traditional organization, emphasizes the interdependence between the organization of jobs and technology.

Notably, in seeking an explanation for the acceleration in productivity and economic growth experienced in many industrialized countries, many economists have looked at the development, application, and utilization of ICT as a critical factor. Information and communication technologies, automation and robotics are changing manufacturing processes in industry (Butler, 1999). In parallel also on the scientific and vocational education level, the integration of different fields like mechanics, electronics and information technologies (mechatronics) is practiced since years.

Nevertheless, many especially small enterprises have rather conservative approaches to new technologies and thereby miss many opportunities by utilizing improved technologies. SMEs need highly qualified staff, competent in operating with new machines and in managing sophisticated production processes. AutoMatic project, that will be described later, addresses the problem of low or missing overview about possibilities offered by industrial automation systems. It adapts and develops an innovative approach and learning contents targeted specifically to SMEs to qualify staff on industrial automation systems (Casalino, 2014). Main reasons for SMEs participation are partner & collaboration opportunities and access to knowledge. An additional view on the relevance of the Cooperation Programme for SMEs is obtained by looking at the motivation of SMEs for their participation in the projects as this also indicates to which extent the objectives of the programme are pertinent in relation to the needs and priorities of SMEs. Partner and collaboration issues together with access to new knowledge are the most relevant motivations to participate in cooperation programmes.

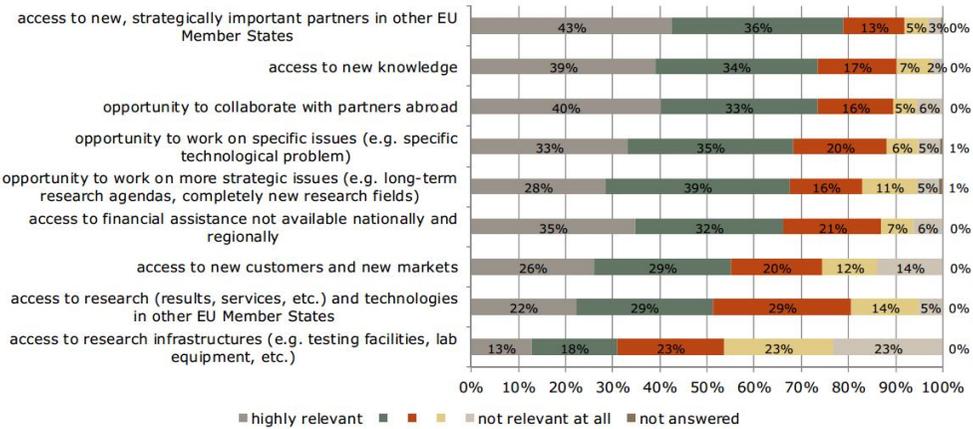


Figure 1: Motivations for Participation in the Cooperation Programmes (Austrian Institute for SME Research, 2013)

Hence, at the firm level, the expectations are of greater efficiency, lower costs, and access to larger and new markets, while governments see the application and use of ICT as generating higher productivity, and competitiveness.

This paper tries to understand what are the main barriers for high-growth innovative SMEs with respect to the realisation of their innovative potential and their capacity to create employment (reduced access to external finance, unavailability of wider distribution channels, low internationalisation, etc.). Moreover, as first argued by New Growth Theory (Romer, 1986), the capacity of continuous innovation has become a key factor in the global competition of high-income regions in order to acquire the additional factors of production and the new value adding processes, which are necessary to keep an economy on a sustainable growth path. SMEs seem to be the ideal vehicle to promote both goals – sustainable innovation-based economic growth and employment creation – without trade-offs, given, as frequently assumed, the high flexibility as well as the relatively labour-intensive mode of production in SMEs. However, the issue as to how realistic these expectations are is anything but resolved.

Despite experience with a different number of SMEs' promotion programmes, it is also still debated as to which specific policy measures are really suitable to guarantee undistorted competition by compensating firm-size specific disadvantages, such as the SME's restricted access to public resources.

Behavioural Additionality, Economic Resources and Taxation in EU Countries

Behavioural additionality concerns the effects on the funded SMEs' behaviour and strategy as a result of their participation in the Fifth, Sixth and Seventh Framework Programmes (FP5, FP6 and FP7), i.e. receiving government subsidies. One relevant issue with regard to behavioural additionality is that many SMEs participating in FPs are already innovation oriented before joining the project. Hence for these enterprises the project experience will be coherent with their innovation behaviour but it does not change it that much. When behavioural changes do occur, they are often related to increased visibility and confidence of the SME leading to more ambitious research and innovation projects, increased cooperation and increased internationalisation (European Commission, 2014). The experience in international cooperative research projects leads to more conscious structuring of innovation activities, increased investments and boosting of innovation. Shortage of own financial resources and the problem of accessing finance for innovation is a perennial problem. Innovation is costly and companies must make investment choices with scarce resources; innovation is often in competition with other business functions.

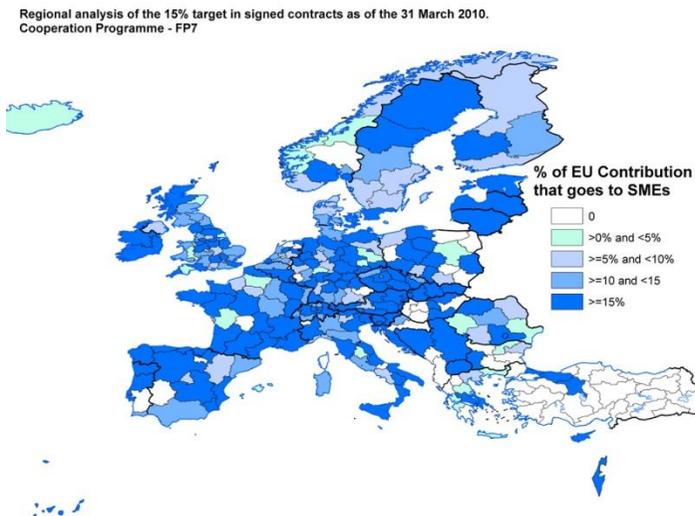


Figure 2: Cooperation Programme FP7 (European Commission, 2011)

Many governments and international financial institutions have tried to address the problems of high transaction costs and risks by creating subsidized credit programmes and/or providing loan guarantees. SMEs represented the largest group of participants in FP5, FP6 and FP7, and 80% had strangely a positive influence on research collaborations, according to the latest impact assessment.

However, the assessment also reveals that there is a need to shift focus from increasing the number of SMEs that participate in research programmes to increasing the impact participation has on SMEs (Erdei, 2010).

As the largest research financier in the world, the European Commission continually looks for ways to improve its funding activity to further enhance innovation and competitiveness in high-growth innovative SMEs across Europe. Impact assessments are an important tool for analysing and improving SMEs participation and the impact this has on Framework Programmes. Until now the focus has been on increasing the sheer volume of SMEs' participants - but now we must turn the attention to enhancing the actual impact research can have on an SME. That condenses the opportunity to exploit and do business based on their research. We therefore need to shift our focus to ensure we support SMEs in the right areas and develop new strategies that help them to grow.

Approximately 80% of research projects saw SMEs' contributions as being crucial or important. In addition, more than 70% of SMEs report a positive impact on their operations, processes, methods, tools or techniques as a result of their research project. In addition, 75% of SMEs have introduced new technologies into their operation and, of this figure, 25% attributed it to their research project.

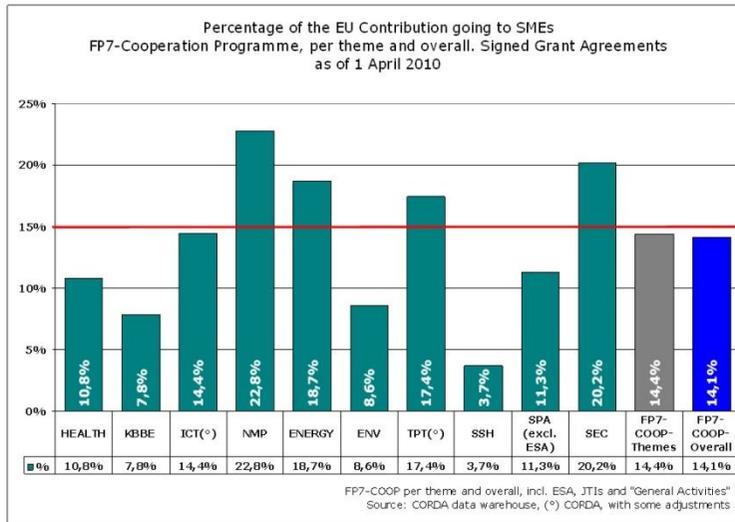


Figure 3: Themes in Terms of Participation of SMEs (European Commission, 2011)

More than 12.000 SMEs took part in FP5 (16.4% of all participants) and 11.200 in FP6 (16.9% of all participants). However, research and technology development (RTD) performers actually made up a larger number of participations. This is because research organisations focus on technical objectives and the FP currently serves more technical rather than business objectives, which is the primary focus for SMEs. As a result, the vast majority (75%) of SMEs only take part in one research project. In addition, just 11.8% of FP6 and 12.6% of FP5 projects were coordinated by SMEs. This is put down to the amount of time and effort (both human and financial) that it takes to coordinate a project. It should be noted that it is another area the European Commission aims to improve. Although SMEs' participation increased, the amount of funding received by SMEs decreased from 13.2% in FP5 to 12.4% in FP6. However, individual funding per SME actually increased from an average of EUR 170.000 in FP5 to more than EUR 220.000 in FP6 (Erdei, 2010).

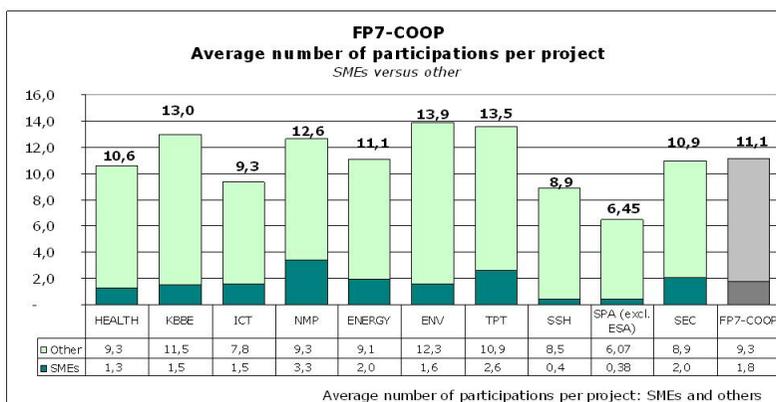


Figure 4: Average Number of Participants per Project per Theme (European Commission, 2011)

However, it is important to underline that such projects have often fostered a culture of non-repayment or failed to reach the target group or achieve financial self-sustainability. On average, neither tax measures nor financial support for R&D were perceived sufficient to encourage SMES to improve manufacturing processes (UNCTAD/ITE/TEB/Misc.3 United Nations, 2002).

Number of participations	All participants		SME-participants	
	number	%	number	%
1 time	11 196	63.5%	5 272	73.1%
2 to 5 times	4 701	26.7%	1 693	23.5%
6 to 10 times	803	4.6%	188	2.6%
11 to 25 times	565	3.2%	52	0.7%
26 to 50 times	199	1.1%	3	0.04%
51 to 100 times	102	0.6%		
101 to 200 times	46	0.3%		
201 to 300 times	13	0.1%		
More than 300 times	4	0.02%		
	Max. = 713 times (see footnote)		Max. = 43 times (see footnote)	

Table 1: Frequency of Participations per Participant, amongst all Participants and amongst SME-Participants, in the Cooperation Programme, 2007-2013, in Numbers and Percentages (Panteia 2013 based on eCORDA, 2013)

Many enterprises highlight that existing tax measures discouraged them to engage in automation investments.

A significant majority of SMEs supports the statement that taxation discourages their adoption. The most of SMEs confirm that public financial support was insufficient to support R&D, diffusion and uptake of information systems. These findings are consistent with other levels of satisfaction with government intervention in, amongst other things, innovation regulation (Chesbrough, 2003).

However, another correlation can be established, namely with GDP per capita and available public funds to support SMEs industrial policies, thus revealing material boundaries to proactive manufacturing policies. Therefore, for the new EU member states in the survey, streamlining some of the EU structural funds towards innovation and stimulation of manufacturing will be highly appropriate in light of previous relevant experience. Use of international loans can also be an option although many of those are seen as too expensive in light of the financial capabilities of the countries at this stage. About 44% of the SMEs indicated that the current education system delivered adequately trained personnel to engage in innovative manufacturing usage and 28% stated that the system delivered inadequately trained personnel.

Compared to existing staff skills and training of firm personnel, which for 69% of all firms appeared sufficient to support the uptake of ICTs, newcomers to the labour market still have a learning trajectory to go through. In all countries, the education system is positively evaluated as adequately preparing for production usage by a significant but moderate majority of SMEs (Johannessen, et al. ¹⁹⁹⁹). Figures on education deviate from the traditional pattern with regard to the government's role in promoting ICT. For obvious reasons, innovative public policies are not the only factor affecting this score, which is dependent on overall levels of pedagogical quality as well. Most of all the speed of response of the educational system in the surveyed countries is still insufficient to accommodate the dynamism and the requirements of the businesses. This stems, in part, from the weak relationship between the business and education and R&D communities. It is the obligation of the government to create an environment that stimulates this relationship and hence makes the educational system more adaptive and flexible to the requirements of the business.

National differences in the appreciation of production services as a stimulating factor for technologies' adoption in the economy correlate relatively well with other governmental efforts to stimulate innovation. However, overall levels of appreciation are significantly lower than for other factors, indicating that the provision of online services is a relatively weak stimulus for the uptake of ICT services in the business community (UNCTAD/ITE/TEB/Misc.3 United Nations, 2002).

Private programs to raise awareness of the efficacy of ICT in firms and private demonstration programs did on average contribute more to improve ICT usage than public programs. Almost 21% of all firms indicated that private awareness raising and demonstration programs were not sufficient. In other words, they could be improved. Following this line of argument, the challenges that the EU is facing with regard to its basic economic and political foundations are arising at a time when stability in these areas is becoming an ever more important prerequisite for stimulating investment and encouraging innovation. The EU's leaders need to continue their efforts to stabilize the political and economic macro environment in order to establish confidence and encourage investment. Yet this is only the first step; the EU must also succeed in addressing a number of challenges on the micro level. In today's world, there are few "independent variables" or "autonomous players". Rather, the competitive advantage of a country is dependent on multiple, interdependent factors – not least of which include its leaders' ability to act on issue areas in a coordinated and collaborative fashion. Thus, the EU's ability to address the challenges of establishing a stable political and economic environment, setting-up the appropriate framework conditions to in still confidence in the business environment, and catalysing innovation in the economy is dependent on a concerted effort of multiple actors, working across sectors or domains in a systemic, inclusive and transparent manner.

Market Conditions and Management of Automation in SMEs

In recent years, policy makers have shown increased interest in fostering fast growing high-growth innovative SMEs as they are seen as a crucial driver of economic growth and employment. Europe has performed relatively badly in generating high-growth innovative companies that quickly become global performers. High administrative costs of lending or investing small amounts do not make SMEs' financing a profitable business. As a result, commercial banks are generally biased toward large corporate borrowers (Casalino & Mazzone, 2008), who provide better business plans, have credit ratings, more reliable financial information, better chances of success and higher profitability for the banks (Capriglione & Casalino, 2014). When banks do lend to SMEs, they tend to charge them a commission for assuming risk and apply tougher screening measures, which drives up costs on all sides.

Many European governments and international financial institutions have tried to address the problems of high transaction costs and risks by creating subsidized credit programmes and/or providing loan guarantees. Such projects have often fostered a culture of non-repayment or failed to reach the target group or achieve financial self-sustainability. Changing market conditions thus force smaller firms to adapt or reinvent their business through new technologies or unique value propositions. At the same time, small firms face several constraints in differentiating their products and changing their business model.

A major liability is that small firms lack the required internal financial resources and technical capabilities. They therefore must collaborate with external partners to innovate successfully, to develop new sources of income, and to reach more profitable positions in the competitive landscape. Innovative manufacturing techniques adoption and organizational change are becoming essential for achieving greater industry productivity, lower operational costs, and higher revenues.

The close correlation between these dimensions of improved economic performance from ICT and organizational change (Casalino, D'Atri, & Fadda, 2005) corresponds well with findings from other studies on the impact of technologies on firm performance. It has thus been argued that the effective utilization of information systems requires more horizontal organizational structures with greater levels of responsibility for the overall coordination of work placed on the individual employee. It also requires the implementation of clearer functional descriptions of tasks. All this often requires a complete re-shaping of the organizational structure of the firm where all aspects of the organizational development are consequently given attention (Dawes, 1996). Hence, it is important to note that the firms are going through a period of rapid modernization, emphasizing improved production processes and flexible organizations that can address the needs of the market, as part of transformations of the socio-economic fabric to a market-driven economy. This may in part explain why ICT is combined with other factors, such as new marketing strategies and organizational change.

Today there is a strong need to collect more revealing data on technologies adoption and its impact on SMEs, the need for more rigorous analysis of how ICT investments and use affects innovation (Simon, 1973), and the need for better understanding how this can translate into productivity increasing and enhancing competitiveness.

How to correlate SMEs in the internationalisation processes or whether they only function as suppliers in global value chains, dominated by large-scale transnational enterprises (Gatti, 2000), is an open question. Without doubt, the current wave of internationalisation is accelerating the diffusion of innovation across industries. Yet it is unclear whether SMEs are driven by globalisation or whether they are a driving force in this process. It is clear from many studies that a wide utilization of information systems is already having an impact on economic performance among firms. This is reflected in the findings on the impact of ICT on economic performance, where it is evident that ICT is a substantial contributor to productivity, profitability, and growth (Kaplan, 1999). Accordingly, a new marketing strategy is particularly relevant for translating the introduction and use of ICT into the improvement of profitability.

This is mainly because the use of technologies together with new marketing initiatives enables firms to strengthen their position in existing markets or enter new markets, thereby improve profitability. Manufacturing technologies is particularly important for lowering operational costs and increasing revenue. In addition to identifying the immediate influence of ICT on the economic performance of high-growth innovative SMEs (Miller, 2000), it is possible to identify how firms use ICT to improve their performance (Fontana & Caroli, 2003), namely through innovation. ICT is only a minor facilitator of innovation; it only becomes powerful in combination with a number of other complementary factors. The main factors contributing to innovation in SMEs are:

- Organizational change;
- Changes in salary structure;
- Training of staff;
- Capital investment in equipment;
- New market strategy.

In most of the sectors surveyed, ICT contributes more to process innovation than to product and relational innovation (Capriglione & Casalino, 2014). The use of information systems is thus mainly for changes in production processes within the organization (D'Atri, De Marco, & Casalino, 2008), rather than the development of new products or the furthering of relationships especially with suppliers. It was demonstrated that relatively fewer firms report decreasing costs because of ICT.

Automation is the adoption of control systems and ICT to reduce the need for human work in the production of goods and services (Casalino & Di Persio, 2004). In the scope of industrialization, automation is a step beyond mechanization.

Whereas mechanization provided human operators with machinery to assist them with the muscular requirements of work, automation greatly decreases the need for human sensory and mental requirements as well.

Automation plays an increasingly important role in the world economy and in daily experience. Automation has had a notable impact in a wide range of industries beyond manufacturing (where it generally originated). In general, automation has been responsible for the shift in the world economy from industrial jobs to service jobs.

The result has been a rapidly expanding range of applications and human activities. Design and manufacturing of products are important for information technology industry and can assist design, implementation, and monitoring of control systems.

Information Asymmetry, Perceived Risks and Innovation Transfer Application

Since there is empirical evidence for the importance of SMEs for employment creation, it appears to be advisable to support high growth of enterprises in order to leverage the positive impact of these enterprises. Well-functioning and sustainable mechanisms for SMEs financing require institution building and a market approach. Lending institutions must improve their ability to provide financial services to SMEs through commercial mechanisms that lower costs and minimize their risk exposure. Only in this way will financial institutions find SME lending to be more profitable, and thus be encouraged to construct lending programmes targeted at SMEs.

There are also a number of trends in the financial services industry that are forcing banks (Casalino & Mazzone, 2008) to have a closer look at the SME markets. Globalization trends are increasing competition especially for servicing large corporate customers and driving down margins and fees. The improving liquidity of securities markets in many countries is increasingly providing large corporations direct access to the capital markets and allowing them to bypass financial intermediaries. Therefore, banks are under increasing pressure to expand their business towards SME customers and to develop mechanisms to improve the profitability of lending to high-growth innovative SMEs.

To compete effectively in the SME financing sector, banks need to provide financial services that meet the specialized needs of SMEs while coping with the high risks and costs associated with servicing them. To achieve this, an increasing number of banks (Casalino & Mazzone, 2008) have adopted separate strategies to service SME customers. The current trend is to shift from a product-based focus to a more customer oriented focus of providing packages of financial services tailored to their needs. This has the potential of considerably improving the banks' relations with the SME sector, as well as increasing the profitability of providing financial services to it. The main initiatives undertaken by banks to support better the SME sector include (UNCTAD/ITE/TEB/Misc.3 United Nations, 2002):

- Reducing information asymmetry of SMEs and high perceived risks by using credit scoring systems; adopting reliable information providers and risk self-assessment for the SME entrepreneurs; assessing the level of risk; sharing risk with third parties; and setting up special support units for high risk customers such as the start-ups;
- Reducing costs of lending by applying latest information technologies (De Marco, 2004); streamlining the organization and simplifying the lending process;
- Developing products better adapted to SME's needs;
- Improving financial services for SMEs through training of bank staff and the segmentation of SME customers;
- Cooperating with SME organizations and other business development providers in order to reduce risks and costs and combine financial with non-financial services.

As regards innovation transfer, Schumpeter is often mentioned as the first economist having drawn attention to the importance to it, defining five types of innovation ranging from introducing a new product to changes in industrial organization.

The Oslo Manual clarified the definition of the two more technical definitions but still it appears that "innovation" is not easy to define precisely (OCDE, 2005). Some researchers gave approximately definitions (Bourne, 1999) on:

- Science: how to understand things;
- Technology: how to do things;
- Management: how to get things done;
- Creation: bringing into existence;

- Invention: devising something new or a new way to do things;
- Innovation: turning an idea into income.

The innovation is a science and explains what innovation and creativity means by these simple formulas (Archibald, 2012):

1. Creativity = Idea + Action

By this, Archibald means that the "idea" is just the beginning to create something. People must do something to bring the idea and create something.

2. Innovation = Creativity + Productivity

In reality the sequence is: get an idea, test or prototype it, produce a finished item and bring it into use. In the case of artists, this corresponds to: get inspiration, sketch it, put it down on canvas, and finally exhibit the work. For many businesses, the ultimate goal is the idea to produce profit. In this case, innovation must come from ideas that lead to sales.

3. Profitable Innovation = Innovation + Marketing

The innovation process is a combination of various activities starting from research but including design, market investigation, process development and may include organizational restructuring, employee development, etc. Innovation implies creativity and dynamism that will benefit the company and result in a higher standard of living. However, as a conclusion it must be kept in mind that measurement of innovation is very difficult.

Technology transfer is the process by which existing knowledge (Carneiro, 2000) and capabilities developed under public R&D funding are used to fulfil public and private needs. Besides an organization must become a learning organization and there must be a constant and unstinting market focus. Market and learning orientation are less formal, less structured (Gibb, 1997), and less progressive in SMEs (Meziou, 1991). Learning-orientation "is a mechanism that directly affects a firm's ability to challenge old assumptions about market and how a firm should be organized to address it".

SMEs have a natural advantage in that it is easier to create a learning environment in smaller organizations (Sinkula & Baker, 1999). Specifically, organizational learning is a workplace learning, which is a lower-level learning style involving the use of existing knowledge to enhance operation efficiency in SMEs (Keskin, 2006). To expand, a learning organization can be described as possessing:

- commitment to learning: the degree to which an organization values that which promotes a learning culture by believing that learning is key to improvement and competitive advantage;
- shared vision: an organization-wide focus on learning, or direction of learning that is evident across all levels of an organization;
- open-mindedness: willingness to critically evaluate the organization's operational routine and to accept new ideas by continually judging the quality of decisions (Casalino & D'Atri, 2005) and activities taken and perceptions about marketplace;
- intra-organizational knowledge sharing: collective beliefs or behavioural routines related to the spread of learning among different units within the organization by having mechanisms for sharing lessons learned in organizational activities from department to department (unit to unit, team to team).

Organizational Edges and Human Resources Training

A new flexible production system involves many changes into firm's organization chart with the increasing use of automation, often pointing out the problem of the lack of trained staff. Indeed, very few workers were able to actively practice with new technology. This structure has to be modern and efficient and its staff have to be extremely skilled.

Critical resources for innovative and growth-oriented companies are knowledge and capital. Technological and business knowledge – including skills – can be separated as follows: issues of human capital, access to specialised technology and business consulting, R&D clustering, technology scouting to identify R&D projects with commercial potential, technology transfer, and an effective regulatory system to protect intellectual property rights. Alignment of competencies with strategic priorities is also an important issue.

Finance and real estate is fundamental for innovation. High-growth finance includes primarily the availability of venture capital through business angels, specialised private companies, other corporations or public funds, but it also requires a functional banking system.

Venture capital should correlate with companies' growth stages. As regards real estate, innovative start-ups may benefit from business incubators as well as science and technology centres (Hamann, 2010; Lilischkis, 2011). Incentives to innovate and grow a company may originate in several individual and social aspects. Individual incentives include first of all income, including issues such as taxation, bankruptcy regulation, rewards for innovative employees, possible income limits, and regulations of sideline income (including equity shares in new companies) of entrepreneurial researchers (Hamann, 2010). A further individual incentive may be self-fulfilment. Social recognition is related to social values, including issues such as recognition for entrepreneurs and innovators, social acceptance of entrepreneurial failure, and business relationships of university researchers in peer groups.

Besides, staff has to use the best technology available at the moment in the market (PLC, systems control, numerical controls, systems of automation distributed, industrial technologies, barriers of protection). The business structure must integrate and elaborate information coming from different sources.

As it regards the different business functions, they must be shaped so that results are accessible from this information. It is necessary to improve competences to allow solutions of personalized automation.

We analyse in the detail the main competences. The technical person must also take care of the management of the cars related to specific phases of the production trial and must verify the conformity of the result in comparison to the standards, affecting the necessary regulations and intervening on possible anomalies. The technical staff must be able to use the principal programming languages and application, developing the ability to work in team and for objective, using different methodologies, as for instance the project management. The principal occupations are assembled in the technical offices and in the centres of research and development (D'Atri, De Marco, & Casalino, 2008). Some unit profiles:

- The technician, in collaboration with administrative personnel, develops experimental researches using all necessary competences for the carrying out of the activities;
- The engineer of trial is the person who knows the trial that must be automated. In most cases, he coincides with the planner (mechanic) head;
- The electric planner designs the structure of the electric system that the cars and the different uses of the production trial;
- The expert of field defines typology, position and technical specifications of several sensors and essential actuators to check and watch the trial;
- The planner of automatic controls is traditionally also an expert of measures and covers the necessary competences of an expert of field. They define the control system architecture and the specifications;
- The person responsible for maintenance is another figure whose role is increasingly growing;
- The person of maintenance of automation must know how to distinguish between corrective maintenance and improved maintenance.

Then the role of management, it is to improve the quality of the products, the flexibility, to reduce the times of production, to adjust laws and rules and to improve the use of the available resources (Kessler & Chakrabarti, 1997). This is possible by means of suitable choices of investment, actions of marketing and naturally through an adjusted plan of production. This last phase must be managed through a fit allocation of human resources and with the control of the productive trials making use of automation. As it regards the control of the production trials, the principal problem is the quick obsolescence of the firm's products.

The solution is therefore the use of flexible systems of production that develop, in an automatic way, different products.

Therefore follow three types of competences to recognize industrial automation:

- Methodological competences. The figures have technical competences, tied to the routine of automation;
- Technological competences. Methodological competences are realized in solutions implemented through technologies therefore technological competencies are necessary for those who are working with industrial automation;

- Competences of trial. Automation requires knowledge (Cardinal, Alessandri, & Turner, 2001) on the trials to automatize. Rather, experience shows that the automation often induces to find formal and general descriptions of the same process;
- Technological complexity. Technological complexity should not be too far ahead of scientific understanding, as it would limit the commercial viability of the innovation by being too sophisticated for the end-user.

Objectives, Research Questions and Methodology

Keeping in mind overall issues and considering the problems analysed it is important to understand and try to explain the following key questions (Lilischkis, 2011):

- What role can the EU level play in fostering high-growth innovative SMEs?
- How are policies for high-growth innovative SMEs distinct from general SME policies?
- Is it more efficient (in terms of economic growth and job creation) to support all SMEs, or to concentrate efforts on those with the highest growth potential?
- Entrepreneurship, access to finance, SME internationalisation, as well as opportunities and risks of sectoral policy approaches are special issues dealt with here.

SMEs are generally resistant not only to training but also to other forms of wider participation. Generally, they also engage in less management development activities than larger firms. Their managers are much less likely to have formal appraisals or discussions on their training needs (Lukas & Ferrell, 2000).

SMEs must still provide the ability for managers to learn by experience, bringing their knowledge, skills and values into the workplace and putting them into practice. Inevitably, these resources are limited and sometimes inadequate. This can be potentially harmful for an organization, sacrificing the strength and consistency of its culture to achieve short-term gain.

AutoMatic project, titled "Development of curriculum and innovative training tools for industrial automation systems for people employed in SMEs" addresses the problem of low or missing overview about possibilities offered by industrial automation systems.

It develops approaches and learning materials directed specifically to SMEs to qualify staff in terms of industrial automation systems (Casalino, 2009). AutoMatic has been selected for co-financing under the Lifelong Learning Programme, Leonardo da Vinci, Transfer of innovation projects (2009-1BG1-LEO05-01640 - period 24 months). The project website is available on www.automatic-project.eu.

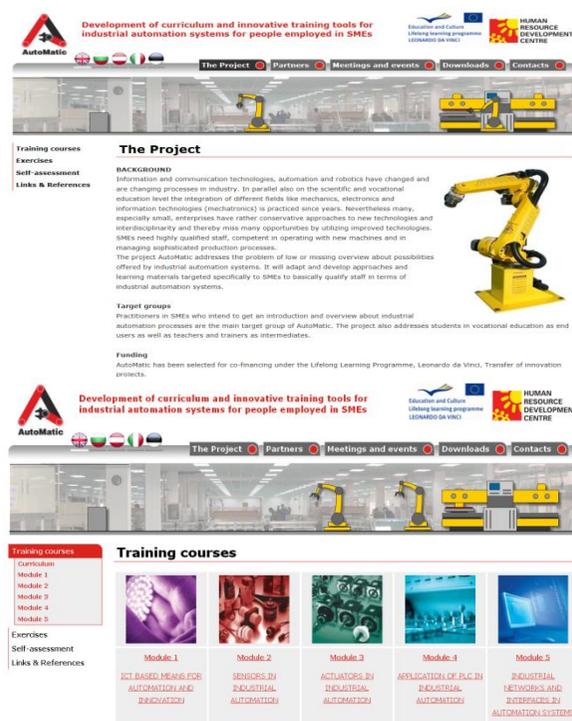


Figure 5: Some Screenshots of AutoMatic Project Learning Contents for SMEs (www.automatic-project.eu)

On the one hand, a new learning approach in the field of industrial automation addressing the needs of small companies is developed; on the other hand, innovation processes supported by information and communication technologies are directly addressed by one of the five modules included in the project and are subject of all modules. Different methodologies were applied to understand the companies' needs, but also technical details, e.g. econometric techniques, sampling for interviews, selection of case studies, and questionnaires for SME interviews. In order to implement these information, several methodologies, at company-level data, was needed as made always by European Commission studies and reports (European Commission, 2014):

- Two existing databases have been used. eCORDA is a database from the European Commission that contains data on applicants/proposals and signed grants/beneficiaries with regard to a specific Framework Programme for Research. The datasets include information on FP7 Grant Agreements and Participants and FP7 calls for proposals and its applicants from 2007 up to 2013. Information on innovation and business performance of the FP7-participants is not available in eCORDA. Therefore ORBIS, an extensive database of Bureau van Dijk on millions of enterprises in Europe and beyond, was used to supplement business information on eCORDA. ORBIS provides a.o. financial data on enterprises, also on enterprises not included in eCORDA that was used to construct a control group;
- Stakeholder interviews. In-depth interviews with relevant stakeholders in the following categories were held: Commission services; European associations of SMEs; European industry associations; Member State SME associations; Member State officials responsible for comparable SME-specific research, development and innovation programmes;
- SMEs interviews. In FP7 about a third of the SMEs are participating in the dedicated Research for SMEs scheme. This has been the basis to opt for dividing the sample of over standardised interviews with SMEs in two layers: about 2/3 focusing on the Cooperation Programme and about 1/3 on the Research for SMEs scheme. SMEs participating in the Research for SME associations scheme were not interviewed. A representative sample across sectors of activity and countries was designed. Thematic priority and country were used as stratification criteria for the Cooperation Programme whereas sector was used for the Research for SMEs scheme. The interviews were all carried out by the core team and by various researchers from our subcontractors in different Partners' Countries
- Case studies. Three types of cases were distinguished: SMEs participating in the Cooperation Programme; SMEs participating in the Research for SMEs scheme; SMEs' associations (European Commission, 2014).

In total more than 300 sources were achieved, but in all only 180 provided comprehensive information for the project needs.

AutoMatic builds upon an existing approach developed in the pilot project "International Curricula of Mechatronics and Training Materials for Initial Vocational Training" for vocational schools developed by Tallinn Technical University, Estonia. The project consortium is composed by:

- Gabrovo Technical University, Bulgaria www.tugab.bg (project coordinator);
- ECQ - European Centre for Quality, Sofia, Bulgaria www.ecq-bg.com (project coordinator);
- Tallinn University of Technology, Estonia www.ttu.ee;
- LUISS Guido Carli University, Rome, Italy www.luiss.it;
- Multidisciplinary European Research Institute Graz, Austria www.merig.org.

Target groups are practitioners in SMEs who intend to get an introduction and overview about industrial automation processes are the main target group of AutoMatic. The project also addresses students in vocational education as end users as well as teachers and trainers as intermediates. The developed products can support SME employees that want to improve their qualification or re-qualify and need to increase their flexibility with respect to market demands and successful realization on the common labour market (Casalino, D'Atri, & Fadda, 2005).

During the project has been developed an innovative training approach e-learning platform, several learning contents and specific simulation tools (Casalino, 2014) in the field of industrial automation systems, which are applicable to European SMEs.

Between the results achieved, interactive training tools for industrial automation systems were developed.

More specifically innovative curricula and the following five training modules targeted at SME management and staff:

- ICT Based Means for Automation and Innovation;
- Sensors in Industrial Automation;
- Actuators in Industrial Automation;
- Application of PLC in Industrial Automation;
- Industrial Networks and Interfaces in Automation Systems.

The figure displays two screenshots of the AutoMatic project learning content for SMEs. The top screenshot shows the interface for 'Exercise 1' under 'Module 1 - Exercise 1'. It features a 'DONE' button and several empty text input fields. Below the input fields are four buttons with text: 'It is possible to reduce expenses and costs, increasing flexibility', 'Better collaboration with research centers', 'It is allowed to increase risks and experiments', and 'Better decision making (time compression)'. The bottom screenshot shows the interface for 'Exercise 8' under 'Module 2 - Exercise 8'. It features a 'DONE' button and a grid of technical diagrams related to sensors and automation.

Figure 6: Some Screenshots of AutoMatic Project Learning Contents for SMEs (www.automatic-project.eu)

The modules ICT Based Means for Automation and Innovation, Sensors, Actuators and the Application of PLC in Industrial Automation, as well as Industrial Networks and Interfaces in Automation Systems consist of text based materials interactive examples, exercises and a self-assessment tool.

AutoMatic materials are designed to be used in course based training sessions, but at the same time support individual learning. In the AutoMatic platform was integrated a “virtual teacher” that speaks slowly, with a clear voice and a perfect intonation. Therefore, AutoMatic proposes an innovative approach for the training with a virtual teacher that holds the lessons, so that the distance training is combined with a similar direct contact (Casalino, 2013).

AutoMatic platform also offers auto-evaluation forms through which the learners can verify the acquired knowledge level. Such forms, at the end of every subject, allow the worker to verify immediately the acquired knowledge through the portal. Four different sections were developed for each training module:

- Tutorials;
- Training courses;
- Exercises;
- Self-assessment;
- Useful links;
- References.

The learning tools and materials are available in 5 languages: English, Bulgarian, Estonian, German and Italian. The learning tools and materials are available on-line, on Dvds and on traditional booklets.

To explore the link between innovation and efficient production in the SMEs, we conducted a multiple-case study using in-depth interviews with representatives of SMEs to find commonalities and success factors. The main practical results arisen (Verhees & Meulenber, 2004) are the following:

- Increased flexibility of SME employees who want to improve their qualification;
- Increased motivation of target groups and their commitment for life-long learning and career planning;
- A good impact on the quality of vocational training and international co-operation in the area of industrial automation systems by providing time-saving and user-friendly approaches.

Conclusions

Since there are empirical findings supporting the importance of high-growth innovative SMEs for employment in EU economy, it appears to be worthwhile for EU policy makers to support high growth of enterprises in order to leverage the positive impact of this type of enterprises.

It needs to be stated clear, however, that the positive impacts of high-growth entrepreneurship in themselves are no ground for political activity; policies should only be the result of market failures (Minniti, 2008, & Audretsch, 2004). One of the principal ways to increasing the access of small businesses to formal financial services is to create conditions that encourage financial institutions to serve small businesses.

The old unprofitable approach of providing limited services to a limited number of customers' needs to be replaced by a "mass-customized approach" that uses technology to increase the number of small business clients but at the same time reduces transaction costs, improves asset quality and broadens service offerings. The result is a business model that offers a complete set of financial services tailored to the needs of individual small business clients with an improved bottom-line contribution per customer, thus enhancing profits for banks.

Studies on the process of information technology acquisition (Kennerley & Neely, 2003) clearly show that these systems go through several evolutionary stages. During this development, the priority in order to succeed does not seem to be tied only to the acquisition process, but mainly to the paths of learning and organizational change (Casalino, 2008).

Experience suggests that these paths should be designed and carefully managed in order to allow the acquisition and effective use of ICT applications by the users and the whole enterprise.

The traditional methodology for the training, in fact, results incomplete to furnish a suitable medium in the professional training field, because of dynamic and continuous changes in the ICT sector and the increasing demand of knowledge more and more in the quality field (Casalino, Armenia, & Canini, 2008). AutoMatic can contribute to the success of the SMEs. The strategy is based on the creation of a system for the training that meets the distance learning with the traditional benefits; therefore, the two different methodologies are integrated.

In fact, on one side, the distance statement is a comfortable method for the training of a vast entourage of people within automation, but on the other hand, many people does not believe in the effectiveness of such method of statement because of the lack of a teacher that mostly involves the trainees.

The research project included the analysis of specific indicators and key aspects that regard the current situation of automation and innovation culture in the European SMEs. These are:

- What is the current situation of quality aspects dissemination through on-line courses?
- How are the main models used and applied?
- What role can have national agencies or institutions, as the universities, on the diffusion of innovation culture (Jin¹⁹⁹⁹) or the implementation of automation for SMEs through both traditional and web-based learning?
- How organizational and cultural specificities affect automation implementation?

The importance of automation is increasing for the reason that lack of quality control and assurance systems (Casalino, D'Atri, & Manev, 2007), lack of accreditation and certification procedures, poor conformity marks, are still diffused. Such impediments are considered as major potential and unnecessary technical barriers to trade, especially concerning international competitiveness and globalization (Fontana & Lorenzoni, 2004). It is important to underline that high-growth innovative SMEs intellectual capital (Marr, Gray, & Neely, 2003) has to meet the challenges of globalization and the new knowledge-driven economy aims. SMEs are a crucial aspect of improving position of Europe in the global marketplace and enhancing their efforts and contributions is crucial.

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