

FINANCIAL IMPLICATIONS OF TECHNOLOGICAL PROGRESS

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Abstract

The study analyses the problem of financing the innovation that is one of the biggest problems facing the companies that want to be innovative.

As a consequence, the paper reveals the main forms of funding the technological progress with their advantages and drawbacks. In particular, it is highlighted the role of innovation and research in the performance of SME and, in relation with them, the difficulties for this companies to access funding under crisis conditions.

INTRODUCTION

Technological progress, throughout history, but especially in the last two centuries has been and remains the key for the development of society. More, technological change and its effects are present in all areas, from the production to the arts, from the political to the economic sphere.

For companies, it has been proved that the implementation of new technologies, innovation and research can lead to the increase of their performances. But, the access to them, very often, is limited by a number of financial constraints. In this regard, the paper analyses the financial implications of technological progress, the problems that companies encounter in financing the innovation.

There have been revealed, also, the main forms of funding the technological progress with their advantages and drawbacks. In particular, it is highlighted the role of innovation and research in the performance of SME and, in relation with them, the difficulties for this companies to access funding under crisis conditions.

1. LITERATURE REVIEW

During the time, a large number of papers have analyzed the effects of technical progress. One of these effects is productivity growth, for economists, the association between productivity growth and technological progress being a relatively well known relation. Certainly, not only technological progress is a determinant of productivity growth. Productivity is influenced also by many other factors like physical, human, financial, informational resources, the allocation of resources by the organization, geographical positioning.

Otherwise, several authors state that "improvement in productivity arises from technical progress alone only if a producer operates on its production frontier" [32]. Below this, any change of productivity could be attributable also to changes in technical efficiency or the catching up effects [26], [6], [27]. Furthermore, Granderson [17] explained productivity growth "as aggregation of technical change, efficiency effects, returns to scale and regulation".

On the other hand, a study made by Growiec and Schumacher [18], through the development of a R&D-based growth model, reveals that the rate of technological progress depends on the amount of technological opportunity. According the author, the technological opportunity is renewed by radical innovations, which have no direct impact on factor productivity.

Technological opportunities are defined as "the set of production possibilities for translating research resources into new techniques of production that employ conventional inputs" [10]. The concept was "originally constructed to reflect the richness of the scientific knowledge base tapped by firms" [30].

There are some works like those of Dosi [12] and Cohen&Levin [10] that have shown that there is not a single, homogeneous source, but rather different sources of technological opportunities, varying from industry to industry and, to a certain extent, from one firm to another.

A study realized on a panel of 51 countries [22] reveals a greater impact of technological progress than globalization on income inequality. In this regard, it can be said that differentiations between per capita incomes

derive from inequalities between countries in terms of their ability to generate or to absorb technological progress.

Foreign direct investment is considered an important channel for productivity growth through international technology diffusion. Calibrations of a neoclassical growth model with this factor show that when technology catch-up due to foreign direct investment inflows is considered, the welfare gains from financial integration substantially increase [23]. Other empirical studies show that disparities in the level of technology explain the bulk of the difference in income or output per worker across economies [19], [15].

Theoretical and empirical studies also show that technology diffusion plays an important role for technologically lagging economies to catch up with the global technology "frontier". In particular, it is believed that inward foreign direct investment is an important channel for the diffusion of technology across countries. Based on a simple calibration exercise, Hoxha&Kalemli-Ozcan, [21] recently showed that if technological improvement is also taken into consideration, the impact of capital integration on welfare is about twice as large as otherwise.

Countries with low level of technology can compensate the gap between them and advanced countries through adoption of new technologies or, even more, by imitation of them.

The transfer of technology can be realized in several ways:

- contracts that capitalize the inventions;
- training programs concerning operation of technical equipments;
- products that incorporate new technologies;
- the amounts of royalties, of taxes in license agreements.

Certainly, the adoption of new technologies by developing countries requires resources and efforts in order to adapt them to the companies and local conditions.

Abramovitz [1] uses the phrase "absorptive capacity" to define domestic capability for absorbing foreign technology. In particular, the lack of human capacity for adopting new

technologies is considered a crucial factor that limits the absorptive capability of a nation. Nelson and Phelps [25] constructed a model in which the facilitation of new knowledge is only possible when a sufficient level of human capital is present in a developing country.

Aghion and coauthors [2] highlighted a model which exhibits an inverted-U-shape relationship between innovation and competition. According to them, competition may increase the innovation profit margin for firms close to the technological frontier, but strong competition could also reduce incentives to innovate for laggards. Starting from this, another model was developed [5] taking into consideration also the size of company. The authors reveal an inverted-U-shape relationship that becomes flatter when the relative cost of R&D increases until it vanishes altogether for small firms.

Berger [7] examines technological progress and its effects in the banking industry, revealing the effects of Internet banking, electronic payments and information exchanges, as well as the differentiations in terms of profitability among the banks that have adopted these technologies and those that have not introduced them, productivity gains and scale economies that reduced costs.

The professor Mihai Drăgănescu [14] highlighted the role of technological innovation in the development of the productive forces of the society, arguing that in terms of economic growth should recognize that "the main driver of growth, economic development is the technology, namely technological innovation". He considered the technological progress as an endogenous factor of economic growth for the first time in 1974 [13].

Endogenous growth models can be grouped into models with or without R & D, i.e. those which stimulate growth in the absence of technical progress (AK models) and those according to which technical progress is the result of doing business in R& D field of developed countries [11].

Solow model indicates that growth ceases while the technical progress is not recorded. Entrepreneurs innovate, and as the market rewards their inventions, they will generate ideas, leading to a continuous technological

progress [31].

Moreover, a number of studies and rankings emphasize the role of technological progress and technological education and research development in the growth of the economic performance of regions of the world.

Technological progress has also effects the improvement in methods of production and the increasing of production, as well as the development of new products and services, new niche product opportunities, all of them with direct and indirect results on the benefits of companies and on national and, consequently on global economy. New technologies can change distribution methods and determine lower delivery costs.

Technological progress may increase also the scale economies, as well as the productivity, in terms of the quality of the service to the consumer, but these benefits may not be always easily quantified. There are also new technologies that have observable effects measurable through different methods.

2. INNOVATION AND RELATED FINANCIAL IMPLICATIONS

The development of an economy is based on capital and labor, extensive growth factors of it, but multiplying their effect is made on technology and technical progress, intensive growth factors of the economy. However, in order to be able to achieve excellence for intensive factors, it is necessary to allocate significant amounts for research and education, by the state, but also as a result of private sector involvement.

Awareness of the role and recognition of the importance of technological progress should be reflected at the level of governments in the direction of increasing budgetary allocation for research and development support, mainly because, besides direct economic effects, its support also brings indirect economic benefits.

Because innovation is essential for the development and long-term prosperity of a country, in this respect, in many countries government officials support research and innovation through a series of programs, including innovation among national interests. The implementation of new technologies in

various industrial sectors leads to reductions, sometimes considerable, of the operating costs. On the other hand, there are technologies that not necessarily make money, but their lack can generate costs or could determine loss of money.

The support by governments of the research programs leads to attract a large number of specialists and hence, the expansion and the development of academic programs and quality of the higher education. In turn, this will cause a chain reaction in the direction of increasing technological performance and thus, at a growing rate of economic performance of the company.

It also needs to take into account the fact that research in a particular area can be used successfully in other economic sectors, benefits resulting from initial investments in research can be extended in other areas, such be the social, environmental, political, etc.

The state can provide also tax incentives. Reduction of taxes for innovative companies is one of the ways by which the state supports these companies. To sustain research and development it can be used different subsidy schemes. The state can support also innovation in SMEs by the tax credits for R & D activities. More, public institutions can support innovative enterprises through certification of their innovative nature, thus facilitating the path to funding.

One of the criteria that are taken into consideration by public institutions in providing financing is the ability of the project to create new jobs.

The question is to what extent state expenditures for research and development or tax incentives can be recovered, because there is a risk that the benefits of technological progress to be reduced by diffusion of innovations abroad.

On the other hand, an important role has the education institutions through university research, alongside the government agencies, research centers and independent inventors.

Also, the organizations from different economic fields influence technological progress. In this direction, a study realized on the influence on technical progress in Switzerland [20] reveals the market organizations making the most important contributions to this, while the contribution of non-market organizations being relatively unimportant. These contributions vary

from one industry to the other.

The reason the USA is more successful and innovative than Europe is that it is less, not more, market-based [24]. In the EU investment in research and technological development is more market-based – and demonstrably less effective. Money spent on fundamental research has a rate of return of 28% a year, according to Frank Press of America's National Academy of Sciences, and technical innovation accounts for 44-77% of productivity increases." [16].

Another form of state involvement in the direction of technological progress is to stimulate private sector spending growth in research and development. The state can support companies in their attempt for innovation through grants, repayable advances, and guarantees for the loans they wish to obtain from banks or financial institutions.

Otherwise, at the micro level, companies that want to grow, appreciating the importance of innovation, direct considerable amount to support applied research, development and industrial. The different possibilities that have innovators from various sectors to value the technical innovations, determines variations in absorption of technological progress between different industries.

The problem of financing innovations is one of the biggest problem facing the companies that want to be innovative. The evolution of technology is fast enough and therefore the costs for companies to maintain a high level technology can be significant. But the access to finance, difficult in most research projects, become more difficult under crisis conditions, these activities being considered with a high risk and, consequently, investors don't show a keen interest in activities concerning innovation.

If access to private sources of funding is difficult, companies can apply for support from public institutions. Firms can submit project proposals for subsidy requests and possible grants.

The access to funding sources depends also on the size and characteristics of the company. Large, multinationals companies with a well-established market, can access a greater variety of sources than smaller companies, especially in relation to start-ups.

The most affordable source of funding is self-

financing. If the big companies have enough funds to enable them to finance their internal innovation activities, not the same can be said for SMEs. They have the advantage of greater flexibility, being more suitable for innovation. In the case of small business is quite difficult to incorporate and to develop complex information or technological systems that are quite costly. Consequently, the creation of partnerships between the big companies and SMEs can create benefits for both parties.

When it comes to using their own funds to support innovation, small businesses, which usually have a single owner would be considered advantaged. Decision on the use of its own resources belongs only to him. But the problem is the scarcity of own funds in such companies that can be allocated to innovation.

In general, within SMEs, the top sources of funding that is used to finance innovation are the personal savings of the associates, those of their family members or friends willing to lend them for certain periods of time, and the amounts on the personal credit cards. Also, reinvestment of profits may be an internal resource that is often used. The reinvested profit is one of the preferred sources because of the low transaction costs and minimum loss of autonomy. For short periods, ensuring the financial resources can be made also from advances received from customers or the amounts derived delaying payments to suppliers.

In case of a joint stock company, issue new shares can be a source of fundraising. But, for existing shareholders, it can lead to lower stock prices and a reduction in control of the company.

Besides the fact that they have fewer funds to finance innovation, SMEs are perceived as being more vulnerable at risk, given the much higher rate of dissolution of these companies on the market compared to large enterprises.

To obtain external funding, companies need to reveal private information about their project to financiers that creates some risks for them. But there is a moderation of the innovators to disclose the research results, being reluctant about ceding control of their own ideas to third parties or investors, in order to protect their inventions and the possibility to capitalize them.

Besides the business plan, innovative companies can present a set of indicators that

reflect their innovative activity, because it is difficult for them to distinguish the part of the financing agreement which is for innovative activities.

In the analysis of the potential of a company requesting financing it is necessary to be taken into consideration the human capital, knowledge, and talent of the human resources. Intangible assets may give an indication on the ability of companies to obtain added value by licensing technologies or creating new products, which might confer a superior market position. But intangibles are considered more risky than financial and tangible assets.

The banks loans are common source of financing, although the cost of money, the interest rate, is relatively high, but most companies already have a relation with a bank. Another attractive feature for entrepreneurs is that as long as the payments are met, the bank does not play a significant role in the governance of the firm.

In the analysis of the creditworthiness, banks follow the availability of collateral, the companies' ability to pay their mortgage, history of the company in dealing with banks, the rating of the company, the quality of business plan, innovative character of projects, business and quality management team, loans short-term payables. Good reputation in relation with banks or other financial institutions may also reduce financing constraints.

An entrepreneur's willingness to invest in the project or to offer collateral could serve as a credible signal of the quality of her project [8]. But for technology-based SMEs, in early stage, it is difficult to demonstrate the quality of projects. More, they have not yet developed a reputation in the field, or human resources cannot be valued as a capital that can weigh for investors. Moreover, in general, foreign investors and banks have difficulties in evaluating the human capital.

The effect of financing of the innovation is difficult to anticipate, to quantify. Sometimes the financing could be ineffective or even worse, could have opposite effects to those estimated. On the other hand, innovations may involve a longer duration for commercialization than for their realization. Companies need to provide

guidance on its ability to rapidly increase the rate of return,

In order to have easier access to bank lending, banks would be useful to evaluate the ability of firms to increase productivity in the long term following financing innovation activities.

A study made at European level revealed that credit scores, for example, often have no relationship to measures of industrial performance, such as productivity [9], “most likely due to the higher risk profile of those firms that engage with innovation. Bank lending to innovative firms of all sizes will increase only when credit scores do not penalize the higher risk associated with long-term productivity enhancing investments”.

It is important for innovative companies to be able to explain the business value of innovation. Investors use for analyzes the companies' financial reports. But they offer limited information on innovation activities. In this regard there are used the rates of development at different financial values (sales, earnings, book value) which provide indications about the existence of a development strategy for new products or services.

As a company can be considered innovative, it needs to be able to improve its products or services, production methods and processes, to introduce new business or marketing strategies and tactics by which to increase its competitive position on the market. It is necessary that these innovative companies to be able to demonstrate direct relations between their innovative works and their financial performance.

Internal and external financiers are more interested in products and services improved than new ones, because the first offers greater security about the capacity of the company to improve its financial position after these activities.

But innovation requirements are different from one market to another. If for some products or services there are preferred classical versions, in other areas there is a constant pressure to achieve new or improved products, such as in the electronics and electrical markets. Moreover, the result of innovation can increase market share and revenues. Successful innovative companies generate positive net cash flows that will attract investors.

Another source of funding for innovation can be the investment funds. Financing through an investment fund has the advantage that they allow more time for the company to demonstrate its capacity for innovation. The merger or acquisition may be also ways to finance innovation.

Public-private partnerships can be a source of development and financing by dividing risks. Development of consortiums between SMEs, large companies, local institutions, universities, research institutions, networks of clusters or platforms, technological innovation for the development of innovation projects, incubators, joint demonstration projects, testing customer-providers alliances for industrialization and commercialization could support innovation of SMEs. Clusters have the role of poles of competitiveness, having the ability to absorb the impact of open innovation.

3. CONCLUSIONS

Globalization increases the pressure on SMEs in their attempts to be competitive, but it offers, among many other advantages and disadvantages, the possibility of easier access to technical resources. The access to the benefits of technological progress can facilitate their efforts towards increasing competitiveness. The transfer of technology, knowledge and skills enables SMEs to be competitive, meeting the requirements that must be fulfilled in order to enter on new markets.

Under current conditions, one of the difficulties they have to face is the access to funding sources for research and development, key elements for new technologies. Access to financial products and services enables investments in new equipments which contribute to technological progress of the companies. But, uncertainty and risk associated with research and development projects reduces the chances of financing these types of projects.

Among the forms of funding can be found financing through own sources of capital, investment funds, financing the acquisition or merger, bank loans, loans by issuing bonds, financing for investments in new technologies or new product development, capital investment, investments in working capital, equipment

leasing, financing export trade credit, franchising.

At the macroeconomic level, the focus on technological development will lead to changes in industrial structure and increase economic development. Innovation and technology transfer can be considered as key factors that can achieve sustainable economic development.

The state can intervene by providing grants for research and development expenses. Also, among the most important contributors to technical progress are the education and training. Education and training in engineering, physics, materials science, are seen determinant to technical progress.

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