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# BUSINESS RESEARCH, DEVELOPMENT, AND INNOVATIONS IN ECONOMIC RECESSION

**Karel Mráček***

**Abstract**

*The article is devoted to the enterprise and state reactions against the impact of economic crisis on business R&D and innovation. It analyses strategic approaches and solution of enterprises during the crisis period with respect to ensuring competitiveness when the economy rebounds. There are used findings from surveys realised in the Czech Republic as well. The article is concluding with the context of general environment for business R&D by analysis of economic stimulus packages introduced by governments as measures in response to the crisis.*

Keywords: *economic recession; strategy; competitiveness; business research and development; innovation*

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## 1. Introduction

The contemporary financial crisis has been swiftly followed by an economic recession on a global scale. Individual states, EU authorities, and management of private enterprises attempt to counteract the impacts of the recession by a series of measures. At the macro- as well as micro-level approaches can be identified that variously emphasize and combine short-term and long-term standpoint in decision making. Economic recession is typically accompanied by an expectation of certain unfavorable impacts in the fields of enterprise research and development, innovation effectiveness, and other determinants of the long-term economic growth and the creation of knowledge economy. To a certain extent, this is affirmed by a time data series from the relevant statistical sources (OECD, EPO, etc.), which address trends in aggregate business research and development expenditures, patent applications, or trademark applications for new goods and services. Increase of aggregate business expenditures for research and development and innovations typically follows the GDP growth and, on the contrary, lower rate of the increase or, respectively, absolute decrease of these expenditures follows a lower rate of the GDP growth (see, for example, the early 1990s and the year 2000). Likewise, the contemporary economic crisis has manifested itself worldwide in this manner. Many companies in the developed economies have witnessed either lower expenditures or their lower rate of growth as soon as the last quarter of 2008. According to a survey by the McKinsey company from the beginning of 2009 (conducted on almost 500 large enterprises), this trend is confirmed: lower expenditures on research and development in 2009 had been expected by 34 % of the respondents, with only 21 % of the respondent expecting an increase [2009b].

## 2. Reaction of enterprises in economic recession

In a period of economic downturn, firms struggle above all with insufficient demand and increasing financial difficulties. Efforts at overcoming or surviving the effects of these adverse circumstances find an expression at the managerial level in a search for strategic approaches that would adequately lead to an effective solution. In choosing between various options, the short- and long-term decision making perspectives come into consideration. Often, the corporate strategies are formulated in the direction of cost reduction, in which the short-term perspectives usually predominate, but with an accomplished optimalization of costs (what costs and in what rate should be reduced), the future, post-recession competitiveness of the company can also be taken into account. Some firms do not concentrate solely on the cost reduction, but instead try actively to seek new opportunities (new markets, segments, etc.). From the long-term perspective, a strategy is important that is based on the effort to secure already at this point the competitiveness of the enterprise for the revival phase. It usually takes into consideration the typical course of demand after the end of recession.

Thus, it is of primary significance, according to some top-level managers, to find a suitable way for maintaining the research, development, and innovation activities, and the overall qualified potential in the enterprise during an economic recession. Especially the large enterprises in the field of information and communication technologies attempt to keep their investments into research, development, and innovations at the level of previous period. For example, the Intel Corp. (the biggest world producer of microelectronics), despite recording lower earnings lately, shutting down five of its manufacturing facilities, and laying off its employees, declares that it will continue in its innovation strategy to introduce new chip architecture every 12 months. On the grounds of the ongoing research and development, this company should by the end of 2009 announce a new

(faster and more effective) microprocessor on the basis of 32 nanometers chip [O'Grady 2009]. Microsoft raised its annual research and development expenditures for 2009 to 9 billions USD, from the previous 8 billions. Honeywell International Inc., which has for a number of years diversified its investments and activities, continues as well with its investments in research, development, and innovations during the economic recession, so as to have new products available when the economy rebounds. Disregarding the economic volatility, it attempts to keep the level of research and development finances stable. Other examples of large enterprises that gear towards maintaining at least the status quo in the expenditures on research, development, and innovations, could be pointed out.

Continuation of the aforementioned investments should secure competitiveness to the companies once the economy rebounds and restores its growth. It is estimated that the time and the resources devoted to research, development, and innovations in the recession period will yield benefits for the enterprises with the view of the function of relation between supply and demand in the post-recession phase, when the consumers are once again able and ready to spend money and invest. Their demand is not usually focused on the hitherto existing products and technologies, which they dispose of already; rather, they have a growing interest in new and improved products and technologies. The sales of new products (moreover, often with higher prices) thus helps firms to recover more quickly from the recession. For this reason, it is necessary to have the product and technology innovations ready before the new consumer demand picks up.

It turns out, however, that the differences in approach among managements of individual companies at the times of recession have to do also with the various position of given branch and field in the structure of economy, which is also often related to different degrees of technological progressiveness (and the resulting speed and impact of the crisis' effects). It is also necessary, in the context of economic recession, to consider the

different circumstances for maintenance of some useful activities for future development in large enterprises and in small and medium firms. It is precisely the situation of many small and medium sized enterprises that becomes an important issue, specifically because their capital position is naturally weaker and more complicated in comparison to large corporations. Small and medium enterprises under the conditions of economic recession reduce more often their expenditures on research, development, and innovations, as well as educational activities; or they even begin their cost reduction with these expenditures and thus commit a strategic error. As a consequence, they will not be sufficiently prepared to introduce new or improved products, developed in the recession period, when the economy rebounds and hence their competitiveness will lessen. Due to allotted losses, many small and medium sized enterprises cannot even benefit from the advantages of tax allowances as one form of the support policy, that include, e.g. in the Czech Republic, the deduction of the costs for research and development from the tax base, or in other countries, a tax credit for research and development. On the other hand, the small and medium sized enterprises in the countries that use this kind of tax credit usually have an option to include it in their assets in the balance sheet with the view of its actual capitalization in future, after the restoration of profitability.

The potential reduction of the expenditures that are needed for the future competitiveness of the firm (essentially, the expenditures with longer-term return, such as the research, development, and innovations expenditures) occurs during an economic recession even when the management is fully aware of their importance for the further development of the firm. Funding of these expenditures is influenced in particular by the state of cash flow (of real money). In economic crisis, the cash flow can diminish, especially as a result of diminishing sales (less orders), which is moreover often accompanied by an increase in unpaid outstanding debts, potentially leading to secondary insolvency. The mounting problems thus occur even

when external sources for research, development, and innovations are secured. The possibility of obtaining resources from banks and investors is confronted with their heightened risk aversion under the conditions of crisis. Banks conduct themselves more carefully and restrict credits and loans. These adverse impacts of the economic recession are felt heavily by small and medium sized enterprises. For example, in the case of small, technologically oriented firms, credit and loans are almost out of question nowadays. Some developed economies, where the risk capital has a certain considerable role in the support of new technologies, a significant decrease in these investments is also observable. For example, according to National Venture Capital Association, the risk capital funds in the US in the first quarter of 2009 invested only 3 billions USD, which is 47 % less than in the fourth quarter of 2008 and actually the least since 1997. The decrease of investments comes also from the business angels. Under the worsened economic conditions, the firms tend to take on short-term and low-risk research and innovations projects, while in the same time abandoning long-term and high-risk projects. This has a certain effect on the possibility of further use of the qualified research and innovation potential in the firm. Small, innovative firms dispose of primarily intangible assets (know-how, patents, etc.) that particularly difficult to transform into liquid assets during the economic crisis. Moreover, as has been mentioned already, these firms do not have many opportunities to reach out for money from various external sources. Therefore, more attention is paid to creating possibilities for obtaining public funding for co-financing of research, development, and innovations (see the various governmental programs for the support of research, development, and innovations, or financing from the structural funds in the EU member countries, etc.).

However, the period of economic crisis should not be only seen as a risk or a threat for research, development, and innovations in firms, but also as a certain opportunity to improve the system of their management

and control and reevaluation of the portfolio of research, investments, and other projects with regard to the acceleration of strategically promising and competitive projects in the future.

It should also be noted that the economic recession often manifest itself as a feeding ground for non-technological innovations. It is especially in the times of economic recession or critical situation that the firms typically create many non-technological innovations (in the field of management and organization, marketing, etc.), which achieve a considerably fast dissemination and can be effectively used in any phase of the economic cycle. Among the examples of new methods (innovations) of organization and management in firms, introduced in the times of a crisis, the following can be listed:

- Lean manufacturing, which is a production based on five fundamental principles; added value from the customer's standpoint, identification of the value flows and elimination of waste, continuous flow of products, production drawn by the customer's demand, and aiming for perfection. Essentially, it is about excluding from production all that brings no benefits to the customer, shorten the time of the production, shorten the stock turnover and distances, making the premises area smaller etc., in order to prevent waste in the production process and bring about cost savings.
- Outsourcing, this is achieved when a firm delegates its activities that do not have the character of main operation to other, specialized firms (subcontractors). Outsourcing was developed with the aim to allow a cost reduction to a firm, while in the same time give it more space for solving the key tasks of increasing its competitiveness.
- Reengineering, which focused on the rebuilding of the organizational structure of the firm with the aim of optimalization

> of the process of production and other activities in the firm, in order to make its functioning more efficient and improve its performance. In-depth analyses are the starting point. Often, this method is associated with the process management, which aims to eliminate superfluous routine procedures, duplicated activities, etc. and to find new ways and procedures. In the recent years, however, reengineering has been reduced to a great extent to a means of radically lowering the number of employees; and after such conceptualization of the process, many firms ended up with a weaker position on the market.

In the times of economic recession some other innovations in the management originated, such as six sigma for the quality control in manufacturing companies as well as service companies; the method of Balanced Scorecard destined to control the effectiveness of the enterprise; 360 degree reviews for the management of human resources; new procedures in logistics; or planning scenarios in preparation for the possible variants of development.

The search for operational excellence in a firm, with positive financial effects – that include maintenance or increase of effectiveness, increasing the effectiveness of processes, providing products and services of higher quality, better motivation of employees, tuning of the managerial system, etc. – gets new impulses precisely in the times of economic recession. The management of the enterprises in this period of the economic cycle finds itself under bigger pressure from the owners, when it comes to such issues as profitability, ensuring of the planned investment returns (innovations), formation of the sufficient cash flow, etc. Management has to meet new challenges for transformations, which it would not dare to attempt in the boom period and which are also harder to assert during a successful growth. In the crisis situation, the aversion usually weakens to changes in the system of organization and control and in the manufacturing proce-

dures. The shared feeling of danger unites and motivates owners, managers, and employees to implement changes, often at the cost of considerable financial losses that may, however, turn out as beneficial for the firm in the long run.

The Czech firms as well strive to react to the contemporary economic recession by certain changes in organization and management. For example, there is an emerging trend for temporary association of exporting companies in alliances, within which the firms exchange information about foreign markets and clients or make use of common presentation on exhibitions and trade fairs (with the aim to reduce the costs of marketing), etc. Another type of issue that they face is an effective use of relatively expensive technology or improvement of teams (support for productive and key employees, taking advantage of the available qualified workers on the labor market). Under the pressure of the crisis, the firms also raise their willingness to seek and conquer new markets and their segments.

With the goal of gaining more detailed knowledge of the current situation in the firms during the economic recession and of the measures that they consider taking, some inquiries have been conducted. For example, the Confederation of Industry of the Czech Republic (CICR), has administered a quarterly survey since the beginning of 2009 [2009a], in order to learn about the actual standing of the Czech enterprises and about their expectations in the current conditions of the economic recession. These surveys by CICR are focused primarily on the capacities utilization rate in the Czech firms and on the development of their contracts, and the steps that they take in this respect. The situation in the business research and development is not specifically addressed and, likewise, the results also do not allow for conclusions about the current attitude of the enterprises towards innovations. Nonetheless, the adverse development in the recorded indicators can have negative effects on the research, development, and innovations, namely if the trends in obtaining contracts will not

get reversed. Similarly, the worsening of the payment moral (increasing outstanding debts and the related risk of secondary insolvency with the impact on cash flow) can significantly interfere with the contracts for the research and development solutions. The problems with maintaining research and development will grow and in many companies this field could be attenuated. A positive phenomenon is, however, an often manifested consciousness of the need to keep the qualified employees (a category that includes the research and development employees in the firms), in order to prevent their current or future passage over to competitors. A firm would thus end up weakened in the crucial period after the economic recession, when it will be urgent to react flexibly to the restoration of economic growth and to the supply bids by the competitors.

The impact of the economic recession (especially in terms of rapidity and force) varies in individual branches and fields also with regard to the progressiveness of utilized and supplied technologies. This was confirmed in a research conducted by the agencies CzechInvest and Czech ICT Alliance at a conference "Information Technologies in the Crisis and their Post-Crisis Development", where the respondents were five dozens of large, medium, and small enterprises in the field of information and communication technologies [2009c]. According to the results of this survey, almost every other of the interviewed companies with the focus on these technologies in the Czech Republic expected to have their turnover in 2009 higher or the same as in 2008. Nonetheless, despite these positive economic outlooks under the conditions of economic recession, 80 % of the respondents have already encountered the need to limit or reduce budget or having to postpone contracted projects or even to have them cancelled. About a half of the responding companies attempt to introduce innovations on the market, namely new services, but only a small portion of the clients have currently a demand for completely new services, which was actually confirmed also in a below-mentioned study by the Technology Centre of the Academy of Sciences of the Czech Republic. In the ag-

gravated economic situation, many firms also plans to make a wider use of European and national subsidies programs, as it shows also in the interest for a new Technological Platform for IT Services, which includes also the universities.

Only the survey carried out by the Technology Centre of the Academy of Sciences of the Czech Republic followed in detail the issue of research, development, and innovations in the context of the effects of economic crisis.

## 3. Results of the survey by the Technology Centre of the Academy of Sciences of the Czech Republic

The Technology Centre of the Academy of Sciences of the Czech Republic (TSASCR) conducted a rapid survey at the beginning of April 2009, using an electronic questionnaire, among enterprises with research activities (with a considerable involvement of the author of this contribution). The aim of the survey was above all to find out what the basic tendencies are in the behavior of enterprises under more difficult economic circumstances in terms of the implementation of research, development, and innovations activities [Pazour, Mráček, Kučera 2009]. The survey research focused on finding out to what extent does the currently used strategy of cost reduction in private sector (especially in small and medium sized enterprises) affect or could affect also the reduction of knowledge economy factors (RDI, lifelong learning). The current economic recession is now also related to suspension of investments. The actual ability of firms to co-finance projects implemented in the framework of relevant operational programs with funding from the EU structural funds has also become an issue. Overall, the economic recession can eventually negatively impact also the absorptive capacities of enterprises regarding the results of research and development and the realization of innovations.

In this context, the respondents (firms) were answering questions regarding their own research and development, utilization of external research and development, the demand trend for research and development solutions, the trends of expected progress of expenditures on research and development, the number of employees directly working on research and development, the preferences in cost reduction in the aggravated economic situation brought about by a decrease in the number of contracted orders and lower revenues, the current and the expected use of public funds (including the structural funds) as a resource for financing research and development in enterprises. In this survey, the respondents also commented on some potential or actual measures taken by the state to mitigate the impacts of the economic recession (from the perspective of **t**heir influence on research, development, and innovations) and also on the limiting (holding back) factors of the corporate research and development in the long term.

A certain problem associated with this survey, as with other current surveys (see e.g. CICR and other subjects, which, unlike TCASCR, can nonetheless take advantage of their membership base) conducted without a interviewers network, is their relatively low rate of return during the ongoing economic recession. The results of the TCASCR survey with its approximately 10 % rate of return have rather a character of a probe. Still, the collected results conform overall to other individually researched or presented information on the behavior of firms under the conditions of current economic recession, and can thus be relevantly considered and regarded as indicators of main trends. Furthermore, the sample of the firms that have responded is relatively balanced in terms of the size structure. The TCASCR survey so far remains to be the only more extensive survey focused on the issue of corporate research and development in the current economic recession in the Czech Republic. Below, some of the relevant results of the TCASCR survey are listed and evaluated.

### *In-house and external research and development in the sample of firms*

More than 90 % of the firms – respondents – carries out their own research and development for their own needs, and of these, the absolute majority (almost 90 %) uses some cooperation with other subjects for solving these research projects. The cooperation is in many cases carried out with a number of subjects (from the public as well as the private sector). The decisive role in it is played by universities and other firms with research and development facilities. The institutes of the Academy of Sciences of the Czech Republic (ASCR) are involved only in a small portion.

The external research and development is used, and hence purchased, by 40 % of the firms that have responded to the survey. In these cases, the predominant partners are the universities and the institutes of the ASCR hold the last position in these contracts. Overall, these results only confirm that the private sector still directs its relationships with the institutions of public research primarily to the universities. The expectations that in 2009 the firms using external research and development would reduce its purchase from the universities, research institutes or other subjects were identified with about a half of these firms.

From the aggregate of respondents, 45 % conducts research and development not only for its own needs, but also based on contracts. The number of those who have expected a decrease in demand for their research and development in 2009 is twice as much as the number of firms who had experienced a fall in these contracts in 2008. In the given sample, it amounts to roughly a half of all the firms that run contracted research and development. About 30 % of the firms with contracts for research and development solutions do not expect the level of demand to change.

### *The expenditures on research and development and the research and development employees*

In the framework of the survey, the expectations of enterprises in the economic recession were researched with regard to the developmental trends of their research and development spending and the number of research and development employees (see table 1 and 2).

The presupposed evolution of the research and development expenditures and the number of employees who are directly engaged in the business research and development are, in comparison to 2008, characterized by a certain trend of reduction in costs and number of employees in 2009, but the most common response is to maintain the status quo (evolution without change). If in 2008 the aggregate expenditures on research and development were raised by 34 % of respondents, in 2009 only 14 % of respondents expect such a raise. On the contrary, the number of respondents that will decrease the research and development expenditures in 2009 has doubled in the given sample in comparison to the previous year. The firms that decrease their research and development expenditures or that consider this option are typically those that want to limit the purchased research and development. In comparison to 2008, the number of firms that do not expect any changes is slightly higher (about 54 %).

Table 1: *Development trend in R&D expenditures (ratio of firms – interviewed in %)*

| **R&D expenditures** | **Increase** | **No change** | **Decrease** | **Total** |
|---|---|---|---|---|
| 2008 | 34 | 50 | 16 | 100 |
| Expectations in 2009 | 14 | 54 | 32 | 100 |

Similarly, when it comes to the number of research and development employees, the number of firms that were considering its downsizing or

had done it already, has doubled annually. Only about 7 % of the respondents were contemplating hiring rise. However, most of the firms (73 %) expects that they will manage to keep the number unchanged, which is a fairly positive signal. On their part, it should be regarded as a rational effort (despite a possible decrease in expenditures) to maintain the existing solving teams and keep the qualified workforce that is needed for the period of conjuncture.

Table 2: *Development trend in R&D employees (ratio of firms – interviewed in %)*

| **Number of R&D employees** | **Increase** | **No change** | **Decline** | **Total** |
|---|---|---|---|---|
| 2008 | 24 | 66 | 10 | 100 |
| Expectations in 2009 | 7 | 73 | 20 | 100 |

With the above mentioned future expectations one has to, however, take into account the specific field of the firms. The enterprises with activities in information and communication technologies, nanotechnologies, biotechnologies, and other progressive technologies declare in 2009 more efforts to raise their research and development expenditures as well as the number of employees in research and development. If it were possible to talk about clearing the market from economically weak and problematic business subject as a kind of positive effect of the economic crisis, then it would make sense to connect this positive effect with a "creative destruction", which means that there is a withdrawal from the supply of less progressive and less competitive technologies (including the reduction of costs for their research and development).

***The research and development expenditures in the context of overall savings in firms***

The key question of the survey was, what is the position of research and development expenditures in the reaction of firms to the economic recession by introducing cost reduction (see table 3).

Table 3: *Position of R&D expenditures in the view of the cost savings in firms*

| **Cost /ranking** | **1** | **2** | **3** | **4** | **5** | **Weighted average** |
|---|---|---|---|---|---|---|
| Administration expenses | 20 | 9 | 5 | 3 | 1 | *1,8* |
| Investment in production | 10 | 11 | 4 | 1 | 3 | *2,2* |
| Labour costs | 7 | 13 | 8 | - | 6 | *2,6* |
| Further education and training expenses | 7 | 3 | 8 | 6 | 8 | *3,2* |
| R&D expenditures | 3 | 2 | 3 | 15 | 3 | *3,5* |

It was inquired what costs (expenditures), under the worsened economic situation (less contracts, lower turnover), will the firms reduce and in what order (with what priorities), and in this process of attempted savings and costs optimalization, what is the position of the research, development, and education expenditures, or the expenditures related to the building of knowledge economy. The responses of the interviewees regarding the expectations about the costs of research and development in 2009 suggest that about one third of them will decrease these expenditures in comparison to the previous year. The question, however, remains, what is the position and urgency in the intentions of the firms of the possible "cost cutting" in research and development. The respondents were offered a choice of five types of cost, or expenditure items, and it was in

their discretion to fill in others, with the view of establishing an order of their reduction in consequence of the economic recession. The results are presented as weighted average, where the weight is the number of respondents, who had assigned a certain cost (expenditure) item to a certain position in the scale (from 1 to 5). The lower the weighted average of the given cost (expenditure) item is, the higher is its priority when it comes to cost reduction.

The results suggest that the interviewed firm focus, or will focus, on the reduction of administrative costs, then production investments and labor costs. The administrative costs also unambiguously appear the most often on the first position (more than 50 % of cases), regardless of the size of the company. Medium and large enterprises intend mostly to reduce production costs after the administrative costs, while small enterprises prefer the reduction of labor costs and further education and training costs to the reduction in production investments. In comparison, the occurrence of reduction of research and development expenditures at the first three positions is much rarer. As far as the reduction of education and training of employees costs are considered, in majority of firms it has higher priority in the attempted savings in comparison to the research and development expenditures. It is worth mentioning that the reduction of the employees' education and training costs had been practiced by many firms already during the period of economic growth. This was partly due to the interest of corporate management to maximally "exploit" the employees while the contracts were accumulating. Especially the small and medium enterprises showed a rather downward trend even when it concerned various educational and training actions financed by the structural funds (the impact on the firms being only the duty to adhere to the *de minimis* rule). In their responses, some respondents also emphasized as a primary source of savings the limitations imposed on business trips, reduction of expenditures for exhibitions and printed advertising (catalogues, etc.) and some other kinds of expenditures.

According to the collected results, the reduction of research and development expenditures is not a priority in the majority of firms in the efforts to find reserves, which is surely an important signal. Naturally, there are certain differences from the perspective of branches and business fields. Namely, the firms that develop progressive technologies (information and communication technologies, nanotechnologies, biotechnologies, etc.) do not expect to reduce these costs. Nonetheless, supposing that the economic situation may worsen even further, it can be assumed that such kind of reduction will be carried out also by these firms.

### *The use of public funding as a source of financing research and development in firms*

Currently, 47 % of respondents make a partial use of public funding (from the programs of the Ministry of Industry and Trade and other ministries, or the EU structural funds) for its research and development. At that, 17 % of respondents have already received a subsidy from the EU structural funds in the framework of the Operational Programme Entrepreneurship and Innovations (OPEI); essentially for the projects in the programs of Potential and Innovations. The absolute majority of respondents have not thus far received or applied for this subsidy. An application for a subsidy from the EU structural funds in the framework of OPEI will be still filled by about 40 % of respondents, with the 70 % of them propose the projects to the Innovations program and a few also to the Potential program. Nonetheless, the majority of respondents do not consider getting a subsidy from OPEI. Some respondents also mentioned that they would attempt to get a subsidy from a new program at the Ministry of Industry and Trade for the support of industrial research and development, named TIP.

The respondents also commented on what they considered to be currently limiting factors for sending in projects' applications to the OPEI

programs. The expectation that in the current economic recession the firms would worry about not having enough financial means for co-financing was confirmed. This factor was listed by 51 % of respondents. The second most listed factor was the difficulty of preparing an application (32 % of respondents). This problem had been pointed out by many firms already in the previous programmatic period 2004-2006. Another possibly limiting factor is a reorganization of a firm (under the influence of savings measures adopted in the economic recession), the lack of information about the individual programs of support, and the lack of qualified workers (probably also from the perspective of sustainability). Having the lack of information about the individual programs of support listed is somewhat contrasting with relatively extensive media campaigns, the number of the seminars devoted to this issue that were held, and the plenty of information that is available on the relevant websites. Surprisingly, this limiting factor for a project application is expressed also by some of the firms operating in the field of information technologies. This may be partially caused by the fact that these firms are small and do not dispose of sufficient human resources and hence are incapable of fully monitor and use the existing available information. Other listed factors include the tuning down of research and development activities in the firm, sufficiency of commercially successful projects (IT, optoelectronics), the hitherto failed project applications and the manner of their evaluation, the administrative demands in the course of the project implementation, the discontent with the costly supervising actions by the state in the course of the project implementation, etc.

### *The benefits of state interventions for mitigating the impacts of the economic recession on research and development*

The interviewed firms also commented on the possible state interventions for mitigating the impacts of the economic recession on business research

and development, namely from the perspective of their benefits for the firm itself (see table 4).

From the possible state interventions for mitigating the impacts of the economic recession on business research and development, the respondents mostly emphasized the decrease of social and health insurance (regardless of the size of enterprise), tax allowance for contracted research and development (preferred mostly by small enterprises), and the accelerated depreciation of instruments, machines, and equipment (preferred more by the medium and large enterprises). With a certain distance, the respondents listed the provision of soft loans (typically with lower interest rates, deferred payments, etc.) and the granted vouchers for the purchase of minor studies. Apart from the measures listed in the questionnaire, some respondents also listed and commented on some other suitable measures, such as decrease of direct taxes, flexibility of the labor market including the option of quicker dissolution of the employment contract, subsidies for new job positions, overall availability of credit, simplified administration, privileges for Czech products, etc. The number of these additionally listed measures was not very significant and thus it can be assumed that the proposed selection of measures to be evaluated by the respondents appropriately covers the actual problems of the research and development support in the private sector. Concerning the collected answers, it must be noted that some respondents only marked one or two measures as important and several others made no choice (they used the answer "do not know"). However, usually, the respondents evaluated all the five options listed in the questionnaire and ordered them according to the perceived benefits. The overall results are presented as weighted average, where the weight is the number of respondents, who ranked a given measure in the scale (from 1 to 5). The lower the weighted average is for a given measure, the higher is its priority from the perspective of the benefits.

Table 4: *Ranking of contribution of government measures to the alleviation of the negative impact of recession on R&D (by firms)*

| **Government measures** | **1** | **2** | **3** | **4** | **5** | **Weighted average** |
|---|---|---|---|---|---|---|
| decreased social and health insurance | 14 | 9 | 6 | 4 | 0 | *2,0* |
| tax allowance on external R&D | 13 | 6 | 6 | 2 | 2 | *2,1* |
| accelerated depreciation of equipment | 11 | 12 | 5 | 4 | 1 | *2,2* |
| granted soft loans | 5 | 4 | 4 | 5 | 4 | *3,0* |
| granted vouchers for smaller studies purchase | 2 | 3 | 4 | 4 | 7 | *3,6* |

***The limiting factors of business research and development***

In the context of the impacts of the economic recession on the overall environment for the corporate research and development, the factors limiting (holding back) research, development, and innovations in firms in the long-term were also a part of the conducted survey. Their impact can have a more significantly negative effect precisely under the worsened economic conditions. In order to determine the answers, a more subtle seven-degree scale of evaluation was used, ranging from non-limiting (1) to very limiting (7).

The factor significance of the long-term limiting factors of research and development in firms has, according to the conducted survey, the following order (from the most to the least limiting according to the rate of average significance):

1. Difficult access to external funding
2. High economic risk
3. Insufficient legislation flexibility
4. High R&D expenditures
5. Low consumer interest in new products
6. Generally little dynamic and innovative market
7. Lack of qualified employees
8. Lack of market information
9. Insufficient technical equipment
10. Inelastic enterprise organizational structure
11. Insufficient premises

Unlike in the previous similar surveys, there were no significant changes concerning the ordering of various economic factors as the most limiting. Very much according to our expectations, the respondents were primarily pointing out the difficulty of access to externals sources of financing (65 % of the respondents who answered the question considered it as a limiting factor, with one quarter of them using the categorical expression "very limiting"). This fact, however, has to be evaluated more closely in the confrontation with the above mentioned utilization of public funds as a resource for financing their research and development. About 54 % of respondents consider in various degrees as a limiting factor the high costs of research and development, and about the same percentage listed the high risks associated with research and development (one fifth of these respondents even designated these factors as very limiting). The same percentage of respondents also mentioned the insufficient legislative flexibility as a limiting factor to a varying degree, which is probably influenced by the slowness of the process of adopting the needed legal regulations in the field of economy and research and development.

On the other hand, the insufficient premises available for conducting research and development activities seem to be an absolutely non-limiting

factor from the perspective of the respondents. Of the respondents who answered this question, 87 % is basically not at all limited by a lack of sufficient premises; the categorical expression "not at all limiting" was used by as much as 45 % of the respondents. All this while the extension of the premises for research and development in firms (new buildings, laboratories, etc.) is one of the goals of the program Potential in the framework of the Operational Programme Entrepreneurship and Innovations. Building of new facilities (areas for scientific-technological parks and entrepreneurial incubators) was the primary aim of the program Prosperity I. as well. A partial influence in this case may be represented by the temporary overcapacity in facilities (available areas) in the consequence of decrease in contracts in the current economic recession. Similarly unambiguous attitude of the respondents, as with the sufficiency of premises for research and development activities, can only be found in the evaluation of the elasticity of enterprise organizational structure. Almost all the respondent did not experience the inelasticity of the enterprise organizational structure as a limiting factor in any way.

Different situation exist when it comes to technical equipment, where there is an overall content expressed, however, for about one third of the respondent this is a somewhat limiting factor of their research and development (nevertheless, not a very limiting one). Comparably somewhat more limiting factor for the interviewed firms seems to be a lack of qualified workforce, in a few cases we can even encounter the categorical expression "very limiting". Overall, however, in the sample of respondents the perception of this factor as non-limiting prevails.

Another group of the inquired factors was related to market. When the respondents were commenting on the low interest of consumers for new products, about 42 % of theme marked it as a limiting factor to a certain extent. As rather limiting or limiting factor it is most often considered by firms in the field of progressive technologies, which can point to some enduring problems with technology push in the condition of Czech

economy. This corresponds with designating market as insufficiently dynamic and innovative by roughly the same number of respondents. With both of these evaluated factors, as well as with the factor termed as the lack of market information, the majority of respondents took the standpoint that they are not essentially limiting factors. Considering the collection of market information, this could be a positive expression of the gradually growing interest of firms in the use of marketing tools and activities.

**Selected conclusions of the TCASCR survey**

- Businesses expect some decline in the research and development expenditures, but the emphasis of the cost optimalization is mostly oriented to other areas (in the majority of firms, research and development is not the priority in the search for savings, and the attention turns towards it only after other alternatives of cost reduction are exhausted).
- A positive signal is the effort to keep the qualified employees in research and development, which is a presupposition for competitiveness of the firm after the end of economic recession.
- The above-mentioned facts signal also certain appreciation of the strategic role of research and development for business innovation activities and future competitiveness.
- Concerning the short-term government measures for mitigating the negative impacts of the economic crisis, the enterprises with research and development activities prefer to decrease social and health insurance, tax allowance for external research and development (thus for not existing), and accelerated depreciation of equipment, which is partially included in the governmental policy of the Czech Republic.

- Concerning the long-term government measures of governmental policy of the Czech republic that should also react (in the context of general environment for business research and development) to long-term limiting factors, there is, to a certain extent, lack of a support for more effective access to external funding**.**
- The conducted survey was a certain confirmation of some differences in behavior and reactions to the current economic recession between large enterprises and small and medium enterprises**.**

## 4. Governmental policies in the developed economies in the time of the economic recession

The governments of the developed economies had begun to react to the economic recession by creating so-called stimulus packages. To a great extent, the measures included in these packages are directed to raising demand in the short-term horizon, with the view of protecting existing job positions. A typical example would the introduction of the so-called scrappage incentive in the countries with a relatively large share of the car industry on the industry as a whole. This is, however, a non-systemic measure that only revives the economy in the short.-term perspective. The majority of countries makes use of temporary and transversal measures that are set up in order to support the business sphere; measures such as lowering taxes including the value added tax, decreasing the taxable portion of the labor costs (lower rates of social insurance for the employers and employees), short-term guarantees of credit, etc. There are also measures oriented on the incentives to household consumption and their protection from the negative influences that they must endure in the times of recession.

Nonetheless, many of the developed countries governments attempt to facilitate medium- and long-term growth by investments that affect the supply. These include:

- support of research, development, and innovations
- support of innovations and business (with the focus on especially the small and medium enterprises, risk capital, etc.)
- investments into human capital, education and training
- investments into environmental technologies and innovation with regard to cutting-down the energetic demands and achieving sustainable economic growth
- improvements of the infrastructure (e.g. by the investments into transportation infrastructure, information and communication technologies, etc.)

These governmental measures are motivated by the need of the economy to get out of the crisis with its competitive position unimpaired and to ensure competitiveness and new bases for future growth. Particularly the investments into research, development, and innovations have an important place in the context of long-term growth and they can be said to be a priority in the economic stimulus packages that are being created [2009b]. The governments of the developed countries attempt in this framework to further implement goals in the expenditures on research and development such as raising or maintaining the amount of public funds for the support of research and development and the investments into the research and development infrastructure, or the stimulation of private investments into research and development (e.g. by using tax instruments, public procurement, etc). The support the implementation measures in the favor of small and medium enterprises, maintenance of the employment rate in research and development, and increase of skills and innovations. In some cases, these measures address the cooperation of public and private sectors, transfer of knowledge, or international coordination, which, however, has

a rather marginal character (they only concern natural sciences or "green" technologies). It also needs to be considered that the economic stimulation packages are, in many cases, formulated with regard to creation of internal bonds. For example, the financial measures for the support of infrastructure overlap with the expenses on research and development (construction of new laboratories) and the expenses on education (new schools). The investments in environmental technologies include some infrastructure expenditures (low-energetic housing), as well as research and development expenditures in the field of renewable sources of energy.

The EU authorities prompt its member states to increase the expenditures on education and training and research and development (in accordance to their national goals) and to seek way of stimulating private sector expenditures in these fields (by fiscal measures, co-financing), and also to lower the fees for patent applications and the maintenance fees for the protection of patents. In the same times, there often mentions of targeted investments into certain research areas, which steer towards technological transformations. The very occasion of the economic crisis is often labeled as a appropriate period for the realization of structural changes, e.g. in industry. The feeling of urgency and willingness to change are usually stronger in the crisis phase of the economy. It is even considered a mistake if the governments strive solely at the maintenance of status quo and focus on the mere financial support of firms in order to keep the existing industrial and technological structure intact [Kosonen 2009].

Let us have a closer look on the fiscal measures of some of the EU countries in relation to research, development, and innovations in the current economic recession (measures on both sides of the public budgets, expenditures as well as revenues). Under the currently worsened economic condition, e.g. Finland announced that it will attempt to achieve its goal of raising its research and development expenditures to the level of 4 % of GDP. However, if the implementation of the goal of raising the research and development expenditures is evaluated by the relative indicator of the

share of these expenditures in GDP, it must be taken into account that the decrease in the GDP growth, or its absolute decrease in the economic recession, makes the goal easier to attain if the existing rate of growth of the research and development expenditures, or even their current levels, are maintained. On the spending side of the public budgets, many of the EU countries prepare or already distribute further research and development expenditures, which are often targeted on specific directions and programs. Sweden will make additional allocations from its public funds in 2009, of which 5 billions SEK will go to university research and other 3 billions SEK to public research institutions (these figures represent almost 0,3 % of GDP in 2008). Germany promised to invest further 1.4 billions EUR in research, development, and innovations in 2009 and 2010, and from this amount, 900 millions EUR is destined to the support of research and development in small and medium enterprises and 500 millions EUR to the acceleration of the development of hybrid and other environmentally friendly car technologies (some of these expenditures, however, will be determined on the sub-federal level). France wants to speed up its research in nanotechnologies by additional investment of 70 millions EUR and also plans to support a university research network in information and communication technologies. Spain intends to strengthen investments into research and development in connection with public procurement, into establishment of research consortia, into improvement of transfer of the research results to business sphere, etc. Luxembourg will rise its research and development support in 2009 with additional 30 millions EUR; more resources for research and development is envisaged by Portugal (224 millions EUR) or Poland. Even Estonia, which has considerable economic difficulties (but better economic position among the Baltic republics, better than Lithuania and certainly better than Latvia), promised to treat the research and development expenditures as its priority and even to secure their increase in the years 2009-2010. Slovenia will spend further 35 millions EUR on the research of new technologies, it will support research

and development activities in business sector, and it will even sponsor acquirement of new instruments and equipment for research at universities and scientific institutions on the condition of gaining more patents and licenses and better cooperation with the private sector. Based on the above mentioned measures that are adopted in order to support research and development in the EU countries from the public funding, it is clear that in many cases they are target on specific research and development orientations, activities, or costs.

Some of the EU member countries focused their fiscal measures also on the support of research and development also on the side of the revenues of public funds. These include, essentially, tax incentives and faster provision of relevant tax reliefs for firms. It also needs to be taken into account that the EU and OECD countries use different schemes of tax incentives for corporate investments into research and development. So far, the most widely adopted measure is the so-called tax credit for research and development applied to the part of research and development costs in current year. The tax credit refers to the calculated and collectable income tax and its actual utilization is conditioned by procedural steps and administrative prerequisites, above all by the rapidity of processing the application by the relevant financial authorities. In some countries (e.g. Great Britain), this tax credit is construed in such a way that it levels out the disadvantages of small and medium enterprises in comparison to large firms. The current stimulus packages convert this very tax credit for research and development into an instantaneous tax relief that allows the firms to increase their cash flow. For example, this method is now applied in the French stimulus package, where the tax credit (crédit d´impôt recherche) is fixed by a flat rate of the volume of research and development expenditures in given fiscal year. Portugal has increased, since 2009, the rate of the tax credit to 82,5 % of the research and development expenditures, with this rate being constituted cumulatively by the tax credit for the volume of overall annual research and development expenditure at the

rate of 32,5 % and the tax credit at the rate of 50 % of the annual increase of these expenditures. In Italy, it was proposed to extend the tax credit also to research conducted by foreign subject in the country. Besides that, Italy also created a new tax incentive related to the return of researchers from abroad. For these researchers, it established a 10 % tax rate on their incomes and exempted their incomes from regional taxes.

As far as the developed economies outside of EU are considered, it can be stated that these countries in their stimulus packages have also adopted a series of measures for the support of research, development, and innovations. From among the European countries, e.g. Norway allocated almost 1.8 billion NOK in the form of further subsidies to research and development and new technologies, and furthermore it increased the top limit of the research and development expenditures that are the object of a tax relief in the scheme of the tax credit (the top limit for the tax credit was raised in absolute number from 4 million NOK to 5.5 million NOK, and it applies to both in-house and purchased research and development, thus the cumulated maximum is now 11 million NOK).

In the US the stimulus packages were created that focus on the increase of financial means in the agencies for support of research and development, such as National Science Foundation (3 billions USD including the support of basic research related to the challenges of environmental issues), National Institute of Health (10 billion USD, including the support of biomedical research), Department of Energy's Office of Science (1.6 billion USD, including the research of future energy sources), NASA (1 billion USD, including the support of research of the climate change), Advanced Research Project Agency-Energy for the support of high risk and high payoff research (400 million USD). The Canadian government plans a modernization of the country's research infrastructure and further investments into science and technologies and to the education and training of highly talented people. In its 2009 budgets, more than 1.5 billion CAD were approved for research and development activities

(investments into instruments and equipment, increase of resources for the funding programs of industrial research with the focus on small and medium enterprises, funding of space and artic research, etc.).

At the present, Japan wants to allocate resources especially into research of progressive technologies and, overall, to maintain the current level of support of research and development from public funds. South Korea formulated 17 new growth engines and the support of research that related to them: six projects in the field of environmental technologies, including new renewable sources of energy, six projects interconnecting existing progressive technologies and branches (e.g. the interconnection of IT systems, application of robotics, biomedicine), and five projects in the field of services with high added value (including healthcare, educational services, and tourist industry). It also announced a program "Green New Deal" with government investments in research and development of environmental technologies in the upcoming four years, with the emphasis on the support of basic research in this field.

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