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Economic and Financial Monitoring of Research Organizations

ABSTRACT

A research project achieves its utmost utility when it manages to combine the achieved technical-scientific results with the optimization of economic and financial resources adopted. Effective research budget structuring is required as well as focused monitoring of the use of resources on the basis of planned scheduling. When creating the budget, it is essential to optimize the times and ways of use of researchers because resources are fundamental. The monitoring phase should make sure that the controlling body is not related to the scientific director of the project itself. Furthermore, monitoring should ensure prompt notification of budget deviations so that the research director can make the required corrections.

Objective: The paper aims at showing the essential role of economic and financial control in order to achieve optimum effectiveness and efficiency of research. The demonstration was achieved by simply using an in-field experience within a private research organization.

Methodology: The sources for this paper included the ones from a process of participating observation.

Findings: The source is specific to the case studied in a participative way by the authors

Value Added: The value of the paper can be seen from the illustration and comment on an operational situation concerning a private research organization. It is especially important for these organizations to achieve an economic and financial equilibrium in order to survive and to become operationally independent with respect to financing entities.

Recommendations: The achievement of an economic/financial equilibrium is essential for all organizations including research entities. The priority given to effectiveness and efficiency in research projects would be desirable in public and university research organizations as well. Field studies for these organizations may highlight ample margins of recovery of efficiency and effectiveness as well as detecting improvement methodologies.

Key words: Research, controlling, efficiency, effectiveness

JEL codes: O30, M19

Introduction

Through the 7-year long framework program, the Horizon 2020 European Union intends to pursue relevant strategic goals:

- strengthen the position of the EU in the scientific sector;
- strengthen industrial innovation through investment in key technologies, facilitating access to capital and supporting small companies;
- addressing fundamental social problems like climate change, sustainable transport, renewable energy, food safety and an ageing population.

The Horizon 2020 program shall pursue effectiveness and efficiency goals according to three guidelines:

- making sure that technological discoveries become truly potential trade products through industrial and government partnerships;
- intensifying international co-operation in research and innovation;
- further developing the European Research Area.

According to targets set by the European Commission, EU member states shall invest 3% of the GDP in R&S by 2020 (1% public funding, 2% private investments) and setting the goal of creating 3,7 million jobs as well as annually increasing GDP to approx. 800 billion euros.

The current situation is far from achieving the above-mentioned goals.

Reports show that Innovation Scoreboard 2017 percentages are lower and have actually decreased slightly:

- R&D expenditure in the public sector (percentage of GDP): 0,71 and estimate 0.01 percentage point decrease in two years' time;
- R&D expenditure in the business sector (percentage of GDP): 1,28 and expected decrease 0.2% in two years' time.

Despite undeniable progress, member states still dedicate little attention to research and development, not only concerning invested resources, but even the quality of investments and outputs in technology innovation sectors, high-tech entrepreneurship and access procedures to capital markets for innovative companies and start-ups. Reduced resource percentages for research and development should make us seriously and urgently ponder on the outcome of R&D in the European Union.

The insufficient percentages invested in R&D is undoubtedly the main concern for the European Commission; in any case, attention should not only be directed towards the quantity of resources for research, but to the effectiveness of it and the efficiency of the resources used as well.¹

Resource investment efficiency requires utmost attention too. This is a typical problem of research organization which directly involves the beneficiaries of research funds, who are not always enabled for adequate planning capacity and project management and control. At the same time, the financial organizations should always adopt effective criteria, indicators

1. This and other issues were discussed at an international meeting in Venaria (Turin), in the G7 framework called THE FUTURE OF SCIENCE (24th-30th SEPTEMBER 2017). The session held on the 28th Sept. dealt with, among other issues, policies and funds for inclusive and responsible research. The main issue regards how to guarantee that general benefits deriving from investments in research can be used to reach solid sustainable development, employment and social welfare objectives. A greater overview is given by Merloni (1990).

and verifiers when viewing planning procedures as well as implementation of programs. In fact, not all the research projects – still awaiting approval by relevant bodies – may include features to be funded. Moreover, research projects presented by public organizations – including universities – do not always meet conditions of usefulness and effectiveness; moreover, they are funded because they are presented or sponsored by eminent people who are usually connected with the big global interest groups.²

The theme of this paper concerns efficiency in using resources as well as economic and financial monitoring over research projects. A practical case is hereby introduced to show how attentive budgeting and monitoring can optimize investment in research and maximize the use of disposable resources.

1. First step: planning and organization of research projects

A research project is expected to have an organizational structure so that the assigned resources – especially if they are limited with respect to requirements – can be adequately arranged according to the objectives to be reached and to procedural constraints required by reference norms. Therefore, a research project has to be structured according to the following phases:

- a) Technical and economic drawing up of the research project, including duration and objectives to be reached at the end of the project;

2. Great scientific research dealing with the future of humanity is mainly controlled by a limited number of people who are connected with six big publishing interest groups. Through his School of Library and Information Science, Professor Vincent Larivière of the University of Montreal conducted a study to show that scientific development is determined by choices made in great specialized media groups. “Indeed, the big publishing houses control over half of the scientific study market, including natural sciences as well as medical, social and human sciences. Furthermore, they produce high volumes of sales as well as 40 % profit margins. We can say that the big publishing groups had a vital role in the historical dissemination of scientific knowledge in the printing world, but it is disputable to think that they are still required in today’s digital world”.

- b) Identification of possible partnerships with companies, universities, public & private organizations; clear assignment of roles and objectives assigned to each partner, from the technical as well as the economic/ financial standpoint;
- c) Formulation/forecasting of research costs, sub-divided into various types of eligible costs;
- d) Assignment of technical, economic/financial and expenditure reporting control liability including any external auditing.

During the entire procedure, the research project shall comply with the following conditions:

- it has to be organized and planned according to effectiveness and efficiency criteria;
- it has to be periodically monitored so that any anomalies and deviations can be duly detected;
- it has to be re-organized (or partially re-planned) in order to rectify anomalies and deviations.

Basically, it involves meeting effectiveness and efficiency criteria which cannot disregard the necessary distinction and independence of the roles assigned to technical-scientific management as well as liability concerning function of research planning and control.

Thus, technical-scientific management of the project shall be assigned to the research team and its leader, who is generally the creator and proponent of the project itself; whereas resource planning and control liability shall be distinctly assigned to an organization with economic and financial expertise which is hierarchically independent from the research team and its leader.

This basic distinction aims to avoid common functional identification issues that endanger the rational optimization of available resources.

Hereinafter, this article shall describe the essential research budget processing phases, including periodical control of deviations.

2. Research budget

The preparation of the research budget shall include the type and quantity of the required resources, distinguishing the accountable items from the unaccountable ones. In fact, the accountable ones shall be subject to funding on the basis of the research tender.

Generally, the main expenditure items included in the budget are:

- New technical plants;
- Personnel dedicated to research;
- Other human resources involved;
- External consultancy;
- Third party services;
- Technical services;
- Consumables;
- Other items.

Taking into account the particular role and value that human capital has in a research organization, special attention is placed on personnel involvement in order to minimize non saturation of researchers' available hours.

In the following part of our paper we shall present an example based on a private technical-scientific organization involved in applied research projects to be presented directly on the sales market. Our current aim is to describe the various phases which will enable correct economic and financial control over research activities.³

The above-mentioned organization, as per the majority of private scientific research organizations, shall have the role of fostering the transfer of technology to companies thus enabling them to acquire price/cost competitive advantage from the most advanced and requested scientific solutions on the market. This role is emphasized when there is co-operation between public

3. The case herein is the simplification of the present case which is far more complex, presented by Pagliacci & Giammari (2004).

and private sectors – in order to transfer public research outcomes⁴ (especially from universities), usually the higher risk type connected with long-term projects – to companies which in turn shall generate products or services.⁵

Table 1 shows that a research organization should plan three different activities with eight operators. The primary budget objective is to avoid having operators who are not used or who are partially used. The example includes 565 unused hours which is an economic inefficiency factor for the research organization; this inefficiency should be tackled through new contracts concerning professionalism of personnel who is still “unsaturated”.

Table 1. Commitment of personnel in research organization YYY for the year 2XXX

Personnel/contracts	Research contract 1	Research contract 2	Production contract 3	Hours claimed	Workable hours	Un-worked hours
Personnel, services: Rossi Bianchi	625 521	907 1000	50 25	1582 1546	1634 1634	52 88
Personnel, production: Yellow Green			1500 1409	1500 1409	1634 1634	134 225

4. According to the European Commission, a research organization is “a non-profit entity, such as a university or a research institute, regardless of its legal status or financial source, with the main aim of carrying out basic research, industrial research or experimental development including dissemination of outcome, through teaching and publication or transfer of technologies; all gains and profit are entirely reinvested in research activities, dissemination of research outcome or teaching.” This is included in Communication 2006/C 323/01 of the European Commission. Nevertheless, also for profit, research organizations operate in the market. This paper concerns this kind of entities.

5. “Development of research jobs in “private research organizations” (Lo sviluppo delle professioni di ricerca negli “organismi di ricerca” ad ordinamento privato)” (Cicala, 2012).

Research- ers area A: Black Blue	60 90	1574 1544		1634 1634	1634 1634	- -
Research- ers area B: Brown Orange	12 246	1556 1388		1568 1634	1634 1634	66 -
TOTAL	1554	7969	2984	12507	13072	565

Source: own work.

The work hours, including hourly cost, are part of the contract budget together with the estimates of the other accountable items. They will be compared with revenues in order to determine the contribution margin.

In our case, we have 3 contracts: two research contracts and one production contract.⁶ A contract budget shall be determined for each one and it will vary on the basis of whether the research contracts are partially or totally funded according to the research competition. The production contract shall not be funded because it will be remunerated by a market price paid by the client.

In the case of a 75%-funded research contract, the contract revenue shall be determined by 75% of the accountable expenditure and the remaining 25% is considered as an initial negative margin. 100% funded contracts are different because accountable expenditure is covered and the initial margin is zero. Production contracts are not funded at all; therefore, revenues derive from the sales market and only the second margin is important, like the difference between sales price and incurred price. In any case, research contracts require the (total) second margin as well after deduction of non-accountable expenditure in order to reach the margin of cover of total costs of the research organization for the year 2XXX.

6. The research contracts are the ones whose output is equal to the information result of a process. The output of production contracts indicates a service given or the production of an item which is directly set for the market.

A brief example is given in Table 2.

Table 2. Budget and the research organization's (YYY) margin of cover of costs for the year 2XXX

Items	Contract 1 (75%)	Contract 2 (100%)	Production contract (A)	Portfolio sub-total	New funded contracts	Production contract in question (B)	TOTAL
Funding (revenues)	456809	805855	700000	1962664	0	300000	2262664
Costs financed: -researchers -personnel, services -investments -special material. -trips -other expenditure -general expenditure	609078	805855	0	1414933	0	0	1414933
1st margin	-152269	0	700000	547731	0	300000	847731
Non-funded costs -researchers -personnel, services -technical serv. -general material -stationary -depreciation	68350	120800	480333	669483	0	200000	869483
2nd margin	-220619	-120800	219667	-121752	0	100000	-21752
General charges, interest expenses and tax payments							100000
RESULT OF THE YEAR							-121752

Source: own work.

It is clear that the research contracts do not even achieve a balanced budget due to the portion of non-fundable costs or part of costs accountable, but not funded. In our case, the 2nd margin for research contract 1 and 2 equals -341,419 Euro. This negative value is partially absorbed by the positive margin of the production contract thus amounting to a subtotal of acquired contracts of -121,752.

The objective of a balanced budget can be achieved if new contracts are acquired primarily for the purpose of absorbing hours not worked by a part of the 'unsaturated' personnel (researchers, service & production personnel). In the acquisition phase, contracts that can achieve revenues higher than costs should be the priority. This objective should be essential for research entities operating in the private sector because they cannot rely on public support for budget losses.

The organization under examination is negotiating a 300,000 Euro contract, estimating costs at 200,000 Euro; this would enact a 2nd margin of 100,000 euros that, in turn, would lower the 2nd total margin to minus 21,752 euros. Other acquisitions or a reduction of costs could lead to a balanced budget in reference to operational income (variable + fixed costs) before interest and tax.

Obviously, the research organization shall also take into consideration other general expenses and tax payments. In our example, final loss equals 121,752 euros.

This kind of annual planning should be part of strategic functions for the implications of its effect on the organization's economic outcome in the year 2XXX because the objective of full research personnel saturation is a respectful way of relating to human capital, thus shielding researchers and technicians from frustration caused by demotion and/or partial employment that would create very serious psycho-behavioral situations, especially for researchers who are very motivated professionally.

3. Economic control

We have previously seen that research organization monitoring has to be separated into technical-scientific and economic-financial liability. In any case, monitoring has to involve both liability areas. That is, monitoring concerns the person-in-charge of research and production contracts as well as the organization's administration controller in order to examine deviations in the light of effective progress phases of the activities and to plan correc-

tive measures accordingly. For example, a negative deviation of the budget would not be so disconcerting if a joint analysis finds that the cause of this is related to the bringing forward of activities with respect to the period initially planned; what is important is that subsequent monitoring has to focus on deviation reabsorption in subsequent periods.

An examination of a 6-month deviation is shown in Table 3.

For the sake of simplicity, let us take the case of two research contracts and two production contracts, both having a linear development in time, so cost evolution is constant. Moreover, we shall consider only total costs, that is, 2nd margin level.

Table 3. analysis of deviations between budget & final balance

	Budget 1st half of yr.	Final balance 1st half of yr.	Deviations 1st half of yr.	Budget 2nd half of yr.	Preliminary report 2nd half of yr.	Deviations 2nd half of yr.	End-of-year estimation
Contract 1: Total costs 2nd margin	338714 -110309	338000 -109595	-714 +714	338714 -110310	339428 -111024	+714 -714	677428: budget confirmed -220619: alignment
Contract 2: Total costs 2nd margin	463327 -60400	463327 -60400	0 0	463328 -60400	470200 -67272	+6872 -6872	933527: budget exceeded -127672: deterioration
Contract A: Total costs 2nd margin	240166 +109833	240000 +109999	-166 +166	240167 +109834	240063 +109938	-104 +104	480063: budget improved +219937: improvement
Contract B: Total costs 2nd margin	100000 +50000	100000 +50000	0 0	100000 +50000	100000 +50000	0 0	200000: budget confirmed +100000 alignment
TOTAL: Total costs 2nd margin	1142207 -10876	1141327 -9996	-880 +880	1142209 -10876	1149691 -18358	+7482 -7482	2291018: budget increase -28354: deterioration

Source: own work.

Therefore, the 2nd margin level is negative amounting to 28,354, that is, even higher compared to budget (-21,752). We have to add general expenses, financing costs and tax costs (=100,000) to reach final result, negative 128,354.

In any case, the following must be pointed out: comparison between the half-yearly budget and the preliminary report is expected in the breakdown of the deviations (briefly shown herein). This means that the controller shall draw up the half-yearly financial statement by the end of the period. If this analysis is carried out in a very short period of time, that is, at least 2 months before the end of the year (including 2nd half of the year preliminary report drawn up on the basis of 4 effective months of financial statement and 2 months estimation), there will be enough time to try and amend serious situations: in our example, research contract 2 shall provide a preliminary report which is much higher than the budget, with sharp 2nd margin deterioration.

Whether amends will lead to favorable results depends on how the technical supervisor of contract 2 intends to proceed. Often technical supervisors focus on the technical quality of the contract and on scientific effectiveness, thus they strongly hesitate to set measures for reducing costs which might have a negative result on the expected research outcome.

We should also point out the second type of management failure which concerns controllers and related administration systems. This failure involves late deviation analysis. We are referring to administration and monitoring entities that frequently provide very late preliminary reports (that is, near the end of the year, leading to impaired correction procedures. This generally depends on the fact that an anticipatory attitude (e.g. a preliminary report drawn up 2 months early, that is, 10 months of effective financial statement and 2 estimated months) could lead to a strong deviation of the final outcome. Obviously, this will not be accepted by persons-in-charge of drawing up preliminary reports. This is simply another form of professional pride, which is no less stringent than the one previously described that could affect the technical and scientific persons-in-charge of research.

In brief, the following should be highlighted: the best economic control and analysis and correction of deviations is the one achieved through collaboration with the person-in-charge of the technical-scientific sector as well as the administration sector controller, so that the deviations are analyzed not only in the quantity scale, but also in the quality scale, thus detecting the causes of the deviations and possible correction measures.

4. Financial control

Research activities can obtain low-interest funds from public sources including security from private organizations.

The major public sources include funds from the EU, supranational bodies and local authorities. The major private sources include profit organizations (venture capital companies, industrial groups, institutional investors, etc.) or non-profit organizations (banking foundations, NGOs, etc.).

On the basis of obtainable credit lines, you can receive funds, duration periods, scheduling and variable security that can lead to the achievement of sustainable research projects.

There can be various entities and procedures for the granting of funds, as follows:

- Case a) 100% funding with initial accountable advance and subsequent funding in payment including advances paid;
- Case b) 75% funding with initial accountable advance and subsequent funding in payment including advances paid;
- Case c) 75% funding with initial accountable advance and subsequent funding on output of final statement upon progress reports.

Of course, the three examples above generate different types of cash flow on the basis of:

- a different type of security to be raised on the banking market;
- different types of financial burden/expenses generated during research activity.

In detail:

- Case a): no need to obtain bank loans; furthermore, payments in advance generate active stock, thus financial income;
- Case b): a bank loan is required to cover 25% of the non-funded expenses; in any case, payments in advance reduce or compensate financing costs generated by the loan;
- Case c): a bank loan is required to cover 25% of the non-funded expenses and to advance required funds pending funding upon progress reports. Financing costs can be generated.

The above-mentioned examples show differing impact that research financing has on the financial management of the research organization. Non assessment or wrong ex-ante assessment of this impact could also have unpleasant effects on the economic balance of the organization.

Thus, financial planning has to create prospective cash flow which allows assessment of the financial requirement and the entity of the financial costs or expenses, so that the research organization can obtain the required security at optimum costs from selected financial sources. It is a well-known fact that frantic search for last-minute security often produces very negative effects.

Subsequently, it will be necessary to carry out itinere checks on cash-flow in order to be sure that provisions are met or to have due time for required corrections.

Final considerations

We have observed that the economic and financial management of a private research entity operating on the market (that has to achieve a given economic outcome without relying on public funds to cover deficits) (Endrici, 1991) is a difficult task, even when research contracts with 75% and 100% financial cover are acquired. In fact, there will always be a part of unaccountable and unfinanced costs, which will have to be covered by internal resources from the organization. These internal resources derive from margins obtained

through acquisition of other contracts (“production contracts” A and B) at market prices and reasonably exceeding costs. Obviously, this type of research, which is essential for the economy of the entity itself, derives from the real economy sector.

In any case, the objective of economic equilibrium is related to careful contract management by technical and scientific person-in-charge of research including controllers and administration and financial organizations.

Given this, these two entities have to be able to collaborate synergically – despite role separation – for the benefit of the research contracts as well as the research entity itself.

On one hand, research content, methods and final products are extremely important for the purpose of analysis, but our work has shown that economic-financial examination is not only a mandatory procedure to assess sustainability of the research project itself, but is fundamental for assessing the global outcomes as well.

Good practice related to the economic and financial management of research projects can and must be considered as a guideline for university research as well, where effectiveness and efficiency criteria are not always used as guidelines.

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