

PORTFOLIO OF RESEARCH PROJECTS AS A PREROGATIVE OF UNIVERSITIES TO ENSURE FINANCIAL AUTONOMY

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Abstract. *The growing role of higher education in modern society and the expansion of the boundaries of science require a change in the models of university funding through the integration of certain corporate governance mechanisms. Of particular importance is the ability of universities to attract funding, including from private sources, by combining basic and applied research. It is critical for universities to find an optimal balance between basic and applied research when making decisions on launching new projects and programmes or adjusting existing ones.*

The purpose of the article is to determine the peculiarities of forming a balanced portfolio of research projects to ensure the financial autonomy of modern universities.

The scientific research uses general scientific and special methods, in particular: analysis and synthesis; comparison, systematisation and generalisation, and the graphical method to clearly present the theoretical and practical provisions of the scientific article.

The proposed approaches to assessing the university's portfolio of technological innovation developments will contribute to the efficient use of limited resources, prioritisation, risk analysis and monitoring of results in the short and long term. This will create a network of partners to share knowledge, research and resources.

Keywords: *university funding models; basic and applied research; research projects; R&D technology portfolio; financial autonomy.*

Introduction

A portfolio of research projects is an important tool for an entrepreneurial university to attract funding in the modern era. It reflects the potential of the university in the field of scientific research, technological innovation and knowledge transfer. A research project portfolio can include a wide range of research areas, from basic research to applied projects. It can be composed of the university's own research programmes, joint projects with industrial partners, and commissioned research from external organisations. Creating a research portfolio requires effective organisation and coordination of efforts by the university team. It should be developed taking into account the scientific state of the industry, the needs of customers (including industrial companies) and the

capabilities of the university. Successful projects can become the basis for creating start-ups, patents, opening new markets and attracting investments. This contributes to both academic advancement and economic growth in the region where the university is located.

The purpose of the article is to determine the peculiarities of forming a balanced portfolio of research projects to ensure the financial autonomy of modern universities. The study uses general scientific and special methods, in particular: analysis and synthesis; comparison, systematisation and generalisation; graphical method.

It should be noted that the portfolio of research projects allows the university not only to develop its scientific base, but also to become involved in the implementation of projects that have practical importance and commercialisation potential. The university can form its portfolio of research projects through active cooperation with higher education institutions, companies, research institutes and other target organisations. The financial autonomy of the university can be ensured by attracting funding from external sources, such as grants, government programmes, contracts with private companies, etc. The task of the university in terms of ensuring financial autonomy is to create an effective system of internal project management, identify and promote potential scientific developments, as well as continuously improve the processes of commercialisation and technology transfer.

Literature review

The role of universities as major centres of research has been debated in recent decades. In the early 2000s, the concept of “university research” emerged, focusing mainly on solving industrial problems and practical implementation of the results obtained. Under this approach, basic research by universities, which is not explicitly applied, lost its importance as a major source of knowledge. Strengthening direct cooperation between universities and industry stimulates more active participation of universities in practical problem solving. In this approach, universities lose their monopoly position in knowledge production, giving way to other actors, such as research institutes, think tanks and other (Tijssen, Winnink, 2016).

The “triple helix” model of interaction between industry, government and universities as elements of the national innovation system (Etzkowitz and Leydesdorff, 2000) assigns the latter a more important role in innovation development and economic growth. Acting as “generators of innovation” (Xu et al., 2018; Rucker Schaeffer et al., 2018), universities around the world are undergoing a transformation – a shift from conventional teaching to a

combination of educational and research activities with a pronounced practice-oriented component.

The current scientific and technological challenges are encouraging academic institutions to switch to practice-oriented research, i.e. practical research funded by industry (Tijssen, Winnink, 2016). In such circumstances, academic science is faced with the task of finding an optimal balance between basic and applied research.

Basic research is an experimental or theoretical activity aimed at gaining new knowledge about the causes of various phenomena. In turn, applied research is aimed at achieving specific practical goals or solving specific problems.

The paper (Bentley et al., 2015) presents the results of a comprehensive analysis of the activities of scientists from 15 countries. The authors analysed the differences in the orientation towards basic or applied research and found significant differences in this regard between different countries. For example, Australian, American and Hong Kong scientists were more likely to specialise in applied research, while Finnish, Norwegian and Dutch scientists were more likely to specialise in basic research. A special place is occupied by China and Malaysia, as Chinese scientists traditionally show a high level of interest in applied research, due to specific professional ethical principles in solving social problems.

The mission of universities is becoming increasingly important in the context of economic development, as it goes beyond the usual teaching of students and the conduct and execution of research. Governments are beginning to see universities as institutions that can contribute to social progress, promote social mobility, train researchers and innovate according to needs. An important task is to strengthen the link between universities and society in order to transfer university skills and knowledge to social needs. Active engagement between universities and knowledge users is expected to lead to improved products, services and systems, as well as to the creation of stable and well-paid jobs. (Crawley et al., 2020).

Methodology and research results

The scientific research uses general scientific and special methods, in particular: analysis and synthesis; comparison, systematisation and generalisation, and the graphical method to clearly present the theoretical and practical provisions of the scientific article.

Higher education institutions in economically developed countries are currently undergoing significant transformations related to the revision of the role of universities in promoting socio-economic and innovative progress. Universities in these countries act as initiators of innovation processes, while the

state and business act as customers, consumers and co-investors of innovative developments. New research areas considered by modern universities include not only technology development and transfer, but also commercialisation of research results, introduction of innovative products to the market, creation of start-ups, formation of new innovative enterprises, and management of intellectual property for financial gain.

Modern universities carry out their mission in the field of social and economic development by intensifying integration processes that promote synergies through coordination of efforts in education, science and business in the interests of the state and society as a whole.

Modern universities are under the influence of various socio-economic and technological factors, which leads to an active transformation of their tasks. A study of the evolution of university models (Etzkowitz and Leydesdorff, 2000) has identified the following models: university 1.0, which functions as an education centre with the main task of ensuring the transfer of knowledge; university 2.0, which focuses on research and technological progress; university 3.0, focused on entrepreneurship and based on the Triple Helix concept, aimed at commercialising scientific achievements; University 4.0, which actively interacts with the outside world, promotes social and societal progress and is closely linked to industry, built on the basis of digitalisation of processes.

The emergence of modern universities implementing the 3.0 and 4.0 models is due to a number of factors. One of them is the need for continuous development of skills and qualifications acquired through formal education. The growing societal demand for active applied research is fostering deep industry partnerships and reducing the time required to turn scientific and innovative ideas into commercial outcomes. In addition, the development of digital technologies is another important factor driving this transformation in the university environment.

The majority of higher education institutions located in economically developed countries and ranked highly in global rankings embody the concepts of 3.0 and 4.0 universities. They are not only productive in research, but also actively promote business education, disseminate practical business experience and effectively commercialise their research, which contributes to the country's economic growth.

Collaborative research between universities and commercial institutions can have a significant impact on society and the economy. When academic institutions and commercial organisations collaborate on research, it facilitates the exchange of knowledge between different sectors. Academic scientists can provide new insights and scientific discoveries, while commercial partners have the opportunity to put this knowledge into practice and create innovative solutions and products. This interaction can lead to significant benefits. Firstly,

academic institutions can receive financial support for their research and additional means for its implementation. Commercial organisations, on the other hand, gain access to the latest scientific research and can give their businesses a competitive edge. Further benefits include the possibility of creating technological innovations, expanding markets, improving the quality of products and services, and increasing the competitiveness of companies. In addition, this type of collaboration can stimulate the development of scientific research and facilitate knowledge transfer between the academic and commercial sectors. Involvement of relevant stakeholders, ensuring interaction and information exchange, and understanding the needs of each party are key to the successful commercialisation of academic research.

A summary of the effects of collaborative research on academic institutions and commercial organisations is presented in Table 1.

Table 1 The effects of collaborative research on academic institutions and commercial organisations (compiled by the authors)

Effects of collaborative research in academia and commercialisation	
Sphere of effects	Description
Academic activities	
Publications	<ul style="list-style-type: none"> - Increase in the number of scientific publications that answer new research questions raised by corporate partners; - Increased efficiency through more precise selection of models and niches by coordinating research and practice of enterprises and organisations; - Reducing the time to obtain scientific results and accelerating their publication thanks to the resources of investors.
Areas of research	<ul style="list-style-type: none"> - Expanding the range of research using resources obtained through cooperation with industry; - New areas of applied research that are of interest to the production sector; - New areas of research, the development of which became possible due to cooperation with industry and the presence of a user – a long-term partner.
Teaching	<ul style="list-style-type: none"> - Transfer of scientific and technological knowledge created jointly with industry to students and postgraduates; - Use of equipment provided by partner companies in teaching; - Using the experience of joint research as a model for organising and managing the educational process and applying the knowledge gained.
Commercialisation	
Start-ups	<ul style="list-style-type: none"> - Scientists create start-ups based on the knowledge gained through joint research without competing with partner firms.
Patents and new services	<ul style="list-style-type: none"> - Creation of new intellectual property, licensing; - Application of knowledge gained from partner firms (analytical control methods) to provide services to other organisations; additional resources for research.

Changes in the role and mission of universities, the transfer of active participation in the development of society instead of focusing on teaching and research, leads to a necessary reorientation of the funding model. Although budgetary funds remain the basis for university research, public funding for universities is declining, while the role of industry and other forms of public-private partnerships is growing. Compared to the US and Western European countries, where private capital plays a predominant role, the share of state support in Ukraine is estimated at 60-70%. The ever-tightening financial environment is forcing universities to actively seek forms of international cooperation to increase the profitability and attractiveness of additional external budgetary resources (Table 2).

Table 2 Mechanisms and tools for expanding the financial autonomy of universities (compiled by the authors)

Mechanisms and tools expansion of financial autonomy of universities	Models of public administration		
	State administration	Public management	Effective governance
Regulation: Legal status	State-financed institution	Public institution / organisation Corporation (public, private) Non-profit / non-profit organisation	
Type/methods of distribution funding	Itemised budget (Estimates)	Block grant	
Forms of financing	Direct (budget / state order) state order)	Direct (budget, project, result-oriented, targeted)	
	Indirect (voucher, loan, grant and scholarship support)		
Accountability	Control	Supervision	Monitoring

Depending on the source of capital, there are internal (budgetary) and external (private) models of financing in the university sector. Basic funding ensures the stability of the university system, its basic infrastructure and remuneration of academic staff, while dependence on external funding gives it greater autonomy. With this in mind, universities that receive funding from external sources are more flexible in implementing new initiatives compared to those that rely on budgetary funding.

In many educational institutions around the world, financial expenditures exceed the amount of available funding, which puts the administration in front of the task of finding additional sources of funding (Lyken-Segosebe and Shepherd, 2013). One of the possible ways to achieve this goal is to develop educational programmes that promote research in various fields and use best corporate practices in the process of educating students and adapting them to new challenges and opportunities. Focusing on market-oriented educational

programmes designed to meet the demand for specialised knowledge and skills of employees can not only have a social impact, but also help solve the financial problems of colleges and universities that demonstrate a willingness to respond effectively to market signals.

Attracting and allocating funding between different research areas remains a pressing issue for universities due to limited resources. Among the works on this topic (Wells, Wells, 2011), some are devoted to the evaluation of academic educational programmes using business tools – product portfolio models. The most likely models of this kind are the General Electric McKinsey model and the growth/market share matrix developed by the Boston Consulting Group (BCG). Although successfully used as strategic analysis tools, these models are not widely used in the academic context. One of the exceptions is the study (Wells, Wells, 2011), which proposes the Academic Programme Portfolio model (APPM), which is essentially an adaptation of the GE/McKinsey strategic portfolio matrix model, widely used by production organisation consultants. The advantages of the APPM include the use of only two dimensions – the attractiveness of educational programmes and the competitiveness of the educational institution – which are easy to understand and measure, and therefore to integrate into the university's strategic analysis and planning system.

The study (Arman, 2019), based on the Portfolio Evaluation Matrix (PEM), presents an analysis of a specific situation – the allocation of a limited amount of resources among the strategic research initiatives of the Kuwait Institute for Scientific Research (KISR). The portfolio assessment matrix is a diagram of “a two-dimensional matrix based on two criteria: the potential effect of a decision over the next five years and the ability of the programme staff to deliver what is promised” (Arman, 2019, p. 154). The use of this tool helped the think tank focus its portfolio on long-term goals. However, in essence, this model is intended for forward planning based on a subjective assessment of results.

The idea of looking at the university through the lens of portfolio theory is quite effective. According to the authors of Crawley et al. (2020), it is advisable for research groups and universities to have a balanced portfolio that will create knowledge to achieve short-, medium- and long-term economic development. Portfolio management has become important, bringing together a number of key decision-making areas, each of which is associated with challenges: selecting and prioritising projects, allocating resources between them, and implementing the strategy.

The modern theory of the investment portfolio was formulated by the famous American economist Harry Markovitz, who was awarded the Nobel Prize for his contribution to economic science in 1990. His most valuable development was the concept of portfolio diversification, which allows reducing the overall risk of portfolio investments at the expense of assets (Mangram, 2013).

The success of a modern university depends on a variety of factors. First of all, the effectiveness of university research and development depends on the diversification of the portfolio of technological innovation projects. This implies the inclusion of both fundamental and applied research, as well as a wide range of unrelated scientific areas.

It should also be emphasised that a balanced portfolio of technological innovation developments should be formed, combining projects and competences of different market maturity. It is also important to ensure a reasonable balance between short- and long-term projects.

The success of the university also depends on the coordination of the research portfolio with the educational programmes to maximise their social utility. This means developing educational programmes that are in line with scientific achievements and the needs of society, which allows for the effective use of research results in the educational process.

In general, the success of a modern university largely depends on the ability to diversify technological innovations, ensure that projects are balanced in terms of their implementation, and coordinate the research portfolio with educational programmes to achieve maximum social benefit.

Researchers (Wells, Wells, 2011) proposed to use the Academic Programme Portfolio Model (APPM) approach to university academic programmes. The APPM methodology is used to evaluate university academic programmes by taking into account the parameters of their market attractiveness and potential. This approach is an adaptation of the GE/McKinsey product portfolio matrix. The market attractiveness and potential of a programme are measured on a five-point scale and combined into a portfolio matrix. The analysis can be conducted at the faculty level (comparing faculty or research areas) or between faculty programmes. The APPM methodology allows you to assess the strategic orientation of academic programmes in relation to the university as a whole or a particular faculty. Managers can simultaneously evaluate several academic programmes in terms of their strategic focus, resource allocation, financial return and importance to the university.

The proposed toolkit used in decision-making aimed at optimising market-oriented academic programmes includes quantitative, work-based methods (Burgher and Hamers, 2020). This approach aims at achieving optimality in the financial and non-financial aspects of university portfolios that include technological innovation and market-oriented curricula. Both approaches are based on maintaining a balance between these aspects in order to achieve the strategic goals of universities, ensure financial stability and meet market demand for their services.

The study (Burgher, Hamers, 2020) presents methods for quantitative parameterisation of the qualitative characteristics of market-oriented study programmes based on a model of strategic planning in the higher education

sector through the optimisation of academic portfolios. The results of applying the model are the implementation schedule and the plan for optimising such programmes and portfolios. The approach we propose, the Research Domain Portfolio Matrix (RDPM), takes into account the following parameters.

1. The use of both qualitative and quantitative methods, the latter of which allow to evaluate the facts and strategy of the university based on the results of the use of allocated financial resources.
2. Emphasis on finding an optimal balance between basic and applied research, as both are important and should not be neglected.
3. A strong focus on tracking the dynamics of scientific achievements over time, rather than on static measurements typical of product portfolio matrices.

The application of the dynamic research project management (RDPM) method over several years allows systematic assessment and tracking of progress towards achieving target areas, which provides much more accurate estimates. RDPM can be used to monitor the research and innovation sphere through several key features: first, the ranking of scientific publications in high quality journals (Q1-Q2); second, the financial return on projects (through grants from the government or funding from the industrial sector). The university administration can reward “leaders” and “punish laggards”, for example, by reallocating funding to promising research or industrial projects with the highest potential return in the short to medium term. Thus, RDPM is an effective and simple tool for balancing the research portfolio, helping to identify and adjust research priorities at the university level, especially in resource-constrained environments.

Conclusions

The main integral outcomes of an academic institution should be not only to ensure profit and increase financial flows arising from scientific activities, but also to create a creative intellectual environment conducive to supporting the active creation of new intellectual tools and innovations; to prepare the public for the comprehensive introduction of advanced technologies into everyday life.

This article attempts to explore the theoretical and practical potential of analysing the technological innovation portfolio of universities in different industries and at different stages of maturity. The approach underlying this study is based on the concept that it is critical for universities to find the right balance between basic and applied research when making decisions about launching new projects or adjusting existing programmes.

The analysis of a university's research portfolio involves a systematic assessment of achievements, such as journal publications, as well as the amount of external funding attracted for basic and applied research carried out in

specific priority areas. This analysis can be used to structure the university portfolio and develop an effective strategy for future development and investment.

To ensure efficient allocation of financial resources, it is advisable to take into account the specifics of a particular research area, the market maturity of technologies and the potential return for the university, economy and society in the short and long term, as well as the importance of research for educational programmes.

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