

Examining factors influencing students' participation in research and development projects during obtaining their first university degree

Barbara Tóth¹, Dóra Szerencsés², Márta Péntek³, László Gulácsi⁴, Zsombor Zrubka⁵

¹Óbuda University, toth.barbara@uni-obuda.hu

²Óbuda University, dora.szerencses@bigdatascientist.hu

³Óbuda University, pentek.marta@uni-obuda.hu

⁴Óbuda University, gulacsi@uni-obuda.hu

⁵Óbuda University, zrubka.zsombor@uni-obuda.hu

Abstract: Universities are a key factor of national and regional innovation. A considerable proportion of the innovative ideas and commitment to innovation-driving professions happen during university years. Accordingly, projects to develop the so-called university innovation ecosystems in universities are already widespread. In this work, we aim to assess the factors that contribute to students' participation in research and development (R&D) projects while obtaining their first university degree, which may be considered as a indicator of students' innovation potential. We analysed data from a questionnaire survey covering four countries: Poland, the Czech Republic, Slovakia and Hungary involving ≤ 30 year-old adults with university diploma. The data were collected between July 2022 and August 2022. Out of 1907 respondents, 333 (17.5%) participated in research and development (R&D) projects while obtaining their first degree. Our results showed a correlation between participation in an R&D project and whether the student participated in a scientific competition or exhibition, and if they published a paper. Of the respondents, 258 had received some kind of research, study or art grant, which also showed a link between participation in the R&D project. Furthermore, respondents, who participated in R&D activities were more likely to participate in social or public activities in the university. These results are useful in identifying touch points through which students with innovation potential can be involved in the university innovation ecosystem.

Keywords: innovation ecosystem, university innovation, innovation potential

1 Introduction

In addition to their traditional teaching and research functions, all universities have a responsibility to contribute to the development of their country and region mostly by innovative projects.(Heaton, Siegel, and Teece 2019) The Triple Helix model sees universities as a key driver of innovation, alongside businesses and government. A core function of the university in the interactions between the three named actors in the model remains to provide students with competitive skills and knowledge. This way universities provide workforce to the labour market in the corporate and public sector as well as ideas and research results for innovation. (Leydesdorff 2013) University students are at the centre of these.

Higher education has a prominent role in shaping students' attitudes towards innovation and entrepreneurship, and universities are investing to build innovation ecosystems to foster this.(‘EcoAction’ n.d.) During their years in university, students are at a point in their lives where they are deciding on their future career paths. With the right motivational tools and the right infrastructure, they can be guided towards innovation-driven professions.(Kaloudis, n.d.) This will create a sufficient labour supply for industry, increasing the competitiveness of the country and the region.

Understanding the role of a university in student’s innovative behaviour, in our research, through the evaluation of a four-country representative questionnaire, we aim to assess the factors associated with the respondents' willingness to participate in R&D projects. The primary benefit of such findings is that we can discover action points along which we can intervene to stimulate innovation at universities.

2 Literature Review

High proportion of studies on innovation interventions focuses on the impact of the workplace environment on workers' innovative behaviour. The results of these researches can be applied to innovation environments in universities by considering students as employees and universities as businesses. According to OECD’s definition “*An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations.*”(OECD)

Schaltegger et al. point out that innovative organisations are able to respond better to changing environments and challenges, while research by Chen et al. highlights the crucial role of individuals in the extent of innovation.(Schaltegger, Freund, and Hansen 2012) (Chen et al. 2013)

Studies on innovation have shown, the positive impact of stress on innovative thinking, (Albort-Morant et al. 2020) while other studies have highlighted the power

of innovation to reduce stress and create well-being.(Dolan and Metcalfe 2012) Students starting their university studies are exposed to a significant amount of stress, that can negatively impact their well-being, adaptation and performance.(Cotton, Dollard, and de Jonge 2002)

Some of the studies focus on gender distribution, women's participation in innovation-driven professions. According to UNESCO's Women in Science 2020, 30% of the world's researchers are women. (Statista) On the other hand in Martín et al.'s study, that is about the innovative behaviour of undergraduate students in arts and humanities, they did not observe any difference in innovative behaviour between the two sexes. The same study highlighted the positive impact of autonomy in stimulating innovative behaviour.(Martín, Potočnik, and Fras 2017) This is somehow in contrast with a study about job design and innovative work behaviour, that shows that job control is positively related to innovative bahaviour.(De Spiegelaere et al. 2012)

In addition, several studies highlight the positive impact of organisational commitment and a sense of belonging on academic performance. (Pedler, Willis, and Nieuwoudt 2022) While in the case of universities, close links with industry have also been identified as an important element in strengthening innovation potential. (Abdul Razak, Murray, and Roberts 2014)

In this phase we briefly described the main approaches of the literature that investigate the mechanisms and different factors that drive innovation in the workplace and universities. The aim of our work is to explore the factors that could potentially influence the willingness of first degree students to participate in R&D projects and its correlation with pursuing an entrepreneurial career in the future, through the analysis of the results of a questionnaire survey.

3 Methods

An online survey, representative of 4 countries was carried out among young adults under 30 years of age with a degree obtained in Slovakia, Hungary, Poland or the Czech Republic. The data were collected between July 2022 and August 2022 on an online questionnaire platform by a data survey company.

The questionnaire asked respondents to recall their experiences at university while studying for their first degree. Questiones related to experiences and perceptions on opportunities relating to university functions were asked. In our analysis, we investigated which factors show significant differences between respondents who participated in R&D activities. We considered participation in R&D projects during studies for the first degree is as an indicator of innovation potential.

For cross-tabulated data, the significance of the influencing factors in the sample was tested using the chi-square test and Fisher's exact test. We used the Fisher's

exact test in the cases where values in any of the cells of a in a cross-table were below five.(ScienceDirect) For variables with ordinal Likert-scale responses, we applied the Wilcoxon rank-sum test, a non-parametric test for the comparison of two independent groups. The relationships were considered significant at a P value of 0.05

4 Results

4.1 Descriptive analysis of the sample

The questionnaire was completed by 1907 respondents out of 37.97% is male and 61.88 % is female. The average age was 27 years. To get an idea of their financial background, respondents were asked to indicate their financial situation relative to the average.

Table 1. Distribution of participants based on their financial situation relative to others

Financial situation	Number of respondents	%
Much better than average	143	7,5
Slightly better than average	533	27,9
Roughly average	845	44,3
Slightly worse than average	263	13,8
Much worse than average	93	4,9
I can't, I don't	30	1,6
Total	1907	100

Almost 60 percent of respondents had their first degree in Arts & Humanities, Engineering & technology, Social science and Business & economics subject area and majority of were full time students (89.77 %).

Slightly more than 17% of the total sample said they had been involved in an R&D project during obtaining their first university degree. The highest proportion of students graduating in Hungary were involved in such projects, followed by the Czech Republic, Poland and Slovakia (Table 1).

Table 2. Respondents participating in R&D projects graduated in the four countries

Country of 1st degree	Number of respondents	Participation in R&D projects	%
Czech Republic	407	109	26,8
Hungary	412	114	27,7
Poland	468	79	16,9
Slovakia	287	31	10,8
Total	1907	333	17,5

4.2 Results of statistical analyses

Research results showed that out of the 1907 respondents those (333, 17,5%) who participated in any research and development (R&D) projects while obtaining their first degree are more typically males than females. Male students were more likely to participate in any kind of university projects (not only in research and development projects), while significantly more female respondents reported that they did not participate in any projects while obtaining their first degree (30,9%) in comparison with male respondents (19,2%).

We analyzed the socio-demographic background of respondents who participated in any R&D projects. Their families more typically have slightly or much better financial situation than the average ($p=0.007$). In case of these respondents, not only the economical status of the families was better than average, but their mothers' education was the less typically at the lowest level (finishing only primary school) ($p=0.019$).

Those who participated in R&D projects, they were significantly more likely complete a full course or degree in foreign language ($p=0.029$), participate in a student research or scientific competition ($p<0.001$), present at a scientific conference ($p<0.001$), publish a research paper ($p<0.001$) or participate in a creative or art exhibition ($p<0.001$).

In terms of incentives and rewards for excellence, our results show that respondents who participated R&D projects were significantly more likely to receive research, study or art grant ($p<0.001$). Another interesting highlight is that participation in organized social or public activities were significantly more common among those who has participated in innovative projects ($p<0.001$).

From specialization point of view, there is a significant difference among respondents graduated in different faculties. Those who participated in any R&D projects were more typically specialized in computer science ($p=0.012$), engineering and technology ($p=0.005$) and life sciences ($p=0.012$) while less

typically graduated in faculty of business and economics ($p < 0.001$), social sciences ($p = 0.002$) and law ($p = 0.016$). Respondents participated more typically in full-time education.

There is association between participating in any R&D projects and satisfaction with their knowledge or skills gained in the university in terms of the projected value of their first degree ($p = 0.043$). It was less typical among them to evaluate their knowledge or skills as useless in their work ($p = 0.002$) and they evaluated their first degree higher in comparison with those respondents who did not participate in any R&D projects when obtaining their first degree ($p < 0.001$).

Our data showed that these students felt that the institution had positive impact on their future career ($p < 0.001$) and they also considered that their institution was better known abroad ($p < 0.001$). There are other important factors related to the institution's services which are highly evaluated among respondents who participated in any R&D projects as personal contact with instructors ($p = 0.044$), research opportunities ($p < 0.001$), study opportunities abroad ($p = 0.018$), sport facilities ($p = 0.013$), student counseling or mentoring ($p = 0.003$), student advocacy ($p = 0.001$) and housing options ($p < 0.001$).

We also examined whether respondents' current careers reflect the entrepreneurial ambitions they had during their first degree. Accordingly, we investigated the proportion of those in the two groups who were working as entrepreneurs or as entrepreneurs employing others. Results show that 5% of those who have not done research, 10% of those who have done research became entrepreneurs ($p = 0.001$).

5 Discussion

Results showed that students participating in R&D projects are more ambitious and tend to put effort in different types of projects for example competitions, foreign language courses etc. In line with this, the results showed that students give greater importance to the university's support in exploiting their innovative potential, for example they rated access to research opportunities, study opportunities abroad, opportunity to take part in student counseling or mentoring and student advocacy more important. This also means that the institution has a greater investment in attracting and retaining innovative students, and possibly in facilitating them to obtain a Master's or PhD degree at the institution. This is very much linked to the issue of talent management, which is not addressed in this article. Furthermore it remains a question, whether this attitude towards innovation will remain consistent after graduation.

Our results also show that income and family background correlates with the willingness to participate in R&D research, but also that students are less entrepreneurial in different fields of study. An interesting finding is that

participation in R&D projects was not common among students in business and economics area, although this field is perhaps the most exposed to the need to adapt to change, alongside technical innovation.

Based on our data, a higher proportion of men participated in the research project, which is in line with the research findings of other available research on gender differences among researchers (van den Besselaar and Sandström 2016). In studies like those, authors suggested that this situation could be addressed through targeted actions and incentives. Accordingly, the greater involvement of female students in similar projects has unexploited potential.

Our results also in line with researches mentioned in the introduction that a sense of commitment to the institution and a sense of belonging can increase the student's willingness to participate in innovative projects. (Pedler, Willis, and Nieuwoudt 2022) In our case, participation in social and public events showed a significant correlation with participation in R&D projects. This suggests that more events organized by the university can lead to higher level of innovation.

Ovbiagbonhia et al. investigated students' perceptions on learning environment for building innovation competence at their university and came to the conclusion that universities should give more focus to create a supportive environment for innovation. (Ovbiagbonhia, Kollöffel, and Brok 2019) This attempt of universities supported by a growing number of methodological research and international collaborations to support research on the topic, such as the EIT-HEI.

Data collection for this study was from a representative online panel and therefore provides a picture of the general behaviour and attitudes of this age group

One of the limitations of our research in terms of examining the relationship between participation in the research project and entrepreneurial careers is that we considered both self-employed and employers as entrepreneurial careers, but we have no information on what percentage of these are innovative businesses or start-ups. Furthermore, the proportion of entrepreneurs is only 10% among R&D students.

Conclusion

We investigated the factors influencing the willingness to participate in R&D projects in a large international survey. Our results show that the university has a great responsibility to provide the resources and infrastructure to support open-minded students in their innovative ideas and also to meet their needs. In addition, a targeted incentive system is recommended to reach groups that are under-represented in participation in R&D projects, such as women or students in certain disciplines or socioeconomic background. The impact of such programmes has an indirect effect on the image of the university and on student satisfaction. Further research is needed to see if there is a correlation between participation in an R&D project and current job status, life satisfaction and future expectations.

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