

Factors Influencing the Commercialization of Academic Products among Students in Higher Learning Institution

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ABSTRACT

The commercialization of university-generated products has become an important strategy for promoting innovation, entrepreneurship, and economic development in Malaysia. Despite various government initiatives and university support programs, the commercialization rate among university students remains relatively low. Understanding the factors that influence students' commercialization activities is therefore essential for enhancing the effectiveness of entrepreneurship and innovation initiatives within higher education institutions. This study aims to examine the relationship between financial support, industry collaboration, social network, and innovator's characteristics on the commercialization of university products among Malaysian university students. Grounded in the Entrepreneurial Ecosystem Theory, this research focuses on final-year students from Universiti Teknologi MARA (UiTM). A total of 104 responses were collected through an online questionnaire, and the data were analyzed using multiple regression analysis. The findings demonstrate that industry collaboration and social network are significantly and positively associated with commercialization. Conversely, financial support and innovator's characteristics were not found to have significant effects. These results highlight the importance of collaborative partnerships and networking opportunities in shaping students' commercialization activities. The findings contribute to the growing body of knowledge on university commercialization by extending the application of Entrepreneurial Ecosystem Theory to the context of Malaysian university students. The study also provides practical implications for universities and policymakers in strengthening industry engagement and networking initiatives to enhance students' commercialization outcomes. Finally, the study discusses its limitations and offers recommendations for future research.

Keywords: Commercialization, academic products, higher learning education, Malaysia

INTRODUCTION

Innovation has become an important driver of both social development and economic progress. In response to this growing importance, Malaysian higher education institutions have increasingly integrated innovation and entrepreneurship into their educational activities to equip students with the creative capabilities and competencies required in a rapidly changing economy. Through structured entrepreneurship and innovation programmes, competitions, and collaboration with industry, universities create opportunities for students to develop their ideas and translate them into products or services with potential commercial value. These efforts are consistent with Malaysia's aspiration to strengthen an innovation-driven economy, as reflected in the Twelfth Malaysia Plan 2021–2025, which identifies research and development (R&D) and commercialization as important components of sustainable economic growth (Ismail et al., 2025).

Within the higher education context, commercialization can be understood as the process through which creative ideas, discoveries, and research outcomes are transformed into products or services that possess market potential and generate economic and societal value (Ismail & Mohamed, 2016). Commercialization, however, extends beyond the act of selling a product. It also involves establishing networks and collaborative relationships among universities, industry, and the wider community to facilitate the transfer and application of knowledge and innovation (Bakar et al., 2016). Effective commercialization can contribute to national competitiveness by facilitating technology application, creating employment opportunities, and supporting the development of businesses initiated by graduates. At the institutional level, successful commercialization can further strengthen the role and reputation of universities as centres for applied research, innovation, and knowledge transfer (Zaki & Hashim, 2019).

Even with these efforts, commercialization of students' innovation projects in Malaysian institutions is still low. Most of the student-generated ideas are not brought to market or become registered start-ups even though many universities have set up entrepreneurship programs, innovation awards, and technology transfer offices (Khademi et al., 2014). Most of these ideas remain in the prototype or idea stage and are mostly showcased in shows or internal contests without turning them into products that can be sold (Bakar et al., 2016). This would indicate a gap between creating an invention and the commercialization of innovation among university students in Malaysia.

Although several initiatives have been put in place by government organizations, such as the Malaysian Technology Development Corporation (MTDC) and Ministry of Higher Education (MOHE) to encourage innovation and technology transfer, the commercialization of student innovation projects is still at infancy stage compared to developed countries (Ismail et al., 2025). It is very important to identify and understand the elements that drive or make commercialization difficult of student innovations for possible action to improve university strategy and innovation ecosystems that promote student entrepreneurial culture. This study looks into commercialization with regards to finance, industrial partnerships, social networks, and innovators' characteristics of student innovation projects in Malaysian universities.

The remainder of this paper is organized as follows. Next section reviews the relevant literature and develops the research hypotheses. It will be followed by the outlines the research methodology, including the sample, data collection procedures, and operationalization of variables. The empirical findings, encompassing descriptive analysis, reliability testing, and hypothesis testing appear then. The last section discusses the findings in relation to prior studies, highlights the study's contributions, acknowledges its limitations, and offers recommendations for future research.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Entrepreneurial Ecosystem Theory

The concept of the Entrepreneurial Ecosystem (EE) emerged from the growing recognition that entrepreneurial activity cannot be explained solely by the characteristics or capabilities of individual entrepreneurs, but is also shaped by the wider economic, institutional, social, and cultural environment in which entrepreneurship takes place. The ecosystem metaphor can be traced to Moore (1993), who introduced the idea of an ecosystem to explain how organizations interact with other actors within their surrounding environment. However, the concept was subsequently developed and popularized in the entrepreneurship field by Isenberg (2010), who proposed the Entrepreneurial Ecosystem framework as a holistic approach to understanding how different environmental conditions interact to stimulate entrepreneurship, innovation, and economic development. Isenberg identified six interrelated domains of an entrepreneurial ecosystem: policy, finance, culture, support, human capital, and markets. These domains encompass factors such as government policies and regulations, access to financial resources, entrepreneurial culture, institutional and infrastructural support, education and skills, and access to customers and markets. Importantly, the framework emphasizes that entrepreneurial outcomes arise not merely from the existence of individual ecosystem elements but from their interaction and collective contribution to creating a supportive environment for entrepreneurial activity.

In the context of universities, the Entrepreneurial Ecosystem framework provides a useful lens for explaining how innovative ideas and knowledge generated by students can progress from the university environment

towards commercialization. University commercialization is not solely dependent on the quality or innovativeness of an invention; rather, it requires an ecosystem that provides the resources, networks, capabilities, and institutional conditions necessary to transform an innovation into a marketable product or service. For example, financial support can provide the resources required for prototype development and market testing; industry collaboration can provide technical expertise, market knowledge, validation, and access to potential customers; social networks can connect student innovators with entrepreneurs, investors, mentors, industry partners, and other relevant stakeholders; while human capital and support institutions such as universities, incubators, technology transfer offices, and entrepreneurship centres can provide knowledge, training, mentoring, and commercialization assistance. Similarly, supportive government policies and entrepreneurial culture can encourage students to pursue commercialization activities and reduce institutional or regulatory barriers. Therefore, the theory suggests that successful commercialization of university innovations is the outcome of interactions among multiple ecosystem actors and resources rather than the result of a single factor. This perspective is particularly relevant to studies examining the effects of funding, industry collaboration, social networks, and innovator characteristics on the commercialization of university products, as these factors represent important resources and conditions within the broader entrepreneurial ecosystem.

Commercialization

Commercialization represents an important stage in the innovation process because it enables knowledge, research findings, and innovative ideas generated within universities to be translated into products or services that can create economic and societal value. Rather than ending with the development of a prototype or the generation of research findings, commercialization involves progressing an innovation towards market application through activities such as product refinement, intellectual property protection, market validation, technology transfer, licensing, and collaboration with industry. In this sense, commercialization provides a mechanism through which universities can extend the impact of their research and innovation beyond the academic environment. Research has also highlighted that commercialization contributes to economic development by facilitating the transfer of knowledge and technology from universities to industry and society (Ismail & Mohamed, 2016; Tweheyo et al., 2022).

Despite its importance, the commercialization of university-generated innovations in Malaysia remains challenging. Recent research indicates that Malaysian universities continue to experience difficulties in translating research outcomes and intellectual property into commercially viable products and services. A study by Abd Jamil et al. (2024), for example, identified several barriers affecting the commercialization of research findings in Malaysian research universities, demonstrating that the transition from research output to market application remains complex. Similarly, Shahidan et al. (2025) reported that the commercialization of intellectual property generated by Malaysian public universities remains relatively low, with the commercialization success rate reported to be below 10 percent. Their review highlighted the importance of resources, awareness, policies, and stronger coordination among government, universities, and industry stakeholders in improving commercialization outcomes. Earlier Malaysian research has also identified intellectual property protection, commercialization policies, production-related issues, and gaps between academics and industry collaborators as important challenges affecting the commercialization of innovative university research products (Ismail & Mohamed, 2016).

The limited commercialization of university innovations can have significant consequences for universities, student innovators, and the wider economy. When promising innovations remain at the prototype, research, or intellectual property stage, their potential economic and societal value may not be fully realized. In Malaysia, previous studies have highlighted persistent challenges in moving university research outputs towards commercial application, including weaknesses in intellectual property management, commercialization policies, resources, and university–industry linkages (Ismail & Mohamed, 2016; Abd Jamil et al., 2024; Shahidan et al., 2025). The low level of commercialization may consequently limit opportunities for universities to generate licensing income, establish spin-off ventures, strengthen industry partnerships, and contribute to economic development. It may also restrict student innovators from transforming their ideas into viable entrepreneurial ventures and gaining practical experience in market development and business creation. More broadly, the continued gap between university research outputs and market adoption may reduce the economic and societal benefits that could otherwise be generated from investments in research and innovation (Abd Jamil et al., 2024;

Shahidan et al., 2025). Therefore, the issue extends beyond the ability of universities to generate innovative products to their capacity to successfully translate these innovations into commercially viable outcomes. This highlights the need to examine the factors that influence the commercialization of university products, particularly among student innovators, to ensure that promising innovations are not left underutilized within the university environment.

Financial Support

Financial support is widely regarded as an important enabler of innovation commercialization, as it provides the resources required to refine prototypes, undertake market validation, protect intellectual property, and support technology transfer activities. In the Malaysian higher education context, insufficient financial resources have been identified as one of the major challenges that can impede the commercialization of research and innovation outcomes. Ismail and Mohamed (2016), for instance, reported that inadequate funding and resource limitations can constrain the commercialization process in Malaysian public universities, particularly in progressing innovative research outputs from prototype development towards market adoption. These financial constraints may therefore limit the capacity of universities and student innovators to further develop, validate, and commercialize promising innovations.

The availability of funds happens to be among the crucial issues that help to decide whether student innovation projects can be made to pass through the research phase and yet be implemented in reality. Availability of adequate financial resources will help students to perfect prototypes, acquire materials, test their products and create feasible business plans that will translate creative concepts into marketable products. Other past researchers also highlight that financial assistance is essential in developing entrepreneurial behavior among university graduates by lowering the risk of loss of money and stimulating innovation-based businesses (Audretsch, 2014). A sufficient financing is also able to enable technical advancement, as well as empower student innovators in the ability to consider the market opportunities and partnership with the industry players. Moreover, financial support tends to bring investors and other external stakeholders, which provides a favorable environment and boosts the commercialization process (Siegel & Wright, 2015). Thus, the hypothesis proposed is;

H1: Financial support is positively affecting the commercialization among university's students

Industry Collaboration

Industry collaboration refers to formal and informal partnerships between students and external organizations (e.g., companies, research institutions, industry mentors) that provide practical insights, technical guidance, and access to facilities that support research and development activities. When students engage directly with industry partners, they are exposed to real-world business practices, customer demands, and market-driven innovation processes (Etzkowitz & Leydesdorff, 2000). This collaboration allows for knowledge transfer between academia and industry, where academic research provides the foundation for innovation and industry contributes practical expertise, funding, and infrastructure support (Rosdi et al., 2021). Through joint projects, students gain valuable insights into product design, marketing strategy, and regulatory compliance, which are critical for successful market entry. Industry partners often act as mentors or investors, offering technical advice and professional networks that accelerate the commercialization journey.

Additionally, such partnerships ensure that student innovations align with industry needs rather than remaining purely academic in nature (Ragupathy et al., 2020). When collaboration is well-structured, both parties benefit, universities fulfil their role in knowledge transfer, while industries gain access to new technologies and young talent. Therefore, it is proposed that effective collaboration with industry stakeholders significantly enhances the commercialization rate of student innovation projects. Based on the preceding discussion, the following hypothesis is proposed;

H2: Industry collaboration positively affects the commercialization among university's students

Social Networks

Social networks encompass the relationships students maintain with peers, mentors, alumni, and other

stakeholders in the entrepreneurial ecosystem. These networks form social capital, defined as the resources embedded in a social structure that individuals can access and mobilize to achieve objectives (Adler & Kwon, 2002). It serves as powerful catalysts in the innovation ecosystem, influencing how student projects evolve into commercial ventures. A well-connected innovator can benefit from access to valuable information, knowledge, and support through personal, professional, and business networks, which may facilitate innovation and commercialization activities (Abd Rahim et al., 2019). Social connections foster trust, open communication, and collaboration elements that help innovators navigate complex commercialization processes. According to social capital theory, relationships function as valuable assets that provide both tangible and intangible resources necessary for success (Burt, 2019).

Studies in entrepreneurship research have consistently shown that strong social networks enhance entrepreneurs' ability to identify opportunities, mobilize resources, and improve venture performance. For example, research synthesizing entrepreneurial social capital indicates that entrepreneurs often rely on their personal and professional networks to obtain information, financial support, and legitimacy for their ventures (e.g., Anderson et al., 2005; Batjargal, 2010). Hence, this study presents the hypothesis as;

H3: Social networks positively affect the commercialization among university's students

Innovator's Characteristics

Innovator characteristics refer to personal attributes of students such as creativity, entrepreneurial mindset, risk-taking propensity, persistence, and self-efficacy that influence their capacity to pursue commercialization activities. The personal characteristics of student innovators are among the most decisive factors that determine commercialization success. Innovators with strong entrepreneurial orientation, creativity, and self-efficacy are more capable of transforming their projects into marketable products (Li et al., 2020). According to Bandura's (1997) self-efficacy theory, individuals who believe in their own capabilities are more likely to persevere, take initiative, and overcome obstacles throughout the commercialization process. Similarly, Ng. and De Clercq (2021) found that students who perceive their research projects as a reflection of their identity tend to show greater passion and persistence. Such innovators display traits like resilience, adaptability, and goal orientation, which are essential for dealing with uncertainty and competition. They are also more open to learning from failures, improving their products based on feedback, and seeking new market opportunities. Moreover, innovators with a proactive mindset often take the lead in securing funding, establishing partnerships, and exploring intellectual property rights. These characteristics collectively contribute to transforming innovative ideas into sustainable entrepreneurial ventures. Accordingly, the following hypothesis is formulated for empirical testing;

H4: Innovator characteristics positively affect the commercialization among university's students

THEORETICAL FRAMEWORK

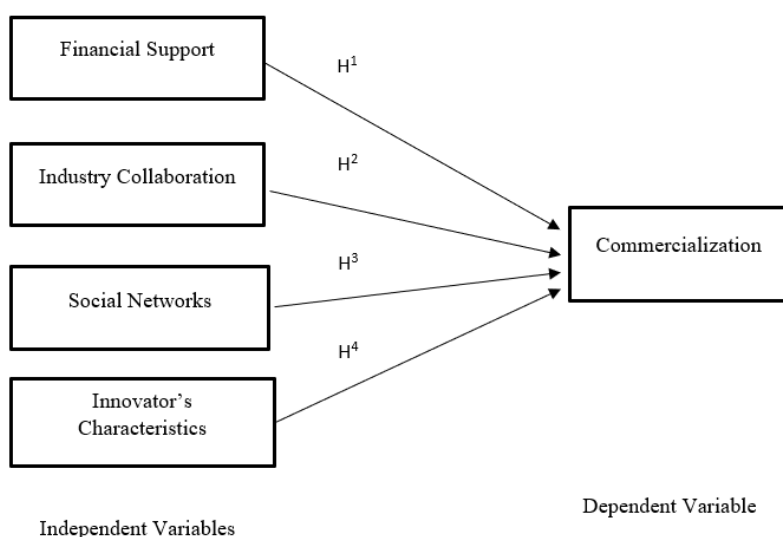


Figure 1: Theoretical Framework

Figure 1 illustrates the proposed conceptual framework, which examines how four factors—financial support, industry collaboration, social networks, and innovator characteristics—influence the commercialization of student innovations. Drawing on Entrepreneurial Ecosystem Theory, commercialization is viewed as an outcome shaped by the interaction between external ecosystem support and the internal capabilities of individual innovators. Financial support provides the resources necessary for prototype development, market validation, and intellectual property protection, thereby facilitating the progression of innovations towards commercialization (Rahman & Alias, 2020; Khademi et al., 2014). Industry collaboration provides access to technical expertise, production facilities, practical guidance, and market knowledge that can enhance the readiness of student innovations for market entry (Othman, 2016). Similarly, social networks enable student innovators to obtain mentorship, relevant information, potential investors, and other resources that can support the commercialization process (Anderson et al., 2005). In addition to these external ecosystem conditions, innovator characteristics such as creativity, entrepreneurial mindset, risk-taking propensity, and persistence represent internal capabilities that may influence an individual's ability to develop and commercialize innovative ideas (Sukri et al., 2024). Collectively, these factors reflect the entrepreneurial ecosystem perspective that successful commercialization depends not only on the capabilities of individual innovators but also on the availability of supportive resources, relationships, and institutional linkages within the surrounding ecosystem.

METHODOLOGY

The target population comprises final-year university students from various faculties and academic disciplines who are accessible and willing to participate in the study. These students are regularly exposed to innovation and entrepreneurship through academic courses, project-based learning, and co-curricular activities. Their experiences and perspectives provide valuable insights into the readiness of future graduates to engage in innovation and commercialization activities. Although the study employs a non-probability sampling approach, involving students from diverse academic disciplines helps capture a broader range of perspectives and experiences. This diversity is particularly relevant because innovation is not confined to a single field of study; students from different academic backgrounds possess distinct knowledge, skills, and competencies that may contribute to the innovation ecosystem. Therefore, including students from multiple disciplines enhances the breadth of perspectives represented in the study and provides a more comprehensive understanding of factors associated with the commercialization of student innovations.

The scales used followed the prior research. The financial support measurement items were adapted from Rahman and Alias (2020), which examined access to financial support in university innovation and commercialization contexts. The industry collaboration items were adapted from Nnorom et al. (2024), focusing on university–industry partnerships, mentorship, and collaborative commercialization activities. The social network items were adapted from Burt (2004), based on the concept of the innovator's social network, which measures network strength, relational ties, information flow, and access to supportive connections for innovation. The innovator's characteristics items were adapted from de Jong and den Hartog (2010), which measure creativity, proactiveness, entrepreneurial orientation and openness to innovation among students. Lastly, the commercialization measurement items were adapted from Pankowska et al. (2025), focusing on readiness, institutional support, motivation, and capability for commercializing student innovation projects. All variables were measured using a 5-point Likert Scale ranging from 1 = Strongly Disagree to 5 = Strongly Agree.

Prior to the actual data collection, a pre-testing and pilot study were conducted to assess the clarity, relevance, and comprehensibility of the questionnaire items. The pilot test involved 30 respondents who shared similar characteristics with the target population but were excluded from the actual study. The respondents were asked to evaluate the questionnaire in terms of the clarity of the instructions, wording of the items, and overall understanding of the questions. Based on the feedback received, minor adjustments were made to the wording and presentation of several items to improve their clarity and ensure that the questionnaire was appropriate for the actual data collection.

The population size of final-year students was unknown because the university's Student Affairs Division restricts access to student enrolment data due to confidentiality and privacy policies. To determine the required sample size, G-Power software 3.1.9.4 was used, with an effect size of 0.15 (f square), an α error probability of

0.05, a power of 0.8, and 4 predictors. The minimum sample size suggested was 85. Scholars recommend that a sample size between 50 and 500 is ideal for most studies (Roscoe, 1975). The study employed a non-probability sampling approach using a convenience sampling technique. This technique was selected because respondents were recruited based on their accessibility, availability, and willingness to participate in the study. Given the practical constraints associated with accessing the target population, convenience sampling provided a feasible approach for collecting data from eligible university students within the available timeframe. Although this approach does not provide every member of the population with an equal probability of selection, it is suitable for reaching respondents who meet the predetermined criteria of the study.

Data were collected using an online Google Form distributed through student networks and academic platforms. The method is convenient for the students and supports high participation rates. Online surveys eliminate manual data entry as much as possible and ensure that responses are filed away securely and automatically, adding efficiency and accuracy to data management. A total of 104 responses were collected. 25 responses were discarded due to incomplete response.

The data were analyzed using the Statistical Package for the Social Sciences (SPSS). This software is widely regarded as a reliable tool for processing research data efficiently, accurately, and in a systematic manner. SPSS facilitates the generation of descriptive statistics and enables the examination of relationships between variables, as well as the testing of research hypotheses. In this study, multiple regression analysis was employed to determine the influence of the independent variables on commercialization. The 95 percent confidence intervals for the standardized beta coefficients (β) were calculated to assess the precision and statistical significance of the estimates. Furthermore, the utilization of SPSS allows for efficient management of large datasets while minimizing human error throughout the analytical process, ultimately strengthening the credibility and quality of the study. Lastly, the assumption checks (linearity, homoscedasticity, and normality of residuals) were conducted before performing the regression analysis. Therefore, the data met the required assumptions, and the regression results are considered valid and reliable.

FINDINGS

Descriptive Analysis

Table 1 showed the demographic profile of the respondent involved in this research. A total of 104 respondents participated in the survey. The characteristics of the respondents are analysed based on the gender, age, faculty, semester and education level. Majority of the respondents were female, accounting for 73 respondents (70.2%) meanwhile 31 respondents (29.8%) are male. This indicates that female students formed a larger proportion of the study sample. Most of the respondents were aged between 22 to 25 years with 87 respondents (83.7%). This followed with respondents aged 18 to 21 years with 14 respondents (13.5%). A small number of respondents were aged under 18 with 1 respondent (1.0%) and 26 years and above with 2 respondents (1.9%). This suggests that the respondents were in the typical age range of undergraduate students. For faculty distribution, the majority of the respondents were from the Faculty of Business and Management with 87 of respondents (82.7%). This was followed by the Faculty of Education with 5 respondents (4.8%). Next, Faculty of Hotel and Tourism Management and Faculty of Built Environment each with 3 respondents (2.9%). Other faculties including Faculty of Health Sciences with 2 respondents (1.9%), Faculty of Accountancy, Faculty of Pharmacy, College of Creative Arts, and other faculties contributed a small proportion of respondents. This distribution reflects the dominance of business-related students in this research. The majority of respondents held a Bachelor's degree, accounting for 100 respondents (96.2%). A small proportion of respondents held a Diploma qualification, comprising 3 respondents (2.9%), while 1 respondent (0.9%) indicated "Others" as their educational qualification.

Table 4.1: Profile of Respondents

Characteristics	No. of Respondents (n=104)	Percentage
Gender		
Male	31	29.8

Female	73	70.2
Age		
Under 18	1	1
18 to 21	14	13.5
22 to 25	87	83.7
26 and above	2	1.9
Faculty		
Faculty of Business & Management	87	82.7
Faculty of Accountancy	1	1
Faculty of Education	5	4.8
Faculty of Hotel & Tourism Management	3	2.9
Faculty of Pharmacy	1	1
Faculty of Health Science	2	1.9
Faculty of Built Environment	3	2.9
College of Creative Arts	1	1
Other	2	1.9
Education Level		
Diploma	3	2.9
Bachelor's Degree	100	96.2
Others	1	0.9

Means, Standard Deviations, Number of Items and Reliability Test

Table 2 presents the descriptive statistics and reliability results for the variables examined in the study. For Financial Support, the construct was initially measured using five items. However, the reliability analysis indicated that one item contributed to a lower level of internal consistency and was therefore removed from further analysis. Following the removal of this item, the Financial Support construct comprised four items and demonstrated a satisfactory level of internal consistency, with a Cronbach's alpha value of 0.816. The mean score for Financial Support was 3.86 (SD = 0.6169), indicating a relatively high level of perceived financial support among the respondents.

The remaining constructs demonstrated satisfactory reliability, with Cronbach's alpha values ranging from 0.842 to 0.924. Industry Collaboration comprised five items and recorded a Cronbach's alpha of 0.857, while Social Network also comprised five items with a reliability value of 0.905. Innovator's Characteristics consisted of five items and demonstrated the highest reliability among the independent variables, with a Cronbach's alpha of 0.924. Meanwhile, Commercialization comprised five items and recorded a Cronbach's alpha of 0.842. Overall, the reliability results indicate that all constructs achieved acceptable levels of internal consistency for subsequent analysis.

Table 2: Means, Standard Deviations, Number of Items and Reliability Test

Variables	Mean (M)	Standard Deviations (SD)	No. of Items	Reliability
Financial Support	3.86	.6169	4	.816
Industry Collaboration	4.15	.5029	5	.857
Social Network	4.16	.5690	5	.905
Innovator's Characteristics	4.14	.5537	5	.924
Commercialization	4.20	.5067	5	.842

Correlation Analyses

The Pearson correlation analysis was applied to determine the relationship between the independent variables, which were financial, industry collaboration, social network, innovator characteristics, and the dependent variable, which is commercialization of student innovation projects. Table 3 shows the that all variables are significantly positively related to the commercialization of the projects of student innovation ($p < 0.01$).

Table 3: Correlations of Variables Understudy

Variables	1	2	3	4	5
1. Financial Support	1				
2. Industry Collaboration	.696**	1			
3. Social Network	.656**	.772**	1		
4. Innovator's Characteristics	.715**	.774**	.697**	1	
5. Commercialization	.580**	.732**	.701**	.683**	1

** Correlation is significant at $p < 0.01$ (1-tailed)

* Correlation is significant at $p < 0.05$ (1-tailed)

The innovator's characteristics were found significantly positive correlate with commercialization ($r = 0.580$). The result also shown the significant positive correlation between industry collaboration and social network on commercialization ($r = 0.732$ and $r = .701$). Meanwhile, there is a weak correlation between finance and commercialization ($r = .580$). These results indicate that increases in these variables are associated with higher commercialization levels, although correlation does not imply causation.

Hypotheses Testing

Referring to Table 4, the final regression model (Step 4) explained 58.3 percent of the variance in commercialization (adjusted $R^2 = 0.583$), indicating that financial support, industry collaboration, social network, and innovator's characteristics collectively accounted for a substantial proportion of the variation in commercialization among university students. This suggests that the model demonstrates good explanatory power in predicting commercialization outcomes. Furthermore, based on Cohen's (1988) effect size guidelines, the model exhibited a large effect size, indicating that the selected predictors collectively provide a strong explanation of commercialization outcomes.

The findings revealed that industry collaboration ($\beta = .344, p < .01$) and social network ($\beta = .282, p < .05$) were significant positive predictors of commercialization. This indicates that students with stronger industry linkages and broader social networks are more likely to commercialize their university products. In contrast, financial support ($\beta = .223, p > .05$) and innovator's characteristics ($\beta = -.004, p > .05$) did not significantly influence commercialization, suggesting that these factors were insufficient to explain commercialization outcomes in the presence of the other predictors. The Durbin–Watson statistic (1.808) was close to 2, suggesting that the residuals are not autocorrelated. This confirms that the assumption of independent errors in the regression model is met.

Table 4: Hypotheses Testing

Variables	Standardised Beta (1st Step)	Standardised Beta (2nd Step)	Standardised Beta (2nd Step)	Standardised Beta (4th Step)
Independent Variables				
Financial	.580	.137	.065	-.004
Industry collaboration		.636	.442	.344**
Social network			.317	.282*
Innovator's characteristics				.223
R	.580	.739	.764	.774
Adjusted R^2	.330	.536	.570	.583
R^2 change	.337	.209	.038	.016
F Value	49.2	57.5	44.3	35.2
Durbin Watson Index				1.808

Note: ** $p < 0.01$; * $p < 0.05$

DISCUSSION, CONTRIBUTION AND LIMITATIONS OF STUDY

This study examines the factors influencing commercialization, with a particular emphasis on students in higher education institutions. Previous studies on commercialization have largely focused on established entrepreneurs,

small and medium-sized enterprises (SMEs), technology-based firms, or university technology transfer mechanisms, with relatively limited attention given to university students as potential commercializers of innovative products. Consequently, there remains a gap in understanding the factors that influence students' commercialization activities within the higher education context. Specifically, limited empirical evidence exists regarding the roles of financial support, industry collaboration, social networks, and innovator's characteristics in promoting the commercialization of university-generated products among students. The findings of this study are expected to enrich the existing literature by providing empirical evidence on the determinants of commercialization among university students from the perspective of the Entrepreneurial Ecosystem Theory. Furthermore, the study offers practical insights for higher education institutions, policymakers, and relevant stakeholders in designing strategies and support mechanisms that strengthen students' commercialization capabilities and facilitate the successful translation of university innovations into marketable products.

The results demonstrate that collaboration with the industry player and social networking are both important predictors of commercialization, and it is important to recognize the importance of external support mechanisms in converting student innovations into marketable products. The first finding is consistent with the university industry collaboration model developed by Etzkowitz and Leydesdorff (2000) that emphasizes the involvement of the external industry actors in the process of commercialization of innovation through Triple Helix Model. The cooperation of industries is highly significant in facilitating a connection between the available academic innovations and the market needs. Collaboration with industry players grants students the advantage of technical skills, production facilities, coaching, and business experience that they would not necessarily be able to receive within the university setting (Perkmann et al., 2013). Such collaboration may help innovators among the students to refine their ideas, increase the marketability of their products, and align innovations with market and consumer expectations.

Our study also confirms that social networks have a massive role to play in commercializing projects of student innovations. The findings corroborated with prior research findings (Nabi et al., 2018). The finding shows that students with stronger social networks like peers, lecturers, mentors, alumni, and industry contacts have increased chances of having a higher readiness to commercialisation. The provided discovery proves the view that social networks are able to provide access to information, emotional support, and learning opportunities that are important during the early stages of entrepreneurial development. Social networks are especially relevant in the student context since students do not often have a great experience in the market and professional exposure. Consequently, their networks tend to serve as main sources of advice, encouragement, and discovery of opportunities. Empirical research findings suggest that positive exposure to peer support and mentors may increase the confidence of students, their motivation and readiness to pursue entrepreneurial opportunities (Nabi et al., 2017). These are very vital factors in the initial stages of innovation that are characterized by uncertainty and fear of failure.

On the other hand, the hypotheses associated with financial support and innovator's characteristics were found unsupported. The financial support was found insignificant impact on commercialization, indicating that the hypothesis was unsupported. This finding is contrast with prior research, indicating that financial support becomes one of the important factors in encouraging commercialization (Ramli et al., 2021). This is rather surprising due to financial limitations are usually seen as the greatest obstacle to business success, especially when it comes to the early-stage entrepreneurs. This observation is a bit surprising, with financial constraints and associated barriers usually listed as the reason why students do not actively engage in entrepreneurial practices and idea-to-action transformations in the student entrepreneurship literature (Makai & Dory, 2023; Wang & Huang, 2020).

A plausible explanation for the unsupported hypothesis is that commercialization among university students does not depend solely on financial resources but rather on the interaction between financial support and other facilitating conditions. This finding suggests that financial resources alone may be insufficient to stimulate commercialization unless they are complemented by an enabling ecosystem that fosters students' entrepreneurial capabilities and market engagement. Previous studies have emphasized that institutional support, entrepreneurial learning, mentoring, and individual capabilities interact with financial resources in influencing entrepreneurship and commercialization outcomes, rather than financial support acting as an independent determinant (Lu et al.,

2021; Makai & Dory, 2023). Similarly, scholars argued that successful student commercialization is driven by a supportive entrepreneurial ecosystem comprising strong support networks, capability development, university support, and industry engagement, rather than the mere availability of funding (Makai & Dory, 2023; Alam et al., 2025). Therefore, financial support is likely to be more effective when integrated with complementary resources and ecosystem support that facilitate students' commercialization activities.

Finally, the hypothesis concerning the relationship between innovator characteristics and commercialization was not supported. This finding differs from previous research, which suggests that individual characteristics play an important role in driving entrepreneurial and commercialization outcomes (Nabi et al., 2017). One possible explanation is that the influence of innovator characteristics among university students may be more pronounced in shaping their psychological readiness for entrepreneurship than in directly producing commercial outcomes. Characteristics such as confidence, resilience, and creativity may influence how students respond to uncertainty, overcome challenges, and recognize learning opportunities; however, possessing these characteristics alone may not be sufficient to transform innovative ideas into marketable products. Previous research on entrepreneurship education suggests that personal characteristics may influence entrepreneurial outcomes indirectly through psychological mechanisms such as self-efficacy, motivation, and entrepreneurial intention (Nabi et al., 2017). Therefore, the non-significant finding may indicate that innovator characteristics require the support of other factors, such as entrepreneurial intention, financial resources, industry linkages, and market access, to translate individual capabilities into successful commercialization outcomes.

This study contributes to the existing body of knowledge by clarifying the factors that influence students' commercialization. In a practical perspective, the study provides a roadmap to the strategic action of institutions of higher learning that seek to improve their student entrepreneurship ecosystems. Because industry collaboration and social networks were the only statistically significant predictors in the regression model, the focus of the universities has to be on the development of formal and active engagement platforms as opposed to class-based innovation training only. This does not only imply the provision of a creative environment, but also the development of organized industry-student mentorships, co-development R&D cycles, and frequent networking symposiums with more experienced entrepreneurs and investors. It is through these real-life connections that institutions will equip the students with the market knowledge and technical advice that is necessary in enhancing the market readiness of their innovations.

Practically, this study provides a roadmap for higher education institutions to strengthen student entrepreneurship ecosystems and enhance the commercialization of university-generated innovations. Since industry collaboration and social networks emerged as the only significant predictors of commercialization, universities should move beyond conventional classroom-based entrepreneurship education by adopting experiential, collaborative, and industry-engaged pedagogical practices. These may include project-based learning, business incubation programmes, structured industry-student mentorship, collaborative research and development, internships, innovation challenges, and networking events involving entrepreneurs, investors, and industry practitioners. Although innovator characteristics such as creativity and proactiveness are valuable, the findings suggest that these attributes alone are insufficient to drive commercialization without a supportive entrepreneurial ecosystem. Therefore, universities should focus on developing students' social capital by equipping them with the skills to build professional networks, collaborate with industry partners, and access commercialization support mechanisms. Such initiatives can bridge the gap between university innovation and market application, ultimately increasing the likelihood of successful commercialization among university students.

From a policy perspective, the findings suggest that government agencies and policymakers should move beyond conventional grant-based approaches toward developing a more integrated and ecosystem-oriented support framework for student commercialization. As financial support was not found to have a significant direct effect on commercialization, funding initiatives should be complemented by mechanisms that facilitate industry collaboration, mentorship, and professional networking. For example, access to government commercialization grants could be linked to industry partnerships, mentorship programs, or collaborative innovation projects to ensure that financial resources are accompanied by the technical expertise, market knowledge, and social capital necessary for successful commercialization. Furthermore, policymakers should strengthen university-industry linkages by encouraging small and medium enterprises (SMEs) to collaborate with student innovators through

incentives such as tax benefits, matching grants, or collaborative research funding. Such initiatives can enhance knowledge transfer, bridge the gap between university innovation and market application, and ultimately improve the commercialization potential of student-generated innovations.

In order to continue the lines of this study, a number of research areas can be suggested to the future academic work. The future research ought to be more cross-disciplinary in nature, i.e. the sample of science, technology, engineering and mathematic (STEM), medical and creative arts faculty should be recruited more equally. It would enable the comparative analysis with a view of ascertaining whether the drivers of commercialization like industry ties are the same or differ in scores with regard to the academic field and the particular needs of the industry. Also, longitudinal research designs that follow student innovation projects across a few years would prove to be very helpful in the field. It would be a far better idea to trace a cohort of the ideation phase all the way to the market launch to have a much better understanding of how the support mechanisms such as the social networks or financial assistance have affected the project on various developmental milestones.

We would also suggest the use of qualitative approaches, that is, in-depth interviews or ethnographic studies of successful student entrepreneurs. Although this paper has presented a solid quantitative argument on the significance of social and industry networks, a qualitative measure would be helpful to reveal the insidious, behind-the-scenes mechanisms through which these relationships lead to success such as how mentors can offer emotional strength, or how industry partners could help one pivot a product into the market. Lastly, conducting comparative studies between the student ecosystems in Malaysia and other developing or developed countries might contribute to the establishment of the global best practice. This would enable one to understand more about the impact of national policies and cultural readiness to risk-taking on the performance of innovation support systems in universities.

Although this research is very insightful, there are some limitations which need to be considered in order to give a balanced background of the findings. First, it has a significant level of geographic and institutional concentration; the study mostly sampled the undergraduates in the UiTM Puncak Alam campus, which can restrict the extrapolative validity of the findings to students in alternative geographical, cultural and institutional settings. Second, the limitation of this study concerns the demographic composition of the respondents. The study was conducted among students whose student population is predominantly composed of Malay and Bumiputera students, including Bumiputera from Sabah and Sarawak. This relatively homogeneous ethnic and institutional context may limit the generalizability of the findings to university students from other ethnic, cultural, and educational backgrounds. Differences in cultural values, entrepreneurial exposure, family background, social networks, and perceptions towards entrepreneurship may influence students' propensity to engage in commercialization activities.

Third, the distribution of the sample was skewed towards the Faculty of Business and Management, which represented the majority of respondents (82.7%). The researchers made considerable efforts to obtain responses from students outside the business discipline; however, the response rate from non-business students remained relatively low. Consequently, the findings may not fully capture the specific commercialization challenges and support needs of students from highly technical or regulated disciplines, such as Engineering, Pharmacy, and the Creative Arts. Lastly, the study was based on self-reported perceptions of readiness and support instead of objective longitudinal measures, i.e., actual revenue generated, number of patents filed and the longevity of the resultant start-ups. This creates some level of subjectivity because the perceptions of the students towards their readiness to commercialize might not be the same as the performance in the market. Lastly, the cross-sectional of the research is limited to a single instance in time when the process of innovation is observed. Since the commercialization process is a multi-year process, this design cannot completely capture how the needs of a project like the ratio of financial support to industry relationship may increase as the project grows as an early conceptual prototype to a full-scale market entry.

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Ethical Approval

Ethical approval for this study was obtained from UiTM Research Ethic Committee, Universiti Teknologi MARA, prior to the commencement of data collection (Approval No. REC/03/2026 ST/MR/64). Informed consent was obtained from all participants prior to their participation in the study.

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