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A Review of Research and Technology Transfer in Agricultural Universities: Practical Issues in Vietnam

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Abstract

This research explored the theoretical and practical dimensions of linking research and technology transfer in Vietnam's agricultural universities. Universities play a vital role in advancing agriculture through technology development, consultancy, training, and knowledge dissemination, bridging the gap between academic research and real-world applications. Key activities include negotiation, contracting, technology transfer, knowledge dissemination, and providing support services, which collectively enhance the integration of research with technology transfer processes. These activities highlight the importance of science and technology policies and mechanisms, which significantly influence the development of a robust agricultural technology transfer market in Vietnam. However, significant limitations hinder progress. Vietnam's science and technology transfer remains underdeveloped, with many innovations failing to achieve real-world applications. Current policies are overly focused on patenting, neglecting broader commercialization and practical implementation. Additionally, the lack of diverse and effective connection channels, limited public awareness, and insufficient financial and human resources exacerbate these challenges. Agricultural universities struggle to establish strong connections and drive impactful technological advancements. The study concludes that enhancing internal university capacities, coupled with supportive policies, are essential to align academic research with agricultural needs, ultimately fostering innovation and sustainable development in Vietnam's agricultural sector.

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Knowledge transfer, science and technology, training and education

Introduction

The connection between research and technology transfer is a critical factor in driving innovation and development (Altab *et al.*,

2015), particularly in Vietnam's agricultural sector, which remains a top national priority. Science and technology are central to Vietnam's national development strategy, as highlighted in the strategy for scientific and technological development and innovation in agriculture and rural development to 2030, with a vision to 2050. This strategy emphasizes measurable goals, such as ensuring that at least 60% of research results are recognized as technical advancements and applied in production, with 15% being registered for intellectual property rights (Ministry of Agriculture and Rural Development, 2023a). Additionally, the value of technology transfer and commercialization from universities and research institutes to enterprises is expected to increase significantly (Nguyen Thi Minh Nga & Pham Quang Tri, 2016; Nguyen Thi Thu Ha & Nguyen Dinh Duc, 2019).

Despite these ambitious targets, the practical application of research in agriculture faces numerous challenges (Ministry of Agriculture and Rural Development, 2023a). These include the limited dynamism and engagement of production and business units, the gap between universities and enterprises, and a lack of integration of research with real-world applications. As a result, the impact of research on agricultural production remains limited, as evidenced by the relatively low number of new technologies transferred and the smaller volume of publications in agriculture compared to other scientific fields. The capacity of universities to connect research with technology transfer is critical for bridging this gap. This competence is essential for fostering partnerships with enterprises, cooperatives, and farm households, which play pivotal roles in improving the quality and relevance of research (Nguyen Tien Thong, 2022). By enhancing this capacity, universities can strengthen their role as key drivers of innovation and practical technology application in agriculture (Ministry of Science and Technology, 2023). Given these challenges and opportunities, it is necessary to synthesize both theoretical and practical insights into research and technology transfer in agricultural universities.

Such a review would provide a foundation for understanding the factors influencing the effectiveness of these connections and identifying strategic directions for improvement. By consolidating the findings from domestic and international researches, as well as analyzing secondary data from authoritative sources such as the Ministry of Science and Technology, and the Ministry of Agriculture and Rural Development, Ministry of Education and Training, this study aimed to establish a comprehensive framework for enhancing the competence of universities in connecting research with technology transfer. This framework will serve as a strategic guide for strengthening collaborations among universities, localities, and the agricultural sector, contributing to Vietnam's broader goals for scientific and technological innovation.

Overview of the Connection between Research and Technology Transfer in Agricultural Universities

Perspectives on research and the transfer of science and technology

Competence is seen as an attribute that allows an organization to survive, grow, and diversify (Komariyah *et al.*, 2023). Competence for connection is related to people acting together to take control of their own lives in some way. According to Morgan (2006), competence is related to collective capacity, that is, the combination of attributes that allow a system to perform, provide value, establish relationships, and innovate itself. Therefore, the capacity to connect research and science and technology transfer creates possibilities that allow organizations to carry out research and technology transfer activities effectively within a certain time frame. The capacity of a university to connect research and technology transfer in the agriculture field is reflected in it's links with enterprises, cooperatives, and farm households to disseminate information and knowledge, and connect and communicate to support the transfer of scientific and technological research results and applications in practice (Bozeman, 2000). The process of connecting research with the

transfer of science and technology involves task assignments, which include: (1) Facilitating communication between parties through activities such as seeking advice or announcing scientific and technological advancements to initiate collaboration; and (2) Using connection mechanisms to coordinate various tasks or, in the case of common tasks, to perform them (Alsaad *et al.*, 2022). For a university, competency includes four factors: capacity for action, capacity for development, capacity for adaptation and self-renewal, and capacity for connection (Morgan, 2006). The capacity for research and the transfer of science and technology can also be divided into four factors **(Figure 1)**, namely development capacity (detecting agricultural problems, designing research programs, and creating technologies); networking capacity (dissemination of information and knowledge, connection and communication); capacity for action (technology provision and technology evaluation); and capacity for adaptation and innovation (capacity to improve scientific and technological products) (Nguyen Tien Thong, 2022).

Functions of higher education institutions in connecting research and technology transfer

Higher education institutions have strengths in scientific and technological research and development. Therefore, the implementation of science and technology transfer works to develop agriculture, provide information, and transfer science and technology to farmers, which takes advantage of these potentials of universities. In addition, the roles of training and information communication are also very significant through article publication activities, promotion, multimedia communication, and associations related to agriculture and rural development. Connection for research and technology transfer can be approached through training and visit programs, the individual contact method, farmer field schools, farm and home visits, and participatory extension, among others (Ashraf *et al*, 2018) **(Figure 2)**.

Normally, previous scientific research on the competency of a university is shown through the quality of its published works and citation indexes. The teaching competency of universities is expressed through the lecturer per student index and other indicators, however, the assessment of the competency of the connection between research and technology transfer is a more invisible and difficult issue. There are many methods of transferring science and technology to farmers such as: farmer to farmer, households, schools, and mass media (Azumah, 2018). The research model of Scanlan (2018) evaluated the competency of universities on their

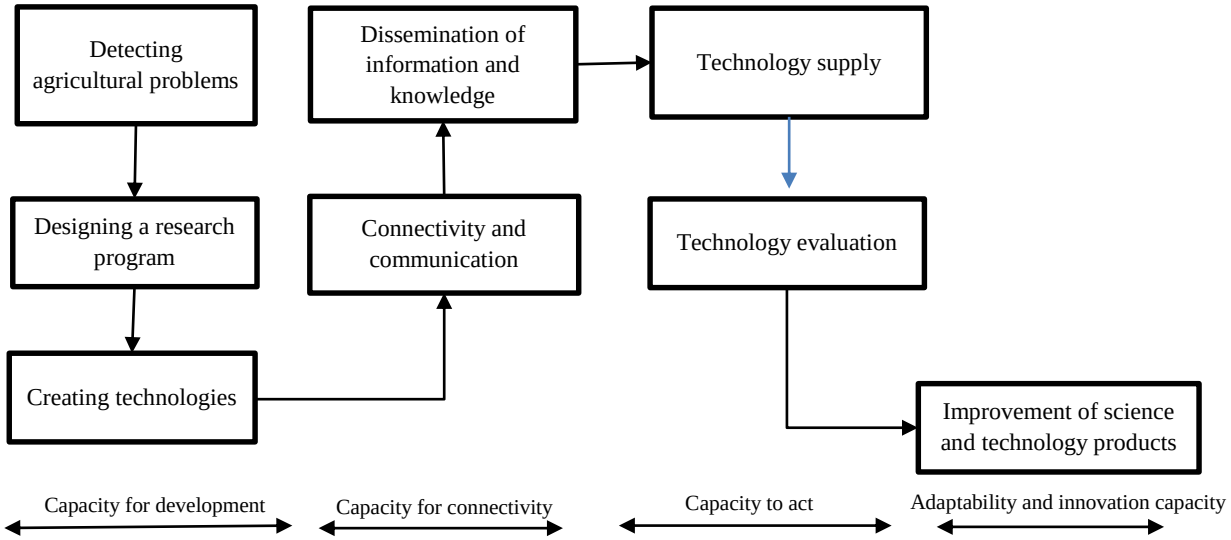

Figure 1. The process of connecting research and science and technology transfer

Source: Alsaad et al. (2022)

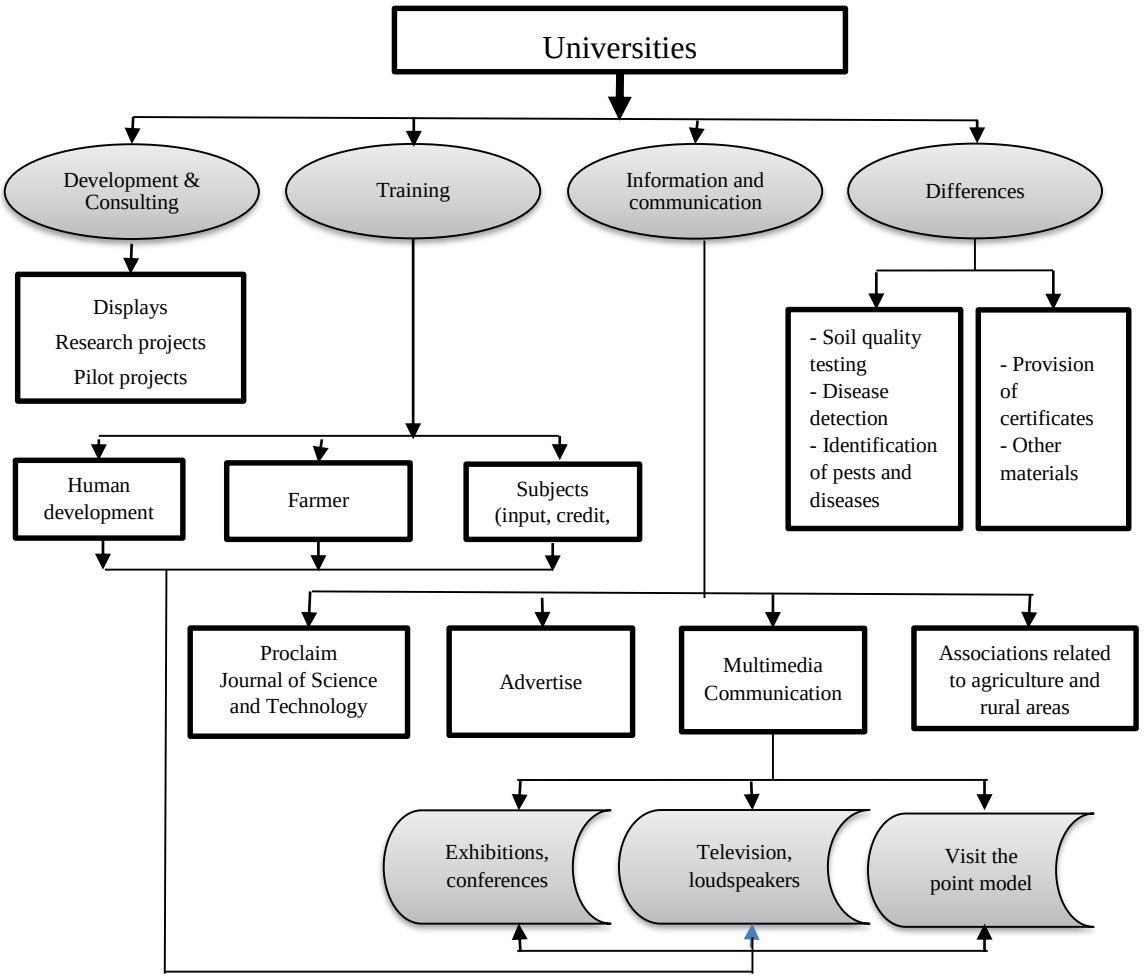

Figure 2. Activities connecting research and technology transfer in the field of agriculture
Source: Rahman (2021)

connection between research and technology transfer using the following criteria: experience of the staff, external connection activities, agreements in agriculture, consulting activities, organizational culture, management process, and quality and speed of transfer. This model can be applied to the capacity of universities in the field of agriculture in Vietnam to connect and transfer science and technology as shown in **Table 1**.

Factors Affecting the Competency of Universities in the Connection between Research and Technology Transfer

Policy on the connection between research and science and technology transfer

The policy of connecting research and science and technology transfer contributes to efforts to create an effective channel in connecting research, education, and training, and expanding science and technology applications (Negrete, 2015). Policies to support the connection of research and transfer of science and technology in the field of agriculture should aim to create an environment for the transfer of smart, environmentally sound, safe, sustainable, appropriate, and nutritious science and technology products, and increase seasonal profits through technology transfer and demand-based technological knowledge towards providing necessary services for agriculture people and start-ups. Developing the science and technology market should be according to the "demand" orientation and market orientation (Akkas *et al.*, 2022).

Table 1. Framework for evaluating the competency of connecting research and technology transfer at universities in the field of agriculture

Competency framework	Level 1	Level 2	Level 3	Level 4	Level 5
Experience of the staff	No experience in implementing science and technology transfer	Just starting to implement science and technology transfer	Developing into science and technology transfer experts	Full capacity for science and technology transfer	Experts in the field of science and technology transfer
External connection operations	Very low, discrete and unplanned	Develop products, first transfer, and have the potential to transfer	Regular and planned transfers	Many years of experience in regularly carrying out transfers	Good profile with many experiences in science and technology transfer
Agreements that promise transfer	No cooperation agreements	There is a package of cooperation agreements	There are multiple packages of cooperation agreements through a research team	There are large-scale cooperation agreements	There is a diverse portfolio of many cooperation agreements
Consultancy activities	No consulting strategy, only the ability to operate internally	Have a service package and consulting plan	Large-scale agricultural consulting services	Market-oriented and managed consulting activities	Comprehensive and professional development consultancy activities
Culture	There is no building a culture of science and technology transfer	A culture of transfer is built and accepted at the researcher level	Transfer activities are calculated when considering emulation and commendation	Extensive recognition of science and technology transfer as an important activity	Extensive recognition of science and technology transfer as an essential activity
Management Process	No management process	Have a management process	Complete and comprehensive management process	Application of management processes for management levels	Extend and disseminate the process to all levels and departments
Speed and quality of science and technology transfer	No experience in negotiating and handling contracts	Have a contract agreeing on labor and time	Contract negotiation is slow because of many stages	Convenient in negotiation and approval	Very quick and effective in negotiation and approval

Source: Scanlan (2018)

Coordination mechanism in the connection between research and technology transfer at universities

A technology transfer sub-system with the mandate of extension services can help farmers adopt technology (Obiora, 2014). The coordination mechanism is important to the connection between research and science and technology transfer because it creates a channel to link and solve problems of differences relating the objectives and mechanisms of operation between universities and enterprises, cooperatives, and farm households in agriculture. While universities are driven by academic prestige, enterprises, cooperatives, and farm households approach problems based on profit results. Besides, there are significant differences between academic and applied research perspectives (Nguyen Tien Thong, 2022).

People's awareness of science and technology

The basic principle of the connection between research and technology transfer of universities is a matter of knowledge and education. Many studies believe that the transfer of science and technology is associated with efforts to convey information and improve understanding of technology and production processes (Bozeman, 2000). The research model of the relationship among education, research,

and farmers has shown that education plays an integral part in the creation and expansion of technologies to improve production systems towards achieving sustainable agricultural and rural development.

Issues related to the farmer's perception of connecting on transferring science and technology include: (1) Perception of usefulness: the extent to which a farmer agrees that the use of technology is necessary (Rezaei-Moghaddam & Salehi, 2010); (2) Ease awareness: when farmers feel that it is convenient and easy to use technology (Rezaei-Moghaddam & Salehi, 2010); (3) Behavior control awareness: when implementing behaviors, farmers depend on available resources and these resources limit the farmers' investment in science and technology in production (Chen & Chao, 2011); and (4) Confidence in the scientific and technological products provided: when farmers believe in the scientific and technological products to which they are transferred as well as the units that transfer the scientific and technological products (Rezaei-Moghaddam & Salehi, 2010).

Finance for researching the connection between research and science and technology transfer

In terms of funding for scientific research activities, the financial capacity of a university is one of the factors affecting the scale and quality as well as the management of scientific research activities and technology transfer (Ustundag *et al.*, 2011). Financial sources for scientific research activities include the state budget; sponsorships and aid from domestic and foreign organizations and individuals; extracts from lawful revenue of the university; and mobilization from other legal sources (National Assembly, 2018b).

Awareness of the leadership and management of research and science and technology transfer

It is necessary to be well aware that scientific research, technological development, and innovation are activities that maintain the existence of a university in the context of today's fierce competition. The environment of leadership awareness is not the contribution of connection competence, but it has a large effect on the competence attributes (Taatila, 2004). Instead of considering scientific and technological research to be mainly oriented to serve as training activities, the current context sets a requirement to consider science and technology and innovation of the university as pioneering activities. The leadership and management of universities need to rethink the position and role of scientific and technological research, and innovation in the context of the Industrial Revolution 4.0, thereby building a reasonable scientific and technological strategy (Scanlan, 2018). The Industrial Revolution 4.0 and the integration process are creating great opportunities for the development of universities and the promotion of scientific research, technology, and innovation. scientific and technological research and innovation in universities in particular.

Innovating and improving management methods can enhance the efficiency of activities. Universities should promote their consulting and advising activities in developing strategies for scientific and technological development and innovation, as well as develop operational plans in each period in accordance with the university's mission. Each university needs to closely evaluate, amend, complete, and promulgate regulations on the management of scientific research, technological development, and innovation activities to suit the practical situation (To Hong Duc *et al.*, 2021). Under the current conditions, a number of universities have applied the mechanism of material and spiritual rewards for works published internationally and scientific and technological transfer products (Trinh Thi Phuong Thao & Vu The Anh, 2021). However, these are only the initial mechanisms for changing the perspective of science and technology activities of universities, and it is necessary to have in-depth promotions to create a driving force for the connection between research and science and technology transfer activities (Nguyen Thi Minh Nga & Pham Quang Tri, 2016).

Human resources

The capacity of human resources is reflected in the quality and quantity of human resources

participating in science and technology connection and transfer activities (Taatila, 2004). This is a direct decisive factor in the promotion of scientific and technological transfer connections. The scientific and technological management team should be professional and perform the functions of advising and linking the actual needs of organizations, enterprises, and localities with the research staff to best meet the scientific and technological demands of localities and enterprises (González-Pernía *et al.*, 2013; Griffioen, 2020) (**Table 2**). Social capital shows the trust and influence of researchers and research institutions on the transferred scientific and technological results (De Wit-De Vries *et al.*, 2019; Griffioen, 2020). This also includes the policy of attracting talented researchers, and at the same time having satisfactory remuneration for those who have made many contributions to the development of scientific and technological activities and innovation of the university.

Practical Challenges in Research and Technology Transfer by Universities in the Field of Agriculture in Vietnam

Currently, the main trends in connecting research and technology transfer in Vietnam's agricultural sector focus on areas such as management, production, and consumption (**Table 3**). Recently, biotechnology basis also become a new trend in the development of science and technology in the field of agriculture. Typical technologies of information technology in the agricultural sector include the digitalization and automation of sensor technologies, the Internet, big data analytics, and cloud storage, among others, applied in the management, monitoring, and automation of agricultural production (Do Kim Chung, 2021; Trinh Hoang Hong Hue & Tran Thien Vu, 2021). Farming techniques and new materials, such as nanotechnology, 3D printing, coating materials, and bio-carpets/nets, increase farming and livestock efficiency (Nguyen Thi Phuong & Nguyen Thi Thu Phuong, 2023). Biotechnology currently has gene, cellular, and molecular biology technologies that have been developed in breeding, which have been utilized to create new varieties with high endurance, good yields, and increased product quality (Chu Khoi, 2024). Science and technology transfer activities are applied in the agricultural production and business processes in order to improve labor productivity and product quality, and at the same time increase value and profits in the agricultural sector. Science and technology are involved in many of the stages of agricultural production, including: *preparing soil, fertilizers, and livestock ponds; development of new trees and seedlings of high quality, ensuring disease prevention and control and good adaptation to harsh natural conditions; taking care of crops, livestock and aquaculture, contributing to*

Table 2. Requirements of human resources participating in science and technology connection and transfer

Request	Content	Assess
Intellectual capacity and understanding	Understanding	Education
	Creativity	Ideas, inventions
	Professional Development	In-depth research
Social capital	Attitude and spirit of cooperation	Joining a research team
	Communication	Communication and promotion of science and technology products
	Trust and influence	Prestige and cooperation in research and transfer of science and technology
Capacity of cooperation and association	Social Relations	Having a social relationship with the local management
		Regularly exchange communication with localities
	Collaboration and Affiliation	Having partnerships and affiliations with cooperatives and local people

Source: Griffioen (2020)

Table 3. Trends in connecting research and science and technology transfer in agriculture in Vietnam

Type	Technology	Administer	Consume	Production
Information Technology, Digitalization, Automation	Sensor technologies, IoT, big data analytics and cloud computing, Smart Weather Station Technology (iMetos), Electromagnetic Insect Warning Station (iTrap), Geographic Information System (GIS)	Monitor, update information, analyze, make decisions, plan, operate, control activities	Automation, marketing digitalization, supply chain management, product consumption	Automation of irrigation and feeding Monitoring and caring for seedlings Weather forecasting, climate change
Farming techniques, agricultural materials and supplies	Based on nanotechnology, 3D printing, coating film materials, and bio-carpets/nets, etc.	Equipment for management	Equipment and supplies for packaging, consumption, preservation, and processing	Materials and equipment for production, greenhouse technologies, greenhouses, greenhouses, biocarpets
Biotechnology	Generic, cellular, and molecular biology technologies have been developed in breeding			New varieties for production create plants/offspring that are capable of reproduction, growth, and resistance Creating yeast, microbiology, biochemistry, drugs, vaccines, etc.

Source: Compiled by the authors (2024)

improving labor productivity; and harvesting and preserving agricultural products to increase the value of goods (Ministry of Agriculture and Rural Development, 2023a).

In 2022, Vietnam had approximately 50 educational institutions offering agricultural training programs. These included 4 universities and 28 colleges under the Ministry of Agriculture and Rural Development, collectively providing training in 38 doctoral disciplines, 39 master's majors, 97 undergraduate training majors, 112 college majors, and 122 intermediate training majors (Ministry of Agriculture and Rural Development, 2023b). Universities play an important role in the development and consultancy of scientific and technological products through exhibition activities, research projects, pilot projects, and other activities. In general, in Vietnam, universities have begun to carry out science and technology transfer activities, however, the number and value of science and technology transfer are low, and the number of science and technology products that can be transferred is still limited (Tran Quang Huy *et al.*, 2021). This is because there are not many partners to receive the transfer (Nguyen Quoc Anh *et al.*, 2021), new science and technology products only solve a few of the practical problems, and their economic value is not significantly high in reality (Tran Thi Hong, 2016). Compared to other fields, agriculture still has a modest number of published research papers, both in terms of domestic and international publications (**Figure 3**).

Policy on the connection between research and science and technology transfer

According to the Law on the Transfer of Science and Technology No. *07/2017/QH14 promulgated by the National Assembly: "Technology transfer* is the transfer of technology ownership rights or the transfer of the right to use technology from the party with the right to transfer technology to the party receiving the technology." Accordingly, the content of science and technology transfer activities includes commercialization of scientific research results, technology transfer consultancy, and technology transfer promotion. Commercialization of scientific research and technological development results means the exploitation, completion, application, and transfer as well as other activities related to

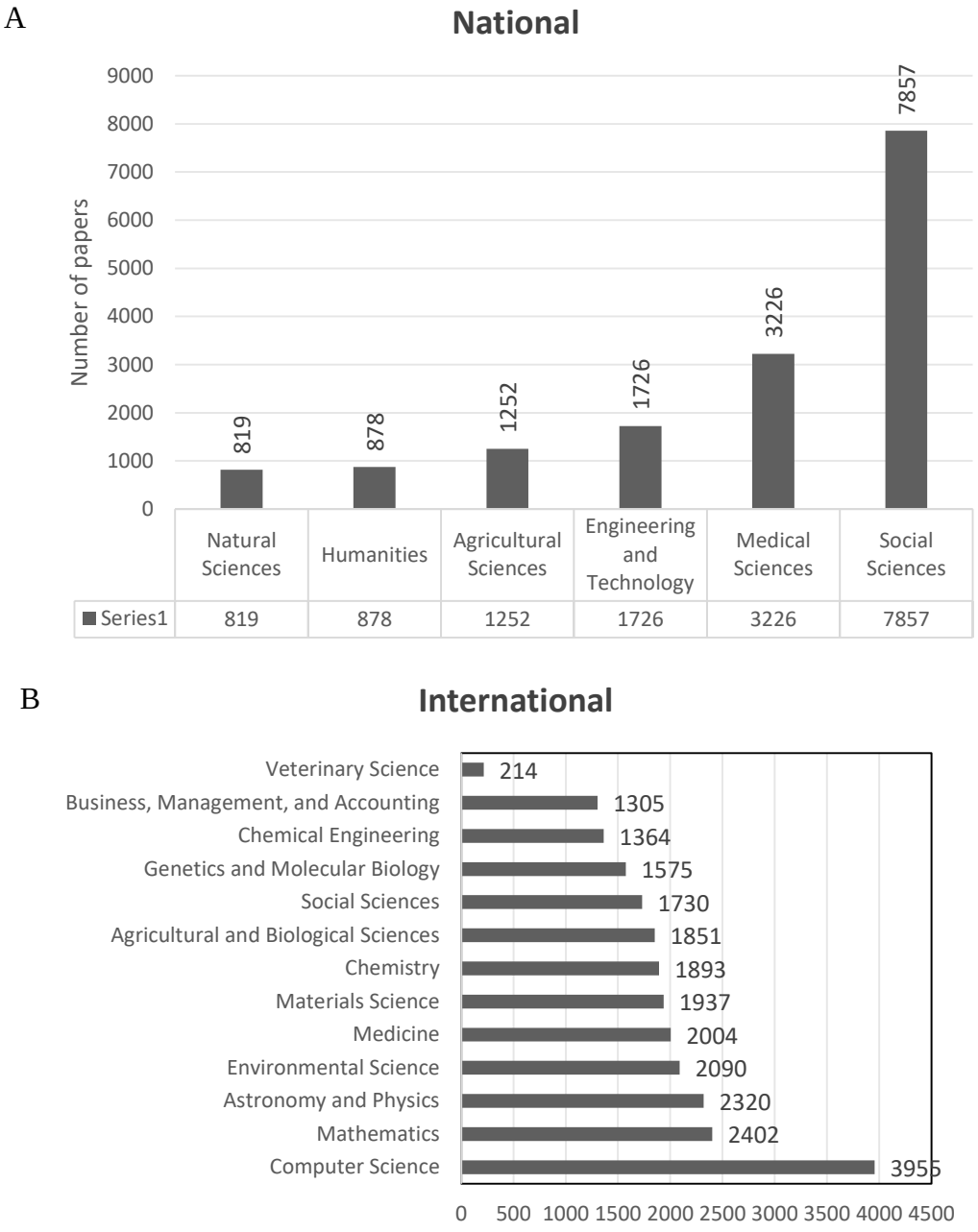

Figure 3. The number of scientific publications in domestic (A) and international (B) science and technology journals in 2022
Source: CESTI (2023)

scientific research and technological development results for the purpose of making profits. *Technology transfer consultancy* is an activity to support the selection and application of technology; exploitation of technological information, patent information, results of scientific research, and technological development; and negotiation, signing, and implementation of technology transfer. *Technology transfer promotion* is the activity of promoting technology transfer opportunities; providing advertising, displaying, and introducing technology services; and organizing markets, fairs, technology exhibitions, technology supply and demand connection points, and technology transaction centers.

In Vietnam, the State's policies are also aimed at supporting and encouraging enterprises

to apply and innovate technology. The University Education Law (National Assembly, 2018b) and the Law on Science and Technology Transfer (National Assembly, 2018a) are two representative documents of strategic policies for the connection between research and science and technology transfer activities. Universities, while managing scientific research activities, need to clearly understand the documents on the Law on University Education, regulations on scientific research activities in universities, and other relevant documents in order to strictly comply with the regulations on time frames, organization methods, funding norms of technology, promoting the commercialization of research results, and building the program "National technological innovation" in order to improve the national technological capacity, efficiency of science and technology transfer activities, serving product development, commercialization of scientific research results and technological development, technological innovation, and strengthening technological resources in rural areas, mountainous areas, and areas with difficult and extremely difficult socio-economic conditions.

The Law on Science and Technology Transfer in 2018 creates conditions to encourage the development of the science and technology transfer market in Vietnam. The science and technology market is entitled to tax incentives for intermediaries and organizers of the science and technology market that earn income from the provision of technology transfer services, or the transfer of science and technology abroad. Policies on the development of the science and technology market and the development of intermediary organizations of the science and technology market are also focused on encouraging the publication, demonstration, and introduction of science and technology innovations.

One of the legal difficulties for science and technology transfer activities is the issue of copyright owners. In Vietnam, “copyright owner” means an organization or individual holding one, some, or all of the rights specified in Clause 3, Article 19 and Clause 1, Article 20 of the Intellectual Property Law 2005 (National Assembly, 2005). There is a difference between copyright and property rights and scientific research results. Therefore, in the process of recording the right to use, exploit, and dispose of a copyright within the framework of intellectual property, especially the monopoly of copying and exclusive use, there is still no transparency between individual scientific research authors and still depends on the agreements and regulations of the training institution and the author. In addition, the copyright protection policy is still loose, leading to the value of brand assets not being high. Data from the National Office of Intellectual Property - Ministry of Science and Technology show that the numbers of applications for the registration of patent protection and utility solutions are significant, but the number of satisfactory dossiers is not high, leading to a small number of applications granted patents for inventions and intellectual property (**Table 4**).

Coordination mechanism in the connection between research and technology transfer at universities

The mechanism of the connection between research and technology transfer at universities in Vietnam is shown in **Figure 4**. In Vietnam, the main limitations in the connection between research and technology transfer of universities are the traditional approach of offering available technologies, and mainly focusing on "supply" but not "demand". Therefore, in order to carry out scientific and technological research well, an effective connection mechanism is very necessary. Universities can introduce their research and technologies based on information technology platforms, internet applications, and by combining knowledge of technology and business in order to connect to enterprises, cooperatives, and households that need to be linked to transfer science and technology in the agriculture field (Le Thanh Phuong, 2018). The connection channels need to focus on both activities through the operation of the connection centers. Activities to connect research and transfer science and technology should focus mainly on field services, plant protection, agricultural cultivation, and production planning and management. Transfer activities include

Table 4. Processing of patent protection dossiers and useful solutions

Application Type	Units	Patent			Useful solutions		
		Year 2022	Year 2023	+/-	Year 2022	Year 2023	+/-
Application reception	number of applications	8,707	9,460	753	601	835	234
Application processing	number of applications	7,280	7,835	555	588	616	28
Processing/receipt application	%	83.61	82.82	-1	97.84	73.77	-24.06
Number of protected documents issued	degree number	3,868	3,668	-200	243	468	225
Number of issued protection documents/ application processing	%	53.13	46.82	-6	41.33	75.97	34.65

Source: Ministry of Science and Technology (2023)

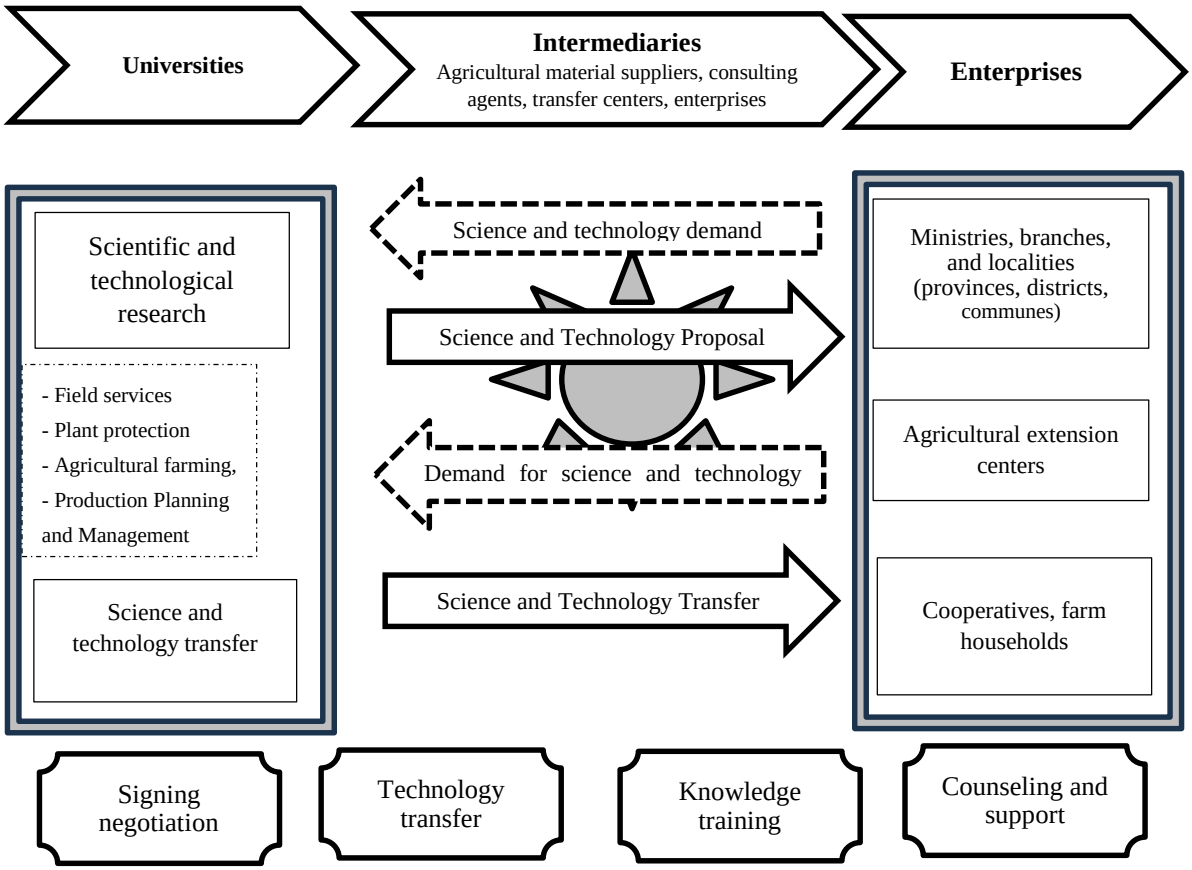

Figure 4. Model of the connection between research and science and technology transfer of universities the field of agriculture in Vietnam

Source: Compiled by the authors (2024)

signing negotiations, technology transfer, and knowledge training, as well as, support and consulting (Ahmed & Moniruzzaman). The development of the connection between science research and technology transfer should focus on intermediary organizations, such as increasing the connection with suppliers of agricultural materials because farmers regularly communicate with suppliers who distribute seeds and pesticides, among other farming needs (Akkas *et al.*, 2022).

People's awareness of science and technology

In Vietnam, awareness of the impacts related to human happiness, economic restructuring, transformation of growth models and support for policymaking, and world peace is not high (**Table 4**). Some previous studies have indicated that insufficient communication regarding scientific and technical advancements has led to limited public awareness and a lack of confidence in the success of new technologies. Consequently, the public's perception of science and technology remains a barrier to the application of these advancements (Truong Dinh Chien & Nguyen Dinh Toan, 2019). Farmers' acceptance of technologies aimed at sustainable production with minimal environmental impacts is lower compared to their acceptance of technologies designed to increase productivity (Bui Bich Xuan *et al*., 2024). For new technologies, farmers still require preferential policies and support to confidently invest in these technologies. Farmers who are diligent and eager to learn, and actively seek out new information about production, as well as those who regularly explore and show interest in new technologies, tend to be more confident in research and adoption of these technologies (Nguyen Duy Hung & Truong Thi Ngoc Thuyen, 2022).

Finance for researching the connection between research and science and technology transfer

Decree No. 99/2014/ND-CP stipulates that higher education institutions spend at least 3% of their funding from tuition fees for scientific research activities (Nguyen Thi Minh Nga & Pham Quang Tri, 2016). A number of higher education institutions have implemented the policy of partly funding investment activities for science and technology activities (Nguyen Dang Tue, 2019), however, this source of expenditure is not much and there is no expenditure for activities to connect research and the transfer of science and technology, but mainly focuses on research activities. Currently, the funding for universities is not enough for lecturers to implement research projects well (**Table 5**). This means that lecturers must make efforts to mobilize financial resources from outside the university to carry out scientific and technological activities (Nguyen Dang Tue, 2019).

Awareness of the leadership and management of research and science and technology transfer

Recently, leaders of agricultural universities have increasingly emphasized the importance of scientific research and technology transfer, particularly highlighting the role of technology transfer within universities. This is reflected in various incentive mechanisms and rewards for faculty members involved in technology transfer activities. Specifically, some key policies include: (1) Early salary increases for faculty members with outstanding scientific and technological (S&T) products or significant achievements in international publications; and (2) Conversion of excess research hours from ISI-indexed international publications, patents, inventions, or outstanding S&T products into teaching hours, allowing them to be counted

Table 5. Revenue from science and technology transfer activities of some universities in the field of agriculture in Vietnam

Unit: billion VND

Universities	Revenue from science and technology transfer activities	Total Revenue	Percent (%)
(1)	(2)	(3)	(2)/(3)
Thai Nguyen University of Agriculture and Forestry	5.18	74.17	7.0
University of Forestry	20.8	153.84	13.5
Vietnam National University of Agriculture	7.8	462.38	1.7
Thuyloi University	14.0	278.0	5.0

Source: Compiled from the three public reports of universities (2024)

towards overtime compensation (Bui Trong Tai, 2021). Universities in the field of agriculture in Vietnam often have regular funds for basic scientific research topics, and the department heads are allowed to proactively propose research contents and funding sources for implementation, that is, assign autonomy to scientists (Nguyen Hong Son, 2012). Some universities have mechanisms to encourage the establishment of science and technology transfer enterprises. These are enterprises developed from science and technology projects, and universities contribute capital in the form of material and intellectual assets (Nguyen Quoc Anh *et al*., 2020).

Human resources

Although Vietnam has made many efforts to improve the quality of human resources participating in the field of science and technology, their research capacity is still limited, and since solving practical problems is necessary but quite difficult, it is imperative to gather a team of leading scientists (Tran Thi Hong, 2016). Human resources for science and technology help improve the efficiency of science and technology transfer, such as increasing the ability to apply the world's scientific and technological achievements in Vietnam, increasing access to new technologies, increasing the prestige of science and technology, and connecting with cooperatives, businesses, and farmers in the application of science and technology (Dinh Viet Phuong, 2023). Currently, the number of professors and associate professors in the field of agriculture is still quite limited, and although there were many recognized agriculture professors and associate professors in 2023, this number was still much lower than some other fields such as economics, medicine, and food sciences, among others (**Figure 5**). This greatly limits the implementation of scientific and technological transfer associated with the urgent needs of reality, as human resources with deep expertise are required.

Conclusions

Research and technology transfer activities in the agriculture field in Vietnam face numerous limitations. This is evidenced by the low value of science and technology transfer, with many scientific and technological solutions remaining disconnected from real-world applications. The current policies on science and technology transfer are largely focused on patent granting, without addressing the broader aspects of

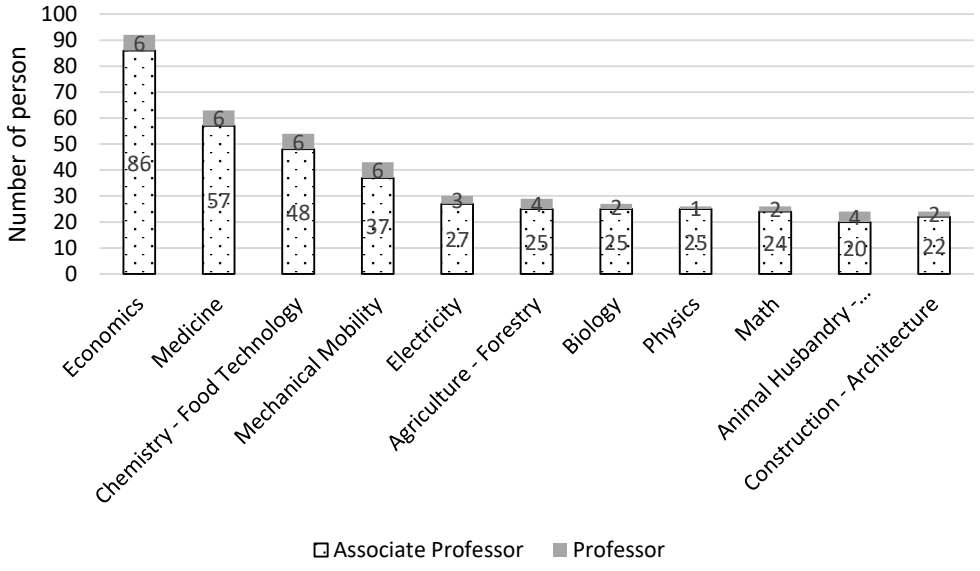

Figure 5. The number of candidates for recognition of the titles of professor and associate professor in all fields in 2023

Source: Council for Professor Title, MOET (2023)

commercialization or application. The existing connection channels are neither diverse nor truly effective. These issues stem from a lack of awareness about the importance of science and technology among the general population, as well as inadequate financial and human resources to support the growing demands for research and technology transfer. Consequently, universities, particularly those in the agricultural sector, have struggled to establish effective connections and drive breakthroughs in technology transfer and collaboration. Strengthening the competence for the connection between research and science and technology transfer at universities in the field of agriculture is an urgent issue in order to increase autonomy, dynamism, creativity, and innovation in higher education, and serving the country's development goals in the context of rapid and strong technological development in the world today.

This research is grounded in a comprehensive review of domestic and international studies on the current theory and practice of research collaboration and science and technology transfer in Vietnam. To gain a deeper understanding and provide a more accurate evaluation of the current state of research collaborations and technology transfer in universities, particularly in the agricultural sector, future studies should incorporate more in-depth empirical investigations, utilizing both quantitative and qualitative methods.

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