

Teaching and Educational Method

Integrating Agricultural Research into Undergraduate Work Integrated Learning (WIL) Courses

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Abstract

Work Integrated Learning's (WIL) contribution to graduates' career readiness has been widely recognized. WIL programs, from internships and fieldwork to newer formats like hackathons and incubators, allow students to experience authentic work and learning practices. Despite the vast literature on students' WIL experiences and WIL effectiveness, there is a gap in our current understanding of whether and how the research component has been embedded in WIL programs. The industry and workplace-centric nature of many WIL programs, and, in contrast, the perceived relevance of research confined to public and academic domains, often present challenges to developing WIL programs that meet academic and stakeholders' requirements while ensuring student benefits. Therefore, this study showcases the experiences of the University of Queensland (UQ; Australia), Sher-e-Bangla Agricultural University (SAU; Bangladesh), and IPB University (IPB; Indonesia), integrating agriculture-related research into undergraduate WIL programs, all of which highlights the continued importance of university-industry engagement.

1 Introduction

Work Integrated Learning (WIL) has increasingly become one of the key features in many undergraduate programs in developed and developing countries. WIL programs, such as internships and fieldwork to newer formats like hackathons and incubators, are centered around building career readiness, providing opportunities for students to experience authentic work and learning practices. Despite the vast literature on students' WIL experiences and WIL effectiveness, there are multiple gaps in the literature, especially involving WIL programs in agriculture-related fields, including agribusiness and agricultural economics. Agriculture, a pivotal sector for sustainability and economic growth where industry demand for university graduates is high, represents a fertile ground for experiential learning opportunities. In Australia, for instance, the demand for agricultural graduates is at least 3,000 per year, while the number of relevant graduates has been fewer than 900 per year (Pratley 2022). Central to addressing this skill shortage is to ensure industry-ready graduates, hence the importance of WIL.

On the other hand, research is vital in agricultural programs given the industry's need for analytical skills in complex and evolving landscapes. However, integrating WIL and research is not straightforward. WIL is focused on industry and workplace, while research is often confined to public and academic domains. This presents challenges in developing WIL programs that meet academic and stakeholders' requirements while ensuring student benefits. A literature search suggests only a few studies on agriculture-related WIL. For instance, Kassem, Al-Zaidi, and Baessa (2021) examine the efficacy of cooperative education partnerships, considered a type of WIL, and factors impacting these partnerships within tertiary agriculture education. Focusing on Bachelor of Agricultural Sciences students at King

Saud University in Saudi Arabia, the study delves into the influencing factors of cooperative education, including program design quality, students' personal and professional attributes, and the organizational climate. However, the study does not incorporate a research component into its framework. Another study by Wilkes and Flavel (2019) examines students' and academic staff's perceptions of WIL in agriculture at the University of New England, Australia. However, little has been written on the research component of the culture-related WIL program.

The literature review also suggests a lack of research concerning whether and how WIL in agricultural courses has evolved since the COVID-19 pandemic. This is despite the voluminous literature on delivering during the pandemic (Dean and Campbell 2020; Zegwaard, Pretti, and Rowe 2020; Hondonga, Chinengundu, and Maphosa 2022). This issue is critical given the practical nature of many agricultural studies. Furthermore, despite various articles on case studies from WIL in various countries, a conceptual framework to understand the drivers, stakeholders, components, and benefits of WIL in agriculture remains lacking.

Given the above background, this study showcases the integration of agriculture-related research within undergraduate WIL programs at the University of Queensland (UQ; Australia), Sher-e-Bangla Agricultural University (SAU; Bangladesh), and IPB University (IPB; Indonesia). This study highlights the methodologies and outcomes of such integrations, emphasizing the role of university-industry engagement in enriching student learning experiences. Additionally, it seeks to develop and assess a conceptual framework for visualizing how research components are embedded in WIL programs, particularly in agricultural courses, with a forward-looking perspective on potentially improving student outcomes through such integrations. To achieve this goal, first, this study reviews the existing literature on WIL by focusing on research components of the WIL courses before formulating a novel conceptual framework. Second, the framework is then used as a base to conduct a three-country comparison deriving experiences from undergraduate agriculture-related WIL courses offered by the UQ, SAU, and IPB. The three universities are selected given their reputable agricultural programs in those countries and to illustrate different economic and agricultural development stages and educational governance structures.

This article is structured as follows. Section 2 presents a literature review on WIL, focusing on its types and benefits, followed by formulating a novel conceptual framework for integrating research into WIL, in Section 3. Section 4 discusses experiences and insights from WIL courses at UQ, SAU, and IPB, while Section 5 concludes the preceding sections.

2 A Review of WIL

WIL has gained significant attention recently as an innovative educational approach bridging the gap between academic learning and real-world work experiences. WIL integrates academic study with practical, industry-relevant experiences, enhancing students' employability and preparing them for professional roles (Berndtsson, Dahlborg, and Pennbrant 2019; Bowen 2020; Winborg and Hägg 2023). Through WIL, students gain experiences by collaborating with industry or community partners to apply their knowledge and skills within or alongside work contexts (Patrick et al. , 2008).

WIL experiences can take various forms. Jackson and Dean (2023) categorize WIL into three main types:

- **Work-based WIL** (e.g., internships, work placements, practicums, and industry-based projects);
- **Non-workplace WIL** (e.g., classroom or virtual projects, consultancies, simulations, and service learning); and
- **Global WIL** (e.g., industry study tours, international internships or placements, and service-learning engagements).

It is important to note that the definition and practices of WIL may vary across universities and over time. Technological advancement and the COVID-19 pandemic, for instance, have driven adjustments in WIL delivery. Wood, Zegwaard, and Fox-Turnball (2020) identify two types of WIL during COVID-19: remote WIL (online work placements) and simulated WIL (virtual reality and simulations). Alanson et al. (2020) discuss how their institution adapted to COVID-19 by introducing various WIL practices, including remote WIL, simulations, projects, service learning, collaborative labs, and micro placements. Simulations gained popularity during the pandemic for student preparation (Zegwaard et al. 2020). Meanwhile, Andrews and Ramji (2020) transformed the Leading-Edge program into a fully online learning experience, emphasizing the importance of high-quality reflective activities during economic uncertainty.

WIL offers a range of benefits to students, making it a vital component of education, especially at higher education institutions (HEIs) to improve:

- **Students' employability** (Fleming, McLachlan, and Pretti 2018; Jackson and Dean 2023) by providing industry-specific skills and practical experience.
- **Students' professional network** and ability to engage with a wide array of stakeholders (Succi and Canovi 2020). This contributes significantly to the broader spectrum of graduate employability (Peeters et al. 2019).
- **Students' academic understanding** (Ibrahim and Jaafar 2017; Rambe 2018). WIL integrates academic learning with practical experience, reinforcing and deepening students' understanding of theoretical concepts and their applications (Winborg and Hägg 2023).
- **Students' communication, teamwork, and problem-solving skills** (Jackson and Dean 2023).
- **Students' industry relevance** (Smith, Ferns, and Russell 2014; Franco, Silva, and Rodrigues 2019; Navarro, Barbarasa, and Thakkar 2019), which is particularly important given the ever-changing industry requirements.

While much of the literature focuses on the benefits of WIL, a noticeable gap exists concerning the integration of research within WIL. In higher education, achieving a balance between teaching and research has emerged as an important issue (Xia, Caulfield, and Ferns 2015). On one hand, the teaching staff's research experience could enrich students' learning experience through exposure to cutting-edge knowledge and methodologies. However, excessive focus on research can detract teaching staff's time away from teaching preparation and delivery, which could compromise the quality of their teaching and, hence, student experience. Research-oriented teaching is also often criticized for its focus on theories, disconnected from real-world applications. This is particularly an issue for undergraduate teaching that focuses on preparing students' industry-readiness such as WIL programs highlighting the importance of addressing the research-teaching nexus in higher education.

3 Methodology

The objective of this section is to provide a comprehensive and nuanced understanding of how research is embedded in the WIL program in the field of agriculture at three distinct universities. It also assesses the potential impact of these integrations on student learning and engagement. This paper employs a qualitative research methodology to investigate the integration of agriculture-related research into undergraduate WIL programs at these universities. Information was gathered through a content analysis where we reviewed curriculum documents, course syllabi, and relevant program materials to understand the structure and content of their WIL programs. We then developed a conceptual framework to link between WIL in agriculture and research. Using the framework, a comparative analysis was conducted to identify commonalities and differences in key aspects such as curriculum

design, student engagement in research activities as part of the WIL programs, and university-industry collaborations.

4 Integrating Agricultural Research into Undergraduate WIL

This paper seeks to establish a connection between WIL and research activities in agriculture. WIL in agriculture encompasses various activities, such as placements, farm visits (including virtual ones), and engagement with industry. Fleming and Eames (2005) argued that WIL enhances students' research capabilities, as well as their critical thinking, clarity of thought, and time and motion management skills. Research skills such as the ability to analyze literature, work independently, understand scientific studies, leadership skills, and effective communication in conveying research findings are found essential for tertiary graduates (Groat, Gray, and Gray 2010; Hamilton et al. 2016). By integrating research skills with WIL, agricultural graduates can excel in roles such as agricultural research scientists, agronomists, and agricultural consultants. These professionals can conduct research to improve crop yields, develop sustainable farming practices, and provide expert advice to farmers and agribusinesses. Additionally, research skills are valuable for agricultural economists who analyze market trends, assess the economic viability of agricultural projects, and contribute to policy development in the sector.

To teach the research skills necessary for success in this field, this paper has highlighted an approach that focuses on application-centric course delivery. The strategy involves active engagement with industry partners, which is integrated into the curriculum to provide real-world context and relevance. Additionally, the program includes a series of workshops designed to equip students with essential research skills. These workshops complement the industry engagement, ensuring that students not only understand theoretical concepts but also develop the practical competencies required in the field. This combination of application-focused teaching, industry collaboration, and skill-building workshops forms a comprehensive approach to enhancing the educational experience in our courses.

Previous work has addressed this issue of integrating research into teaching practices. For example, Healey (2005) adopts a method to integrate research into teaching practice by “giving students first-hand experience of commercial consultancy (e.g., as an ‘intern,’ as a work-based learning activity, as a consultant assistant or as a supervised consultant).” The consultancy-type of WIL programs allows students to conduct research activities such as defining the research problem, reviewing the existing reports and information, collecting and analyzing data, and presenting it to industry and academic audiences both written and through a presentation. This engagement also strengthens the connection between academia and industry by fostering innovation and knowledge transfer (Curtis and Mahon 2010). The rationale for emphasizing research within WIL lies in its potential to provide a deeper understanding of complex industry challenges and contribute to sustainable solutions. This is highlighted by Ferguson (2011) through a creative collaboration involving educators, industry partners, and students.

Integrating agricultural research into WIL courses requires collaboration between educational institutions and industry partners and the development of integrated learning models that combine theory with practical research opportunities. This capability is essential for disseminating knowledge and driving innovation in agribusiness sectors. Despite its importance, there is a paucity of literature on integrating research into WIL programs. Recognizing that there have been gaps in the integration of agricultural research in WIL courses, a few studies have suggested ways to integrate them better, as follows:

- 1. Develop sustainable partnerships:** WIL programs rely on developing sustainable partnerships between educational institutions and industry partners (Kassem et al. 2021). This is done to

- establish and undertake important research that can have a significant impact and benefit industrial clients, providing practical solutions based on what students have learned at university.
2. **Design integrated learning models:** WIL provides an opportunity to integrate practical applications in the form of learning models, for instance, integrating agroecology and sustainable food systems theory with practical agricultural research (Ahmed et al. 2017).
 3. **Focus on specific areas:** WIL programs can focus on areas such as international agricultural development, food systems, food security, sustainability, and animal science, which can help students develop skills in these areas (Zickafoose and Wingenbach 2023). This is to align research topics with industry needs.

However, the means to achieve the above strategies and the experiences of HEIs in delivering WIL programs that include a research component remain unclear.

To this end, this study develops a novel conceptual framework (Figure 1), the Work Integrated Learning-Research (WIL-R) framework. This framework adopts at least three frameworks: (i) the Linking Research and Teaching-Work Integrated Learning (LRT-WIL) framework developed by Xia et al. (2015); (ii) the Researcher Development Framework (RDF) by Vitae (2011); and (iii) the Theory of Change, which describes how change is expected to occur from program output to outcome and impact. It consists of the following aspects.

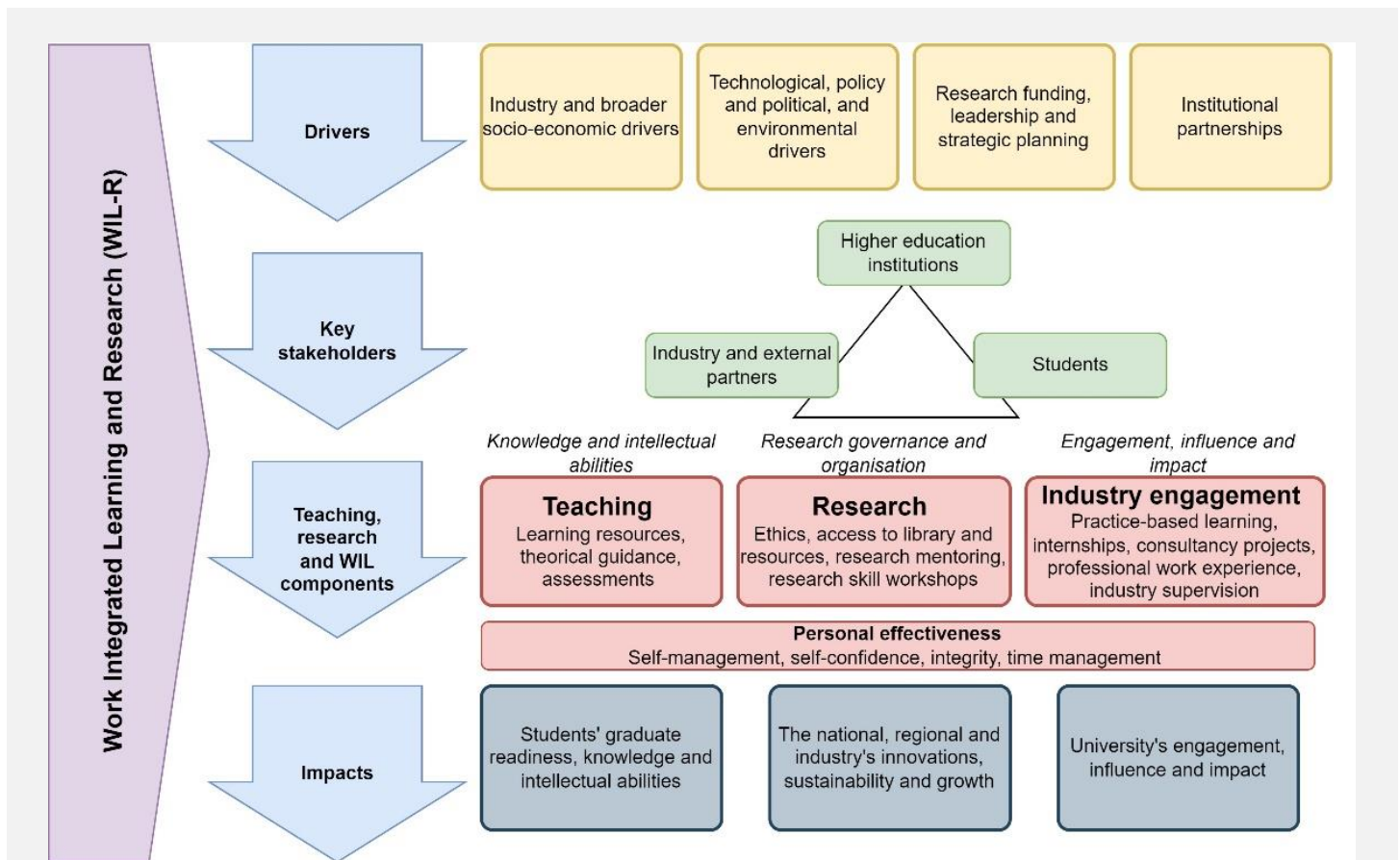


Figure 1: Work Integrated Learning-Research (WIL-R) framework.

Source: Authors' illustrations

- **Drivers** – The WIL-R framework illustrates the various external drivers that can influence the design and delivery of WIL programs, including at the industry and macroeconomic levels, and drivers that are more directly related to research support and partnerships.
- **Key stakeholders** – Adopted from Xia et al. (2015), the framework centrally positions the roles of education institutions (including academic staff, administrative support, and university management), industry and external partners, and students and the interactions between these stakeholders. “Within-stakeholder dynamics,” such as those among students (if the WIL program involves group work) and between different parts of the university (for example, between academic staff, university management, and administrative support), should also be considered to ensure successful delivery of the WIL program.
- **Teaching, research, and WIL components** – The contribution of this new framework is clarifying the different components of teaching, research, and industry engagement involved in the WIL programs that include a research component. Adopting the RDF by Vitae (2011), the framework looks at the four domains that include knowledge, behaviors, and attributes of researchers, under which multiple sub-domains exist. In this research, we interpret those sub-domains as “research skills.” Components under the **teaching** domain mainly focus on developing students’ knowledge and intellectual abilities to do research. Research skills developed under the teaching program include the ability to collect and analyze data, discipline knowledge, critical thinking, and creativity. This is done through assessments and provision of learning resources. Meanwhile, the **research** domain is centered around introducing students to research governance and organization, which include research skills such as addressing ethics, professional conduct, and research project and risk management. In most undergraduate courses, these aspects are not always embedded in typical courses, hence the need to incorporate additional activities and resources such as research skill workshops. The last domain, **industry engagement**, facilitates authentic students’ learning experiences by providing an opportunity for students to learn and work with the industry and demonstrate the applicability of their research to address real industry issues. Key research skills developed through industry engagement include working with others as well as communication and dissemination. Activities that fall under WIL programs that incorporate research activities vary greatly between institutions and programs. Xia et al. (2015), for instance, provide examples such as a research-oriented teaching methodology where students in the geographic information system (GIS) project management course apply the project management knowledge and skills they learn in class to solve real-life problems of an industry client, and a final year project where students work in a group on the spatial and temporal distribution of vehicle crashes for a transport agency, resulting in journal publications. Last, to succeed in the WIL programs that incorporate research components, students must also develop their **personal effectiveness**, including critical research skills such as self-confidence, upholding integrity, and time management.
- **Outcomes** – The RDF developed by Vitae (2011) is adopted to recognize the impacts of research as part of the WIL programs as well as partnerships built with the industry at the university, individual student, and broader levels such as the national, regional, and industry levels.

The framework presented in Figure 1 is important for demonstrating the different approaches to integrating research into WIL programs, as observed in the UQ, SAU, and IPB. These approaches will be detailed in Section 5.

5 A Multi-Institution Comparison of WIL Courses

This section is to showcase the experiences of UQ in Australia, SAU in Bangladesh, and IPB University in Indonesia. Specifically, four WIL courses that integrate a research component into the program are reviewed (Table 1), positioning them as fitting case studies for this study.

Table 1. Integration of Research into WIL Courses' Activities.

Course Name	AGRC3000 Food & Fiber Case Studies III	AGB1423 Agribusiness Managerial Experience	AGBM125 Introduction to Agribusiness	AGBM475 Agribusiness Management
Type of research activities	<p>A semester-long group project for real industry clients. In-person placement is not required.</p> <p>Projects include desktop research to review the literature, analysis of data and information, and providing practical recommendations to the client organization.</p>	<p>Empirical studies for one semester on real-world experiences (case studies) related to business and value chain management.</p> <p>A compulsory three-month internship with the clients.</p> <p>Methods include a literature review, observations, and primary and secondary data analysis.</p>	<p>A case study or assignment based on an industry field trip in the course, which includes desktop research to review the literature, analysis of the secondary data, and information gathered from the field trip and providing recommendations.</p>	<p>A case study or assignment based on an industry field trip in the course, which includes desktop research to review the literature, analysis of the secondary data, and information gathered from the field trip and providing recommendations.</p>
Course learning objectives	<ul style="list-style-type: none"> • Critically analyze an agribusiness-related problem using an appropriate method • Work collaboratively with a client to develop a detailed plan to solve a specific agribusiness problem • Work collaboratively with the mentor to conduct research and analyze results • Document the results of research and analysis into a professional report • Articulate the results of research and analysis to different audiences and an agribusiness client 	<ul style="list-style-type: none"> • Capable of effectively and efficiently demonstrating managerial functions within a tropical agribusiness system and enterprise • Capable of analyzing managerial problems within a tropical agribusiness system and enterprise • Capable of designing stages of problem-solving for managerial issues within tropical agribusiness systems and enterprises in the form of conceptual and operational frameworks • Capable of designing problem-solving alternatives or business models to address managerial problems within a tropical agribusiness system and enterprise • Capable of evaluating problem-solving alternatives or business models to address managerial problems within a tropical agribusiness system and enterprise 	<ul style="list-style-type: none"> • Acquire knowledge of the fundamentals of agribusiness • Enrich knowledge of planning, organizing, targeting, and positioning an agribusiness • Implement knowledge about risk management of agribusiness in Bangladesh • Seek knowledge about the problems and prospects of Information and Communication Technology (ICT) in agribusiness • Detect major obstacles and opportunities in the Small- and Medium-sized Enterprise (SME) sector in Bangladesh 	<ul style="list-style-type: none"> • Calculate the production costs and use the fixed/variable concepts in business decisions • Determine the different costs involved in agribusiness alternatives • Explain the financial management for agribusiness • Demonstrate the input sectors in Bangladesh • Determine the output and value-added sectors in Bangladesh's economy • Identify appropriate goal-setting activities that could be used for a farm business • Describe the Integrated Market Development (IMD) approach in the agribusiness sector • Show the role of niche marketing, product development, and product marketing in agribusiness • Identify how to obtain product, company, and industry knowledge and use it in a sales presentation

Table 1 Continued.

Course Name	AGRC3000 Food & Fiber Case Studies III	AGB1423 Agribusiness Managerial Experience	AGBM125 Introduction to Agribusiness	AGBM475 Agribusiness Management
Examples of research topics addressed by recent students	<ul style="list-style-type: none"> Sustainable packaging for agri-food products Carbon-neutral agriculture Identifying export opportunities Developing strategies to achieve carbon-neutral agriculture Marketing sustainable agriculture 	<ul style="list-style-type: none"> Internal and external analysis Existing condition Business model Competitive advantages Managerial issues identification (financial, human resources management, logistics) Marketing strategy Partnership Consumer preferences for the company's product 	<ul style="list-style-type: none"> Existing supply chain and value chain of industry products Marketing strategy Business model 	<ul style="list-style-type: none"> Existing supply chain and value chain of industry products Marketing strategy Business model Consumer preference for the company's product Customer satisfaction with the company's product
Examples of analytical methods used in the research projects	<ul style="list-style-type: none"> Financial analysis Trend analysis Marketing research Supply chain analysis 	<ul style="list-style-type: none"> Business model development Marketing analysis Consumer preference analysis Profitability analysis Linear programming Forecasting analysis Partnership development strategy Production efficiency analysis Logistic regression for marketing channel choices Business strategies formulation 	<ul style="list-style-type: none"> Trend analysis Marketing research Profitability analysis 	<ul style="list-style-type: none"> Trend analysis Supply chain and value chain analysis Marketing research Profitability analysis Consumer preferences analysis
Other learning activities or skills developed during the course	Workshops on research proposals, literature review, getting access to library resources, teamwork (including the group charter), analytical methods, and writing academic research	Literature review, workshops on writing proposals of program activities, business environment analysis, managerial problem identification, formulation of alternative strategies, consultation, activity documentation on logbook individually, writing reports, writing an academic paper, and conducting an exhibition of the program activities and the outcomes to wider audiences within the IPB community	Field trips, workshops and seminars, training on fundamental courses such as computer skill development run by the university computer club, short-term statistical courses, and academic writing	Field trips, workshops, seminars, consultations, training on analyzing data, and academic report writing

Source: Authors' compilation in consultation with academic staff involved in the course delivery

- UQ's AGRC3000 Food and Fiber Case Studies III** – As a “capstone course,” this course provides students with an opportunity to apply key conceptual frameworks, analytical tools, and knowledge of food and agribusiness that they have acquired throughout their agribusiness study into a realistic consultancy-type project.

- **IPB's AGB1423 Agribusiness Managerial Experience** – As a capstone course, this course is designed to provide empirical experience to students in applying conceptual and operational frameworks, analytical tools, skills, and knowledge of agribusiness sciences in planning, organizing, directing, and controlling tropical agribusiness enterprises.
- **SAU's AGBM125 Introduction to Agribusiness and AGBM475 Agribusiness Management**– AGBM125 is designed to provide fundamental knowledge on shifting procedures from the subsistence level of agriculture to commercialization, while AGBM475 is to provide knowledge on agribusiness performance, business management, market foundations and applications, agribusiness sectors, and product marketing.

The course descriptions presented earlier show that all four courses emphasize applying frameworks and fundamental knowledge to real industry agribusiness issues. This highlights the continued importance of discipline-specific knowledge in the WIL program despite its applied nature. The diversity of agricultural systems and educational programs is shown through each course's focus on agribusiness issues. UQ's AGRC3000 is formatted as a consultancy-type project to respond to industry demand directly. In this course, students are assigned into groups to complete a semester-long project. They work with a mentor, who is usually a PhD student in either agricultural science or agribusiness, to address issues presented by the client. In 2023, for instance, the course involved 17 client organizations ranging from a family farm business and a food processor, an industry association, to a multinational beef processing company. Consequently, topics and methods being used in students' projects vary greatly given the diverse nature of the clients and their issues. For example, one of the student groups explored an alternative interstate supplier base for a legume-based snack company in Queensland by researching both economic factors such as the cost of transport, competition with other buyers, and agroclimatic conditions. Another group researched market segmentation and factors affecting social media engagement before developing a new social media strategy for a pet food producer. While there is no requirement for students to have in-person placement activities, students meet the clients, either in person or via Zoom, regularly throughout the semester to ensure their progress and alignment with the client's expectations.

Meanwhile, given Indonesia's agricultural systems, IPB's AGB1423 is designed to provide real-life industry experience and highlights the importance of tropical agribusiness in its program. In this course, students must undertake a three-month placement at the client organization and are tasked to identify managerial problems that may exist at the organization before designing a project, which accounts for 50 percent of the total marks. The projects are focused on problem-solving using research methods such as forecasting analysis, linear programming, and consumer preference analysis depending on the client's issues.

SAU's AGBM125 and AGBM475 focus on industry case studies introduced to students during the field trip. While the field trip is a typical WIL activity, the research component is embedded in the case studies. In AGBM125, which serves as an introduction to agribusiness for SAU's first-year students in its Bachelor of Agricultural Economics program, students are tasked to collect data during the field trip to small- and medium-sized enterprises (SMEs). Then, they analyze the client's production costs, financial performance, and marketing before presenting recommendations on navigating SMEs' barriers to shifting commercial agribusiness. Meanwhile, AGBM475 delves further into agribusiness management while still using a case-study approach. Final year students in SAU's Bachelor of Agricultural Economics program research financial, marketing, and supply chain management applying more advanced techniques in supply chain, consumer, and financial analyses. The design of these courses follows the University Grant Commission of Bangladesh (UGC) approved curriculum, which was a "Higher Education Quality Enhancement Project" (HEQEP) funded by UGC (Government) special project for curriculum development in 2019 to enhance the quality of higher education aligned with developing industry and embrace opportunities (Sher-e-Bangla Agricultural University, Institutional Quality Assurance Cell 2019).

Referring to the WIL-R conceptual framework derived in Section 3, the next section looks into more detail into (i) teaching; (ii) research and WIL components; and (iii) challenges and opportunities. The comparison and associated tables (Tables A1 and A2 in the appendix on course description and challenges and opportunities) provide a detailed illustration of the various methodologies and practices used to embed research into WIL programs, showcasing the intricacy and variety of such integrations and their potential effects on student learning and outcomes.

5.1 Comparison of Teaching Aspects

Most WIL programs are offered to final-year students. Three courses, ARGC3000 at UQ, AGB1423 at IPB, and AGBM475 at SAU, are offered to the final-year students in Bachelor of Agribusiness at UQ and IPB, and Bachelor of Agricultural Economics at SAU, respectively. This offering to the final-year students is a typical format for a WIL consultancy-type program, given the purpose of the program to apply discipline-specific knowledge requiring them to complete core courses before being able to solve industry problems. However, this does not necessarily mean that WIL programs are only appropriate for final-year students. At SAU, AGBM125 is offered in the first year. UQ also has AGRC1012 Food and Fiber Case Studies I, and AGRC2000 Food and Fiber Case Studies II for first- and second-year students, providing them opportunities to engage with the industry through, for instance, developing a business canvas in AGRC1012 and case studies in AGRC2000. The difference between these courses and the final-year one is the flexibility and expectation for students to define research problems and select analytical tools to solve industry issues.

Teaching resources and facilities are provided to students undertaking WIL programs in different formats. These are critical given the core and intensive nature of the WIL courses. At UQ and IPB, for example, AGRC3000 and AGB1423 require about 20 hours of learning per week. At UQ, in addition to independent study, students must participate in lectures, workshops, client meetings, and group work. Regarding resources, technologies such as the Blackboard learning platform, and communication and interaction facilities, including Zoom, Slido, and Ed Discussion Board have been used by UQ, while IPB uses an e-learning platform (Centralized Learning and Aptitude Support System, or CLASS) and communication facilities like WhatsApp and Google Drive. The online platforms are particularly important for universities offering WIL programs to online students (or external students within the UQ context). UQ also uses a relatively new BuddyCheck peer assessment tool, given the group work assessments in this course, hence the importance of peer assessment to monitor and evaluate teamwork.

Furthermore, some courses have recommended textbooks, with UQ providing both science- and business-focus textbooks, indicating the diversity of topics students address in their industry projects. Meanwhile, SAU focuses more on agribusiness management. Using learning modules developed by academic staff is also common to tailor to specific students' needs and industry contexts. Support is provided not only by academic staff but also by the clients.

In terms of learning assessments, AGRC3000 at UQ and AGB1423 at IPB incorporate teamwork assessments. At the same time, SAU's two courses provide a more flexible arrangement for the academic staff to decide whether individual or group assessments are applied. Similarities are observed in terms of assessments, such as presentations. All the reviewed courses, except AGRC3000 at UQ, have exams and participation as assessment items. AGB1423 at IPB also mandates students to organize an exhibition to showcase their learning outcomes to the broader IPB community.

The three universities provide a wide range of support for students to conduct research as part of their WIL course learning activities. There is a consistent pattern across all the reviewed courses regarding the involvement of academic staff and the industry. Additionally, UQ students in AGRC3000 also receive support from mentors, typically PhD students within the School of Agriculture and Food Sustainability. There are approximately ten students per mentor. In this structure, mentors are vital in bridging communication between the course coordinator, students, and client organizations. This is in line with a previous study that highlights the roles of mentors in facilitating learning by providing

guidance, feedback, and support to students in their WIL experience (Wang, Gill, and Lee 2023). Moreover, the involvement of other university staff members, such as library staff, learning advisors, and academic coordinators, is also critical. Students' research that includes primary data collection may also involve the ethics committee.

5.2 Comparison of Research and WIL Aspects

Referring to Table 1, the types of WIL-R activities vary between courses. UQ's AGRC3000 does not require an in-person internship as part of the course, while IPB's AGB1423 sets a three-month internship compulsory. The two universities include client projects involving a literature review, data collection, and data analysis, while SAU's AGBM125 and AGBM475 ask students to do a case study based on field trips. Given the ethics requirement, data collection activities at UQ typically do not involve primary data collection.

Research involving human participants at UQ requires ethics review, as in other Australian universities. If the data collection activity is to be published as research formally, then an ethics review will be required. However, an ethics review would not normally be required if it is an educational or learning exercise for students in an assessment with no intention of formal publication. This highlights the importance of students and academic staff's understanding of ethical requirements in research.

Regarding research topics and analytical methods, the four courses share similarities in terms of their business focus and differences. Agribusiness management topics and tools, including financial, marketing, and supply chain analysis, are observed across all the reviewed courses. In Australia, however, there is a stronger push toward sustainable agriculture, reflected by the topics addressed, including carbon-neutral agriculture, marketing sustainable agriculture, and sustainable packaging. With more than 70 percent of Australian agricultural produce being exported, identifying export market opportunities is another topic many industry clients have requested for students in AGRC3000. While sustainable agriculture has also gained some traction in developing countries like Indonesia and Bangladesh, it is observed that consumer analysis, business development, and supply chain analysis seem to still dominate undergraduate WIL project topics at universities such as SAU and IPB.

UQ, SAU, and IPB also provide students with opportunities to develop personal and professional skills. Activities such as workshops cover two areas: research skills and personal and professional effectiveness, as shown in the WIL-R conceptual framework in Figure 1. The research skills workshops include literature reviews, library resource utilization, analytical methodologies (including statistical analysis), and writing skills. There is also a greater emphasis toward "soft skills" such as teamwork, project management (e.g., developing an effective task allocation), and interpersonal communication skills within the WIL programs.

5.3 Opportunities and Challenges

The WIL-R framework in Figure 1 indicates various outcomes that WIL and undergraduate research programs can achieve. There is a consistent message across the three universities that the WIL programs provide opportunities for students to improve their graduate and industry readiness. Drivers of this outcome vary, including alignment with the national program, such as Indonesia's *Kampus Merdeka*, a policy issued by the Indonesian Ministry of Education and Culture and support from alumni working in the industry. Outcomes from the WIL and undergraduate research programs are also identified at the university level, such as opportunities to leverage the partnership to greater academic and research excellence collaborations.

Several challenges are also identified. First, the intensive nature of the WIL course can pose significant challenges for students, as observed in UQ's and SAU's courses. For example, in AGRC3000, students must complete the client project in less than thirteen weeks while doing two other courses. This tight timeline means a limited period for them to collect primary data that requires an ethics clearance if

the project report is to be published. It also implies the importance of carefully determining the project scope while meeting clients' expectations.

Second, industry engagement can sometimes be challenging. First, there is a consistent observation across UQ, SAU, and IPB on alignment between academic requirements or curriculum and industry needs. For example, a literature review is critical in academic writing but is not seen as an important task among industry clients. Given data issues, the application of analytical techniques students learn in their university studies is not always straightforward. Students often have restrictions to access the company's internal data, limiting their understanding of the topics being posed by the clients. Second, in AGB1423 at IPB and in AGBM125 and AGBM475 at SAU, the primary challenge is establishing partnerships with and securing client support. In AGB1423, there is a high demand from students to do internships as part of this course, but as of this year's offering, only a quarter can be accommodated in this course. Other students can enroll in other capstone courses. Therefore, a growing need for additional corporate partnerships necessitates a strategic approach to identify and engage potential collaborators effectively. On the other hand, for AGRC3000 at UQ, while support from the industry is evident, given the tight timeline, ensuring successful course delivery requires intensive engagement between academic staff and the clients before the semester starts. In AGRC3000, the course coordinator works with the clients to create an introduction video where the client provides an overview of their organization and explains possible topics that students can work on. Tools like Zoom and Canva video editor help complete this task, though the task remains time-consuming and requires video editing skills that not all academic staff members have. These videos are then made accessible to students at the start of the semester so that they can nominate their preferred clients. This series of activities highlights the resource requirements of WIL course delivery that involve not only the teaching and research capabilities of the academic staff involved but also other sets of skills.

6 Conclusions and Recommendations

This study is one of the first to link undergraduate research and WIL programs in the post-pandemic era. A novel WIL-R conceptual framework is proposed in this study, explaining the various drivers, stakeholders, teaching, research and WIL components, and outcomes from the implementation of WIL and research programs. While this study focuses on agricultural programs, the framework can be applicable to other disciplines.

Guided by the framework, this study presents a comparison of undergraduate WIL programs in agribusiness at UQ, SAU, and IPB. The comparison highlights various program attributes and research activities, as well as opportunities and challenges in delivering undergraduate WIL programs. Despite their differences, these programs share the common objective of equipping students with the necessary skills to apply discipline-specific knowledge, theories, and frameworks they learn in the classroom to real-world industry contexts. They achieve this through specialized courses that align with national and agricultural industry contexts. For instance, UQ's AGRC3000 significantly emphasizes real industry issues such as agricultural sustainability and global market opportunities in line with Australia's agriculture sector's focus. Meanwhile, IPB's AGB1423 and SAU's AGBM125 and AGBM475 focus on agribusiness managerial abilities and management skills such as marketing, finance, and supply chain to support the countries' growing agribusiness industries.

Understanding the challenges facing WIL course delivery highlights two key points. First, finding "a middle ground" on the level of support, assessment types, topic selection, and project management approaches that can meet both the university's and industry's requirements and expectations remains a challenge. Consequently, as the second point, maintaining engagement with the industry requires strategic and continuous approaches and resource allocation. Such engagement should not only be initiated prior to the WIL program offered to the final-year students but also adopt a "scaffolding" approach introducing the industry involvement in WIL course delivery in students' early years before

their transition to a more independent consultancy-type project in the final year. At the institutional level, the setting up of an industry advisory group might also be beneficial to inform how the university should develop its curriculum and industry engagement strategies, including WIL programs. The significant roles of students in strengthening this university-industry partnership are also critical, hence the importance of embedding strategies to improve students' soft skills and broader professional development as part of the WIL courses.

With support from the industry, government, and university management and strong demand from students, WIL and undergraduate research programs are expected to gain growing importance. To this end, the framework and three universities' experiences presented in this study can inform academic staff, industry representativeness, and university management on practical strategies to enhance student experience and emphasize the continued importance of university-industry linkages. If optimized, such linkages can lead to greater outcomes, including research and education excellence and contribution to a competitive and sustainable agricultural industry supported by the next agricultural generation. While direct evidence of research-enhancing student outcomes might not be immediately apparent, the study is still in a conceptual phase. The authors acknowledge the need for more concrete evidence demonstrating the impact of research on student outcomes, indicating a direction for future investigation.

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Appendix: Course Descriptions, Opportunities and Challenges

Table A1: Course Description.

Course name	AGRC3000 Food and Fiber Case Studies III	AGB1423 Agribusiness Managerial Experience	AGBM125 Introduction to Agribusiness	AGBM475 Agribusiness Management
School/ Department and University	School of Agriculture and Food Sustainability Faculty of Science <ul style="list-style-type: none"> The University of Queensland 	Department of Agribusiness Faculty of Economics and Management <ul style="list-style-type: none"> IPB University 	Department of Agribusiness and Marketing Faculty of Agribusiness Management <ul style="list-style-type: none"> Sher-e-Bangla Agricultural University 	
Students	Bachelor of Agribusiness third (final) year students	Bachelor of Agribusiness fourth (final) year students who have met the prerequisite course requirements and have completed a minimum total of 105 credit hours, typically, in their seventh semester	Bachelor of Agricultural Economics first-year students	Bachelor of Agricultural Economics fourth (final) year students
Course duration and semester	One semester (13 weeks); Semester 2 (July–November)	One semester (16 weeks); Semester 2 (July–December)	One semester (16 weeks); Semester 1 (January–June)	One semester (16 weeks); Semester 2 (July–December)
Enrolment mode	Internal (on-campus) and external (online) modes	Internal (on-campus)	Internal (on-campus)	Internal (on-campus)
Credits/ Units and Learning hours	4-unit course; 3 scheduled learning hours per week; up to 20 hours of learning per week, including independent study; 3-hour workshops in Weeks 1 to 5 on research skills	11-unit course; 495 learning hours in one semester, equivalent to 21 learning hours per week	Three scheduled learning hours per week (42 hours in one semester)	Three scheduled learning hours per week (42 hours in one semester)
Compulsory (core) or optional (elective)	Core course	Core course	Core course	Core course
Technology use	Learning and communication platforms: Blackboard, BuddyCheck peer assessment, Ed Discussion board, Slido for class interactions, and Zoom	Blended learning: Face-to-face and online platforms including e-learning (Centralized Learning and Aptitude Support System: CLASS), Zoom, WhatsApp, and Google Drive	Face-to-face	Face-to-face

Table A1 Continued.

Course Name	AGRC3000 Food and Fiber Case Studies III	AGB1423 Agribusiness Managerial Experience	AGBM125 Introduction to Agribusiness	AGBM475 Agribusiness Management
Resources (e.g., textbooks)	<ul style="list-style-type: none"> Module including research skills (e.g., literature review, analytical methods, etc.) Zikmund, William, et al. 2019. <i>Business Research Methods</i>. Cengage. Sahu, P.K. 2013. <i>Research Methodology: A Guide for Researchers in Agricultural Science, Social Science, and Other Related Fields</i> (Vol. 432). New Delhi: Springer. 	<ul style="list-style-type: none"> Module Literature related to agricultural business management Industry-related data where the business operates Relevant previous course material 	<ul style="list-style-type: none"> Broadway, A.C., and A.A. Broadway. 2002. <i>A Textbook of Agribusiness Management</i>, 1st ed. New Delhi, India: Kalyani Pub. Ricketts, C., and O. Rawlins. 2001. <i>Introduction to Agribusiness</i>, 1st ed. Delmar Pub. Recent industry reports and agribusiness literature 	<ul style="list-style-type: none"> Barnard, F., J. Akridge, F. Dooley, and J. Foltz. 2000. <i>Agribusiness Management</i>, 4th ed. Waveland Publisher. Beierlein, J.G. 2008. <i>Principles of Agribusiness Management</i>, 4th ed. Waveland Publisher. Nutz, N., and M.A. Sievers 2010. <i>Rough Guide to Value Chain Development, How to create Employment and Improve Working Conditions in Targeted Sectors</i>, 1st ed. ILO Publication. Recent industry reports and agribusiness literature
Assessment	<ul style="list-style-type: none"> Group project proposal (20%) Final group presentation (20%) Group final report (30%) Peer evaluation, reflection, and evidence of individual contribution (30%) 	<ul style="list-style-type: none"> Participatory activities (25%) Project results (50%) Orientation class exam (10%) Expo and oral presentation (15%) 	<ul style="list-style-type: none"> Quiz/assignment (10%) Class test/assignment/oral presentation (30%) Class participation/attendance (10%) Final exam (50%) 	<ul style="list-style-type: none"> Quiz/assignment (10%) Class test/assignment/oral presentation (30%) Class participation/attendance (10%) Final exam (50%)
Academic support and supervision	<ul style="list-style-type: none"> Course coordinator, mentors (PhD students; approximately ten students per mentor), and supervisor at the client organization 	<ul style="list-style-type: none"> Course coordinator, teaching team (lecturers), and supervisor from the company 	<ul style="list-style-type: none"> Course coordinator, teaching team (lecturers), and guest lecturers from industry 	<ul style="list-style-type: none"> Course coordinator, teaching team (lecturers), and guest lecturers from industry

Source: Authors' compilation in consultation with academic staff involved in the course delivery

Table A2. Opportunities and Challenges

Course Name	AGRC3000 Food and Fiber Case Studies III	AGB1423 Agribusiness Managerial Experience	AGBM125 Introduction to Agribusiness	AGBM475 Agribusiness Management
Opportunity	<ul style="list-style-type: none"> The use of learning technology to support WIL programs Strong support from the industry and students' high interest in linking with the industry, hence the positive outlook of the course Leveraging alumni networks working in the agribusiness industry Opportunities to extend for teaching purposes and industry engagement to research partnership 	<ul style="list-style-type: none"> Alignment with the Indonesian national government curriculum so-called <i>Kampus Merdeka</i> (independent campus) and budget Existing companies' internship programs that the course can connect to The presence of alumni working in the companies to support students Students may continue researching the clients for their bachelor's thesis, thus speeding up the research process To align the curriculum with industry needs A means to apply the Three Pillars of Indonesian higher education (education, research, and community services) by collaborating with the industry 	<ul style="list-style-type: none"> The use of technologies to support effective learning Field trips and assignments to experience real problem-solving Opportunity to work in the industry after graduation Group work to develop team skills 	<ul style="list-style-type: none"> The use of technologies to support effective learning Field trips and assignments to experience real problem-solving Opportunity to work in the industry after graduation Group work to develop team skills Alumni support in different organizations
Challenges	<ul style="list-style-type: none"> Pre-semester intensive engagement with the clients Short project duration (13 weeks), therefore intensive load Students typically need to do two other courses during the semester, hence challenging time management Group dynamics Ensuring effective and efficient communication between the teaching staff, students, and the clients Determining the project scope Balancing between meeting clients' expectations and embedding academic research into industry projects Ethical requirements to collect primary data 	<ul style="list-style-type: none"> Initiating partnerships with the right client Aligning the perception between higher education curriculum and the needs of the business world High student demand but limited capacity, hence a very competitive selection process. The need for more partnerships with companies in the future 	<ul style="list-style-type: none"> Securing more support from the industry High coursework in each semester makes it challenging for students to do effective learning Aligning between the course curriculum and the needs of the business world 	<ul style="list-style-type: none"> Securing more support from the industry High coursework in each semester makes it challenging for students to do effective learning Aligning between the course curriculum and the needs of the business world Translating the case study or assignment experience into research skills Resources to organize workshops or invite guest lectures

Source: Authors' compilation in consultation with academic staff involved in the course delivery

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