

University–Industry Linkages in Agriculture: The Case of Palestine

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The usual crisis mode of economic operations in Palestine intersects with the adverse consequences of COVID-19 and necessitates an innovative response to survive. This research builds on potential synergies between industry and university to expand the Palestinian agriculture sector resilience. We report on an explorative study that sought to understand the reality of the university–industry linkages (UILs) by considering information and experience gathered from 29 interviews in January 2020 and April 2021. Interviewees represent five key actor groups: farmers and agribusinesses, private institutions, universities, the Ministry of Agriculture, and NGOs. Content analysis revealed a nascent collaboration scope and uncovered the lack of a confident attitude among farmers towards agriculture research efforts, the poor communication performance, and misalignment of purpose. University actors need to encompass the UILs in their mission and touch farmers' needs by providing novelty evidence research. Yet, farmers and agribusinesses may take the initiative to communicate their problems and search for renovation. We developed a framework of underpinnings to enhance collaboration and a healthier agriculture sector. We suggest activating the cooperatives and diversifying farmers' income as deemed more resilient to face the pandemic.

Keywords: University–industry linkages, agriculture, innovation, resilience, Palestine, COVID-19

Introduction

The COVID-19 outbreak brought a significant threat and dramatic worldwide implications on agriculture and food systems (Béné, 2020; Timilsina et al., 2020). So far, agriculture has been one of the most affected sectors by the pandemic (Wang et al., 2020);

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Palestine is no exception. However, its healthcare system's fragility makes tuning between the pandemic's economic impacts and healthcare consequences a highly challenging matter (AlKhalidi et al., 2020). On March 5, 2020, the early extreme restrictions on movement and the social distancing procedures imposed by the Palestinian Government to control the spread of coronavirus directly harmed all economic operations, including farmers, the agricultural labour force, and all actors along the agriculture supply chain (Sultan & Sultan, 2020).

The donors' budget support for Palestine has declined substantially in recent years, falling from 32% of GDP in 2008 to 3.5% in 2019 (UNCTAD, 2020). Being heavily dependent on agricultural imports and international aids, Palestine's economy exposes extraordinary risks following COVID-19 (Calis, 2013; R. Sharma et al., 2020). Farmers are hesitating about when or how much to plant because of the ambiguous demand and the perishable nature of their products. The scope of our research effort is to investigate the links between universities and agribusinesses in a regressed economy, namely in Palestine.

The farmers' innovative capacity, including developing new products and introducing new production techniques, may potentially improve the conditions of helpless farmers in emerging economies (Mathews & Hu, 2007; Quayson et al., 2020; R. Sharma et al., 2020). To achieve this aim, collaborative efforts between the university and the agriculture sector become necessary tools to improve the sector's performance (Barbolla & Corredera, 2009; Béné, 2020). Therefore, examining university–industry linkages' (UILs) reality (failures and potentials) is a forward-looking step for better future functioning.

It is believed that university–industry collaboration in developing countries' settings is less addressed in the literature than in developed countries because it is less practised (Saad & Zawdie, 2011). Due to the lack of scholars in these countries, there are gaps in understanding the situation in these countries. Hence, this research seeks to fill this literature gap by looking at the UILs as a tool to foster Palestinian agricultural innovation. The article's premise is that active UILs are vital for innovative ways to modernise agriculture and increase agricultural productivity. We report on an explorative study that sought to understand the reality of the UILs by considering information and experience gathered from 29 interviews with key Palestinian actors in agricultural UILs. We intend to address three primary research objectives:

1. To uncover the limitations, challenges, and innovation potentials among actors by examining the status of agricultural UILs.
2. To propose a framework with critical insights to improve UILs to improve the Palestinian agriculture sector's performance.
3. To propose supportive actions and expert opinion for better UILs that may absorb the adverse impacts of COVID-19 on the Palestinian farmers.

We will present an overview of the agriculture sector in Palestine, and then a literature review is submitted to figure out the relevance of our research work.

After that, our methodology is followed by findings and discussion. Finally, we summarise the results and conclude for managerial implications and present the limitations of the study.

Overview of Agriculture Sector in Palestine

The Palestinian agriculture sector is poorly structured and evolved in a complex political context branded by the chronic conflict between the Israelis and the Palestinians (Brooks et al., 2020; Naqib, 2000). Palestinian farmers show relatively low productivity levels due to traditional production methods' low return farming approach. Palestinian farmers are small-scale producers and operate in challenging settings, including poor infrastructure, lack of advanced technologies, and limited governmental subsidies (Béné, 2020).

Furthermore, the Paris Economic Protocol (1994) envisaged that Palestinian trade with other countries continues to be handled through Israeli sea and airports or through border crossings between the Palestinian National Authority (PNA) and Jordan, which Israel also controls (Marzin et al., 2019).

The 5.2 million Palestinians living in West Bank and Gaza Strip WBGS (59.8% in WB, 40.2% in GS) struggle to survive against prolonged crisis and ongoing Israeli occupation. Therefore, they are becoming more dependent on aids, less able to produce food, and more reliant on imported goods (90 % of primary commodities). Agriculture production is characterised by narrow access margins to natural resources (land and water), severe restrictions on the movement of people and goods (markets), and barriers to infrastructure investment (Bank, 2017; OCHA, 2012; PCBS, 2020). Over time agricultural imports increased to exceed exports significantly (PCBS, 2019).

While the Palestinian agriculture sector may play a vital role in economic growth, food security, poverty reduction, and rural development (Ministry of Agriculture, 2016; PCBS, 2012; Sultan, 2014), the agricultural sector's contribution to Palestine's GDP had declined from 36% in the 1970s to about 3% in 2018. Moreover, the agricultural sector's budget remains the least across sectors (Marzin et al., 2019). In 2018, the agricultural sector's budget did not exceed 1% of the total public budget, indicating a severe failure to strengthen the farmers' steadfastness to increase Palestinian production and sovereignty over food. The Palestinian agricultural sector added a value of US\$ 339.1 million in 2012 at constant prices, representing 4.6% of GDP at that time. In 2018, the value of agricultural production at constant prices was US\$ 540 million, and at peak value, agricultural production rose to US\$ 721.5 million (PCBS, 2019).

All employed Palestinians (above age 15 years) are 1,015,800 by the end of 2017 (730,600 in WB and 285,200 in GS). In 2006, farm labour represented 16.7% of the total labour force, which fell to 10.4% in 2014, then to 8.7% in 2015 and 6.6% in 2017 (PCBS, 2018). According to the Palestinian Central Bureau of Statistics (PCBS), there is a constant decline in the percentage of workers in agricultural activity. The agricultural sector recorded the lowest daily wage rate in

West Bank and Gaza Strip (UNCTAD, 2015). This situation weakens the agricultural sector and leads to farmers' inability to apply the concept of food sovereignty as part of the right to self-determination and is considered the leading cause of poverty, unemployment, and food insecurity.

Young people (less than 40 years old) make only about 20 % of landholders. Palestinian youth lack evidence about opportunities, innovation, and the potential for value addition in agriculture. Moreover, given the tendency for youth to desire a modern/urban lifestyle, Israel's labour market is attractive for the Palestinians; the relatively high wages offered in Israel lead to youth abandoning agriculture (Marzin et al., 2019). Noteworthy, 13% of the employed Palestinian labour force by the Israeli occupation work in agriculture (OCHA, 2012).

Despite the yet-to-be Palestinian state, the reality on the ground suggests the Palestinian Government has limited self-determination (Sultan & Crispim, 2018). Israel has the upper hand in controlling resources; therefore, the Palestinians suffer restricted access to water sources, supplies, and markets. Palestine's agriculture sector suffers from low technological content and relatively low value-added (Ali et al., 2012; UNCTAD, 2015). Although Palestine and Israel share similar soil and climate, the Palestinian agricultural output and productivity are far behind.

On average, during 1984–2016, the agricultural land area in Palestine (WB and GS) decreased by 0.65% each year. The Israeli occupation insists on moving forward with the annexation of parts of the occupied West Bank lands. Within the plans of gradual dispossession of the Palestinian land and the forced displacement of the Palestinian people, the latest of which is the annexation of the Jordan Valley and the so-called major settlement blocs in the West Bank. The land of the Jordan Valley exposed to annexation is estimated at 26% of the West Bank. It constitutes 50% of the food basket of the Palestinian people, contains groundwater basins, and is rich in mineral salts.

In the Gaza Strip, the Israeli occupation denied access to 18% of the arable land on the eastern and northern borders of the Gaza Strip under the pretext of security (Marzin et al., 2019; PCBS, 2019). Besides, the Israeli authorities are exercising all forms of restrictions and repression against fishers through arrest, confiscation of fishing boats, constraints on the fishing zone, in addition to the continued isolation of the entire Gaza Strip.

Nevertheless, the multiple crop structures resulting from climate diversity advantage in Palestine helps to design a resilient sector. The agricultural land is cultivated with many types of vegetables and fruits. During 2015–2016, the total cultivated area was 1,382,492 dunums (1000 sq. meter), producing three main crop categories (Table 1). Trees include mainly olives and orange trees. However, over time, changes in crop structures result from coping with Israeli market demand, subcontracting with Israeli dealers, and changes in the Palestinian consumption style (Marzin et al., 2019).

The country's nature characterises production with benefits from environmental diversity and climatic variances. These characteristics reflect the agriculture

TABLE 1
The Percentage of Agricultural Land in West Bank (2015–2016)

| <i>Type of Cultivated Area</i> | <i>Percentage of Cultivated Area</i> |
|---|--------------------------------------|
| Horticulture | 62 |
| Vegetables | 11 |
| Field crops (such as corn, chickpeas and tobacco) | 27 |

Source: Palestinian Investment Promotion Agency (2017).

sector's resilience and capacity to develop and effectively contribute to employment and socio-economic growth (FAO, 2018; UNCTAD, 2015). Even though the pace of agricultural productivity growth is still slow in WBGs, mainly, this condition refers to the lower level of local research, extension services, and scarcity of financing (Abugamea, 2008). Unless the right interventions are made, these potentials will serve for the sake of hopefulness.

The Palestine National Agricultural Research Centre (NARC) is the research and development arm of the Ministry of Agriculture (MoA) and is responsible for conducting agricultural research. The NACR approaches its goals through five research units and seven agricultural experiment stations, of which five are located in the West Bank and two in the Gaza Strip. Educationally, Palestinian universities operate one agricultural sciences faculty in Gaza Strip: Al-Azhar University. Another five faculties of agriculture in the West Bank: (a) An-Najah University (North), (b) Hebron University (South), (c) Palestine Technical College (Khadoury) (North), (d) Al-Quds Open University (Middle) and (e) Al-Quds University (middle) (Table 2). They offer agricultural bachelors and masters' degrees in some disciplines and recently established a joint master's programme in agribusiness (Suhail, 2020). Besides, there are two agricultural secondary schools: Beit Hanoun Agricultural School in Gaza and Al-Aroub Agricultural School in the West Bank. In addition to these educational institutions, NGOs conduct agricultural research, such as the Jerusalem Institute for Applied Research (ARIJ) and the Land Research Centre (Ministry of Agriculture, 2016).

Statistics of the Ministry of Higher Education and Scientific Research show that the total number of students enrolled at the faculties of agriculture in 2020 was 1,338 (number of female students was 518), representing 0.6% of the total number of students. The same report shows that the total number of academic staff who teach at the faculties of agriculture in 2020 was 130 (number of female staff was 50), representing 0.05% of the total number of academic staff.

The Palestinian NGOs (Table 3) call upon civil society organisations and social movements that support farmers' rights to stand by farmers exposed to the risks of annexation, starvation, and poverty to push them to emigrate their lands. All NGOs, cooperatives, and MoA assessed FAO as a critical, value-added partner in securing the livelihoods of farmers and vulnerable groups in Palestine. The consensus among all stakeholders is that FAO has a positive impact as a UN institution committed to developing the agricultural sector through support and vital interventions.

TABLE 2
Palestinian Universities Having Agriculture Faculties

| 1. An-Najah University | 2. Al-Quds University |
|---|---|
| <ul style="list-style-type: none"> • Veterinary medicine & animal husbandry • Plant production and protection code • Animal production and animal health code • Agricultural economics and rural development code • Nutrition and food technology code • Agricultural extension and veterinary services • Research group in <ul style="list-style-type: none"> • Plant protection • Plant Tissue culture[ctb]o[tab]Ruminants Nutrition • Animal breeding[ctb]o[tab]Animal reproduction • Artificial insemination • Water resources and the environment | <ul style="list-style-type: none"> • Environmental economics • Agricultural trade • Agribusiness finance • Agribusiness marketing • Soil & hydrology laboratory • Sustainability of water resources for urban and agricultural users • Soil remediation • Centre for chemical & biological analysis • Water sample analysis • Food processing & engineering |
| <p>3. Hebron University</p> <ul style="list-style-type: none"> • Plant & animal production & protection • Soil & irrigation • Agricultural economics & extension • Natural agricultural resources • Agricultural centre for training & extension • Plant protection resource centre | <p>4. Palestinian Technical University (Khadoury)</p> <ul style="list-style-type: none"> • Plant production & agricultural extension • Hydrology and water studies • Agro-ecology and environmen • Research laboratory in molecular and plant disease |
| <p>5. Al-Quds Open University</p> <ul style="list-style-type: none"> • A newly established faculty of agriculture offers a bachelor's degree | <p>6. Al Azhar University in Gaza*</p> <ul style="list-style-type: none"> • Department of Plant Production and Protection •]Department of Food Technology • Department of Animal and Poultry Production |

Source: Palestinian Ministry of Higher Education.

Note: *Al Azhar University is in Gaza Strip; it is out of reach to the authors. Therefore, it is out of our scope of discussion.

TABLE 3
Palestinian Agricultural NGOs

| Institution | Founded in |
|---|------------|
| Palestinian Agricultural Relief Committees (PARC) | 1983 |
| Union of Agricultural Work Committees (UAWC) | 1986 |
| Arab Centre for Agricultural Development (ACAD) | 1988 |
| Applied Research Institute Jerusalem (ARIJ) | 1990 |
| Economic and Social Development Centre (ESDC) | 2003 |
| Land Research Centre (LRC) | 1986 |
| MA'AN Development Centre (MDC) | 1989 |
| Palestinian Hydrology Group (PHG) | 1987 |

Source: Palestinian Ministry of Agriculture.

There are weaknesses in the coordination mechanism between these three groups (NACR, Universities, and NGOs) regarding their research activities. The institutional groups do not integrate efforts and are sometimes duplicate activities. For example, universities keep on theoretical research without building on farmers' needs or the national extension services. Therefore, academic graduates have a low impact in the agriculture marketplace (Ministry of Agriculture, 2016).

Despite the abundant literature on university–industry relationships in developed countries (Ritzen, 2020), the need to bring about the university–industry–government linkages has been recently grasped in developing countries (Vaaland & Ishengoma, 2016). In Palestine, The weaknesses of UILs are well documented in the literature (Abu Hanieh et al., 2015; Khatib et al., 2013; Morrar et al., 2018; Sultan, 2020). Previous research proposes, among other causes, the lack of policies to facilitate UILs and the state of minimal resources of both Government and universities as determinants for poor collaboration.

Literature Review

Although UILs offer mutually advantageous arrangements (Davey et al., 2011; Liu et al., 2020), a great deal of complexity exists when managing such cross-sector relationships in developing economies (Plewa et al., 2013). The poor infrastructure and the prevalence of small-scale producers and suppliers in developing countries extend this complexity (Béné, 2020; Sultan, 2020). In response, researchers emphasise understanding the nature of UILs to achieve effective university–industry collaboration (Awasthy et al., 2020; Bloedon & Stokes, 1994). Better collaboration can be attributed to the possibility of making an informed decision in selecting a type of interaction appropriate to the particular context (Awasthy et al., 2020). Hence, a context-based approach is more likely to develop a framework that considers various possible linkages to meet the targeted context settings (Bloedon & Stokes, 1994).

Recently, the innovation and uptake of new technologies on small farms in developing countries have been an area of profound research with numerous studies and initiatives (Gatzweiler & Von Braun, 2016). Efforts stem from seeing agricultural innovation support reaching better national food security and less poverty (Lundvall et al., 2009). Indeed, the adoption of new technologies is still slow, which has led to a substantial interest in 'agricultural extension' by educating farmers in new and emerging technologies (Danso-Abbeam et al., 2018; Leeuwis, 2013). Yet, agricultural extension services' effectiveness is still questioned in developing countries (Ali et al., 2012).

Whether forward or backward, the linkages between agriculture and other economic sectors are relatively weak in Palestine (Fallah, 2018; MoA, 2016). Sultan (2020) investigated the coordination between three Palestinian domains of university, industry, and Government and identified structural weaknesses and poor communication hindering collaboration. Khatib et al. (2013) investigated two main Palestinian industrial sectors' innovation performance: quarrying and stone fabrication and the food and beverage sectors. Their findings revealed high innovative

potentials on the industry side. They identified the weak interactions between the industrial sector, higher education, and R&D institutions in Palestine as crucial problems that should be addressed to strengthen firms' ability to innovate.

Universities can contribute to technological innovation in several ways, including conducting field research and applying for studies in specialised fields relevant to the industry. Therefore, effective UILs provide technical consultation to local firms, educate well-trained professionals, and support faculty members to engage in consulting and commercialisation activities (Geiger & Sá, 2008). A supportive environment is necessary to achieve effective UILs, guarded by academic administrators to transfer technology. They ensure objectivity and balance in allocating their available resources to the university's mission (Prigge, 2005; Rahm et al., 2013). In terms of factors that facilitate university–industry partnerships, universities' organisational structure has been identified as an essential dimension in their technology transfer performance (Bercovitz et al., 2001).

The agriculture sector is not an exception (Wu, 2007); however, erratic rainfall threats, climate change, desertification, and drought necessitate collaborations and innovative actions (FAO, 2020). After that, the COVID-19 outbreak severely affected the agricultural chain actors (seeds and fertiliser providers, farmers, traders, transporters, food producers, and consumers).

On the other side, industrial partners should have the internal capability to fully absorb the research and transform it into marketable products. It is further facilitated by industrial personnel having a level of research cleverness matching the university's innovation.

Agricultural education plays a significant role in boosting the economy and speeding up the development process. It can create a landmark in achieving food security and sustainability. Human recourses need to be adequately developed, and untapped agricultural potential can be tapped by educating people about this green jewel called agriculture. Sensitisation of people with awareness programmes, training sessions, and camps can help in improving the statistics of education required for exclusive growth of this sector. The biggest challenge faced by this sector at present is lack of education and guidance. Education does not mean just teaching; it is a way of sustainability. People involved in agriculture should be equipped with all the requisite skill sets to ensure maximum productivity from this sector. This article tries to examine the effects of agricultural education and how it can affect the economy as a whole (Jibrán et al., 2019).

Research Methodology

In this study, qualitative exploratory approach is adopted to investigate Palestinian agricultural UILs. In an effort to investigate the status of UILs, we have employed in-depth interviews to collect data. Then we developed a theoretical interpretational framework (Saunders et al., 2012; Sekaran & Bougie, 2016). Qualitative research increases our understanding of the detected phenomenon and helps find relevant influencing factors for further quantitative studies (Van't Riet et al., 2001).

TABLE 4
Actors in the Palestine Agriculture—Industry Sector and Interviews
Sample Characteristics (n = 29)

| <i>Main Actors</i> | <i>Description</i> | <i>Number of Interviews</i> |
|-------------------------------|---|-----------------------------|
| Private sector | Farmers and agribusiness firms | 13 interviews |
| Private-sector institutions | Food Industry Associations, Farmers' Union, Palestine Trade Centre, and Federation of Chambers of Commerce, Industry, and Agriculture | 5 interviews |
| Universities | NNU, HU, PTUK, AOU and AQU* | 7 interviews |
| Ministry of Agriculture (MoA) | Research centres and outreach centres | 2 interviews |
| International and local NGOs | Catholic Relief Services and Union of Agricultural Work Committees (UAWC). | 2 interviews |

Source: The authors.

Note: *NNU: An-Najah National University; HU: Hebron University; PTUK: Palestine Technical University Khadoury; AOU: Al-Quds Open University; AQU: Al-Quds University.

We started by identifying the main groups of actors in the Palestinian agricultural UILs. We conducted 29 face-to-face semi-structured interviews. Twenty interviews took place from July 2019 to January 2020. Later, to capture a better understanding of the phenomenon during COVID-19, another nine interviews were conducted in April 2021. Participants represent the key actors (See Table 4) in the Palestine UILs.

We adopted non-probability purposive sampling to interview the thirteen farmers and agribusinesses. We were considering differences in locations and sizes. Based on our qualitative research design, open-ended questions were used to collect primary data. We revised all the 29 responses; we derived quotations from the transcripts and connected them with created codes. We grouped codes according to three concepts: Innovation, challenge, and cooperation. This allowed for the further richness of information (Saunders et al., 2012).

Secondary data was extracted from the Palestinian institutions, Food and Agriculture Organization (FAO), and World Bank. The rich literature related to UILs in various developed countries has facilitated structuring relevant ideas about trends in UILs, their implications, barriers, and motivations, among others.

Problems in UILs: Findings and Discussion

Status and Challenges Facing the Agricultural UILs in Palestine

There are many small scattered farmers in Palestine. Most producers are micro and small enterprises with 111 thousand farm holdings, of which 94% are smaller than 40 dunams ($\times 1,000 \text{ m}^2$) (Office of the Quartet Representative, 2014). Farmers are producing traditional products and facing difficulties in marketing or promoting their products more often in the local market. They are not very competitive; they utilise connections to sell their products rather than an innovative competition

approach. Finally, the consequences of COVID-19 in Palestine add to the complexity of managing the agriculture sector.

The interview data and discussions held with various agriculture-related institutions confirm the limited collaboration between university and industry. They revealed many forms of communication weaknesses. Surprisingly, most respondents are not aware of the local universities' programmes and services. Some private-sector interviewees are not mindful of the training activities and research actions of the universities. One of the respondents expressed that there seems to be a lack of information about agriculture professionals in universities and how can be accessed for assistance.

I am interested in increasing the volume of production per meter square and interested in expanding the production turnover per year but did not find an address to contact. I am curious to know more about agricultural financial modelling to optimize my revenues but can find no one to help. Many businesses are not aware of the universities' agricultural academic programmes or research or services.

Firms' owners prefer to buy the know-how from abroad to avoid knowledge leach to other competitors or perceive local universities as less capable of serving them. Others are familiar with the local universities' services. Still, they prefer to collaborate with non-local sources of knowledge by acquiring Israeli or European assistance. Hence, they shy from collaboration.

I am working in the date's production, and I am facing two concerns: water and insects. I hope the universities and research centres can help us. I am hiring technical consultants from Israel to develop new products such as seedless grapes and avocado as we lack local experts in the field. Some of the fertilizers are prohibited to import as they have 'dual-use' purposes; thus, we need researchers who can find out substitutes (alternative fertilizers).

Private-sector institutions, mainly the food industry associations, believe that the lack of evidence of research contribution in the marketplace strengthens the gap between industry and universities and creates distrust. The private-sector members have doubts that local universities are capable or can meet their demands.

The order of collaboration between universities and businesses in Palestine is to organize joint workshops and seminars, then conduct training, and lastly to scientific research. Until now, there are no spinoff-success-stories recorded.

Besides the lack of defined communication channels, agriculturalists doubt the researchers' interests to assist the industry. Researchers conduct research activities for their own sake rather than solving industry problems.

Sometimes, I am looking for a local expert to improve the quality and increase the life shelf of my product, and I do not find.

Some universities have the resources, but their researchers controlled these resources.

Some universities researchers are selfish as they care about their professional career path without paying attention to community problems.

Many research efforts are not market-oriented or tailored to the business sector's needs in the university domain. Activities are undertaken for individual academic objectives such as career progression as many researchers directed their efforts and research activities for getting promoted and not serving the community. Hence, it is essential to redesign research units or innovation networks, including different R & D system actors (universities, industry, government, and non-government institutions). This is proposed to facilitate the flow of knowledge across actors, minimise the R&D risk, and ensure a market-based R&D strategy. Abu Hanieh et al. (2015) recommend that academic institutions improve curricula by including sustainability concepts and new teaching methods necessary to bridge the gap between industry and university.

Officials from the Ministry of Agriculture stated specific challenges for such linkages: the lack of national framework and regulations facilitating collaboration and role duplication rather than integration.

As a ministry of agriculture, we are keen to solve our daily problems and compensate farmers due to closures and climate changes rather than focusing on innovation and new product developments.

University research centres are duplicating the services offered by the National Agricultural Research Center (NARC) rather than coordinating and integrating efforts.

University researchers focus on theoretical-based research papers for promotion issues rather than solving practical problems.

We observed that the level of these linkages varies from region to region. Actions include support in conducting businesses' R&D activities and in improving their production process/unit. In Hebron's area (Southern West Bank), the Palestine Polytechnic University, a technical one with its biotechnology research unit, records two successful knowledge transfers to the agriculture sector: (a) They found that an imported veterinary drug commonly used in the poultry industry is less influential within the Palestinian environment than the manufacturer prescribes and (b) In cooperation with local NGOs, namely the Union of Agricultural Work Committees (UAWC), successfully designed and implemented the Seeds Bank in Palestine. Yet, Hebron University, with its agriculture school, provides local agricultural extension services. To some degree, their efforts duplicate the Ministry's initiatives. The UILs advantaged from the surrounding competitive agribusiness industry in Hebron.¹

Despite the role of the Ministry of Agriculture (MoA) in providing quality solutions for doing business and supporting research by providing frequent internship opportunities, unfortunately, the UILs in Palestine are more donor-driven initiatives than self-oriented motives. Foreigners (diplomats or officials from the UN and FAO) often develop these initiatives as supporting Palestinian agriculture. Yet, Palestinian agriculturists are rarely consulted (Brooks et al., 2020).

Fostering Innovation in the Palestinian Agriculture Sector Through UILs

The Palestinian government is expected to provide some strategic guidelines for such collaboration and guarantee the financial sourcing of R&D activities. The government is also responsible for launching the R&D projects, particularly those of particular importance for the agriculture sector and the high financial standards projects that cannot be met without the government's financial subventions (Rodrigues & Melo, 2013). The FAO reports and action plans in Palestine repeatedly stress the importance of institutional capacity development in Palestine. Besides, their role in strengthening education and knowledge among farmers is to enhance their productivity, quality, and nutrition of domestic food (AFO, 2011).

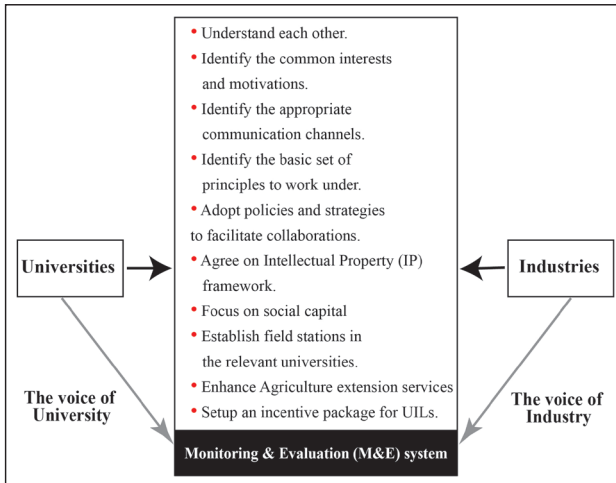
On the industry side, the actors' role is to pay considerable attention to their resources on the commercial part of the R&D activities. Inputs in the form of feedback information on some new potential research scope (the voice of farmers) can ease joint development of new products or technologies and position universities and R&D institutions' efforts in the right direction (FAO, 2020; Shinn, 2002).

Palestinian universities are still relevant; pieces of evidence show many exciting collaborations between universities and industry. However, such interactions tend to be short-term consultancies, whereas dedicated work in research and development calls for engagements in problem-solving for longer time horizons. The perceived enthusiasm for cooperation with the industry is more often driven by a desire to close fiscal gaps among universities as they are grossly underfunded in Palestine.

In their attempts to bridge the significant mismatch between skills produced and the skills demanded, few Palestinian universities offer entrepreneurial and dual-studies programmes. They seek to solve local development problems and improve their students' position in the labour market. The Palestine Polytechnic University in the southern part of the West Bank is reforming to become an entrepreneurial university (Mudde, 2020). Al-Quds University in the middle part (close to East Jerusalem) offers dual programmes, an educational system that combines theoretical study and practice. The later initiative is inspired by the German experiment launched in 2015 with funding from the German Government (GIZ) (Al-Quds University, 2015).

There is a need to develop an all-inclusive framework to strengthen Palestine's agricultural UILs. Universities and industries have a better approach with a new mindset that recognises each other's mission to achieve a win-win scenario (Ehrismann & Patel, 2015; Valentín, 2000). The framework (see Figure 1) lists the

FIGURE 1
The Proposed Framework to Enhance the Agricultural UILs in Palestine



Source: The authors.

proposed nuts and bolts for effective Palestinian agricultural UILs. The list builds on the extracted information from the interviews.

The Proposed Framework to Enhance the Agricultural UILs in Palestine

Understanding the possible relationships between universities and the agriculture sector appears to be the best-fit starting point. Then choose the style that creates fit by aligning the university services with industry needs. Both sides need to identify their needs, interests, and motivations for collaboration. Finding the appropriate channels to communicate between themselves and establish the basic set of principles to work under is essential at this stage. Both sides must adopt policies and strategies to facilitate collaboration and agree on the intellectual property (IP) framework. The literature suggests ways to overcome such obstacles associated with UILs include a legal framework for the cooperation that must be established; contracts must include exclusivity clauses; cooperation should minimise information constraints (Valentín, 2000).

Social capital includes trust, mutual obligations, shared understanding, access to information, and opportunities which play a crucial role in the formation and success of UILs and building long-term commitment (de Wit-de Vries et al., 2019; Thune, 2007). However, governments need to set guidelines and mandates to restrain universities from going on alone in their direction (Krimsky, 2004).

The Palestinian Government is expected to adopt policies and provide incentives that encourage industries' cooperation with the local universities. Universities may create a new incentives system that recognises the academics' efforts to partner with the industry. Rewards and incentives are expected to influence

individuals' motivations and levels of engagement, leading to more effective collaborations (Perkmann et al., 2013). The relevant agriculture-related universities need to act more effectively by expanding their agriculture extension services and establishing field stations (Dutta & Thaker, 2019; Gulati et al., 2018; Patel & Patel, 2020). Finally, there is a need for a monitoring and evaluation (M&E) system to plan, monitor, and act for corrective actions.

How Can UILs Help in Fostering the Resilience of the Palestinian Agriculture Sector?

Managing UILs can help in benefiting from the innovative potentials of the Palestinian agricultural sector by developing state-of-the-art linkages concerning modernisation and productivity through:

- Helping farmers enhance their abilities to diversify their income. Income diversification can help them mitigate risk by generating a income portfolio (Delgado & Siamwalla, 1997; Senger et al., 2017).
- Cooperatives business models can promote integrating small farm holdings and achieve benefits of economies of scale. They are an excellent resilience style to responding against the supply chain disruptions and the adverse impacts of the COVID-19 pandemic (Dongre & Paranjothi, 2020).

Cooperatives can create social relations that enable farmers to achieve goals that they may not otherwise be able to achieve individually.

Cooperatives can help farmers benefit from economies of scale and economies of scope by lowering their costs of acquiring inputs or hiring services and increase the variety of products.

Cooperatives might help the farmers to reduce or share risks.

- Middlemen (farmers' proximate interface with markets) capture a vital part of the agricultural chain's value (Liverpool-Tasie et al., 2020). To improve the supply chain's function, universities are asked to model the farmers' business and emphasise building the long-run relationship along the chain. Supply chain collaboration has been identified as a mitigation strategy to face COVID-19 risks (Sharma et al., 2020).

Agricultural University–Industry Linkages might lead to optimize the supply chain and reduce redundant intermediaries.

UIL will lead to value engineering processes in the Palestinian agricultural sector.

- Product development helps farmers cope with market demand for various needs. This requires entrepreneurs to engage in product development. Given that many farmers have limited resources and new markets are

emerging, they will undoubtedly need to develop a business model that builds on effective UILs and helps budding entrepreneurs have the breathing space to incubate ideas and develop products. Therefore, farmers may adjust their capacity to the new business needs and uncertain market demand, particularly under the continued economic uncertainties of COVID-19 (Ratten, 2020).

UIL efforts are focused specifically on aligning and matching agricultural products with consumer needs and using research and product development to deliver these products and services.

To compete with Israeli imported products, there is a need to enhance the quality of our products and also new methods for developing these new products, so product developments are required.

To sum up, building independent knowledge and technology-based centres inside universities are crucial; after that, the transformative processes' management will be more likely driven by data, experience, and technology rather than functioning reactively. These centres must prioritise creating a resilient agriculture supply chain by analysing the market links and the associated food supply chain risks following the COVID-19 pandemic (Hobbs, 2020; Sharma et al., 2020).

Conclusion

Given the normal crisis mode of economic operations within Palestine's conflict settings, the agriculture structural deficiencies intersect with the adverse consequences of the COVID-19 pandemic and badly harm the farmers' businesses. In this research article, we were interested in exploring the reality of agricultural UILs by investigating the influential factors for the success or failure in Palestine. This widespread mechanism of innovation is examined in light of 29 key actors' experiences and explanations. Our premise is to recognise the role of synergies between industry and university in achieving the growth and competitiveness of the agriculture sector. However, the discussion was broadened to consider strategies that may improve the resilience of the Palestinian agriculture sector in the face of the pandemic's extra shock.

The semi-structured interviews revealed the existence of collaborations between universities and industries. However, collaboration tends to be discrete, selective, and unplanned. Thus, Palestine is at a very nascent and moderate stage for agricultural UILs. The missing critical ingredients of robust UILs include confidence, shared plans, and an institutional structure to coordinate activities.

The main stimulating finding is the misalignment between the two groups vis-à-vis interests, motivation, purpose, conditions, and collaboration scope. The noteworthy results include poor communication performance and the lack of confident attitude among agriculturists towards university research efforts. This work's contribution represents a proposed framework to enhance the functioning of the agriculture sector in Palestine. Mitigation strategies aimed at the adverse

impacts of COVID-19 include, among others, the activation of the role of the agricultural cooperatives, supply chain collaborations, and the diversification of farmers' income.

Palestine is at a very nascent stage when it comes to agricultural UILs. There are very few interdisciplinary working opportunities because of a weak innovation system in academia and relatively low UILs. Therefore, working on creating the absent institutionalised framework for cross-group collaboration is a country priority. Although this article is a sector-specific effort that explores just one facet of collaboration, we hope that demonstrating the proposed framework will help the agriculture sector's healthier position and prepare for a sustainable future.

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NOTE

1. Agriculture is one of the most important and oldest sectors of the Palestinian economy. Many crops are produced to satisfy the local needs and achieve food security and economic growth. The agriculture-based industry is the essential processing industrial sector in Palestine. It includes the production of confectionery, dairy products, poultry and processed meats, beverages, pasta, cereals, canned food, oils, and animal feed. Food producers create about 24% of the total industrial sector, amounting to about 400 million US dollars, and employ about 16.8% of the entire Palestinian workforce (Fanack, 2020).

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