Realizing Business Model Innovation in Social Entrepreneurship through Sustainable Agriculture

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ABSTRACT

Business model innovation (BMI) is often marginalized when making decisions in social entrepreneurship. For this study, the value chain is emphasized to illustrate the needs in modern agriculture where fertigation activities with appropriate technology are the highlighted solutions. In challenging urban life, fertigation can be one of the options for self-reliance. Therefore, the objective of this study is to explore the BMI framework based on the Resource Based Value (RBV) theory to pave the way for unemployed graduates to venture into sustainable agriculture which itself is a guarantee of daily food sources. A total of 103 survey data were successfully collected from respondents in Melaka City through an online platform. Structural Equation Modeling (SEM) analysis has examined the relationship between the complex variables studied with new insights. Results from SPSS and AMOS confirmed that the business model innovation hypothesis is statistically significant and shows good model fit. In answering the research questions, the critical ratio index was considered. The standard return of the mean square residual and the root mean square error of the estimated results were found to be very good, thus further strengthening the competitiveness of the BMI framework for the unemployed group. CFA and regression analysis were used to validate the framework. In conclusion, the sustainable agriculture framework is seen to support the robustness of the research constructs. Agriculture in urban communities presents unique challenges as it is very difficult to predict. With support from government and other agencies, fertigation activities can be promoted as social entrepreneurship to encourage unemployed graduates to become self-sufficient with high motivation to work and low operating costs.

Keywords: Business Model Innovation, Fertigation, Appropriate Technology, Unemployed Graduates, Social Entrepreneurship.

INTRODUCTION

Background of study

Competitive advantage in innovation requires a mechanism that can shape modern entrepreneurial leadership that dares to face the challenges of the digital economy (Ramadan et al., 2023). According to Budiantoro et al. (2024), business model innovation (BMI) has become an important trend in Asia and Malaysia cannot escape from focusing on the Industrial Revolution 4.0 for the competitiveness of micro, small and medium enterprises (MSME). Furthermore, Omowole et al. (2024) argues that useful technologies in the current economic system can enhance the innovative power of micro and SME participants through the implementation of social media marketing, online finance, ICT systems, automation and so on. However, business continuity after the COVID19 pandemic may require different BMIs from each other. Saptono et al. (2024) emphasize the role of incentives by the government in integrating economic innovation with the social and entrepreneurial

environment. Most BMI research is more focused on quantitative impact (Andreini et al., 2022) and the use of technology as a critical component for sustainable industrial development (Mughal, 2022).

At the same time, today's world, especially the agricultural sector, is facing new challenges related to land scarcity, high operating costs and climate factors that affect business models based on digital innovation. Studies by Ragaveena et al. (2021) and Nwanojuo et al. (2025) confirmed the effectiveness of controlled environment agriculture (CEA) in increasing crop productivity with the support of digital infrastructure provided by the Malaysia Digital Economy Corporation (MDEC). Applications of digital platforms such as IoT, AI, big data, drones, and the like will be good research topics to explore agricultural sustainability in business value chains and entrepreneurial interaction settings.

Fertigation technology for agriculture

Hydroponic cultivation through fertigation system combines the fertilization process with irrigation as implied in the term (Pibars et al., 2022). This type of modern agriculture has been found to be effective in increasing the productivity of agricultural crops involving the development of vegetable and fruit crops. Likewise, researchers looked at the fertigation system as a key initiative for the implementation of social entrepreneurship that can be a trend for the prospects of urban agriculture (Yuan et al., 2022; Mainardis et al., 2022). The expected target is to instil innovation capabilities in this community in the agricultural sector, especially among unemployed graduates.

In doing so, they will need to learn new knowledge about fertigation technology to be prepared to explore future technological opportunities (Shokati Amghani et al., 2023). This activity can be realized because of its low cost and uncomplicated implementation so that it is easy to succeed. An important aspect that needs to be paid attention to is the use of bio-fertilizers for fertigation. Finally, quality agricultural products can be produced stably as a sustainable source of income for this unemployed community, where they need to be independent as future agricultural entrepreneurs.

Roles of social entrepreneurship

In Malaysia, the spirit of helping is an important value practiced in its society (Robertson et al., 2022). This is not only limited to government agencies but also contributions from NGOs and private bodies such as Mercy Malaysia. Their aid is also often channelled as humanitarian aid to countries facing conflict, war, disaster, and so on. However, financial support for them is limited and uncertain.

Social entrepreneurs thrive in society by solving the problems of affected communities and helping them develop products that bring life (Dowling, 2022). Over a period of time, this initiative encourages the unemployed graduates to create a start-up where they can use their knowledge and innovative ideas to build a life and benefit their communities. This initiative is carried out through the spirit of volunteerism and genuine compassion. Its mission is to positively impact the target group to become self-reliant, different from traditional business models. The role of social entrepreneurship has now gone beyond its implementation where it is now implemented by various industries as their social responsibility.

The National Economic Policy 2030 emphasizes the mission of creating new entrepreneurs for the long term who can contribute to the well-being of society. This sustainability is expected to succeed in making Malaysia an entrepreneurial nation by 2030. Stakeholders such as the Ministry of Higher Education (KPT) and the Ministry of Science, Technology and Innovation (MOSTI) also play a key role in enhancing and funding entrepreneurship programs that aim to eradicate poverty and unemployment among graduates and those who have lost their source of income.

While, the National Entrepreneurship Program has been mandatory for university students since 2021. They are taught the basics of sustainable business in preparation for a rainy day. Several private agencies are also involved in providing capital, social entrepreneurship training, promoting start-ups and being a bridge to recognize this government initiative (Mittal & Bansal, 2024). Finally, these unemployed realize that they can

still get involved through social innovation and play a role in contributing to solving societal and ecosystem issues (Rezky et al., 2024).

Problem statement, research objective & research questions

At the time of COVID-19 pandemic, there were over 300 thousand unemployed graduates which prompted the government to introduce the Malaysia Social Entrepreneurship Action Plan 2030 (SEMy2030). Social entrepreneurship offers a sustainable approach by creating social priorities for the well-being of the people, especially for communities facing hardship. Access to capital assistance and entrepreneurial training is provided to the marginalized groups not only to housewives and single parents but also opens up small business opportunities to the unemployed. The study by Alamgir et al. (2023) rationalizes that agricultural irrigation project efforts create economic activities for the unemployed and help social entrepreneurs. Similarly, productivity, operating costs, energy consumption, environmental risks and others are very sensitive components of modern agricultural efforts and must remain sustainable (Mainardis et al., 2022). However, due to the small-scale practice of IoT by the needy in Malaysia, business model innovation in agriculture has created a research gap in its standardization for social purposes. Compared to existing literature, this study goes beyond the technological aspect where it integrates value chain into the framework of business model innovation as a factor of social mechanisms. In this sense, the researchers propose a quantitative study to analyse the relationship between readiness, value chain, implementation and achievement to verify whether they can effectively support business model innovation among unemployed communities under social entrepreneurship.

Hence, the objective of this study is to assess the extent to which the effectiveness of the proposed business model innovation (BMI) for the agricultural sector can be achieved through the integration of fertigation technology in social entrepreneurship.

To answer this objective, three research questions will be attempted, namely:

1. Is the business model innovation (BMI) framework in the study effective?
2. Does the value chain influence the innovative business model innovation (BMI) study?
3. To what extent does the hypothesis support the business model innovation (BMI) study?

LITERATURE REVIEW

Unemployment issues in Malaysia

The post-pandemic unemployment in Malaysia has recorded quite a significant number. The government is very concerned about the issue of unemployment resulting from the problem of job shortages, and mismatched skills. Nevertheless, the unemployment trend shows a decrease from 3.4% to 3.0% (520,000 people) based on the latest figure from the Department of Statistics Malaysia (DOSM, 2025). This situation becomes very challenging for policymakers because in reality the labour force continues to increase by 0.2% per month to 17.51 million (August 2025) in contrast to the current employment of about 16.99 million. In the 2nd quarter of 2025, youth aged 15–24 recorded an unemployment rate of 10.2% (or 297,700 individuals). Where else, 6.2% or 399,000 individuals among youth aged 15–30 are still unemployed. Berita Harian (Sept. 2025) also quoted the Minister of Human Resources, Steven Sim Chee Keong as confirming that the number of registered graduates had decreased from 1.55 million to 1.54 million between 2022-2023. These figures have raised the uncertainty surrounding youth participation in the labour market.

The year 2024–2025 shows that the agriculture sector only contributed 9.0% of the employment sector in comparison with the services sector (65.6%) and manufacturing (16.3%), indicating that there is still room for graduates or the unemployed to explore in agriculture which provides employment opportunities (DOSM, 2025).

It was also noted that with low or moderate skill levels, they need to enhance their individual skill in farming. Those scattered in various parts of the Melaka city need to be motivated, re-trained and invited into agriculture

as a short-term relief solution. They have to be participative to be self-sufficient until a certain period of time. Because of that, they were given additional knowledge in business aspects where social entrepreneurship could be the source of their income (Olasky, 2022, Malak et al., 2022). On the other hand, agencies around Melaka could render contributions and financial assistance to support the noble venture from time to time. In this sense, a group of researchers has been determined to replicate the systematic and innovative model by perceiving agricultural struggle like in city of Kuala Lumpur where the authorities have successfully turned around the life of the unemployed community.

The success of the BMI project by the researchers is vital as it would motivate and re-energize such communities to keep up the hope for self-employment. It is through the communities own awareness, desires, and efforts which would drive their success. They need support to feel strong to get up and work than to live in a state of uncertainty and dependency knowing that they can live and earn like other people. In this study, and as asserted by Logue et al. (2025), it is interesting to explore how social enterprises incorporate a hybrid form (for-profit and not-for-profit) legitimacy.

The implementation of fertigation technology

Fertigation technology is becoming increasingly popular in a modern agricultural activity that is very suitable for urban environments, limited spaces or community projects. Its main benefit is low and economical operating costs (Parkes et al., 2022). This process involves an ideal irrigation and fertilization system where nutrients are directed to the roots of the plant. Water containing dissolved fertilizers is distributed evenly according to the exact dose of nutrients as needed. Indirectly, the automation system controls water use so that it is efficient, no waste or loss of water through evaporation. Hence, limited land or its fertility level is not a problem and allows agriculture to be carried out throughout the year. In fact, crop harvest is also productive and of quality and faster. This activity is more environmentally friendly to the agricultural ecosystem as it is free from chemicals and pesticides.

Fertigation works by injecting a mixture of water and nutrients directly into the plants. This technique is very synonymous with commercial agriculture, especially vegetable, fruit crops and so on. This irrigation measurement analysis is made first in identifying the needs of plant tissues. This appropriate quantity will reduce soil erosion from occurring and the use of the right quantity of water and fertilizer. The fertigation system still requires some simple specialized equipment for effective irrigation purposes with a small budget (Delbaz et al., 2023). Among the main electronic components used include sensors, controllers and regulators. A complete fertigation system also contains several other critical components such as water pressure pump, fertilizer injector, backflow preventer, storage tank, scheduling timer, water and fertilizer regulators, watering programmable controller, inlet hose, pressure control valve for dripping, constant pressure mechanism, ‘T connector to control flow, venturi valve for fertilizer, fertilizer storage tank and float valve for water level setting.

Next, the related devices must be installed properly. Regular maintenance is very important to prevent these components from breaking down. It turns out that a fertigation system needs to be made neatly to be strong and function smoothly. This careful preparation will prevent the system from clogging due to improper handling of fertilizer solution, debris, waste or the like.

Value chain as social mechanism

Value chain is an important factor where one of the activities carried out adds value to the product and always remains optimal to increase agricultural income. This is a higher level of social entrepreneurship achievement which can support the country's economic growth in the future. A number of government and private agencies that are able to provide support to ensure that this social entrepreneurship transformation process can empower the agricultural sector. Trainings can be arranged to provide an understanding of this fertigation activity so that participants can adapt it to implement sustainable agricultural operations. The intensive training will help to improve the practices, capabilities and competencies of participants (unemployed) in the challenging urban agriculture. Business Model Innovation (BMI) emphasizes value creation where various factors are combined with strategic goals to meet the needs of increasing change. With this added value, the operational component

ensures that the governance of the business model can deliver the new value expected by customers (Cheng & Wang, 2022). As a result, an optimal value chain helps make success more realistic through a comprehensive value proposition for the product or service.

Besides, technological developments are evolving in line with global business trends (Mikkonen, 2022). Continuous emphasis plays a key role in supporting market dynamics and customer expectations. Meanwhile, weaknesses in adaptation hinder future opportunities and prospects that are diminishing. Likewise, business models for social entrepreneurship are recommended to always consider innovation capabilities in order to compete in the ecosystem of the sector involved, thus adding value to the investment and strengthening the value chain built (Desiana et al., 2022). The role of social entrepreneurship at the global level has a more complex business network that requires competence in managing innovation activities among the communities involved.

In the context of the value chain, researchers have identified six important factors. Selectivity - the network of partners needs to be reviewed through due diligence so that its selection for the venture is appropriate (Suriyankietkaew et al., 2022). Non-business intermediaries – other interested entities including government agencies, research institutions, higher education centres, NGOs, independent organizations, trade unions, social services and so on (François & Goi., 2023). Multiple feedback – standard benchmarks are established by considering all aspects in assessing the performance of stakeholders (Iskandar et al, 2022). Joint strategy development – value creation requires joint and not separate decisions as it involves quite complex governance (Lashitew et al., 2022). Relationship capital – various resources can be contributed by partners so that potential innovations become a strategic focus and continue to grow (Camilleri et al., 2023). Fair value distribution – arbitration to create a balance of decision-making power and maintain an equitable relationship between the outsourcer and the supplier (Mol & Lee, 2024).

Resource based view (RBV) theory for the BMI framework

Resource-Based View (RBV) is a theory that emphasizes various critical values of an organization to strengthen its competitiveness in a business model that believes in continuous innovation. For that reason, Barney (2001) stresses the uniqueness of efficient participants to be competitive in a sustainable manner based on the four RBV characteristics of competitive advantage strategies, namely valuable, rare, inimitable and non-substitutable; regardless of whether the resources are tangible or intangible and also include elements related to training, skill development, machinery, equipment and also basic human capital and others. For applications in agriculture, the awareness factor is critical in ensuring the successful implementation of the fertigation system as a technology transfer initiative. It will be a weakness if the agricultural model fails to be implemented properly in Malaysia given its climatic suitability which should provide great advantages to carry out this economic activity on a large scale. This opportunity should be welcomed by unemployed graduates who are interested in becoming agriculture entrepreneurs to continue learning about the concept of modern agricultural enterprises. This includes a deep understanding of the application of equipment, methods, processes, financial systems and marketing so that they can manage their businesses globally. Continuous evaluation also ensures the extent to which the applications and methods practiced are truly effective and make them diligent in increasing fertigation yields. Every agricultural start-up company needs to prepare standard working procedures to achieve agricultural crop production targets for the ever-increasing local market demand.

According to the Resource-Based View (RBV) theory, a business model innovation can be sustainable by including critical values in order to meet enhance organization competitiveness. In organizing agricultural activities, Yusuf et al. (2024) stressed that awareness plays an important factor because it could determine the extent of readiness to adapt technology transfer in fertigation effectively (Hafeez et al., 2023). The importance of advancing modern agriculture needs to be done because Malaysia has a good climate for such activities. This will not harm the country and the people and can even improve the economy of the individuals involved. The knowledge conceptuality must be taught to workers among the unemployed so that they would be able to continue their work independently (Engeström & Sannino, 2021). In this situation, the understanding of the process, equipment, and correct method to use needs to be emphasized in order to bring results to the entrepreneurs. The necessary efforts have already been made by agencies related to agriculture, welfare, entrepreneurship and interested parties. In this sense, established skills and efficiency are necessary to manage

the fertigation system management (Obaideen, 2022). The ability to organize, manage and a bit of technical skills is not an unusual thing anymore in succeeding in the model of agriculture in the new millennium. Nchanji & Nchanji (2022) asserted that as the equipment is put into practice, the more agricultural know-how they would achieve (such as in vegetables cultivation) although in the challenging limited land areas of the urban. The ability to focus on what has been learnt should be put into practice all the time. Their persistence would certainly ensure improved techniques being applied in fertigation activities. Practically, the new business start-up would be implementing a work culture based on standard operating procedures while the expected outcomes should enhance the capability to manage a future large plantation for local market as well as to increase the products in order to meet a larger marketplace (Singh et al., 2022). This norm to produce excellent work will eventually demonstrate a new business image in the competitive market. These entrepreneurs would become successful in the local fertigation sector and are now ready to try the export market. Therefore, Giudici et al. (2020) were confident that the Resource-Based View theory explains well to the unemployed people as business managers about legalizing their income. Hafeez et al. (2023) alleged that maintenance of technological equipment by using more recent or at least suitable agricultural techniques need to be continuously planned.

Researchers affirm the suitability of the RBV theory in the study related to the role of the unemployed who are able to generate income in the business. One of the important elements for agricultural success is the ability to maintain technological equipment that is used neatly and regularly. Obviously, individual entrepreneurs must be capable and have sufficient resources to carry out their work. The commitment, professional attitude and competitiveness of entrepreneurs will create a strong business image so that they can become a major competitor in this industry until the results of fertigation crops successfully penetrate the global market.

In the meantime, sponsorship provides medium-long term capital prospects for the implementation of the fertigation system. This also requires knowledge because successful implementation must start with a minimum budget and gradually increase according to current achievements. Importantly, the results of the initial investment have been proven and signal that this entrepreneurship is ready to be more productive in generating more profits. All these plans show the extent of the ability of individual or organizational participants in overcoming business challenges and boldly aligning the use of technology to drive future productivity.

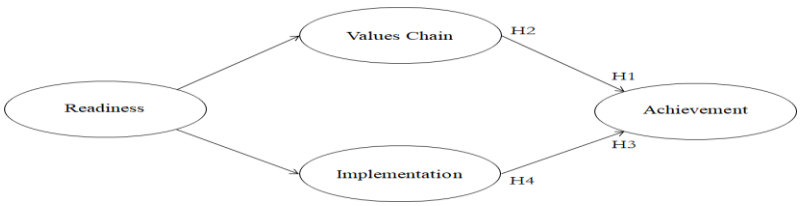
RESEARCH FRAMEWORK

Various possibilities, challenges and weaknesses can affect global social mechanisms. Nothing can guarantee success for social entrepreneurship, and this requires a realistic business model innovation.

So, this study focuses on the unemployed and wants to realize such a model to help them become self-reliant through modern agriculture. In neo-classical economic resources, businesses need to generate 'economy rent' for competitive advantage. Similarly, new capabilities need to be developed for agriculture, the efficiency to manage appropriate technologies used for fertigation which will contribute to the future economy success of individuals, companies, industries and countries.

The following Figure 1 reflects a Business Model Innovation (BMI) of the unemployed in fertigation. This structural model (the research framework) describes the relationship between the variables of the study, forming the constructs of Readiness, Implementation, Value Chain and Achievement.

Figure 1 Structural model of BMI based on RBV perspective



The study on social entrepreneurship will attempt to investigate the five research hypotheses with regard to the business model innovation of the unemployed potential involvement in agricultural activities, as follow:

Hypothesis 1 (H1): Values Chain has a positive effect on Achievement.

Hypothesis 2 (H2): Values Chain mediates the influence of Readiness on Achievement.

Hypothesis 3 (H3): Implementation has a positive effect on Achievement.

Hypothesis 4 (H4): Implementation mediates the influence of Readiness on Achievement.

The willingness of the unemployed to engage in social entrepreneurship is important to ensure that fertigation activities have a positive impact. In this context, readiness requires awareness, learning new skills, acquiring business knowledge and having an infrastructure that enables strategies to mobilize agricultural activities and achieve the set goals.

Hypothesis 1 (H1) proposes the enrichment of the 'value chain' to create a positive impact on the 'achievement' of the project. By adding value, agricultural activities should be well interconnected and effectively turn the business concept into the expected performance. The result will increase business productivity and increase income. Hypothesis 2 (H2) maintains that the 'value chain' mediates the relationship between 'readiness' and 'achievement'. A clear value chain can increase the readiness of the unemployed to achieve better achievements. An achievement requires a structured entrepreneurial attitude that is translated from their readiness and appreciation across the value chain while carrying out agricultural activities. Hypothesis 3 (H3) asserts there exists a positive relationship between 'implementation' and 'achievement' of the project. Social enterprise implementation can use a business plan to formulate the required activities and transform them into results. For Hypothesis 4 (H4), it assumes the positive relationship between 'readiness' and 'achievement' is mediated by 'implementation'. In other words, the implementation of a strategy for achieving goals requires a comprehensive process to prepare the unemployed to carry out the task. Such efforts will motivate participants to achieve better social entrepreneurship outcomes.

METHODOLOGY

Instrument development

This study consists of four latent variables namely Value Chain, Readiness, Implementation and Achievement. Design of the survey questionnaire intended to get answers to the research questions from respondents and measured using a five-point Likert scale, in which 1 implied 'strongly disagree' and 5 indicated 'strongly agree'. The variables indicators were also practiced by many previous social studies.

Sampling plan

The cognitive study aims to understand the extent to which unemployed graduates can venture into social entrepreneurship in modern agriculture by emphasizing the appropriate value creation mechanism. In this case, the study data collection was conducted around Melaka City through the Google online platform. This took 2 months. Non-probability sampling was set in determining the sample size where the estimated number of respondents for the unknown real population was within the acceptable range among start-up entrepreneurs. The advantages of using this approach are that it is simple, inexpensive and does not require a rigid survey frame for data collection purposes. The unit of analysis of the study is the individual. Respondents are among unemployed graduates who are interested and willing to be trained in the field of social entrepreneurship.

For social sciences research, previous studies have discussed the minimum number of samples required for data analysis validation. According to Hair et al. (2017), the minimum sufficient number for most research situations is 100 samples. Kline (2005) and Kline (2015) also added that a sample size between 100 and 200 is considered moderate and suitable for most structural equation modelling (SEM) analyses. Based on best practices, when the research model is very complex, a larger sample size estimate will be required.

For this study, the researcher managed to collect 116 responses but only 103 were confirmed to be usable after screening. Data validation was performed using SPSS software version 26 for observed variables reliability and correlation. AMOS software version 23 was used to define latent variables of the structural model and to

analyse the measurement model between the factors and latent variables. Finally, the goodness of fit index will be used to evaluate the regression results, while the significance of the variable coefficients will be assessed according to the SE value for the hypothesis testing.

RESULTS AND DISCUSSION

Descriptive Statistics

As shown in Table 1, it was evidence that despite the digital era that has currently taken place and become the trend for business evolving products, processes, equipment, etc., 46.6% of respondents still believed that agriculture is important as a business start-up.

Internet of Things (IoT) with big data has created a new way to intervene in agricultural activities (Misra et al., 2020). In this case, 98% respondents believed that the after school-aged of 18-24 (66%) and the youth aged between 25 and 30 (32%) were most suitable groups to carry out the venture since they were exposed to technology. Respondents with a majority of 91.3% agreed that social entrepreneurship (SE) could be the right platform to engage and explore business start-up around their community, society, and maybe global. According to Kullak et al. (2022), SE as a micro business played a significant role to overcome the emerging economies' resource and infrastructure inadequacy. On the appropriate technology, many (98.1%) considered its adaptation into a business start-up would boost their work rate and productivity. Otherwise, firms could be facing hindrances because of insufficient capital, low skills, and outdated technology used that negatively impact competitiveness (Ridwan et al., 2020). While sponsorship was important, however a fresh entrepreneur must be able to minimize the capital required to get the business start-up going as the findings of 72.8% and 77.7% revealed respectively.

Table 1 Descriptive statistics (of social entrepreneurship)

Category	Responses	Percentage
1. The easiest sectors to business start-ups.		
Retail	94	91.3
Agriculture	48	46.6
Manufacturing	44	42.7
Services	87	84.5
2. Suitable age categories for business start-ups.		
< 18	1	1.0
18-24	68	66.0
25-30	33	32.0
31-35	1	1.0
3. Social entrepreneurship suitability as a business start-up.		
Yes	94	91.3
No	9	8.7
4. Appropriate technology adaptation for a business start-up.		
Yes	101	98.1
No	2	1.9
5. Sponsorship requirement for business start-ups.		
Yes	75	72.8
No	28	27.2
6. Minimum capital requirement for business start-ups.		
Yes	80	77.7
No	23	22.3
7. Suitable individuals to carry out social entrepreneurship as a business start-up.		
Retirees	70	68.0
Homeless	40	38.8
Graduates	93	90.3
Jobless	90	87.4
8. An entrepreneur readiness for a business start-up (process training, skills, equipment, etc.).		
Yes	103	100.0
No	0	0.0
9. An entrepreneur implementation of the knowledge learnt ensure an effective business start-up.		
Yes	100	97.1
No	3	2.9
10. A business start-up achievement through collaboration for future growth.		
Yes	98	95.1
No	5	4.9

In addition, based on the entrepreneurs readiness, all respondents (100%) agreed that training was ever necessary to acquire important competencies as stressed by Sannikova et al. (2023) and Vázquez-Parra et al. (2022). The entrepreneurial skills development would also offer suitable knowledge, technical know-how,

financial literacy, marketing excellence, and management skills which encouraged their great performance (Hasan et al., 2024). Apart from that, implementation of the knowledge acquired by entrepreneurs provided an effective business start-up. Fakoussa et al. (2020) perceived the efforts vested on good practices as crucial with focus on continuous learning process. Furthermore, micro, and small business could gradually seek to collaborate with others for better future achievement. Eventually, these initiatives on global value chain would further boost a more socially aware culture, economy, and political landscape.

Data Validation

Table 2 Reliability and correlation outcomes

Label	Variable	Type	Reliability: Cronbach's Alpha	Correlation: Pearson			
				R	VC	I	A
R	Readiness	Independent	0.813	1	0.691	0.879	0.774
VC	Value Chain	Mediator 1	0.874		1	0.749	0.830
I	Implementation	Mediator 2	0.852			1	0.821
A	Achievement	Dependent	0.875				1

SPSS measures the consistency of the scale for each variable through reliability. This tells us how well the data obtained provide consistent results for each item measured. This statistical test uses Cronbach's Alpha unit to measure the internal consistency of a multi-item scale. The ideal value is 7.0 (or within the range of +-1.0 for best practice). Higher values are also said to have high reliability. As shown in the above table, all four values of these measures are recorded between 0.813 and 0.875, where reliability results can be considered as very good.

On the other hand, the Pearson correlation coefficient tells us about the direction and strength of the linear relationship between two variables. A positive correlation value means that when one variable increases, the other variable also increases. When the correlation value is negative, it means that when one variable increases, the change in the other variable decreases. The strength of the relationship between the two variables is measured between 0 and 1. The number 1 indicates a perfect relationship, while the number 0 indicates no relationship between the variables. In this study, the Pearson correlations achieved as shown in Table 2 were generally good, between 0.691 and 0.879 (above 0.5). Therefore, there is a strong relationship between any 2 variables being studied.

Measurement model: validation of BMI

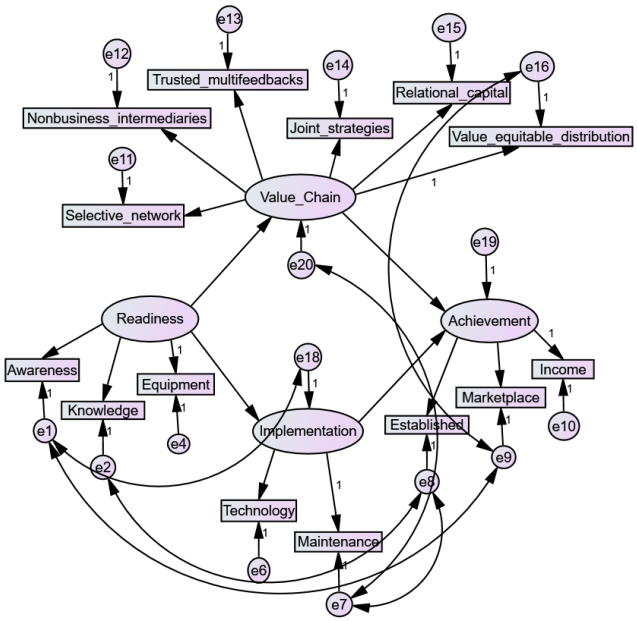
In statistics and research, the relationship between observed variables (indicators) and the underlying latent constructs they are meant to measure is represented by a measurement model. In essence, it characterizes the degree to which the hidden concepts are reflected in the observed variables, which should reflect its validity and reliability.

Evaluating the validity of the theory of construct measurement is one of the measurement model's main goals. It enables researchers to thoroughly investigate whether the indicators selected accurately reflect the latent construct they are meant to represent. Because a poorly fitting measurement model may indicate problems with the conceptualization of construct measurement or the assumed relations between constructs, testing the measurement model is an essential step before testing the structural model. The measurement model, which is essential to guaranteeing the precision and validity of the measurement procedure, essentially investigates the complex relationship between a latent variable and its observable indicators.

From Figure 2, a factor loading in AMOS (or other SEM software) indicates how strongly a particular item (or variable) is related to the underlying latent factor. In essence, it measures the degree to which each indicator accurately captures the underlying construct. A stronger relationship is indicated by a higher factor loading, which implies that the item has a greater contribution to the measurement of that factor. A general rule is that

factor loadings should be greater than 0.4 for interpretational purposes, and ideally, they should average at least 0.70 at each construct, though there is not a single, universal threshold. According to some researchers, all standardized factor loadings ought to be at least 0.5.

Figure 2 The measurement model



Hence, strong relationships between the observed and latent variables are indicated by moderate to high factor loadings. Likewise, factor loadings in this study are recorded between 0.52 and 0.86, suggesting moderate (for non-business intermediaries and equipment scores slightly below 0.7) to stronger relationships (for all other factors).

Confirmatory factor analysis results

Model fit is evaluated using path analysis and the acceptable ranges are based on the particular metric. AMOS made it possible to analyse numerous predictors and outcomes, mediating variables, intricate and causal chains where it enables researchers to go beyond basic linear models.

Table 3 Model fit of the BMI

Measure	Estimate	Threshold	Interpretation
CMIN	63.200	-	-
DF	67	-	-
CMIN/DF	0.943	Between 1 and 3	Excellent
CFI	1.000	>0.95	Excellent
SRMR	0.040	<0.08	Excellent
RMSEA	0.000	<0.06	Excellent
PClose	0.18	>0.05	Excellent

Confirmatory factor analysis (CFA) was conducted using AMOS to assess the measurement model fit. The chi-square test is not significance. Hence, as shown in Table 3, the measurement model demonstrated a good fit to the data, as indicated by the following fit statistics: □2(14) = 63.2, p = 0.609, CMIN/DF = 0.94, Comparative Fit Index (CFI) = 1.00, Standardized Root Mean Square Residual (SRMR) = 0.04 and Root Mean Square Error of Approximation (RMSEA) = 0.06. Since all values fall within acceptable ranges, it indicates a good fit between the model and the data.

As a result, the research framework, namely Business Model Innovation (BMI), was successfully validated. The BMI framework represents the high potential for the involvement of unemployed graduates in fertigation agriculture through social entrepreneurship.

Table 4 Regression weights (default model)

Hypothesis			Estimate	S.E.	C.R.	P	Label
mv1	←	iv	1.228	.173	7.087	***	H1
dv	←	mv1	.465	.119	3.897	***	H2
mv2	←	iv	.798	.132	6.067	***	H3
dv	←	mv2	.563	.153	3.691	***	H4

***statistically significant at the 0.001 level

Table 4 also shows the results of the regression weights. In AMOS, paths can be analysed by examining the standard estimate (path coefficient), standard error (S.E.) and critical ratio (C.R) values. On the other hand, the C.R value represents the hypothesis for each of H1, H2, H3 and H4. The probability of obtaining a critical ratio (C.R.) greater than 1.96 in absolute value is less than 0.001. Apart from that, the S.E. values for value chain which are always greater than that for implementation is a proof that the former has a higher contribution to achievement. Therefore, since all P values are less than the significance level (<0.05), it is concluded that the null hypothesis is rejected and the hypothesized relationship is statistically significant. All hypotheses are accepted and support the business model innovation (BMI) framework.

CONCLUSIONS

Conclusion on research outcomes

The importance of implementation is based on the fact that it has a direct relationship with achieving desired results. The value chain has to be enhanced in order to optimize the stages of delivering goods and services for better performance. Implementation and the value chain are mediational mechanisms, and thus readiness needs to be channelled through them strategically for success to be achieved.

Based on the results of SPSS and AMOS analysis results in the previous section, several conclusions can be made as follows.

i. Data validation: a total of 103 questionnaires analysed had very good Alpha and Pearson Cronbach values. So, in general, respondents (unemployed graduates) understood the questions and managed to provide accurate answers which is important to use for framework analysis using AMOS. If data validation is achieved, then it means the data has undergone stringent checks for accuracy, consistency, and reliability, thus earning trust for its intended use. This indicates that the data is of quality and will support sound decision-making, rather than leading to erroneous or inefficient decisions. (Reference, subtopic 4.2)

ii. Comprehensive framework for BMI: AMOS was used in the analysis of the BMI framework. The results obtained are very useful for understanding the dynamics of the challenges faced by unemployed graduates. The regression results of the measurement model have supported the importance of path analysis and have successfully confirmed the validity of the BMI framework of the study, evaluating the statistics related to factor loadings. In the CFA, the significance implies that the statistical analysis confirms the collected data fitting the researchers' pre-defined theoretical model and statistically valid relationships between observed variables and underlying constructs, not due to chance. This is gauged through various measures: statistically significant factor loadings (correlations between items and factors), which indicate instrument validity and reliability; and overall "model fit" statistics, which describe the extent to which data supports the hypothesized structure. (Reference, subtopics 4.3 and 4.4)

iii. Research hypothesis: in this context, AMOS has provided very good results on the impact of implementing modern agriculture in social entrepreneurship based on the relationship between latent variables namely Readiness, Value Chain, Implementation and Achievement which have direct or indirect relationships. In this case, all hypothesis H1, H2, H3 and H4 are accepted. They are essential components in achieving stakeholder goals. When a research hypothesis is significant, it signifies that the study has found a result which probably

cannot be explained by random chance. It suggests a real relationship between the variables being studied rather than a random occurrence. Generally, a statistically significant result is presented with a probability value below the set threshold, normally at (0.05). (Reference: subtopic 4.4)

Conclusion on research objective and research questions

1. Research objective: the study confirms that the extent to which the effectiveness of the proposed business model innovation (BMI) for the agricultural sector has been achieved through the integration of fertigation technology in social entrepreneurship.
2. Research question 1: the study confirms that the business model innovation (BMI) framework is statistically effective.
3. Research question 2: the study confirms that the value chain influenced the innovative business model innovation (BMI). Its C.R. values are greater than for 'implementation'.
4. Research question 3: the study confirms that all the four hypotheses support the business model innovation (BMI).

Implications of the agriculture entrepreneurship on future employment

In the face of rising graduate unemployment in Malaysia, urban agriculture offers a transformative opportunity for inclusive economic empowerment. Through the integration of social entrepreneurship and fertigation-based urban farming, unemployed graduates will be able to move from being job seekers to impact-driven agriculture entrepreneurs. The business model addresses food security and urban sustainability and encourages innovation in business models oriented toward community development, environmental stewardship, and income generation. Gradually, this can be scaled into socially responsible yet economically viable agribusinesses with structured training, access to technology, and institutional support. The success of the approach lies in combining entrepreneurial mindset with agricultural innovation, creating a pathway for graduates to meaningfully contribute toward societal improvement while earning a livelihood.

In the era of the digital economy and the current job market pressures, urban agriculture-based social entrepreneurship has emerged as a strategic approach with the potential to transform the future of unemployed graduates in Malaysia. Through technologies such as fertigation, graduates can not only generate income but also contribute to urban food sustainability and community development. This approach combines social value and business innovation, making agriculture not only an economic activity, but also a platform for social empowerment.

However, the success of this initiative depends on several important and interrelated elements: readiness, value chain, implementation and achievement. Readiness encompasses the aspects of knowledge, skills, attitudes and access to resources needed to start and sustain social entrepreneurial activities. Without an adequate level of readiness, graduates may face difficulties in adapting fertigation technology or understanding the structure of an appropriate business model.

Furthermore, the value chain plays a crucial role in determining how inputs (such as seeds, nutrients, technology) are converted into valuable outputs (crop yields, food products, social impact). Improvements in the value chain—through digitalization, automation and community collaboration—can increase the efficiency and competitiveness of social agribusinesses.

Implementation, on the other hand, refers to the actual act of operating the business model. It involves strategy, operational management, marketing, and impact measurement. Studies show that effective implementation is a key driver for achieving desired outcomes.

Ultimately, achievement encompasses outcomes such as increased income, reduced unemployment, strengthened communities, and environmental sustainability. To achieve this success, readiness needs to be channelled through the value chain and strategic implementation. These two elements act as mediators—showing that readiness alone is not enough without supporting structures and actions.

Therefore, the future of unemployed graduates in urban agriculture through social entrepreneurship depends on their ability to prepare, understand, and optimize the value chain, as well as effectively implement the business model. This study aims to explore how these four elements interact to shape sustainable and inclusive success.

Future recommendation

The future research can explain in detail how the potentials of the unemployed regarding skills, motivation, and access to resources could be directed through value chain integration and implementation strategies toward the realization of sustainable outcomes in social entrepreneurship based on urban agriculture, such as fertigation, hydroponics, among others.

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