Factors affecting success in information technology utilization in business operations of agri-tech startups in Southern Thailand

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Abstract

This study aimed to explore the factors that affect the success of information technology utilization in the business operations of agri-tech startups in Southern Thailand. Purposive sampling was used for random sampling, and the samples consisted of startup entrepreneurs in the agricultural sector in the south, registered with the department of business development, and a trade association to promote new technology entrepreneurs in 2019. The total number of cases was 48, and there were five experts in information technology management, startup business management, and executives involved in the startup business. Data were collected using in-depth semi-structured interviews and a questionnaire with a 5-point rating scale. Frequency, percentage, mean, standard deviation, and multiple regression analysis were applied using the R program. The results showed that 11 factors were associated with the successful use of information technology in operating a startup. The main predictor of success in information technology utilized in business operations of agri-tech startups in Southern Thailand were the characteristics of Information technology (X_1), behavior on using information technology (X_3), familiarity with basic technology in the organization (X_6), financial technology (X_{10}), and policy and law (X_{11}) ($R^2 = 0.511$, $P < 0.05$). The results of the study could provide useful guidelines for developing and improving information technology, innovation utilization, and for setting policy suggestions regarding needs analysis, developing information technology in supporting agriculture entrepreneurs, and other businesses in Southern Thailand to manage the startup ecosystem.

Keywords: Agribusiness, Agri-tech startup, Business operations, Entrepreneur, Information technology for agriculture, Information technology utilization, Southern Thailand, Success in information technology.

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Transparency: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained.
Ethical Statement: This study followed all ethical practices during writing.

1. Introduction

Our society is transforming into a knowledge-based community, in an innovative age and a creative economy, where data, knowledge, and information technology are used to drive, produce, and add value to business while reducing manpower [1]. As a result of this rapid change, businesses in Thailand are faced with numerous challenges [2].

Having effective information technology to share and collaborate in doing business with other countries could contribute to bargaining power. Therefore, Thailand may need to ask for more collaborations and share information regarding human

resources and information technology internationally [3]. To handle these changes, many entrepreneurs may need to learn and apply technology to solve problems and improve their business competitiveness [4].

Startups are new business platforms, and their environment is becoming more competitive since the ASEAN Economic Community (AEC) announced that the Association of South East Asian Nations (ASEAN) would become a single market and production base [5] that allows the free flow of raw materials, labor, and products, with the same standards, rules, and regulations across ASEAN [6, 7]. According to the Global Competitiveness Index 2019/2020, which measures business competitiveness in 141 countries, Singapore had the highest competitive level, whereas Thailand ranked the 40th. This ranking raises concerns about several aspects, namely infrastructure, total factor productivity, innovation, and Information Technology and Communication (ICT) [8]. These factors can indicate the well-being and happiness of people in a country and can also indicate innovation capability, which supports enhancing management performance or competitiveness through knowledge, innovations, and technology.

Applying innovations and Information Technology (IT) in business enhances competitiveness performance. For example, it can reduce the chance of duplicate work, save time and money, facilitate easy access to investment sources, and reduce manpower. More importantly, its accuracy enhances working effectively and efficiently. Keeranan [9] also stated that change agents play an important role in disseminating technology widely so that users or entrepreneurs can accept the particular technology. Users should participate in the development or application process [10] to fully accept it. Consequently, entrepreneurs are the key persons in the change process and can use IT effectively. In contrast, if they do not accept or use the technology, the change will be aborted [11]. IT acceptance is a state of mind in which entrepreneurs respond to technology, develop attitudes, and either accept or deny the technology. The latter process takes time and also depends on technology and entrepreneur characteristics, such as personality, attitudes toward technology, motivation, and IT competencies and skills. These factors are based on entrepreneurs, and they affect business objectives via work processes and policies [12].

Startup policies under Thailand 4.0 are to enhance and advance the Thai economy to become a knowledge-based economy along with innovation and technology, especially in Small and Medium-sized Enterprises (SMEs) and startups. These policies aim to add growth and value based on knowledge management and IT [13] concerning 4 aspects: 1) promoting startups to access investment funds; 2) supporting startups to be able to use IT and e-business; 3) promoting entrepreneurship knowledge; and 4) having collaborations among related organizations [14]. Moreover, startups are capable of building local business networks that add value to raw materials, with in-house products from agriculture and agricultural tourism [15].

Southern Thailand is located on the Malay Peninsula, which includes 14 provinces covering 44.2 million rai or 13.3 percent of the overall land in the country. The South has 10.93 million rai or 24.73 percent of forest and 1.53 million rai of mangrove forest. The mangrove forest is located at the Andaman seacoast, whereas the forest is at the Thai gulf coast covering 17.79 million rai or 74 percent of overall land in the region. Furthermore, the Thai Gulf area is a significant wetland where people are able to grow plants, have agriculture-based industries and promote agricultural tourism [16]. Therefore, people can utilize the area effectively, accounting for 35 percent of land usage in the region [6]. The Southern economy consists of agriculture, industries, commerce, and tourism. Agriculture, with rubber and palm plantations, is an important part of the Southern economy, contributing 27 percent of the Gross Regional Product in the Gross Domestic Product (GDP). Process industries contribute 2 percent, while border commerce, logistics, and tourism each account for 10 percent, 9 percent, and 8 percent respectively. These characterize the southern economy with abundant resources and people effectively consuming and producing Srirai [17]. The Bank of Thailand [6] finds that the south possesses high potential, unique identities, various cultures and attractions, and fruitful natural resources, all of which align with the Thailand 4.0 policy, which promotes services in agriculture along with service design to develop innovations, services, and products based on existing resources and IT for people's wealth and economic growth.

8.71 percent of agriculture startup entrepreneurs in the south employ IT in their working process, according to the information system of the Department of Business Development as of 22 November 2020. Employing IT in work processes is challenging since each business is different in context and issues, such as user attitudes, technology support, and technology compatibility. These issues might reflect business development competencies and IT acceptance [18]. Promoting positive attitudes when employing IT in business could enhance IT adoption since users would have effective IT support for devices, workshops, and up-to-date software. The support could promote positive attitudes of the users [19]. Consequently, the users would employ technology to enhance their business activities, which would benefit long-term goals and competitiveness Ruksorn [20]. Rogers [21]; Davis [22]; Venkatesh, et al. [23] also mentioned that to adopt innovations or technology, people might get through 5 stages: 1. Awareness, people notice new technology, practices, or innovations but do not prefer to try or use them because there is not enough information. 2. Interest, people show interest in innovation or technology since they could use it to solve problems or apply it in work processes. After showing interest, people would search for more information by asking for some testimonials or developers. 3. Evaluation, when sufficient information has been gathered, people would evaluate the innovation or technology regarding application, value, compatibility, functions, and conditions before using it. 4. Trial, after evaluation, people would try out the innovation or technology to see if the results are satisfactory, then they would accept and continue using it permanently. 5. Adoption, when people use the innovation or technology as preferred, they would adopt and use it frequently until the innovation or technology is institutionalized.

According to many research frameworks, it has been found that different business entrepreneurs adopt IT differently and may not utilize it in business due to varying factors such as IT features, experiences, familiarity with organizations, business management knowledge, personal and strategic skills, communication technology and platforms, financial technology, and policies and laws. However, some entrepreneurs realize the importance and necessity of employing IT in business, allowing them to maximize the use of IT in business. As a result, overall IT employment is not always effective or efficient in improving business competitiveness and activities. This study aims to explore and develop regression models that identify

factors affecting success in information technology utilization in business operations of agri-tech startups in southern Thailand by applying the Balanced Scorecard (BSC) of Kaplan and Norton [24] in measuring the success of an organization. The expected findings will provide concepts and frameworks that support or promote IT in startup businesses in the southern agriculture, which could be applied to other business models in both the government and private sectors.

2. Materials and Methods

2.1 Unit of Research and Samples

The units of research in this study are: 1) Agri-tech startup entrepreneurs in the agricultural sector in southern Thailand that operate a business using technology or innovation in driving production, service, and competition, and are registered with the Department of Business Development and a trade association to promote new technology entrepreneurs in 2019. A total of 48 cases are included in this research. The business group to be studied was selected by using purposive sampling on the following criteria: (1) being an entrepreneurship that is a startup business in the Agri-tech sector, (2) being a place of business operating in a related area of the southern region, (3) an establishment employing information technology in the business operations, and (4) being a place of business whose shares are registered or registered for a business person, and 5) experts in information technology management, management of startups business, and executives involved in the startup business for a total of 5 people were included in the study.

2.2. Case Study

The mixed-methods research aimed at selecting startups with great potential in driving business through technology and innovation. The researchers collected primary data through in-depth interviews and questionnaires, and secondary data were collected from various documents and publications. The approaches were as follows:

2.2.1. Primary Data

1. Semi-structured in-depth interviews were conducted with a sample of key informants, which included agricultural startup groups that drive the technology and innovation business in Thailand, to observe the general conditions of business processes with the use of technology and innovation.
2. A questionnaire was used to collect information from the same sampling group in order to inquire about the level of technology use in their business.

2.2.2. Secondary Data

Secondary data were information collected from documents and publications that can disclose non-confidential information, including related general basic information in business and related information of startup process in Thailand, aimed at improving productivity, service, and competitiveness. This may also include meeting reports, seminars, and intranet systems of relevant companies.

2.3. Research Instrument

The research instruments used in this study were semi-structured interviews and questionnaires. These instruments aimed to investigate the factors that affect the success of information technology utilization in the business operations of agri-tech startups in Southern Thailand. The questionnaire was divided into 5 parts:

1. The R project for statistical computing was used to create forecasting equations and mathematical models from questionnaire data. The aim was to identify factors that contribute to the success of information technology utilized in the business operations of agricultural startups in southern Thailand. The study used 11 factors as independent variables and the level of success in information technology utilization as the dependent variable.

2. The Python program was used for sentiment analysis (opinion mining) from semi-structured interviews. The program applied the Naïve Bayes Classifier algorithm, a binary tool in Python from Abromberg [25], for the data collection on business management conditions, the process of using information technology or innovation, and other factors that contribute to the success of information technology utilized in agricultural startups in Southern Thailand. The process involved:

(1) The form of research interview was introduced from analysis of various documents that related to the interview method and theories about business management and information technology management following the research framework.

(2) Using data to formulate in-depth interview questions, which were applied to a group of startups in Thailand who run a business with technology and innovation in the manufacturing sector, service, and competition.

(3) Using information gained from in-depth interviews to improve and revise the interview format with the specialist before using it as the instrument for collecting information on technology in business and managing agricultural startups. This research unit covered issues related to information technology management processes for agricultural startups and served as supplementary information to explain the use of information technology in business operations.

(4) Developing a questionnaire on the use of information technology in business operations, corresponding to five indicators of organizational success and using 11 factors as characteristics on a 5-point scale. Interpretation criteria included mean behavioral levels expressing opinions on the use of information technology in business operations, which are as follows:

The behavioral level expressing	Score
The highest level of expressing behavior	5
High level of expressing behavior	4
Moderate of expressing behavior	3
Low level of expressing behavior	2

Poor level of expressing behavior   1

The criteria for interpreting the mean of behavioral levels that express opinions and use of information technology in the business operations of agricultural startups are as follows Srisa-art [26]:

The average score of 4.51-5.00 indicated expressing behavior at the highest level.

The average score of 3.51-4.50 indicated expressing behavior at a high level.

The average score of 2.51-3.50 indicated expressing behavior at a moderate level.

The average score of 1.51-2.50 indicated expressing behavior at a low level.

The average score of 1.00-1.50 indicated expressing behavior at a poor level.

2.4. Construction and evaluation of research tools

For constructing instruments for data collection and analysis of the factors affecting success in information technology utilization in business operations of agri-tech startups in Southern Thailand, the study followed these methods and steps systematically:

(1) The researchers collected various data from documents, papers, and related research on the use of information technology or innovation in driving business. This data was used to cover the objectives determined by the researchers and applied them in the questionnaire design.

(2) The researchers drafted the tools used in the research, which included semi-structured interview forms and questionnaires. These tools were subjected to examining, language revision, and formatting in order to ensure accuracy, suitability, and comprehensive content before publishing them to specialists.

(3) The researchers brought the tools developed for the research to an expert to assess and examine the semi-structured interview form. Moreover, the researchers selected 5 specialists who are experts in information and technology, entrepreneurship, or business startups, and research in order to assess and verify the quality and accuracy of the research tools as well as provide recommendations to ensure content validity. The researchers used the principle of considering the experts' qualifications and positions, which were experience, knowledge, capability, and expertise in the research area and field, by using purposive sampling methods.

(4) the researchers assessed the quality of the research tools by using evaluation results from the five experts. They determined the fluency index between the research issue, question, definition, or IOC (Index of Congruence), and content validity following the specialist's comments. They graded and provided scores in accordance with the evaluation criteria [27]. Most items in the questionnaire had IOC in the range of 0.6-1, indicating that the questionnaire can be used to collect data.

Table 1.
The reliability of questionnaire.

Factors	Level of reliability scores
1) Information technology attributes a level of reliability.	0.81
2) Attitude for use level of reliability.	0.99
3) Use behavioral on information technology level of reliability.	0.99
4) Technical expertise level of reliability.	0.99
5) Business management knowledge level of reliability.	0.81
6) Technology familiarity level of reliability.	0.99
7) Personal skill level of reliability.	0.99
8) Strategic capacity level of reliability.	0.99
9) Communication technology and platform level of reliability.	0.81
10) Financial technology level of reliability.	0.99
11) Policy and legal level of reliability.	0.99
12) Overall reliability of the questionnaire, part 3 l.	0.81-0.99

(5) The researcher developed research tools based on recommendations from experts. The tools were then tested with a sample group of 30 business entrepreneurs, who were asked to comment on the clarity of content and language in order to ensure they align with the purpose of the research. The results were then analyzed for reliability using the Cronbach α coefficient [28]. It was found that the questionnaire on success in the application of information technology in business achieved the following reliability scores: 1) finance level of reliability = 0.84, 2) customer's level of reliability = 0.92, 3) working process level of reliability = 0.90, 4) learning and development level of reliability = 0.90, 5) information technology level of reliability = 0.92. The reliability score for the second part of the questionnaire on success in the application of information technology in business was 0.97.

The reliability score for the questionnaire's third part, which examined the factors affecting the application of information technology in business, is shown in Table 1.

(6) To revise the structure and data for further research, the researcher used questionnaires and followed the steps shown in Figure 1 during the construction of the research tools.
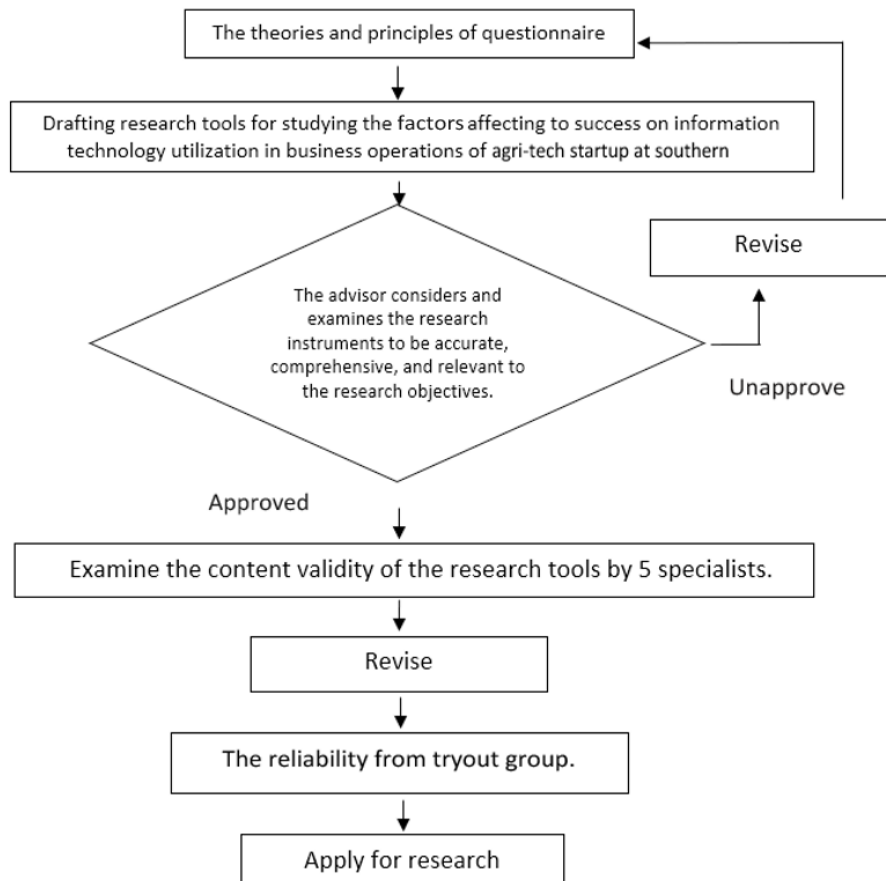
Figure 1.
Flowchart of the tool construction process.

2.5. Data Collection

The process of collecting data was as follows:

1. A memorandum requesting help to collect data from 48 agricultural startup entrepreneurs in the southern region was brought to the Faculty of Science and Industrial Technology at Prince of Songkla University. The data were collected from October 2021 to January 2022, totaling 4 months. No pressure or discomfort was exerted on the interview subjects, who were entrepreneurs. Ethical principles of human research were followed.

2. The tools used to collect information on general business conditions, the use of information technology and business management, the success of the application of information technology in business, and the factors affecting success in information technology utilization in business operations of agri-tech startups in Thailand were as follows:

(2.1) In-depth individual semi-structured interviews were conducted with entrepreneurs or related persons assigned by entrepreneurs to collect information on general business conditions and the use of information technology in startup operations.

(2.2) A questionnaire was used about the use of information technology in business operations, success in the application of information technology, and the factors affecting the application of information technology in business, using 5-point rating scale.

In case individual interviewing was not possible, online questionnaires were used to assist in collecting data.

3. The response rate to questionnaires was 100%, with a count of 100. The questionnaires were subsequently selected for further data analysis using statistical methods.

In order to collect the data through in-depth interviews and questionnaires as research tools, it is essential to adhere to moral and ethical standards. The Declaration of Helsinki principle and guidelines from the International Conference on Harmonization (ICH), Good Clinical Practice (GCP), and ethics guidelines of human research at the Prince of Songkla University should be followed, as well as comply with the regulations of the Office of Human Research Standards of the National Research Council of Thailand (NRCT). The researchers participated in training activities on "Ethics in human research" and received certification of passing the human research ethics course test for researchers on the 29th of March, 2020.

2.6. Data Analysis and Statistics

The data were subjected to qualitative analysis and quantitative analysis as follows.

2.6.1. Analysis of Data from In-Depth Interviews with Semi-Structured Interviews

    1. The information on the general business condition and the use of information technology collected from entrepreneurs was analyzed using content analysis with classification approach, and sentiment analysis for opinion mining, by employing the Python program and by training a Naïve Bayes Classifier algorithm, using a binary in Python from Abromberg [25].

    2. The knowledge gained from data analysis of the general business condition and the use of information technology in the startup business was summarized and recorded as a quality report on the general business and the condition of using information technology to drive the startups in the agricultural sector.

2.6.2. Analysis of Data from Questionnaires About the Use of Information Technology in Business

    1. Analyze general information of organizations and entrepreneurs, using statistical distributions, frequency, and percentage [28].

    2. Analyze the success level of information technology used in business and the level of opinions of entrepreneurs towards factors affecting the use of information technology in business by using mean and standard deviation [28].

    (2.1) Standard deviation is used to analyze the data in conjunction with the mean to characterize the distribution of scores for each item [28].

    3. Analyze factors that significantly affect the application of information technology in business operations of agricultural startups, by using the R project for statistical computing to create forecasting equations and mathematical models.

2.7. Symbols Used in Data Analysis

    n is the number of people in the sample.

    $\bar{x}$ is the mean.

    S.D. is the standard deviation.

    t is the value to be considered in t-distribution.

    F is the value to be considered in F-distribution.

    R is the multiple correlation coefficient.

    R^2 is the forecast coefficient.

    SE_{est} is the standard error in forecasting.

    SE_b is the standard error of the forecast coefficient.

    b is the multiple regression coefficient for the predictor variable in the raw score.

    β is the multiple regression coefficient for forecast variables in the standard score.

    a is the forecast equation constant in raw score form.

    Y is the successful use of information technology to operate a startup business in the agricultural sector in Southern Thailand.

    X_1 is the characteristics of Information technology.

    X_2 is the attitude to use.

    X_3 is the behavior of using information technology.

    X_4 is the technology expertise.

    X_5 is the knowledge of business management.

    X_6 is the familiarity with basic technology in the organization.

    X_7 is the personal skills.

    X_8 is the strategic ability.

    X_9 is the communication technology and platforms.

    X_{10} is the financial technology.

    X_{11} is the policy and law.

    $\hat{Y}$ is the estimate of the success of using information technology in operating a startup business in the agricultural sector in southern Thailand in raw score.

    Z_{x1} is the characteristics of information technology in standard score.

    Z_{x2} is the attitude to use in standard score.

    Z_{x3} is the behavior of using information technology in standard score.

    Z_{x4} is the technology expertise in standard score.

    Z_{x5} is the knowledge of business management in standard score.

    Z_{x6} is the familiarity with basic technology in the organization in standard score.

    Z_{x7} is the personal skills in standard score.

    Z_{x8} is the strategic ability in standard score.

    Z_{x9} is the communication technology and platforms in standard score.

    Z_{x10} is the financial technology in standard score.

    Z_{x11} is the policy and law in standard score.

    $\hat{Z}_Y$ is the estimate of the success of using information technology in operating a startup business in the agricultural sector in southern Thailand in raw score

3. Results and Conclusion
3.1. The Results of General Data Analysis of the Respondents

The personal data presented by the respondents consisted of the type of agribusiness sector, the industry in which they operate, the age of the organization, the type of registration form of the organization, and the province in which the business operates. Frequency distribution and percentage statistics are summarized in the following table:

Table 2.
The frequency and percentage of respondents.

Personal information	Frequency	Percentage
1. Types of industrial agribusiness sectors that operate		
Seafood	8	16.67
Vegetable or fruit	10	20.84
Agricultural equipment	7	14.58
Processed products	9	18.75
Transport / Logistics	7	14.58
Agricultural farm	7	14.58
Total	48	100
2. Organization age		
Less than 5 years	11	22.92
6-10 years	20	41.67
11-15 years	13	27.08
More than 16 years	4	8.33
Total	48	100
3. Organization registration type		
Natural person (Single owner)	26	54.17
Natural person (Ordinary partnership)	4	8.33
Juristic person (Registered ordinary partnership)	0	0
Juristic person (Limited partnership)	6	12.50
Juristic person (Limited company)	5	10.42
Juristic person (Public company limited)	1	2.08
Association foundation / Producer group	6	12.50
Total	48	100
4. Business province		
Krabi	3	6.25
Chumphon	3	6.25
Trang	2	4.17
Nakhon Si Thammarat	2	4.17
Narathiwat	2	4.17
Pattani	3	6.25
Phang Nga	3	6.25
Phatthalung	3	6.25
Phuket	5	10.42
Yala	3	6.25
Ranong	3	6.25
Songkhla	6	12.50
Satun	6	12.50
Surat Thani	4	8.33
Total	48	100

Table 2 shows that the types of agro-industrial businesses that operate mostly are vegetable or fruit related (10 organizations, 20.84%). When considering the age of the organization it was found that most of the business organizations were 6-10 years old (20 organizations, 41.67%). In the type of organization registration most of the entrepreneurs were Natural persons, (single owner 26 organizations, 54.17%). When considering the provinces that do business most were operated in the areas of Songkhla and Satun provinces (6 organizations, 12.50%) in similar numbers.

3.2. Analysis Results on the Level of Factors Affecting Success in Information Technology Utilization in Business Operations of Agri-Tech Startups in Southern Thailand

The criteria for interpreting the mean of behavioral levels that express opinions and use of information technology in the business operations of agricultural startups are as follows [26]:

Table 3.
The mean, standard deviation, and level of factors affecting the success of information technology utilization in business operations of agri-tech startups in Southern Thailand.

Item	Level of agreement (n = 48)		
	$\bar{x}$	S.D.	Level
1. Financial success	3.70	0.63	High
2. Customer success	3.41	0.76	Moderate
3. Process success	3.93	0.53	High
4. The success of learning and development	3.97	0.59	High
5. The success of information technology	3.89	0.45	High
Total average	3.78	0.48	High

Table 3 shows that the overall success of information technology utilization in business operations of agri-tech startups in Southern Thailand was at a high level ($\bar{x}$ = 3.78, S.D. = 0.48). When considering each item, most of them were at a high level, and the items with the highest mean were learning and development success ($\bar{x}$ = 3.97, S.D. = 0.59), and process success ($\bar{x}$ = 3.93, S.D. = 0.53). The lowest mean was for customer success ($\bar{x}$ = 3.41, S.D. = 0.76).

Table 4.
The mean, standard deviation, and level of success of information technology utilization.

Item (Y)	$\bar{x}$	S.D.	Level
Financial success (Y1)			
4. Businesses have introduced information technology systems to help them check their financial systems.	3.92	0.89	High
5. Businesses use information technology to secure their finances.	3.94	0.80	High
7. Businesses use information technology in their financial reporting to report corporate growth rates (profits, losses, and costs).	3.92	0.76	High
Customer success (Y2)			
3. Businesses use technology to monitor or assess customer satisfaction after sales/services.	3.58	0.70	High
4. Businesses use technology to monitor results. or assess customer satisfaction while receiving services.	3.56	0.49	High
5. Businesses use technology to present products/products to customers before launching sales/services.	3.50	0.55	Moderate
Process success (Y3)			
4. Businesses focus on using technology to communicate or coordinate within the organization.	4.08	0.79	High
5. Businesses use information technology in advertising and marketing to publicize the organization/products/goods and services.	4.17	0.88	High
7. Businesses use information technology in production control and transportation systems (logistics).	4.27	0.76	High
The success of learning and development (Y4)			
2. Businesses support and encourage employees to use information technology to seek additional knowledge.	4.21	0.58	High
4. Businesses promote positive attitudes towards using information technology or new innovations.	4.06	0.86	High
5. Businesses always promote the process of research and development in order to expand and develop new knowledge.	4.15	0.79	High
The success of information technology (Y5)			
4. Businesses focus on evaluating information used in the organization.	3.98	0.64	High
7. Businesses pay attention to the prevention and caution of accessing websites that are illegal or against the law.	4.13	0.84	High
9. Businesses have a culture of good practice in using/adapting in the context of information technology.	4.06	0.63	High

Table 4 shows most items were at a high level, and the items with the highest mean were businesses that use information technology to secure finances (Financial Success: Y1) ($\bar{x}$ = 3.94, S.D. = 0.80). When considering customer success (Y2) it was found that most items were at a moderate level, and the items with the highest mean were businesses' use of technology to monitor or assess customer satisfaction after sales/services ($\bar{x}$ = 3.58, S.D. = 0.70). In the part of the process Success (Y3), it was found that most of them were at a high level, with the items with the highest mean being businesses that use information technology in production control and transportation systems (logistics) ($\bar{x}$ = 4.27, S.D. = 0.76). When considering each the success of learning and development it was found that most of them were at a high level, with the items with the highest mean being businesses support and encouraging employees to use information technology to seek additional knowledge ($\bar{x}$ = 4.21, S.D. = 0.58), and when considering the success of information technology it was found that most of them were at a high

level, the items with the highest mean being businesses pay attention to the prevention and caution of accessing websites that are illegal or against the law ($\bar{x}$ = 4.13, S.D. = 0.84).

Table 5.
The mean, standard deviation, and level of factors affecting success of information technology utilization in business operations of agri-tech startups in southern Thailand.

Item	Level of agreement (n = 48)		
	$\bar{x}$	S.D.	Level
1. Characteristics of information technology	4.15	0.43	High
2. Attitude to use	4.15	0.38	High
3. Behavior on using information technology	4.20	0.36	High
4. Technology expertise	4.00	0.38	High
5. Knowledge of business management	4.18	0.34	High
6. Familiarity with basic technology in the organization	3.86	0.42	High
7. Personal skills	3.95	0.43	High
8. Strategic ability	4.03	0.38	High
9. Communication technology and platforms	4.14	0.41	High
10. Financial technology	3.98	0.53	High
11. Policy and law	4.21	0.39	High

Table 5 indicates that the level of factors affecting success in information technology utilization in business operations of agri-tech startups in southern Thailand had 11 factors with a high level, arranged in descending order of mean as follows: policy and legal ($\bar{x}$ = 4.21, S.D. = 0.39), behavior on using information technology ($\bar{x}$ = 4.20, S.D. = 0.36), knowledge of business management ($\bar{x}$ = 4.18, S.D. = 0.34), characteristics of information technology ($\bar{x}$ = 4.15, S.D. = 0.43), attitude to use ($\bar{x}$ = 4.15, S.D. = 0.38), communication technology and platforms ($\bar{x}$ = 4.14, S.D. = 0.41), strategic ability ($\bar{x}$ = 4.03, S.D. = 0.38), technology expertise ($\bar{x}$ = 4.00, S.D. = 0.38), financial technology ($\bar{x}$ = 3.98, S.D. = 0.53), personal skills ($\bar{x}$ = 3.95, S.D. = 0.43), and familiarity with basic technology in the organization ($\bar{x}$ = 3.86, S.D. = 0.42), respectively.

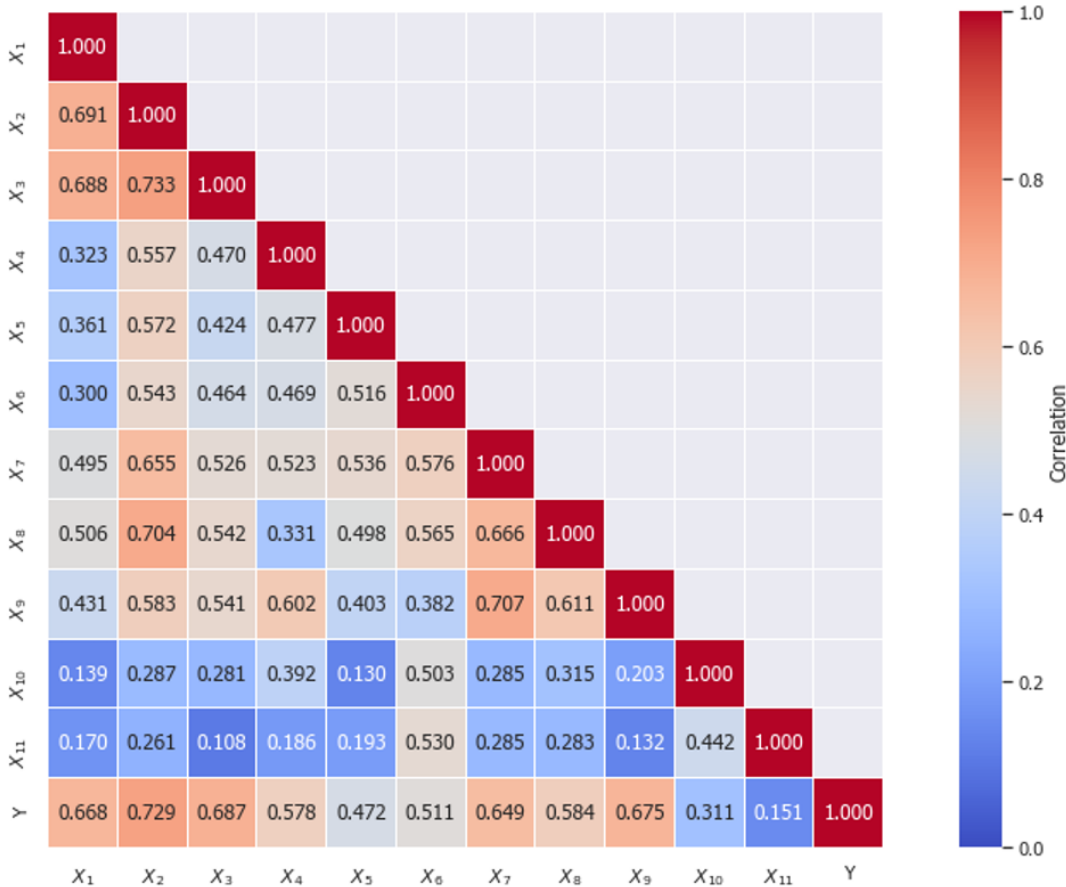*3.3. Correlation Analysis Between the Independent Variable and the Dependent Variables*

Figure 2.
Correlation analysis between the independent variable (X) and the dependent variables (Y).

X_1: Represents the characteristics of Information technology.

X_2: Represents the attitude to use.
X_3: Represents the behavior of using information technology.
X_4: Represents the technology expertise.
X_5: Represents the knowledge of business management.
X_6: Represents the familiarity with basic technology in the organization.
X_7: Represents the personal skills.
X_8: Represents the strategic ability.
X_9: Represents the communication technology and platforms.
X_{10}: Represents the financial technology.
X_{11}: Represents the policy and law.

Figure 2 summarizes the correlation analysis of the underlying variables and the dependent variable. It can be concluded that there is a high correlation between the Characteristics of Information Technology factor (X_1), the Attitude to use factor (X_2), the behavior on using information technology factor (X_3), the Technology expertise factor (X_4), the Familiarity with basic technology in the organization factor (X_6), the personal skills factor (X_7), the strategic ability factor (X_8), and the communication technology and platforms (X_9) with the level of success of information technology utilization in business operations.

The correlation between the knowledge of business management factor (X_5) and the financial technology (X_{10}) with the level of success of information technology utilization in business operations was found to be at a low level. Regarding the relationship between policy and legal factors (X_{11}) and the level of success of information technology utilization in business operations, it was found that these were not related.

Table 6.
A multiple regression analysis of factors affecting success of information technology utilization in business operations of agri-tech startups in southern Thailand, model 17 classified by the information technology success (Y_5).

Variables	B (Raw score)	Standard error of b	Beta (Standard score)	T	P value
Characteristics of information technology (X_1)	0.464	0.162	-0.506	2.854***	0.007
Behavior on using information technology (X_3)	-0.372	0.212	-0.224	-1.752**	0.088
Familiarity with basic technology in the organization (X_6)	0.406	0.178	0.196	2.271*	0.029
Financial technology (X_{10})	0.222	0.111	0.569	2.003**	0.052
Policy and law (X_{11})	-0.315	0.148	-0.186	-2.121*	0.040
Constant (b)	0.588	0.807		0.729	0.470

R = 0.625   Standard error of the estimate = 0.312
R square = 0.511   F = 5.46*

Note: * $p \le .05$ / ** $p \le .1$ / *** $p \le .01$.

Table 6 shows the characteristics of the Information Technology factor (X_1), the behavior of using information technology factor (X_3), the familiarity with basic technology in the organization factor (X_6), the financial technology factor (X_{10}), and the policy and law factor (X_{11}) have a positive effect on the success (Y_5) of information technology utilization in business operations of agri-tech startups in Southern Thailand. These five factors can predict success (Y_5) with a statistical significance of .05 and account for 51.10% of the variance. The financial technology factor (X_{10}) had the largest effect ($\beta = 0.569$), followed by the familiarity with basic technology in the organization factor (X_6) ($\beta = 0.196$).

The correlation of success (Y_5) with the regressors (X_1, X_3, X_6, X_{10}, X_{11}) was equal to .625, and the standard error of the estimate (SE_{est}) was equal to 0.3121. The raw score model was as follows:

$$\hat{Y}_5 = 0.588 + 0.464 (X_1) + -0.372 (X_3) + 0.406 (X_6) + 0.222 (X_{10}) + -0.315 (X_{11})$$

From the multiple regression fit, if the characteristics of Information technology factor (X_1) increase by 1 unit, it is expected that the success of information technology success (Y_5) will increase by 0.464. If the behavior of using information technology factor (X_3) increased by 1 unit, it is expected that the success of information technology (Y_5) will reduce by -0.372 units. If the familiarity with basic technology in the organization factor (X_6) increases by 1 unit, it is expected that the success of information technology (Y_5) will increase by 0.406 units. If the financial technology factor (X_{10}) increases by 1 unit, it is expected that the success of information technology (Y_5) will increase by 0.222 units. If the policy and law factor (X_{11}) increased by 1 unit, it is expected that the success of information technology (Y_5) will reduce by -0.315 units.

The forecasting equation for the success of information technology utilization in business operations of Agri-Tech Startup at Southern Thailand in the standard score model was as follows:

$$\hat{Z}_{Y5} = -0.506 (Z_{X1}) + -0.224 (Z_{X3}) + 0.196 (Z_{X6}) + 0.569 (Z_{X10}) + -0.186 (Z_{X11})$$

From the multiple regression equation in the standard score model, if the characteristics of Information technology factor (X_1) increase by 1 standard unit, it is expected that the success of information technology (Y_5) will be reduced by -0.506 standard units. If the behavior on using information technology factor (X_3) increased by 1 standard unit, it is expected that the success of information technology (Y_5) will be reduced by -0.224 standard units. If the familiarity with basic technology

in the organization factor (X_6) increases by 1 standard unit, it is expected that the success of information technology (Y_5) will be increased by 0.196 standard units. If the financial technology factor (X_{10}) increases by 1 standard unit, it is expected that the success of information technology (Y_5) will be increased by 0.569 standard units. If the policy and law factor (X_{11}) increases by 1 standard unit, it is expected that the success of information technology (Y_5) will be reduced by -0.186 standard units.

4. Conclusion

Factors affecting success in information technology utilization in business operations of agri-tech startups in Southern Thailand can be summarized as follows:

1. The level of success in information technology utilization in business operations of agri-tech startups in Southern Thailand is high due to various factors, including policy and legal aspects, behavior in using information technology, and knowledge of business management. Developing suitable products and services, implementing a knowledge management system, and investing in human resource capital are also important contributors to success. In addition, management support, encouragement, and stimulation play a crucial role in promoting policies, ethics and the development of suitable products or services for customers. This includes having a knowledge management process and human capital management that involves training or receiving support in materials and tools. In addition, executives who support the use of innovation and technology and have clear organizational management policies can help operators increase their potential in business development and self-development. This is particularly relevant in the current context of the COVID-19 pandemic, where social, environmental, and operational environments may combine to optimize the efficiency of an organization's business activities. The research of Phuangcharern [29] suggests that people change and develop themselves in the process of activities and change. this is related to behavioral variables in the use of innovations or technological tools that are in harmony with the social context, policies that support self-improvement, and the pursuit of knowledge. These factors can affect the level of success in performance, including the level of acceptance of the use of information technology in the operation at a high level. However, if employees do not show acceptance or use of information technology for the performance of work, it may be due to a lack of support from management or factors related to innovation or technology characteristics this is consistent with the research of Niyomchart [30], according to his study on the acceptance of educational innovations among secondary school teachers found that the adoption or use of innovation will occur the least if the management does not appreciate or does not support the use of information technology, as well as with lack of budget and clear policies to support the use of information technology in operations. Therefore, it is evident that the factors mentioned above affect the success of using information technology to operate a startup business in the agricultural sector in Southern Thailand. However, their implantation is not always supported and their inadequacy can be caused by the policy, regulations, or behavior of not fully using information technology.

2. The mathematical scores from Table 6, which presents multiple regression analysis of factors affecting success in information technology utilization in business operations of agri-tech startups in Southern Thailand (Model 17 classified by the success of information technology success: Y_5) in business operations of agri-tech startups in Southern Thailand show statistical significance at a .05 level, which can explain the success of information technology utilization in business operations, with a positive result and a forecast coefficient R^2 of 51.10. The two factors with the highest predictive values are the financial technology factor and the familiarity with basic technology in the organization factor. These two factors affect the success of information technology utilization in business operations of agri-tech startups in Southern Thailand, which is at a high level since all three factors are fundamental factors in organizational management.

2.1 The financial technology factor is important and necessary for business operations. Moreover, financial technology is an important mechanism for effective organizational management and can be used to add value to the services of the organization. This is consistent with the research of Jarusen [31], who stated that financial technology affects the quality, completeness, and speed of financial transactions and the quality of service that meets the needs of customers. Financial technology indirectly influences financial transactions, promotes access to funding, and helps increase the competence of business operators. It is also consistent with research by Gambetta [32] who confirms that financial technology can improve trust, create a competitive advantage for organizations, and influence the level of competence of entrepreneurs, promoting all organizations to adapt to the circumstances [33, 34]. Operators must be aware of safety and prioritize trust by creating a system with high safety standards and protecting users. They must also comply with the rules and standards set by the Bank of Thailand from system design to system testing and undergo regular inspections. Lastly, there should be a mechanism to take care of and compensate for the damage caused to the affected users [31].

2.2 The familiarity with basic technology factor in the organization, because the familiarity with basic technology plays an important role in the success of entering a new economy that requires an innovative and digital-driven economy; however, communication will directly affect the human capital development of the organization [35]. In addition, familiarity with the use of ICT can both positively and negatively affect an organization's business operations. This will depend either positively or negatively on the personnel of the organization, where/when/how long they use ICT. In addition, familiarity with basic technology in the organization can create familiarity and respect among personnel in the organization, promoting exchange of ideas and teamwork [36, 37]. Furthermore, it enables corporate personnel to work in harmony with intelligent technology for operational pleasure as shown by Lampongchart [38] and create opportunities for growth and value for sustainable startup business.

3. The level of success in information technology utilization in business operations of agri-tech startups in Southern Thailand was at a high level in four areas: financial success, process success, the success of learning and development, and the success of information technology. However, in terms of customer success, it was at a moderate level.

3.1 The Success of Learning and Development has the highest average success ($\bar{x}$ = 3.97) because the success of learning and development indicates the importance of using technology to create a society/context of knowledge sharing/knowledge sharing among employees in the organization, supporting and encouraging employees to use information technology. In the pursuit of additional knowledge, providing opportunities for employees to present innovative products or services or new inventions resulting from learning, fostering a positive attitude towards the use of information technology or new innovations, and promoting processes of research and development always in order to expand and develop new knowledge, and to promote creative thinking in the development of products and services such as Share & Learn activities, business model design activities or Lesson learned activities, etc. As a result, agricultural startup businesses in Southern Thailand in terms of learning and development have the highest averages and chances of success [39]. In addition, the promotion of learning and self-development in the fields of information technology or innovations also affects the acceptance of the implementation of information technology into operations and increases the desirable characteristics of learning to develop to use more technology and innovation [40].

3.2 The success of customer has the lowest average success ($\bar{x}$ = 3.41). As a result, there are indications that technology is used to assist customers after sales/services, during service, and to provide follow-up or evaluation. Technology is used to monitor or assess customer satisfaction while receiving services, present products/products to customers before sales/services are launched, and deliver value to customers using QR codes or 3D images to tell the story of the product history. Additionally, a focus on e-waste and social responsibility is important. Consequently, startup businesses in the agricultural sector in Southern Thailand have the lowest average and chance of success in terms of customers, consistent with the research of Limcharoen [40] who confirms that the process of tracking customers has the effect of reinforcing customers to return to use more products or services of entrepreneurs. Using technology or innovation to promote or deliver value to customers can also help stimulate reinforcement and create opportunities for access to products and services. Therefore, the use of information technology or innovation to provide customer service is related to the success of information technology utilization in the business operations of agri-tech startups in Southern Thailand.

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