

Article

Modelling Association between Production Practices and Business Performance of Northern Thailand OTOP Using Ordinal Logistic Regression

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Citations: Singasai, W., Malaipun, S., Surin, P. & Chattinnawat, W. (2022). Modelling Association between Production Practices and Business Performance of Northern Thailand OTOP Using Ordinal Logistic Regression. *International Journal of Global Optimization and Its Application*, 1(3), 162-173.

Academic Editor: Ahmad Faisal bin Mohamad Ayob.

Received: 26 May 2022

Accepted: 20 September 2022

Published: 30 September 2022

Abstract: This study presents the model representing the association of the operational management practices of the OTOP producer to the business performance and revenue growth. This study used ordinal logistic regression to analyse the collected business performance data of 101 OTOP producers located in three northern provinces of Thailand. The production and operation management practices and their levels of adoption on the Production and Stock Management, Technology and Innovation adoption, Cost and Data and IT management assessed during the site visits were statistically modelled and tested for association with business performance. The ordinal logistic regression with nominal explanatory variables was used to identify the association between the OTOP business performance measured with the revenue growth and those production and operation practices. This analysis considers the different contexts of the different OTOP product groups. The association model was demonstrated in terms of the odd ratios and event probability of gaining higher revenue growth.

Keywords: One Tambon One Product (OTOP); correspondence analysis; supply chain: business performance.



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1. Introduction

Small and Medium Enterprises and local businesses have formed the main driver for Thailand's economy. Thailand's government initiated a program called Thailand One Tambon One Product (OTOP) in 2001 to help support local businesses (Sensang et al., 2022). This OTOP project has been designed to increase the revenue and income of the rural community. This program was proven to help improve the local

economy and generate both entrepreneurship and income for the locals. This OTOP program has been part of the regional development concept for the Thai economy. The OTOP program concept utilises local resources to create valued products representing local cultural value (Suttipong et al., 2022). Several OTOP products are developed from natural and plentiful agricultural materials the local (Phadungkiati et al., 2011). Several OTOP handicraft products have been improved in quality and aesthetics and can be exported to wider markets. The income generated from the OTOP products creates capital flow for the Thai economy. Thus, the Thailand government and the responsible units such as the Ministry of Industry, Community Development Department, Ministry of Interior, Department of International Trade Promotion, and Ministry of Commerce have all cooperated and are responsible for increasing the revenue for the OTOP. For instance, increasing sales channels and centers, i.e., ThaiTrade.com, Thailand's official B2B E-Marketplace.

Presently, numerous sales channels have been created to increase the opportunity for OTOP to increase sales and revenue. However, the operation and production management of the OTOP also play important roles in satisfying the customers and consumers. The Community Development Department of the Ministry of Interior has initiated several programs to improve the quality and value of the product and the operation and capabilities of the OTOP. The production, operation, and supply chain improvement are also important for increasing the sales and revenue of the OTOP producer. Organisational operation and management are the main drivers for the businesses and OTOP business performance. This operation and supply chain concept helps increase the business operation and consumer satisfaction of the OTOP and hence the sales. Sitabutr & Deebhijarn (2017) reported that consumer satisfaction with the OTOP product and brand could be attributed to perceived quality, competitiveness, trust, and distribution satisfaction. (Nanthasudsawaeng, 2019) also reported that the key business activities and cost structure are important factors affecting the performance improvement of entrepreneurs in addition to the product's value proposition.

Therefore, to increase the consumer satisfaction and revenue of the OTOP, production and operation must also be focused on and improved. The existing operation and management practices of the OTOP may differ depending on the entrepreneurial skill of the OTOP producer. It will be advantageous if the government can justify which operation and production practices and components that associated with higher business growth and revenue. Once identified, those important attributes can be incorporated into the supporting plan and policy of the government. However, it is a fact that production and supply chain operation increase the business capability of all organisations. The level and degree of practice may be needed depending on the business's size and context. For the OTOP business, no study reports the association between the existing practices and the business growth of OTOP. The affirmation of the relationship or association can then be used to develop a model for enhancing OTOP operation. Moreover, this model can be used to develop the investment decision for the OTOP and the government to fund the operational improvement project for the whole program.

This research employed the ordinal logistic regression technique to determine the association between the OTOP operation practices and their business performances. This research aims to describe how different levels of operation and supply chain components impact the business growth and revenue of the OTOP, especially in Northern Thailand. The results of this analysis can be used to define the right component of the operation so that the Thai government can outline a productivity improvement policy in addition to the present project of value creation and design improvement. This study aims to report which production management components consisting of Stock Management, Technology and Innovation, and Cost and Data and IT management have associated and impacted the business measured in revenue growth. Multiple logistic regression was used to analyse the association between the response of business growth measured with categorical scales and the production and operation management practices of categorical values. Up to present knowledge, no OTOP-base research has determined the association between OTOP operational practices and their business performance. This research adopted the ordinal logistic regression with nominal explanatory variables to analyse the association and report the significant relationship and influencing factor by accounting for the different OTOP groups. Section 2 provides the literature review, whereas the methodology is explained in section 3. The results and discussion are provided in the last section.

2. Literature Review

The consumer perception and satisfaction with the OTOP product are related to the cultural pride reflected in the value of the OTOP product. Numerous reports have been presented on which drivers or factors relating to the OTOP sale and export performances for different markets (Leonidou, 2004; Sousa, 2004). The general findings are that sale and export performance is closely associated with the enterprise attributes such as size, age, and entrepreneurship (Leonidou et al., 2002; Ogunmokun & Ng, 2004; Sinkula, 1994; Zou et al., 1998). The key finding of the common factors is associated with the organisational

characteristics, capabilities and management, as well as the strategy implementation (Aaby & Slater, 1989; Voerman, 2003).

In addition to the value creation and proposition of the product, Nanthasudsawaeng (2019) reported that the key activities, key Resources, and cost structure are also the important factor affecting the performance improvement of the OTOP. For example, Sitabutr & Deebhijarn (2017) and Sitabutr & Deebhijarn (2018) revealed that OTOP product brands are not only influenced by perceived quality. Competitiveness, trust, and distribution satisfaction also impact business performance. Vanpetch & Sattayathamrongthian (2019) collected data from the local entrepreneurial projects supported by the Thai government during 2016-2019 and observed some significant business failures due to the lack of principle of business, lack of experience, and lack of financial support. In addition, the author also suggested that other factors depending on the different business can contribute to the OTOP performance and failure. For instance, the business disruption and overwhelming competition are also affect the business performance.

Many reports have been given in terms of status, impact, and factor contributing to the success of the OTOP business management without considering the operational context of the OTOP. (Ruengdet & Wongsurawat, 2010) found that the five salient factors emerged as the most important determinants of success for small and micro community enterprises in the province of Phetchaburi, Thailand are the members' drive for business ownership; systematic division of work; regular accounting records; intelligent marketing plans; and achieving some kind of quality certification. (Tuamsuk et al., 2013) presented the knowledge management model that can be applied based on the top successful Thai OTOP businesses. The knowledge management process and success factors including leadership, organisational cultures, man, and knowledge/intellect. Thus the organisational practice and production, i.e., man and knowledge could play important contribution to the OTOP business success. Similarly, (Thammasang & Poonikom, 2016) presents the finding on the selection of the important set of indicators that associated with the knowledge management of OTOP. (Smith & Tubsree, 2016) explored and presented the leadership development model for the OTOP leaders that contribute to the success of the OTOP.

The finding on the driving factor focusing on the production and operation practices are limited. Kasabov (2016) presented the 5 key success factors for Thai OTOP using the empirical data selected by multi stage sampling from 355 five stars OTOP entrepreneurs. The confirmatory factors and the causal relationship with the structural equation model confirmed that the major factors affecting success of Thai OTOP consisted are 1) the accounting and finances, 2) the production and marketing, 3) the creativity, 4) entrepreneurship, and 5) the innovation. However, the report only confirmed the direction of the relationship without giving the model or prediction how various indicators within each factor groups were contributing to the success. In addition, the production and operation practices and components have been assessed using a questionnaire rather than the actual audit. Hence, this research is interested in determining the association between the operation and production management and the business performance especially the revenue of OTOP product. Therefore, this research aims to study the existing organisation practices of the OTOP producers such as stock management, cost and data management, technology and innovation, and IT management that directly support sale and business alignment. The current literature reviews do not provide information on the operational drivers or practices that affect the OTOP business performance. This research presents statistical analysis model based on multiple logistic regression.

The ordinal logistic regression technique has been used widely especially in marketing and business. Logistic regression is a statistical technique to model discrete events' probability or outcomes (Agresti, 2003). The logistic regression analysis provides a relationship model on what variables are likely to associated with the event of the outcomes. The multiple logistic regression applies when there is a single dichotomous outcome and more than one independent variable (McCullagh & Nelder, 2019). In this research, we measured and interested in predicting the revenue growth classified as ordinal variables. Hence the logistic regression with ordinal response is used (Hosmer Jr et al., 2013). This research is interested in finding which factors defined as the operation practices and how their levels influence or associated with the probability of revenue increases. In this research we would like to identify the relationship and model in which factors of the operation management that can increase the business performance and finally the revenue of the OTOP. Up to present knowledge, there no report the applies the ordinal logistic regression to relate the OTOP performance with the operational characteristics that directly relate with the firm's value chain. In general, the sale and market structure of OTOP could be different among the different group of OTOP according to the cultural characteristics of product itself. This research will take into account the different OTOP product groups and summarise the relationships.

3. Materials and Methods

3.1. Measurement Scale of Variables and Levels

The business performance of the OTOP producer was measured in terms of the revenue growth. The assessment of the records and face interviews suggested that the revenue and income of the OTOP in 2019 varied within the ranges that can be classified into four levels of stable, slightly increased, moderately increased and high increased. After consulted with experts, this research used the ordered interval scale displayed in Table 1 as the ordinal response. The OTOP revenue growth distribution vary within certain interval. The stable revenue was defined as non-significant changes, which can be varied within 5% from the previous year. The increase of revenue from 5%-10% was considered as significant small growth. The increase of 10%-20% is consider significant increase and was denoted as level 3. The last level 4 denotes the OTOP whose revenue growth is significantly greater than 20%. Note that this response is naturally ordered from the level 1 to level 4. In this research we used the level 1 of stable revenue as the reference.

Table 1. Ordinal Scale of the OTOP Business Performances.

Variable	Level	Category
Revenue Growth	1	Varied within -5% to 5%
	2	Increased 5% to 10%
	3	Increased 10% to 20%
	4	Increased more than 20% (Reference)

We defined and measured the production and operation practices in three aspects. First we are interested in the stock management of the OTOP. According to the supply chain concept, the stock management play important role for the business responsiveness. We investigated if the existing practice for the OTOP regarding the stock management. The performance of the stock management practice was classified into three levels with level 1 of low efficient stock management is set as the reference. At this level, there is no full time staff responsible for the stock management in which the OTOP is facing some stock out in the past and sporadically. Some OTOP producer has high efficiency stock management practice with full staff designated for the production and stock control is well managed and synchronised with the production planning. This is referred to Level 3, the highest level of stock management efficiency. The Level 2 is defined to be medium level of stock management efficiency.

Second, the literature reviews suggested the success factor of the key activities, innovation and key resources. Also for the modern operation and business re-engineering, the use of technology can help increasing the productivity and reduce response time for the customer. The innovation also contributes to the new design and value of the OTOP product. This research is interested in the practice of technology and innovation adoption of the OTOP. The assessment of this practice is classified into three levels with level 1 of no technology and innovation adoption as referenced. From the research experiences, there are number of OTOP producers who still utilise the traditional, i.e., handicraft technique without technological instrument for their production technique. Also many OTOP still have few line of items available suggesting that they may not familiar with new product development or lacking of innovation process. This producer will then be classified into the level 1 with no technology and innovation adoption. However, some OTOP producers have employed some technology with machine in the process especially for some Food and Beverage product. The level 2 and 3 are then used to designate the OTOP producers who partially or fully employ the technology or the innovation into their operation respectively.

Third, this research measured whether the Cost, Data and IT system has been adopted for the business. The cost and data connected with IT help increasing the business and sale operation. The cost control and management are crucial to the business success. We classified the performance of the OTOP producer on this second practice or factor using three levels with level 1 represents the traditional use of the costing with no IT and data are not connected to the business operation. The level 2 represent the state where there exist some data management and IT system adopted or connected with the business operation. The highest level 3 is designated if there is evidence of the business improvement operation on the cost, data and IT system. The summary of the explanatory variables with all nominal scales consisting of three main operation and business practices was displayed in the Figure 1.

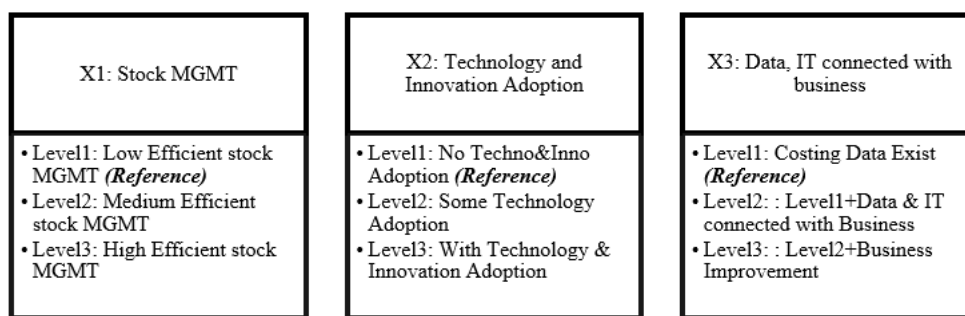


Figure 1. Nominal Scales for the Explanatory Variables of the OTOP Practices.

In addition to the finding presented by several researchers that the significant success factors attribute to the sale performances are the size, age, and its entrepreneurship. Those factors that drive the sale and export of the enterprise may not be applied directly with the OTOP context. In general, it may be advantageous for the government to affirm what practices and which level are associated with the OTOP performance. Different OTOP group may need different operational competences and practices. Hence this research will identify if there exist the association between the practices and the revenue growth among different groups of OTOP. This research aims to test 4 basic hypothesis which and what level of the practices are associated with the chance of growing revenue. The research hypotheses are illustrated in Figure 2.

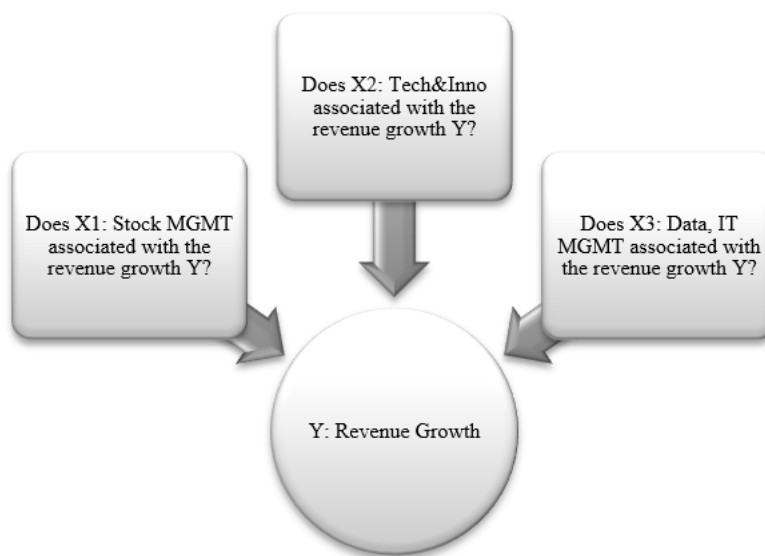


Figure 2. Research Hypothesis on the Association.

3.2. Data Analysis Framework

This research collected data from the site visits to the OTOP from three provinces in the north of Thailand. The data were collected and validated during the field visit. This research collect data from all 5 main groups of OTOP producers which are (i) Food, (ii) Clothes, Apparels, and Accessories, (iii) Beverages, (iv) Herbal products, and (v) Utensils, Decorative items and Souvenirs. The total of 101 producers were sampled and assessed for their current sale, revenue and business condition. Each selected OTOP producer was assessed with their current condition and practices on the operational management.

This research analysed the data in three steps in which the marginal analysis of the association between X1-X3 and Y were conducted using the simple ordinal logistic regression where the logit function of the odds of the revenue growth were regressed on each explanatory variables. This helps the researcher to gain understanding about the marginal association of each explanatory nominal variables of the three practices. Next the multiple ordinal logistic regression was performed whereas the full model with interaction was

fitted. The statistical hypothesis testing and the model reduction is then carried whereas the final model was reported. The step of analysis to analyse the association is explained in Figure 3.

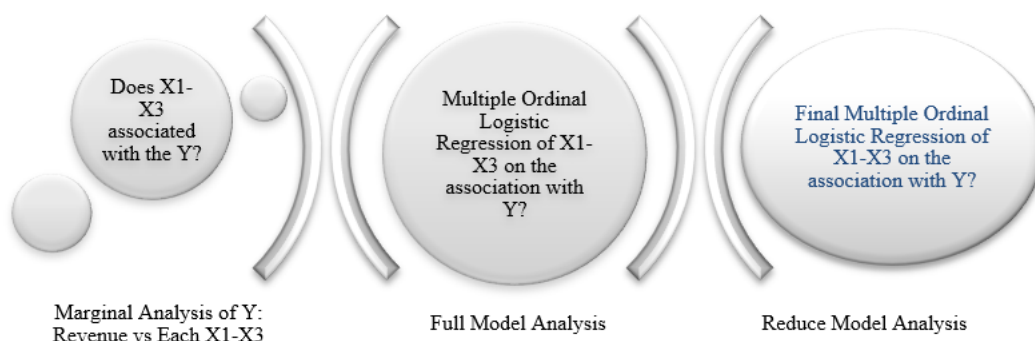


Figure 3. Steps of Ordinal Logistic Regression Analysis

4. Results

4.1. Marginal Analysis of the Ordinal Logistic Regression

This research collected data from the site visits to the OTOP from three provinces in the north of Thailand. The data were collected and validated during the field visit. This research collect data from all 5 main groups of OTOP producers which are (i) Food, (ii) Clothes, Apparels, and Accessories, (iii) Beverages, (iv) Herbal products, and (v) Utensils, Decorative items and Souvenirs. The total of 101 producers were sampled and assessed for their current sale, revenue and business condition. Each selected OTOP producer was assessed with their current condition and practices on the operational management.

Table 2. Ordinal Logistic Regression (Stock MGMT) - Without OTOP Category

Predictor	Coef	SE Coef	Z	P	Odds Ratio	95% CI	
						Lower	Upper
Const(1)	-1.67003	0.415147	-4.02	0.000			
Const(2)	-0.577420	0.384290	-1.50	0.133			
Const(3)	0.472717	0.382846	1.23	0.217			
X1 (Stock MGMT)							
(2) Yes Staff, some stock MGMT	0.295430	0.478731	0.62	0.537	1.34	0.53	3.43
(3) Yes Staff, effective stock MGMT	0.840896	0.466367	1.80	0.071	2.32	0.93	5.78

Table 3. Ordinal Logistic Regression (Stock MGMT) - With OTOP Category

Predictor	Coef	SE Coef	Z	P	Odds Ratio	95% CI	
						Lower	Upper
Const(1)	-1.90632	0.705251	-2.70	0.007			
Const(2)	-0.772854	0.682954	-1.13	0.258			
Const(3)	0.325765	0.679897	0.48	0.632			
X1 (Stock MGMT)							
(2) Yes Staff, some stock MGMT	0.355747	0.503365	0.71	0.480	1.43	0.53	3.83
(3) Yes Staff, effective stock MGMT	0.913206	0.475389	1.92	0.055	2.49	0.98	6.33
Product Types Code							
Group 2: Clothes, Apparels	0.859098	0.707520	1.21	0.225	2.36	0.59	9.45

Group 3: Beverages	0.0206849	0.676094	0.03	0.976	1.02	0.27	3.84
Group 4: Herbal products	0.342547	0.739207	0.46	0.643	1.41	0.33	6.00
Group 5: Utensils, Decoratives	-0.205415	0.621464	-0.33	0.741	0.81	0.24	2.75

Table 4. Ordinal Logistic Regression (Technology & Innovation)- With OTOP Category

Predictor	Coef	SE Coef	Z	P	Odds Ratio	95% CI	
						Lower	Upper
Const(1)	-1.83860	0.648537	-2.83	0.005			
Const(2)	-0.710573	0.625077	-1.14	0.256			
Const(3)	0.365440	0.622808	0.59	0.557			
X2 (Technology & Innovation)							
(2) Some Techno	0.621027	0.407746	1.52	0.128	1.86	0.84	4.14
(3) With Inno&Techno	0.988519	0.676855	1.46	0.144	2.69	0.71	10.13
Product Types Code							
Group 2: Clothes, Apparels	1.05256	0.720623	1.46	0.144	2.86	0.70	11.76
Group 3: Beverages	-0.0578060	0.678438	-0.09	0.932	0.94	0.25	3.57
Group 4: Herbal products	0.293193	0.728083	0.40	0.687	1.34	0.32	5.59
Group 5: Utensils, Decoratives	0.0200521	0.633261	0.03	0.975	1.02	0.29	3.53

The results of marginal analysis of X3 is shown in Table 5. The statistical analysis at 90% confidence indicated that the level of X3 Cost & DATA, IT for business practice can significantly increase the odd ratio of gaining higher revenue growth compared with no practice. The analysis reveals that this effect does not depend on the OTOP product group.

Table 5. Ordinal Logistic Regression (Cost &DATA,IT for business) - Without OTOP Category

Predictor	Coef	SE Coef	Z	P	Odds Ratio	95% CI	
						Lower	Upper
Const(1)	-1.48724	0.285661	-5.21	0.000			
Const(2)	-0.392393	0.243397	-1.61	0.107			
Const(3)	0.661649	0.250150	2.65	0.008			
X3 (Cost & DATA, IT for business)							
Level2: Data & IT connected with Business	0.936535	0.451179	2.08	0.038	2.55	1.05	6.18
Level3: Continuous Improvement	0.401579	0.528578	0.76	0.447	1.49	0.53	4.21

Table 6. Ordinal Logistic Regression (Cost &DATA,IT for business) - With OTOP Category

Predictor	Coef	SE Coef	Z	P	Odds Ratio	95% CI	
						Lower	Upper
Const(1)	-1.68942	0.598468	-2.82	0.005			
Const(2)	-0.549393	0.575216	-0.96	0.340			
Const(3)	0.566832	0.575898	0.98	0.325			
X3 (Cost &DATA,IT for business)							
Level2: Data & IT connected with Business	1.19035	0.500918	2.38	0.017	3.29	1.23	8.78
Level3: Continuous Improvement	0.591851	0.564903	1.05	0.295	1.81	0.60	5.47
Product Types Code							
Group 2: Clothes, Apparels	0.855308	0.711968	1.20	0.230	2.35	0.58	9.49

Group 3: Beverages	-0.418508	0.700786	-0.60	0.550	0.66	0.17	2.60
Group 4: Herbal products	0.468524	0.731593	0.64	0.522	1.60	0.38	6.70
Group 5: Utensils, Decoratives	-0.185859	0.619773	-0.30	0.764	0.83	0.25	2.80

4.2. Full Model Analysis of the Multiple Ordinal Logistic Regression

The full model analysis starts with the aggregation of all three practice variables X1-X3 in the model. By accounting for all three explanatory variables simultaneously, the results show that only X3 Cost & DATA, IT for business has significant impact at 90% confident on increasing the odd ratio of having larger revenue growth compared with no practice. The analysis reveals that this effect does not depend on the OTOP product group. However, when compared with the marginal analysis in previous section 4.1, we found that the X1 stock management practice was detected as significant predictor for the odd ratio. The in depth analysis reveals that the variables X1 and X3 are closely related.

Table 7. Logistic Regression - Full Model Analysis of the Ordinal Logistic Regression of X1-X3

Predictor	Coef	SE Coef	Z	P	Odds Ratio	95% CI	
						Lower	Upper
Const(1)	-1.96676	0.454634	-4.33	0.000			
Const(2)	-0.842299	0.418592	-2.01	0.044			
Const(3)	0.245747	0.410615	0.60	0.550			
X1 (Stock MGMT)							
(2) Yes Staff, some stock MGMT	0.171139	0.496916	0.34	0.731	1.19	0.45	3.14
(3) Yes Staff, effective stock MGMT	0.717997	0.485578	1.48	0.139	2.05	0.79	5.31
X2 (Technology&Innovation)							
(2) Some Techno	0.237259	0.418629	0.57	0.571	1.27	0.56	2.88
(3) With Inno&Techno	0.685559	0.654012	1.05	0.295	1.98	0.55	7.15
X3 (Cost &DATA,IT for business)							
Level2: Data & IT connected with Business	0.811766	0.476509	1.70	0.088	2.25	0.88	5.73
Level3: Continuous Improvement	-0.0407073	0.583414	-0.07	0.944	0.96	0.31	3.01

The analysis of cross tabulation between these two variables in Tables 2 shows that the majority of the OTOP group either assessed with Level 1 or 2 or 3 with inefficient or somewhat or efficient stock management are likely having Level 1 of Data and IT. However the test of independence reveals that the two variables are correlated. Hence we need to consider the interaction between the variable X2 Cost, Data and IT and the X1, the stock.

Table 8. Cross Tabulation Analysis of X1 and X3.

	Level1: Costing Data Exist	Level2: Data & IT connected with business	Level3: Continuous Improvement	All
(1) No Staff, inefficient stock	20 83.33	3 12.50	1 4.17	24 100.00
(2) Yes Staff, some stock MGMT	22 62.86	10 28.57	3 8.57	35 100.00
(3) Yes Staff, effective stock	23 54.76	9 21.43	10 23.81	42 100.00
All	65 64.36	22 21.78	14 13.86	101 100.00

Table 9. Chi-Square Test

	Chi-Square	DF	P-Value
Pearson	8.981	4	0.062
Likelihood Ratio	9.204	4	0.056

Thus the full model of ordinal logistic regression with interaction between X1 and X3 was fitted and the result was shown in Table 10. When we account for both variable X1 and X3 with all cross combination of their levels, the analysis confirms that both variables are significant predictors for the odd ratios. Therefore, by considering the stock management practice crossed with the Cost & DATA, IT for business, both practices increase the odd ratio of having larger revenue growth compared with no practice. The analysis reveals that this effect does not depend on the OTOP product group.

Table 10. Logistic Regression Final Model Analysis of the Ordinal Logistic Regression of X1-X3

Predictor	Coef	SE Coef	Z	P
Const(1)	-2.15919	0.472864	-4.57	0.000
Const(2)	-1.01711	0.435951	-2.33	0.020
Const(3)	0.103848	0.422091	0.25	0.806
X4 (Stock MGMT)				
(2) Yes Staff, some stock MGMT	0.716458	0.567025	1.26	0.206
(3) Yes Staff, effective stock MGMT	0.987565	0.563278	1.75	0.080
X7 (Cost &DATA,IT for business)				
Level2: Data & IT connected with Business	2.62409	1.23634	2.12	0.034
Level3: Continuous Improvement	1.58817	1.85795	0.85	0.393
X4 (Stock MGMT)*X7 (Cost &DATA,IT for business)				
(2) Yes Staff, some stock MGMT*Level2: Data & IT connected with Business	-2.31762	1.40931	-1.64	0.100
(2) Yes Staff, some stock MGMT*Level3: Continuous Improvement	-2.87779	2.22461	-1.29	0.196
(3) Yes Staff, effective stock MGMT*Level2: Data & IT connected with Business	-1.72925	1.42119	-1.22	0.224
(3) Yes Staff, effective stock MGMT*Level3: Continuous Improvement	-1.27241	1.97657	-0.64	0.520

4.3. Odd Ratio Analysis of the Full Model Ordinal Logistic Regression

From the statistical estimation results of the full model analysis, the odd ratio of having larger revenue growth can be represented using Eq.(1) to (3). The analysis reveals that this effect does not depend on the OTOP product group.

$$\frac{\pi_1}{1 - \pi_1} = \exp \left(\begin{array}{l} -2.159 + 0.7164X_{1(Level2)} + 0.987X_{1(Level3)} + 2.624X_{3(Level2)} + 1.588X_{3(Level3)} \\ -2.317X_{1(Level2)}X_{3(Level2)} - 2.877X_{1(Level2)}X_{3(Level3)} \\ -1.729X_{1(Level3)}X_{3(Level2)} - 1.272X_{1(Level3)}X_{3(Level3)} \end{array} \right) \quad (1)$$

$$\frac{\pi_1 + \pi_2}{\pi_3 + \pi_4} = \exp \left(\begin{array}{l} -1.017 + 0.7164X_{1(Level2)} + 0.987X_{1(Level3)} + 2.624X_{3(Level2)} + 1.588X_{3(Level3)} \\ -2.317X_{1(Level2)}X_{3(Level2)} - 2.877X_{1(Level2)}X_{3(Level3)} \\ -1.729X_{1(Level3)}X_{3(Level2)} - 1.272X_{1(Level3)}X_{3(Level3)} \end{array} \right) \quad (2)$$

$$\frac{1-\pi_4}{\pi_4} = \exp \left(\begin{array}{l} 0.104 + 0.7164X_{1(Level2)} + 0.987X_{1(Level3)} + 2.624X_{3(Level2)} + 1.588X_{3(Level3)} \\ -2.317X_{1(Level2)}X_{3(Level2)} - 2.877X_{1(Level2)}X_{3(Level3)} \\ -1.729X_{1(Level3)}X_{3(Level2)} - 1.272X_{1(Level3)}X_{3(Level3)} \end{array} \right) \quad (3)$$

Where :

π_1 = probability that the Y is in Level4 with revenue growth >20%

π_2 = probability that the Y is in Level4 with revenue growth between 10% to 20

π_3 = probability that the Y is in Level4 with revenue growth between 5% to 10%

π_4 = probability that the Y is in Level4 with revenue between -5% to 5%

and $\pi_1 + \pi_2 + \pi_3 + \pi_4 = 1$.

With some algebra, we can calculate the predicted individual probability of gaining revenue growth which were shown in Table 11. First notice that, under the condition of running business with inefficient stock management and no data and IT connected to business, there is about 47.40% chance that the revenue will not be increase. Instead, if the OTOP producer has invested in staff and have effective stock management and IT system connect with the business, the chance of gaining higher revenue growth increased from 52.60% to 88%. The chance that OTOP producer will gain revenue growth more than 20% will be increased from 10.34% to 43.12%. Hence this model provides descriptive and quantitative method to predict the business performance with respected to the choice of practice adopted by OTOP.

Table 11. Individual Probability of Revenue Growth

	Revenue growth >20%	Revenue growth between 10% to 20%	Revenue growth between 5% to 10%	Revenue growth between -5% to 5%
Inefficient Stock Management, No Data, IT connected	0.103476	0.162115	0.260348	0.474061
Effective Stock Management, Data, IT connected	0.431244	0.272523	0.175580	0.120653

The analysis and calculation also reveals that the effective stock management alone can increase the odd ratio of gaining more than 20% revenue growth by 2.68 times the odd ratio without the good practice. Also the use of Cost & Data, and IT connected with business also help increasing the odd ratio of gaining more than 20% revenue growth by 13 times the odd ratio without the Data and IT practices. Hence we can see that this practice has great impact and be the most influencer or driver to the OTOP business.

5. Conclusions

In conclusion, this study indicated that good practice of stock management together with the Cost & Data, IT connected with the business have great impact on increasing the odds of gaining higher revenue growth. The practices of Data, IT seems to have greater impact to the business performance. This can be used by the Thai government to deploy the policy to support the OTOP business. The new proposed technique leads to stronger discrimination of product targeting and suggests the new positioning of the OTOP product for the elderly market. Thus, the results of this new technique affirm the right selection on the right OTOP product group. This can justify the strategic action plan for both OTOP product and process development.

The ordinal logistic regression is suitable for the analysis and provide predictive model for the researcher to justify the hypothesis that good practices of operation will help transforming the business process which in turn satisfying the customer. The ordinal logistic regression can identify the changes in the opportunity that the OTOP which can be used to identify the what and how the combinations of the practices will change the pattern of chances of having more revenue. This analysis on the association between the stock management, Technology and Innovation Adoption, Data and IT connected with business were not subject

to the different groups of the OTOP product. The OTOP product group does not play an important role as exogenous variable. The association between the practices and the business growth can be applied to all OTOP product group. This research does not only validate how the operation strategy support the business but also provide the modeling tools for the decision maker to deploy the level of practices compared with the targeted revenue growth.

Author Contributions: Conceptualisation, W.S., S.M., P.S. and W.C.; methodology, W.S. and S.M.; software, W.S., P.S. and W.C.; validation, W.S., S.M. and W.C.; formal analysis, W.S., S.M. and P.S.; investigation, W.S., S.M., P.S. and W.C.; resources, W.S.; data curation, W.C.; writing—original draft preparation, W.S., S.M., P.S. and W.C.; writing—review and editing, W.S., S.M., P.S. and W.C.; visualisation, P.S.; supervision, W.C.; project administration, W.S., S.M., P.S. and W.C.; funding acquisition, W.C. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Acknowledgments: The author would like to Chiang Mai University, National Committee of One Tambol One Product of Thailand, Ministry of Education of Thailand, and Chiang Mai Rajabhat University for supporting this research and publication. We would also like to thank the reviewers for their constructive comments and suggestions.

Conflicts of Interest: The authors declare no conflict of interest.

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