

NEW PRODUCT DEVELOPMENT CO CREATION PROCESS: A THAI CASE OF MICRO COMMUNITY ENTERPRISES OF NON-FOOD HERBAL PRODUCTS AND R&D GOVERNMENT ORGANIZATIONS

Prapaisri, Chulalongkorn University
Tratri Taiphapoon, Chulalongkorn University
Achara Chandrachai, Chulalongkorn University
Sukree Sinthupinyo, Chulalongkorn University

ABSTRACT

This research aims to explore the best practice components affecting the new product development process in non-food herbal product sector of the micro community enterprises and R&D government organizations in Thailand. Drawn from a literature review, four components were identified with influence on the new product development process of R&D government organizations: 1) Ideation and screening including; entrepreneur characteristics, business analysis and market analysis 2) Matching technology including; technology assessment and researcher capability 3) new product development process and marketing strategy, and 4) government support.

In order to seek for the best practice components for the success of the new product development, the mixed method was employed. In the first phase, the conceptual model and interview questions were subsequently designed and developed in accordance with the literature review, data were collected by in-depth interviews through purposive sampling, the interview questions were asked to ten specialists in new product development in R&D organizations as well as fifteen micro enterprise communities with experience in newly developed products and commercialization in non-food herbal product sector. During the interviews, there were discussions about the new product development process, and content and descriptive analyses were then conducted with the interview data. The second phase involved the use of questionnaire to collect data with a sample of 354 entrepreneurs from micro-enterprise communities in the non-food herbal product sector. Descriptive statistics were conducted to analyze the micro enterprise communities' demographic data. While Pearson Product Moment Correlation was employed to analyze the correlation, multiple linear regression analysis was used to find any influence among independent and dependent variables.

The current results revealed that both the R&D organizations and the micro enterprises have applied the above four components, which were found to have a correlation and factor analysis to the new product development process. In addition, findings from the questionnaire showed such other new components are Ideation and screening entrepreneur, Matching process for appropriate development, Research and product development and Coordinate product efficiency innovation to commercialization.

Keywords: Micro Community Enterprise Herbal Products, New Product Development Process, R&D Government Assistance, Co-creation.

INTRODUCTION

The Thai herb industry is prevalently managed by small and micro community enterprises (98%). To enhance competitiveness of the whole industry, scientific and technological knowledge as well as research and innovation, coupled with local wisdoms are vital for creating new ideas as well as a variety of products to better serve the changing needs and contexts. For higher efficiency and productivity in the sector, National Science Technology and Innovation Policy Council, in 2017, introduced the "*National Master Plan on Development of Thai Herb vol. 1 (B.E.2560–2564)*" comprised of four key policies: 1) promotion of potential herbal products, 2) upgrade of the herb industry and its marketing to global level, 3) the use of herbal products for both treatment and health promotion, and 4) the development of a comprehensive policy from upstream to downstream through relevant government agencies: ranging from starting business, industry and manufacturing, know-how and consulting organizations, product development organizations, as well as procedures, standards, and funding for product development, including organizations responsible for advisory services in import-export. (*National Master Plan on development of thai herbal vol.1 2017-2021*, 2017)

In terms of product development, the Thai government has taken on supportive plans and implementations through related agencies such as universities and research organizations. Learning and exchange activities between universities and enterprise communities have been initiated. Examples include the fieldwork conducted by university students to collect data on herbal formulas and cultivation in the communities, and the compilation of local wisdoms. Moreover, research centers were founded, equipped with modern devices for testing quality and properties of herb, herbal extraction and products, drug development for convenient use as well as in-depth studies on existing research results, including the establishment of standardized laboratories as well as testing centers for cosmetics and natural products. (National Science Technology and Innovation Policy Council, 2017)

Ministry of Higher Education, Science, Research and Innovation plays a key role in product development of community enterprises in six areas: 1) raw material development, 2) product innovation, 3) package design, 4) standard system development, 5) improvement of manufacturing process, and 6) machine design to cover all product categories in each OTOP (One Tambon One Product) group.

The success of new product development has many success factors and processes, one of the most important factors is government's support. The new product development process to launch the product in general including ideation, concept feasibility, product development, testing and launch product. Even though they attempt to achieve the success product, the suitable products development processes for success guidelines are needed to develop. One significant drawback affecting the entrepreneur is the government's product development process, which is often difficult, sophisticated, and ambiguous resulting in the inconvenience and dissatisfaction of the service recipient. According to the literature review and interviews with entrepreneurs, it was found that the governmental sectors still need collaboration (Government Collaborative) by co creation, as well as, providing consultation process on the entire product development system (Integrated Consultant) and advancing the demand to concerned authorities (Problem Matching). (Prapaisri et al., 2019)

To fill the research gap, the present study intends to explore the process and best practice components affecting the new product development process in non-food herbal products of the micro community enterprises and R&D government organizations in Thailand. The next section

begins with a literature review which examines the new product development process in R&D government organizations; followed by the research framework is divided into 4 parts: part 1 ideation and screening, part 2 matching technology part 3 new product development process and marketing strategy and part 4 government support to new product development as well as a platform to accelerate innovative product success of Thai community under the collaboration with government support for micro community enterprises of non-food herbal products in Thailand and research methodology . The findings are subsequently discussed in detail. Finally, the best practices for the new product development process are recommended with objectives to accelerate successful innovative products and to improve the working process of R&D government organizations.

LITERATURE REVIEW

Ideation and Screening

Entrepreneurial characteristics: Refer to a set of personal characteristics appropriate for operating a business. These characteristics can support entrepreneurs to gain success in enterprises. This can be drawn from different characteristics or orientations of successful entrepreneurs that were previously identified in the literature. According to Frese (2000) there are five orientations to become a successful entrepreneur. First, innovativeness orientation is having creative ideas to develop new, non-repetitive products as well as leading new services and technologies to operate business. Second, risk taking orientation means courage to decide, with an equal chance to win or lose. Competitive aggressiveness orientation represents strong determination to complete missions, manage to fare better than competitors and to sharpen a competitive edge (Frese et al., 2000). Stability and learning orientation means being stable, not emotional with any situations or mistakes as well as being able to learn from mistakes or to turn mistakes into lessons learnt. Finally, achievement orientation refers to entrepreneurs, while in a highly competitive age (Barringer, 2015), should be resource assemblers/leverages, self-starters, and networkers.

Business Analysis: There are various concepts established to give more insight into the business analysis to find the advantages or to build a business strategy. Kenichi Ohmae offered a framework consisting of the three key elements which are the corporation, its customers and its competitors. This conceptual model called 'strategic triangle' suggests the individual analysis and also integrated analysis for the successful business performance.(Ohmae, 1983) The factor used in five forces specifically in the rivalry among existing competitors might depend on the intensity of the competition, including how it would affect on the industry itself such as the growth rate of the industry, fixed costs, and switching costs (Bruijl, 2018). Eskandari et al. stated that there are various factors in the analysis of five forces which may include the number of buyers in the market, purchase volume, substitute products, and the necessary investment required by the new players who may want to enter the existing market (Eskandari et al., 2015). According to Power et al. (Gürel & Tat 2017), there could be multiple factors that researchers might use in SWOT Analysis which can consist of both internal and external factors such as the changes in demand and input cost, market share, experience, interest rates, legislation, and more. The frameworks above are well-accepted and could be used to analyze in any area of business. Business analysts should concentrate on every factor that could possibly affect the developing process of the enterprise product and also be aware of the external factors that could affect the profitability in a negative way.

Matching Technology

Appropriate technology: Technology means skills, knowledge, and procedures for doing, making, and using things. A successful technological society should continuously find ways to maintaining the cycle between resources, production, consumption, and waste (Date, 1984). Technology assessment, which can be transformed into valuable new products (Rip, 2018), is considered in an analysis of continuous changes in technological development and the impact of technology on society, which include the identification of various technological development's potential consequences and analytical management from knowledgeable experts relevant to technology circles. Moreover, this involves product performance, technology improvement, competitiveness, technology readiness to implement stage of technology, resources/supply availability, and technology skill base requirement, as well as difficulty in copying, including cost of technology

Researcher characteristics: An open mind and ability to adapt themselves to a critical way of thinking, hardworking, diligence, being focused and devoted to a specific field of interest; and updated knowledge for enhancing ideas to exchange with colleagues working in the relevant field (Stefanadis, 2006). An ability to use the English language well and the sufficient amount of time and financial resources are the factors that are associated with a successful researcher's profile (Paiva et al., 2017). Moreover, good researchers essentially need to show a dedicated interest to do the best research possible. Furthermore, interest, motivation, inquisitiveness, commitment, sacrifice, excelling, knowledge, recognition, scholarly approach, and integration are the essential qualities good researchers could have.(Toledo-Pereyra, 2012)

New Product Development Process

The new product development process has been explored by numerous researchers. For instance, Kolter stated that the process consists of idea generation, idea screening, concept development, marketing strategy, business analysis, product development and test of marketing and commercialization. Details of each factor are described below.

Stage 1 idea generation is to search any ideas that are feasible with selling potential. The new product development is divided into two sources: internal is generated by ideas from employees who are in direct contact with consumers and thus understand what consumers want; research and development team who is up to new technologies and innovations; and high-ranked executives who know strengths and weaknesses of their organizations, direct their respective organizations to the vision while planning for new products. External is generated by ideas from consumers to meet their needs. These ideas can come from competitors as well in order to catch up with their actions and competitive edge. Stage2: idea screening after securing ideas for new products, there must be a feasibility study to select the best ideas for further development and testing. Stage 3 concept development and testing: after obtaining the best idea from Stage 2, the next thing to do is to make the idea more concrete and test it with the target consumers to appraise their feeling and acceptance of the new products. Stage 4 marketing strategy development is to develop a marketing tool to introduce new products to the target market. Stage 5 business analysis is to analyze sales volumes, costs and benefits out of the new product project, and to seek customer satisfaction as stated in the company objectives. This is to assess the market needs or sales volumes as well as likely costs and benefits as indicated in the objectives, and to decide on new product development. Stage 6 product development is to develop new

products that have been through the business analysis for further research and development by making product prototypes. Stage 7 market test is to bring the newly developed products to the target market for testing. Such products must be branded, packaged, and assessed on customer satisfaction. Stage 8 commercialization is to bring the newly developed products to the target market. This is the costliest part for the company because it will go on a full-scale production to be estimated on the right volume of products. (Philip Kotler, 2006)

As for the product development related to cosmetics extracted from fruit or herb, Cernasov proposed a concept of developing a new cosmetic product concerning anti-aging. The proposed concept is conducted in four steps with the integration of the regulations about the manufacturing of cosmetic products into the development process. The first step is to conduct a market analysis by obtaining data from both local and international markets, consumer needs, competitor information, and product trends so as to determine the needs and demand of the market. Secondly, the product development process (R&D process) is about extracting active ingredients as well as finding raw materials to use as a guide for product development (to produce a new product that meets the market demand). Thirdly, the manufacturing process features a safety test, with a request for standards in order to ensure the efficiency of the product and make use of the testing and/or standard results to plan for marketing, including a guarantee that the manufacturing process is in compliance with the formula. Lastly, product launch involves the development of packaging, marketing, and bringing a new product to the market. (Cernasov, 2008)

The product development of Traditional Chinese medicine (TCM) for various applications, including for massage therapy (Pan et al., 2011) and there are a variety of variables to consider in developing Chinese herbal medicine (CHM) that includes more than 11,000 kinds of medicinal plants which have been processed down to more than 5000 medicinal products. Apart from what stated above, there are more angles in terms of research and development which includes the development of the new chemical compound, modification of the CHM compound, and interaction for multiple components in the herbal formulae. From just the research and development step, it may clarify how a new product development process of the medicinal herb, which can be used for massage therapy, can take a long period to complete with the exclusion of clinical trials and many more. This may include the sourcing step of the ingredient to match with the current formulae used by the industry and even more difficult in creating a new formula altogether. It would imply that the new product development process specifically in medicinal herbs for massage can be a long process that needs to be dealt with care and attention from the research and development team more than anything.

Marketing Strategy: Robert F. Lauterborn identified 4C's marketing: 1) consumers, 2) communication, 3) cost and 4) channel of convenience as the concept to understand consumers, rather than products, coupled with two-way communication in order to better understand consumers, products, and services. To elaborate, it is an analysis of information based on what consumers want and need such as placing products in appropriate and commensurate with the target consumers. Cost is not only about pricing to gain profits, but also consumer feeling at the buying time. Communication means how to communicate with consumers, with awareness of what consumers want and need in behavioral dimensions. Channel of convenience can be the use of internet at distribution channels or any other channels other than physical ones. Insights into how to make it convenient for consumers to use services and products (Lauterborn, 1990) (Schultz et al., 1994). While 4Ps emphasize on environmentally friendly marketing, green logistics, marketing channels with two-way marketing channels, as well as the integration of

green and social marketing, 4Cs focus on value creation to products and services, and the value transfer to consumers (Ozturkoglu, 2016). When 4Ps and 4Cs are well blended, this will result in more comprehensive marketing strategies.

Government Support and Collaboration

The positive characteristics of entrepreneurs are considered to be important factors in the process of developing a successful rural enterprise. The government should give the marketing-related program, seminars and conferences to develop desiring success factors: advancement drive, achievement target, commitment, decision-making capacity, ability to handle risk, tenacity, network and optimism. (Paul et al., 2014)

The success factors of government support such as Japan, Thailand, Indonesia, Malawi, Nigeria, Guam, Philippines, Nepal or even Republic of Kyrgyzstan the local government attempt to encourage, assistance and support in the term of business activities, research and development product, training related the business product, knowledge to enhance their abilities, product roadshow in local and global, Funding, laws and the establishment of production plants in order to enhance capability. (Igusa, 2006) and Government subsidize funding of private R&D project (Wallsten, 2000)

Moreover, in Malaysia, government assist and provide an environment conducive to small enterprises in rural areas in training workers with industrial skills and creativity, strengthen business with a stricter set of business training, investment in infrastructures and facilities to create a positive local business environment and provide support services for the market effectively regarding the promotion of products, market access and network. (Kader et al., 2009). In case of SMEs, the internal R&D activities are the important factors of product innovation for both Large company and SMEs. Moreover, financial support for SMEs had a positive effect on product innovation. (Kim et al., 2016)

RESEARCH DESIGN AND METHODOLOGY

The objective of this research was to identify best component affecting new product development process performance, as the literature reviews, government new product development process have the following 4 main criteria: 1) Ideation and screening including; entrepreneur characteristics, business analysis and market analysis 2) Matching technology including; technology assessment and researcher capability 3) new product development process and marketing strategy, and 4) government support, Therefore, the research framework has been developed as follows;

Methodology

This research was use mixed method to collect data;

1. Qualitative method

Data were collected by in-depth interviews through purposive sampling with ten experts and relevant technical officers and scholars in charge of product development at R&D government organizations with at least five years of relevant experience and fifteen entrepreneurs from community enterprises of non-food herbal products for commercialization.

2. Quantitative method

The questionnaire was administered with 354 entrepreneurs of micro enterprise communities in non-food herbal product sector shows in Figure 1.

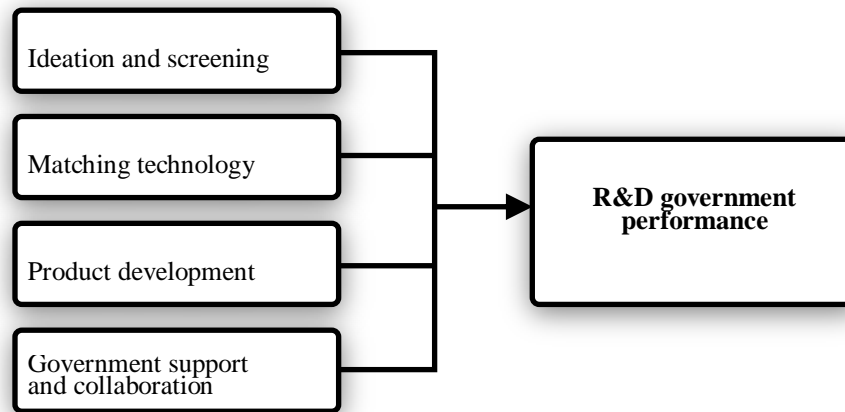


FIGURE 1
RESEARCH FRAMEWORK: GOVERNMENT NEW PRODUCT DEVELOPMENT
PROCESS BEST PRACTICE

RESULT

Qualitative Method

A content analysis was conducted to interpret and capture key words and relevant phrases for grouping in themes drawn from the interviews (Berkowitz, 1997). The data analysis was conducted as follows: 1) content examination by recording the interviews, theme grouping and an analysis of relevant issues, including additional data from interviews, 2) the encoding of the interviews from both the expert respondents and enterprise respondents, checking the accuracy of the encoding, and checking the accuracy of the content with word-by-word transcription, and 3) interview data were supported by an examination of secondary data to provide a cross-check on internal validity. The use of triangulation was applied to help increase the accuracy of the results as the findings can be strengthened across the validation of multiple data sources. Qualitative analysis is fundamentally an iterative set of processes (Berkowitz, 1997) Shows in Table 1.

Table 1 THE QUESTION FOR IN-DEPT INTERVIEWS	
	Questions
Stage 1 Demographic information	1.1 Position 1.2 Duties and responsibilities 1.3 Experience and years of serving in product development for entrepreneurs.
Stage 2 Product development Process	2.1 In your organization, is there any process or stage of product development that can bring entrepreneur's products to the market, what is your organization process

Table 1 THE QUESTION FOR IN-DEPT INTERVIEWS	
	Questions
	have? 2.2 Which process the important?
Stage 3 Comments about government support to product development	3.1 In your organization, is there any policy in support of product development for entrepreneurs or not? If so, how is the policy like? 3.2 In your organization, what stage of product development that you think should be added or removed?
Stage 4 Appropriate government support to product development	4.1 In your organization, what is the appropriate government support to product development?
Stage 5 Additional comments (if any)	5.1 Additional comments (if any) pursuant to other factors that may affect the product development process.

Based on the interviews, it was clear that both the government R&D organizations and micro enterprises have applied the concept of new product development process to their workplaces. Prior to support provision, the government organizations also conduct a preliminary assessment of entrepreneur characteristics. Factor from each interview are summarized below shows in Table 2.

Table 2 FINDING ON PROCESS AND SUCCESS FACTOR ON NEW PRODUCT DEVELOPMENT PROCESS		
Process	Interview topics	Keyword Factor Finding
Ideation and screening entrepreneurs	Potential of entrepreneurs	“Entrepreneurs are determined to success by themselves, with creative ideas to make their products better. They keep learning new technologies, plan for business strategies, intend to produce good products for consumers, create networks for raw materials as well as own a factory, including local-wisdom based formulas.
	Analysis of entrepreneurs’ business capability	“Analysis of strengths and weaknesses in terms of production capacity, human resources, product development fund, raw materials sourcing capability, knowledge of existing customers and their concerns, as well as awareness of competitors and their plan to launch products, including knowledge of product strengths and its advantage edge over competitors. Knowledge of how to identify target market and customers, and what kind of products the target market wants and its cost per unit.
	Search for product development idea	From the storytelling of products and materials From customers and trading partners From brainstorm meeting to select the best idea, consulting with experts, searching information from different sources, a questionnaire to survey satisfaction
Matching Technology entrepreneurs	Guide for appropriate technology	Select and develop the existing technologies for purposes. Simple and/or low-cost technologies that can be developed at factory
	Guide for appropriate researcher	Able to develop products for purposes, with expertise in the product development process

Table 2 FINDING ON PROCESS AND SUCCESS FACTOR ON NEW PRODUCT DEVELOPMENT PROCESS		
Process	Interview topics	Keyword Factor Finding
		through commercialization
Product development	Business and marketing plan	<p>Business plan should indicate objectives, target markets, cost calculation, and innovation, including marketing plans</p> <p>“A variety of products: there should a product presentation, data collection and evaluation after sales.</p> <p>“Reasonable pricing in comparison with the market. The price should be reasonable and in the promotional range”.</p> <p>“Appropriate online channels, including booth exhibitions in collaboration with other agencies”</p> <p>“Public relations through a variety of media channels, beautiful and proper packages with adequate details for communication with customers. Introduction to access stores via applications, advertising via online media, and give customers advice on products while being able to communicate product value”</p>
	Product development and testing & document preparation and standard testing	<p>Needs to develop formulas for the expected efficiency. Able to produce at factory scale, and obtain certification of standards to make the products to become qualified for FDA Thailand, including teaching all procedures to be able to do it yourself.</p> <p>Documentation for product registration as well as factory accreditations. Advisory services for trade protection of products such as intellectual properties (IP), petty patents</p>
Government support	Government support to product development process	<p>“Formula development, management of raw materials for consistent production standard. Product testing e.g. allergy testing”</p> <p>“Procurement of appliances and machine as well as the development of machines and products”</p> <p>“Business matching and taking to contests for trust building. Seeking markets in both Thailand and overseas. Exhibition and show case organizing”</p> <p>“Advice on adjustment and development of formulas for experiments by entrepreneurs. Each process of product development can lead to commercialization”.</p> <p>“Product development process, knowledge of a number of technologies, including herbal products”</p>

As Qualitative research, most of the government organizations tend to pay attention to entrepreneurs endowed with knowledge of their products, production potential, assessment of entrepreneurs’ business capability, ideas of product development. Meanwhile, community

enterprises appear to focus on support in terms of formula and product development, as well as funding and machines, including advice on communication of innovativeness of their products.

Quantitative method: The questionnaire was administered with 354 entrepreneurs of micro enterprise communities in non-food herbal product sector. Details are described below.

Demographic Data

In terms of demographic data, 143 of the entrepreneur respondents were aged 50 years or over (40.40%); 136 of them aged 41 to 50 years (38.40%). As for education, 133 of them hold a bachelor's degree (37.60%), with 129 of them having a vocational certificate (36.40%). In their roles and responsibilities in community enterprises, 66.10% of them were the leaders of their enterprises, with 10.20% in charge of production. 212 of them had the duration of operating business from one to five years (59.90%); 72 of them from six to ten years (20.30%). With respect to the size of community enterprises, 206 of the respondents belonged to the enterprises with seven to fifteen members (58.20%); 82 of them being with the enterprises of below seven members (23.20%). Based on the production capacity, 209 of them remained at household production (59.00%) while 129 of them owning a factory (36.40%). 332 of the entrepreneurs used product development services provided by the R&D government organizations (93.80%).

An exploratory factor analysis (EFA) was conducted with the questionnaire in terms of components impacting the new product development process in order to find out how many components, what are these components, and reasons for explaining them.

Reliability and Validity

As this study, 5-point Likert scale was used for item measurement of Entrepreneurs Potential, Business Analysis, Market Potential Technology assessment Researcher characteristic Product development process including; idea generation, Safety Testing, Standard test, Claim Substantiation, Product Testing, Testing Market, Commercialization, government and entrepreneur collaboration. Initial results of internal consistency analysis show that value of Cronbach's Alpha for all constructs is greater than 0.7 indicating high scale of reliability. Exploratory Factor Analysis (EFA) was 151 attribute that represent the items in this study. However, this initial purification exercise of EFA results in the deletion of 89 items because of failing to fulfil the above mention criteria as shown in Table 3 EFA. Subsequently, EFA with the remaining 89 items, which resulted in 14 structure solution.

Prior to the EFA, a preliminary data check was conducted so as to find out whether the collected data were of correlation to an extent adequate for a CPA or not by considering the statistic results of Kaiser-Meyer-Olkin (KMO) and those of (Bartlett's Test of Sphericity) the value of statistics results of Kaiser-Meyer-Olkin (KMO) is 0.964, which is above 0.80. This means that all data and variables are highly correlated, thereby being appropriate for factor analysis

Factor Analysis

In analyzing factors impacting the new product development process, the study identified the organization performance indicators after the application of the new technology development process as dependent variables, while fourteen factors impacting the new development process as

independent variables by using multiple regression stepwise. These variables are indicated as follows:

X ₁	represents	Entrepreneurship
X ₂	represents	Encourage for innovative product performance
X ₃	represents	Concept evaluation
X ₄	represents	Concept finding
X ₅	represents	Business plan
X ₆	represents	Researcher ability
X ₇	represents	Integrated Marketing communication strategy
X ₈	represents	Customer Relationship Management
X ₉	represents	Laboratory level of product development
X ₁₀	represents	Financial investment support
X ₁₁	represents	Product capability
X ₁₂	represents	Product Potential and ability
X ₁₃	represents	technology Appropriation
X ₁₄	represents	Documentation Readiness for Product Commercialization
Y	represents	organizational performance indicators after the application of new development process

Table 3
EXPLORATORY FACTOR ANALYSIS (EFA)

X1 Entrepreneurship	
Networking in term of business and government connection	0.794
Raw material networking	0.784
Business Planning	0.748
Teamwork organization	0.727
Creativity to create product	0.636
Innovativeness orientation	0.614
Competitive aggressiveness	0.588
Ability to gain new knowledge in technology as concept for product development	0.525
X2 Encourage for increase innovative product performance	
Exhibition to showcase and distribute the product	0.735
Find a contest/competition to promote reliability	0.707
Find partnership in terms of product and raw material	0.664
Business training on various business knowledge such as accounting, tax, strategy planning, marketing planning, business plan, organization development, team management, and partnership	0.619
Strategic Partnership for market expansion both international and domestic	0.570
Innovative product and herb knowledge training	0.567
X3 Concept evaluation	
Evaluate existing investment in new product development	0.721
Evaluate current human resource for new product development	0.718
Evaluate technologies to be used in new product development	0.685
Evaluate the standard that the product requires and able to execute that defined standard for distribution	0.596
Evaluate the exact number of resources and quality required for production	0.529
Evaluate the existing production capacity for new product development	0.576
X4 Concept finding	
Able to define the product's market positioning	0.685
Able to define the target market	0.650

Table 3
EXPLORATORY FACTOR ANALYSIS (EFA)

Able to define the cost evaluation per unit	0.647
Have knowledge on customer's need	0.609
Utilize customer's feedback to create concept in product development	0.553
Group Brainstorming	0.529
Utilize local wisdom in creating concept for product development	0.511
X5 Business plan	
Marketing Mix Strategy	0.713
Business Objective	0.689
technology utilization information	0.694
Cost and sales forecast	0.662
Production process forecast and legal evaluation that involves the production	0.628
X6 Researcher ability	
Able to transfer knowledge to entrepreneurs to create tangible results	0.753
Possess adequate experience from product development to product distribution	0.750
Have the ability to apply the knowledge for the benefit of the business	0.737
Possess determination and enthusiasm in giving advice to solve problems	0.690
Have the ability to manage the work and research under various limitations	0.673
Adaptable (Eg. Open to new ideas from others)	0.630
X7 Integrated Marketing communication strategy of products	
Pricing based on the market which is affordable and valuable to the consumer	0.642
Social media distribution channel preparation (Eg. Facebook, Instagram, and LINE) and appropriate logistics process of the product	0.704
Appropriate pricing and promotion preparation	0.687
After sale service evaluation	0.569
Distribution channel sourcing that is appropriate for the product such as storefront and rent a space in retail shops that has the right target market	0.548
Have a distribution channel through event/booth	0.529
X8 Customer Relationship Management	
Media advertising application	0.685
Brand engagement such as Live commerce on Facebook	0.684
After sales service	0.627
Provide advice to customers in both innovation of the product and product knowledge	0.557
X9 Product development	
Technology transfer to pilot scale	0.617
Development in existing formula, formula alteration, and production trial	0.615
Finding and raw material testing to gather the knowledge on appropriation for production	0.600
Product safety testing	0.597
Product performance Information	0.579
X10 Financial investment support	
Financial Investment Support for the Business	0.683
Financial Investment Support for Product Development	0.585
Financial Investment Support for Factory Improvement to meet with GMP Standard	0.533
X11 Product Capability	
Have their own product and understanding of the product	0.683
Have the formula or know-how in producing the product	0.585
Have an outstanding and quality raw material	0.533
X12 Product Potential and ability	
Able to define who is the customer	0.614
Able to define the problem of the customer from the product	0.605

Able to define the needs of the customer	0.572
Able to analyze the efficiency of the raw material used in the production	0.546
Able to analyze the financial investment for new product development	0.531
X13 Technology Appropriation	
Able to acquire knowledge of the technology by self-study easily, easy to buy, and does not require high capital investment	0.647
The technology has been widely accepted and able to pass standard check as dictate by the law	0.5715
If there is a finding or investment in new technology, it must be able to breakeven in 2 – 3 years	0.578
The technology is able to produce in a large scale that is suitable for production	0.562
The technology is able to increase the performance of the product	0.539
X14 Documentation Readiness for Product Commercialization	
Documentation Preparation for Product efficiency claim	0.652
Intellectual Property	0.621
Documentation Preparation for Factory Standard Certificate	0.608

Table 4 RESULTS OF THE MULTIPLE REGRESSION ANALYSIS (SHOWING HOW EACH DEPENDENT VARIABLE CAN IMPACT THE ORGANIZATIONAL PERFORMANCE INDICATORS AFTER THE APPLICATION OF NEW PRODUCT DEVELOPMENT PROCESS TO THE ORGANIZATIONS.							
Independent variables	B	Std. Error	Beta	T	Sig	Tolerance	VIF
(Constant)	3.021	.574		5.265	.000		
X ₂	1.003	.187	.336	5.377	.000	0.352	2.845
X ₇	0.693	.207	.228	3.339	.001	0.295	3.388
X ₁₂	0.376	.168	.132	2.233	.026	0.394	2.537
X ₁₃	0.302	.153	0.111	1.975	.049	0.435	2.298
R = 0.721 R Square = 0.520 F = 94.473 Adjusted R Square = 0.514 SE = 1.046							

***p-value < 0.05*

Table 4 shows that there were variables impacting the organizational performance indicators after the application of the new product development process, which were of high significance: Encourage for increase innovative product performance (X₂), Integrated marketing communication (X₇), Product Potential and ability (X₁₂) and technology appropriation (X₁₃), respectively. These variables were all statistically significant at 0.05. After multicollinearity (the state in which there is correlation among the previous mentioned independent variables) was conducted with tolerance and VIF, it was clear that these independent variables were of tolerance > 0.1, and VIF < 10. This means that the variables were not correlated to one another or there was no multicollinearity.

Therefore, when there is a prediction in the form of raw scores was drawn from the multiple regression results, it was

$$Y = 3.021 + 1.003X_2 + 0.693X_7 + 0.376X_{12} + 0.302X_{13}$$

This could be formulated in a prediction equation in the form of standard scores as follows

$$Z = 0.336Z_2 + 0.228Z_7 + 0.132Z_{12} + 0.111Z_{13}$$

$$(R) = 0.721$$

Coefficient of determination (R Square) = 0.520

Adjusted coefficient of determination (Adjusted R Square) = 0.514 or can be predicted at 51.40%.

Standard error of multiple regression square (Std. Error) = 1.046

DISCUSSION AND RECOMMENDATIONS

Based on the new product development process conducted at government R&D organizations, four components are identified as significant to the process: 1) Encouragement to increase innovative product performance, 2) Integrated Marketing communication strategy of products, 3) Product Potential and ability and 4) technology appropriation. With these four components, the approach by which technology is managed is in general based on the management expectations that by seeking new and advanced technological knowledge, also new business opportunities can be opened, product technology includes the set of ideas embodied in the product (Capon & Glazer, 1987) and it is possible to create new product uniqueness, the most important single variable explaining new product success (Cooper, 1994). New product development requires the team to have clear objectives in acquiring the business requirements from the market and feedback directly from the needs of the market is essential to the betterment of the product development (Fazilah et al., 2014).. The government should give the marketing-related program, seminars and conferences to develop desiring success factors: advancement drive, achievement target, commitment, decision-making capacity, ability to handle risk, tenacity, network and optimism. (Paul et al., 2014). The coordinated government support in combined marketing and promotion between producers and sales market of the OTOP commodity is essential for developing strong rural industrialization (Muslim et al., 2020). New structure of engagement in social media create new opportunities for entrepreneur's brands to extract value from current and attainable consumers. Social media can now get hold of remarks and guidelines more easily from customer thru these social media networking sites, permitting to respond to their customer, decorate their offering, manage issues and furnish better carrier this find out about introduces two modes of interplay that customers may additionally have, i.e. broadcasting and communicating, as the mediating variables in the relationship aforementioned this learn about introduces two modes of interplay that buyers may also have, i.e. broadcasting and communicating, as the mediating variables in the relationship aforementioned (Hausman et al., 2014)

The creation of the processing model of product development increases the quality of the process since the model clearly demonstrates the processes in order. The researcher has collected data from the qualitative and quantitative results, including the process of using 14 statistical processes in order to suit the new product development process for government agencies to support community enterprises on developing and producing herbal products (non-food). There are 4 processes as follows. The first process "Ideation and Screening" consists of five stages. There are "Entrepreneurship", "Concept finding", "Concept evaluation", "Product Potential and Ability" and "Product capability". As a result of following these five first stages, the development potential of entrepreneurs can be acknowledged which will be used in the matching process for the appropriate product development direction. The second process "Matching

Technology” consists of three stages. There are “Technology Appropriation”, “Researcher ability”, and “Financial investment support”. Through these three stages, there will be appropriate recruitment of the researcher team and the appropriate type of technology, whose common objective is the development of products, including the ability to access financial support. These will benefit the development process and marketing plan of the project that is aimed to be commercialized in the future. The third process “Product Development” consists of two stages. Those are “Laboratory of the level of product development” and “Documentation Readiness for Product Commercialization”. The latter stage is utilized in order to develop the commercial practicality of the product, from laboratory to commercial platform. This has been done by market testing, measuring consumers’ satisfaction, safety testing, and preparing all the necessary documents for commercial purposes. The fourth process “Government support and collaboration to commercialization” consists of 4 procedures. There are “Integrated Marketing communication strategy”, “Customer Relationship Management”, “Encourage for innovative product performance”, and “Business plan”. When products are fully developed to innovation and ready to enter the market, the fourth process encourages the innovation into the commercial market by initiating product recognition via innovational communications, consumer-seller relationship building, and consumer after-sale service. Our main aim is to actively present our product so that the product gains more recognition and competitiveness; hence, it can compete against other innovations in the market. Each stage of product development has an assessing tool in which they are expected to proceed further by only having adequately possessed the relevant qualities. Each stage is to be examined collaboratively between entrepreneurs and either researchers or government agencies, so it raises some feelings of participation in building the innovation. Entrepreneurs commented that there should be an idea exchange. Evidently, co-decision results in innovations with co-creation in a way that the government and the entrepreneur have discussed and granted the appropriate decision-related ability to the entrepreneur in making their own innovation. New product development co creation in a case of micro community enterprise of non-food herbal product for R&D government organization as follows shows in Figure 2.

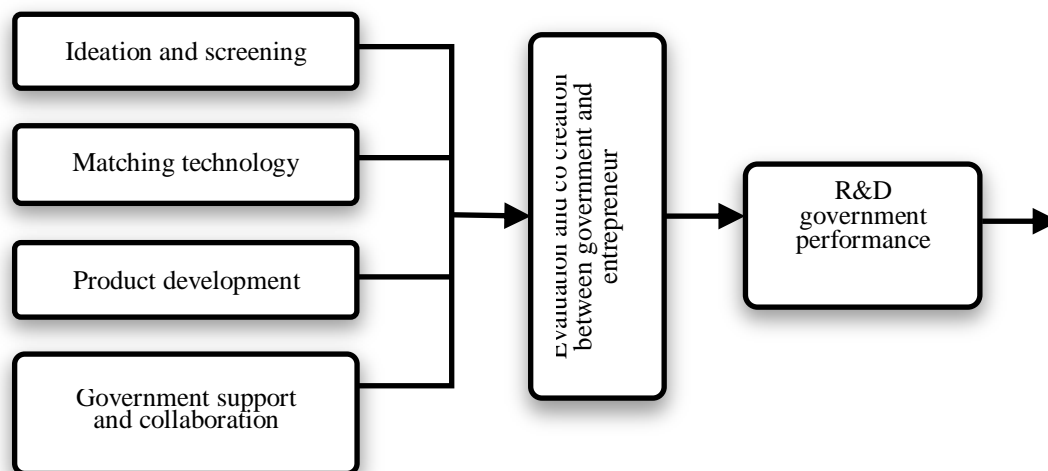


FIGURE 2
NEW PRODUCT DEVELOPMENT CO CREATION PROCESS IN THAILAND R&D ORGANIZATION

REFERENCES

- Barringer, B.R. (2015). *Entrepreneurship: Successfully launching new ventures*: Pearson Education India.
- Bruijl, G.H.T. (2018). The relevance of Porter's five forces in today's innovative and changing business environment. Available at SSRN 3192207.
- Capon, N., & Glazer, R. (1987). Marketing and technology: a strategic coalignment. *Journal of Marketing*, 51(3), 1-14.
- Cernasov, D. (2008). The design and development of anti-aging formulations. In *Skin Aging Handbook* (pp. 291-325): Elsevier.
- Cooper, R.G. (1994). Third-generation new product processes. *Journal of Product Innovation Management: An International Publication Of The Product Development & Management Association*, 11(1), 3-14.
- Date, A. (1984). Understanding appropriate technology. *Appropriate technology in third world development*, Greenwood Press, Westpor (CT).
- Eskandari, M.J., Miri, M., Gholami, S., & Nia, H.R.S. (2015). Factors affecting the competitiveness of the food industry by using porter's five forces model case study in Hamadan province, Iran. *Journal of Asian Scientific Research*, 5(4), 185-197.
- Fazilah, A.A., Jaafar, N.N., & Suraya, S. (2014). *Critical success factors of new product development and impact on performance of malaysian automotive industry*. Paper presented at the Advanced Materials Research.
- Frese, M., Van Gelderen, M., & Ombach, M. (2000). How to plan as a small scale business owner: Psychological process characteristics of action strategies and success. *Journal of small business management*, 38(2), 1-18.
- Gürel, E., & Tat, M. (2017). SWOT analysis: a theoretical review. *Journal of International Social Research*, 10(51).
- Hausman, A., Kabadayi, S., & Price, K. (2014). Consumer–brand engagement on Facebook: liking and commenting behaviors. *Journal of research in interactive marketing*.
- Igusa, K. (2006). Globalization in Asia and Local Revitalization Efforts: a view from one village one product (OVOP) movement in Oita. Retrieved February, 18, 2015.
- Kader, R.A., Mohamad, M.R.B., & Ibrahim, A.A.H.C. (2009). Success factors for small rural entrepreneurs under the one-district-one-industry programme in Malaysia. *Contemporary Management Research*, 5(2).
- Kim, S.J., Kim, E.M., Suh, Y., & Zheng, Z. (2016). The effect of service innovation on R&D activities and government support systems: the moderating role of government support systems in Korea. *Journal of Open Innovation: Technology, Market, and Complexity*, 2(1), 5.
- Lauterborn, B. (1990). New marketing litany: four Ps passé: C-words take over.
- Muslim, A.R., Sinaga, O., Bainus, A., & Darmawan, W.B. (2020). Implementation of Rural Development Policy in Thailand through the One Tambon One Product (OTOP) Movement. *Systematic Reviews in Pharmacy*, 11(1), 585-587.
- National Master Plan on development of thai herbal (2017). 2017-2021.
- Ohmae, K. (1983). *The mind of the strategist*: Penguin Harmondsworth.
- Ozturkoglu, Y. (2016). On the 4Ps & 4Cs of Green Logistics Marketing Mix. *Logistics and Transport*, 29.
- Paiva, C.E., Araujo, R.L., Paiva, B.S.R., de Pádua Souza, C., Cárcano, F.M., Costa, M.M., & Lima, J.P.N. (2017). What are the personal and professional characteristics that distinguish the researchers who publish in high- and low-impact journals? A multi-national web-based survey. *ecancermedicalscience*, 11.
- Pan, S.Y., Chen, S.B., Dong, H.G., Yu, Z.L., Dong, J.C., Long, Z.X., & Ko, K.M. (2011). New perspectives on Chinese herbal medicine (Zhong-Yao) research and development. *Evidence-Based Complementary and Alternative Medicine*, 2011.
- Paul, K.C., Hamazah, A., Samah, B.A., Ismail, I.A., & D'Silva, J.L. (2014). Rural Malay involvement in Malaysian herbal entrepreneurship. *Asian Social Science*, 10(2), 202.
- Philip Kotler, K.L.K. (2006). *Marketing Management*. : Pearson Prentice Hall.
- Prapaisri, M., Tratri, T., Achara, C., & Sukree, S. (2019). *Innovative Product Development Process under Governmental Collaboration in Non-Food Herbal Product Industry: Conceptual Framework*. Paper presented at the The 22th International Conference on IT Application and Management Creativity and Entrepreneurship in the age of 4th industry revolution, Soul, Korea.
- Rip, A. (2018). *Futures of science and technology in society*: Springer.
- Schultz, D.E., Tannenbaum, S.I., & Lauterborn, R.F. (1994). *The new marketing paradigm: Integrated marketing communications*: McGraw Hill Professional.

- Stefanadis, C.I.J.H.J.C. (2006). Characteristics of the good researcher: innate talent or acquired skills? *47*, 52-53.
- Toledo-Pereyra, L.H. (2012). Ten qualities of a good researcher. *Journal of Investigative Surgery*, *25*(4), 201-202.
- Wallsten, S.J. (2000). The effects of government-industry R&D programs on private R&D: the case of the Small Business Innovation Research program. *The RAND Journal of Economics*, 82-100.