Strategic Analysis of the Invention Commercialization to Increase Competitiveness (Case Study on Food Beverage Invension of IPB)

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Abstract - IPB has many inventions, but unfortunately the percentage of the commercialization is low. The study was aimed to optimalize the commercialization strategy of IPB's food and beverages inventions. It consists of (1) inventions the grouping into clusters and (2) formulating commercialization of the effective cluster strategy of each invention. The methods included Cluster Analysis and AHP (Analytic Hierarchy Process). IPB's Inventions of food and beverages can be categorized into three clusters ie food diversification, added-value, and utilization of local source. The cluster of food diversification with low entry barriers has competence to be more developed. Meanwhile the cluster of added-value and utilization of local source with medium and low entry barriers respectively, has limited competence to be developed. Hence, the priority for the cluster strategy of diversification and added-value food is joint and for utilization of local source is license.

Keywords: Inventions, Food and Beverages, Commercialization, added-value, clusters analysis

I. INTRODUCTION

Scientific discoveries or findings do not always have commercial value. The end product of scientific findings can be journals, books or inventions. Actually, scientific finding called the invention typically have commercial value. Particular invention can be upgraded into commercial products while others do not. The product of the invention may include goods, services (ideas, processes, technology) or both are to some extent can be filed as patents. The patented invention has a high potential commercial value. The invention can be marketed to require innovation. Innovation is creativity embodied in the form of products or services. Form of the product or service is relatively more easily assessed, evaluated or modified so that it can be marketed. Product's innovation which is already marketed can be evaluated whether or not acceptable to the market. This evaluation can be used as scientific findings to the development of subsequent products. This cycle by Khalil (2000) referred to as component innovation cycle (Figure 1).

One of the universities in Indonesia whhich are productively filed patent's applications is the Bogor Agricultural Institute (IPB). IPB are always proposing patent as well as invention at the national level competition of Business Innovation Center (BIC) which is supported by the Ministry of Research and Technology.

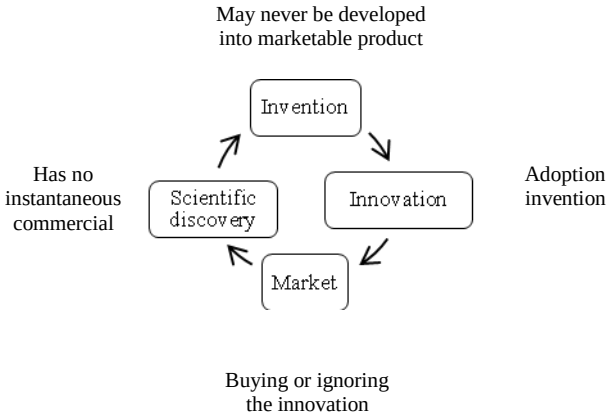

Figure 1 Components of innovation cycle (Khalil, 2000)

IPB has included the invention of products since 2008. It has institutionally been managing the product innovations in an organized way than other universities. Cummulatively, the number of the IPB innovation reached two-thirds of the inventions compared to the ones created by other universities (see Table 1).

IPB, as the university which want to promote research *(research based university)* as its trademark in the coming year, always try to improve products either in the form of research publications or inventions. Preliminary survey results indicate that many of the inventions in the Directorate of RKS IPB have not been used optimally. So that the benefits can socially and economicaly not be felt by the inventors as well as the surrounding community. To be successful commercially exploited, it takes careful planning of corporate strategy.

Table 1. Number of university inventions in the book version of BIC Innovation Most Prospective

College	2008	2009	2010	Cumula-tive	Cumula-tive(%)
IPB	21	24	50	95	69.85
ITB	3	6	2	11	8.09
UGM	1	2		3	2.21
Universitas Brawijaya		2	2	4	2.94
Bandung FE Institute		1	3	4	2.94
Unika Widya Mandala			3	3	2.21
Universitas Hasanudin		1	1	2	1.47
Universitas Bina Nusantara			2	2	1.47
Universitas Lampung	1			1	0.74
Universitas Negeri Yogyakarta	1			1	0.74
Universitas Mataram	1			1	0.74
STMIK Amikom Yogya	1			1	0.74
Universitas Jember	1			1	0.74
Universitas Udayana		1		1	0.74
Universitas Sriwijaya		1		1	0.74
Universitas Dharma Persada		1		1	0.74
Institut Teknologi Nasional Malang		1		1	0.74
Universitas Muhamadiyah Malang			1	1	0.74
UNDIP			1	1	0.74
Universitas Atmajaya			1	1	0.74
TOTAL	30	40	66	136	100

Sources: KNRT (2008), BIC (2009, 2010) (data processed)

There are several options for commercialization strategy, among others thing are to create a new business (c*reate a new venture)*, any licensing or royalties, the sale or a true sale, and *joint ventures* (Dit.RKS, 2010a). These options are based on several strategic factors such as characteristics of the product/technology, production capability, market and financial requirements.

This study aims to analyze the effectiveness of the invention commercialization strategy that includes the preparation of the classification of the IPB invention to increase competitiveness in terms of food products and beverages based on certain characteristics, and analysis of appropriate commercialization strategy based on the characteristics of the invention. This study is expected to be useful as an alternative commercialization strategy for invention of products primarily for the university and inventors.

The analysis is limited to product commercialization strategies invention IPB mainly related foods and beverages because of the fairly extensive and the food sector is one of the priority agenda in the IPB. List of the invention taken based on the book IPB Technology for Food-Beverage Industry Sector (Dit.RKS, 2010b).

II. RESEARCH METHODS

A. frame of mind

Invention developed in universities are generally *technology-driven* rather than *market driven.* According to Crawford and Benedetto (2008), invention which is controlled by the technology *(technology drivers)* have a laboratory power while the invention of products controlled by the market *(market drivers)* have a comsumer power based on certain issues. Another approach is a combination of both. The ones that been developed in the universities are usually more concern on *spin-offs*.

Spin-offs are defined as companies that produce products or services related to research conducted by universities (Giannisis, et al 1991). There are three *Spin-off* models that been developed by any institution, namely the **entrepreneurial** model**,** the **traditional** model and the **institutional** model**.**

Founder and developer of business in an **entrepreneurial** model is a faculty member (faculty and staff) or student. Entrepreneurial approach encouraging the creation of entrepreneurs conducted by either natural or designed (trained). IPB has a functioning institution design, training and fostering entrepreneurship. This institution is known as an *incubator*. One of the institutions in charge of encouraging the creation of new entrepreneurs in IPB is P3K (Center for Entrepreneurship Research and Development), while the institutions that serve as incubators of technology/business is the F-Technopark.

Developers in the **traditional** model is a business entity from the outside, and the university is recognized as a source of ideas and technological innovation. Through several meetings, business entity tries to approach inventors or the university to develop a university-owned inventions, and is usually required in development proposals. Success of this model depends on the reference network industries and universities.

Commercialization of the **institutional** model is managed by an organization or a specialized unit within the university aimed at non-profit organization, which is usually called as Foundation. Development of such thing is done through a formal process of identification, and evaluation. The university helps in whether the patent strategy, licensing or commercialization of the technology. The institutional model approach is a more progressive approach to commercialize the invention. Expected that this approach can accelerate the creation of new businesses, create jobs and accelerate technology transfer so as to improve the image of universities.

This study is based on the premise that a considerable number of inventions and diverse in the IPB requires good management policies on inventions. Managers can create alternatives to the effective commercialization

strategy according to product characteristics. In addition, managers can also assist in finding suitable partners for all shareholder including employers/industry, technology buyers, prospective entrepreneurs, investors, and government. With this strategy requires the cooperation partners of interest so as to raise the level of commercialization and revenue. Cooperative activity can also increase the activity of research that ultimately could also raise the quality and quantity of the invention. Research activity will increase the number and quality of the invention. Effective commercialization strategy is expected to raise the number of commercialized products. Successful commercialization may increase income and improve welfare. Better earnings will attract researchers to enhance research activities that produce the invention. Success of the commercialization will generate *profit*, and these need management of *profit sharing* system. Profit sharing or other creative management can attract partners so as to raise the level of commercialization. Such thought can be seen in Figure 2.

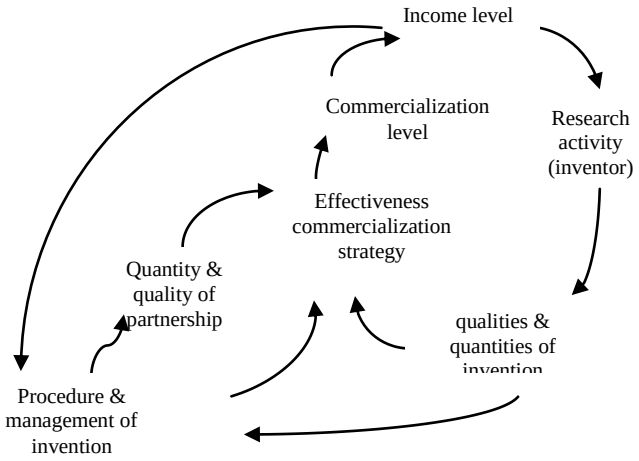

Figure 2. The relationship of cause and effect an effective commercialization strategy

B. Stages of Research

The study was conducted in June 2010 - April 2011. The initial phase is to identify the characteristics of the invention. This characteristic, which is based on literature studies and expert opinion, can be categorized into three aspects, namely the marketing, technical and financial aspects. The marketing parameters used are aspects of market size, market growth, the level of competition (Thompson & Strickland, 1989; Watson, 2004; Dharmawan, 2007; Jonathan, 2008). The production parameters used are raw material availability, product protection/ease of imitation, uniqueness/innovation, technology development (Dharmawan 2007; Jonathan, 2008). Financial parameters such as capital (Thompson & Strickland, 1989; Dharmawan, 2007), and manufacturing cost (Jonathan 2008). This invention relatively new so the initial valuation *(assessment)* can be performed by the inventors or team.

The next stage is to create a cluster analysis of the product. In principle, the analysis is used for grouping the objects (respondents, products etc.) or is the process of summarizing the number of objects become less and named it as a cluster. The clustering process is analized by using hierarchical cluster analysis (Simamora, 2005; Suliyanto, 2005). Prioritization strategy is analized by using the AHP *(Analytic Hierarchy Process)* approach (Saaty, 2008; Marimin and Maghfiroh 2010). Stages of research can be seen in Figure 3.

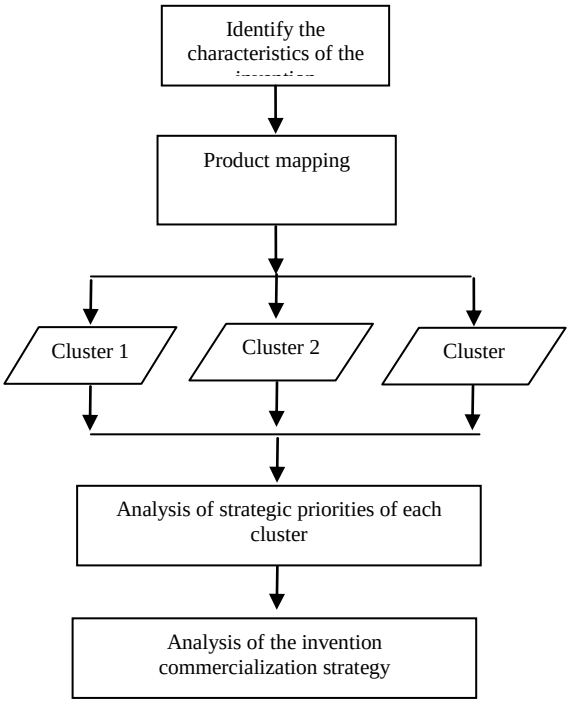

Figure 3 Stages of research

III. RESULTS

A. Composing the Clusters

Of the 27 respondents with 67 food-drink products that are listed in book of *Teknologi IPB untuk Industri Makanan-minuman* (IPB technology for food-beverage industry), are only 17 respondents with 32 products who are willing to fill the questionairres. It was selected some market, production (technical-technological) and

financial variables. Then the cluster was named according to the characteristics and experts suggestions. Result of simulation cluster analysis showed that the variables of food-beverage IPB invention which can be quite good differentiator consists of market size, product protection, technology development, availability of raw materials, and the minimum investment requirement.

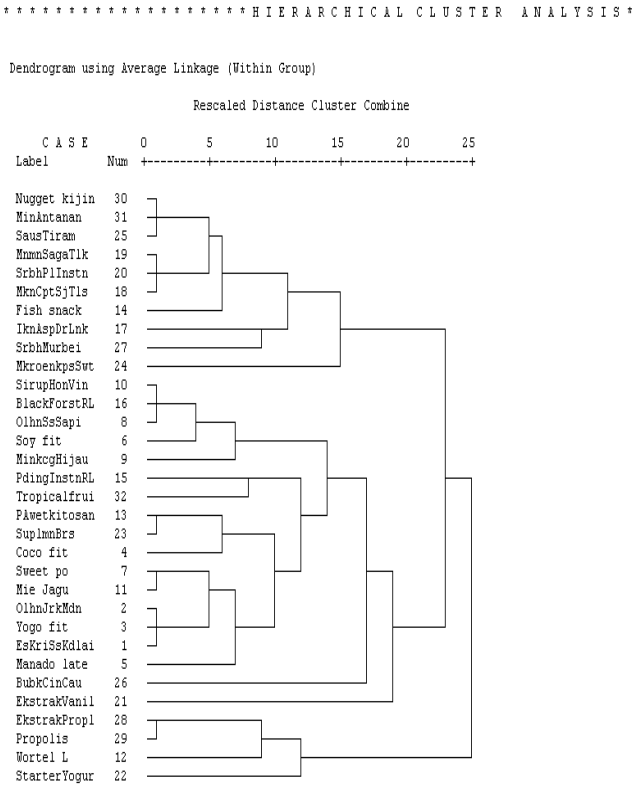

Figure 4. Cluster Analysis Dendogram Food-Beverage IPB

Approach of using cluster analysis *(hierarchical cluster analysis)* with *the within-group linkage* method produces several alternative cluster. From Dendogram (Figure 4) and table clusters (Table 2) selected the three cluster approach. Approach for 4 additional clusters produced an additional different product, namely vanilla extract. If using a cluster approach for 2, the third cluster entered in the first cluster. Considering any special characteristics that can be developed then the third cluster approach is chosen as a better and more in line with dendogram. Details of the three clusters are as follows:

Table 2. Alernatif 2, 3, and 4 clusters

Case	4 Clusters	3 Clusters	2 Clusters
1:EsKriSsKdlai	1	1	1
2:OlhnJrkMdn	1	1	1
3:Yogo fit	1	1	1
4:Coco fit	1	1	1
5:Manado late	1	1	1
6:Soy fit	1	1	1
7:Sweet po	1	1	1
8:OlhnSsSapi	1	1	1
9:MinkcgHijau	1	1	1
10:SirupHonVin	1	1	1
11:Mie Jagu	1	1	1
12:Wortel L	2	2	2
13:PAwetkitosan	1	1	1
14:Fish snack	3	3	1
15:PdingInstnRL	1	1	1
16:BlackForstRL	1	1	1
17:IknAspDrLnk	3	3	1
18:MknCptSjTls	3	3	1
19:MnmnSagaTlk	3	3	1
20:SrbhPlInstn	3	3	1
21:EkstrakVanil	4	1	1
22:StarterYogur	2	2	2
23:SuplmnBrs	1	1	1
24:MkroenkpsSwt	3	3	1
25:SausTiram	3	3	1
26:BubkCinCau	1	1	1
27:SrbhMurbei	3	3	1
28:EkstrakPropl	2	2	2
29:Propolis	2	2	2
30:Nugget kijin	3	3	1
31:MinAntanan	3	3	1
32:Tropicalfrui	1	1	1

Cluster 1 (product diversification) is characterized by the low *entry barrier* (protection products, the need for investment), the small market size (<USD 500 million/ year), having the capacity to develop technology, and adequate raw material. Examples of this cluster is soy milk ice cream, processed citrus fields, Yogo fit, fit coco, Manado latte, soy fit, sweet potato, a variety of processed cow's milk, juice drinks green beans, honey vinegar syrup, corn noodles, preservatives chitosan, pudding grass sea, the black forest of seaweed, vanilla extract, a supplement of rice, tropical fruit.

Cluster 2 (provision of value added) is characterized by *the medium entry barrier* (protection products, the need for investment), the medium size of the market (USD 100 million - USD 2.5 billion million/year), and limited development capacity. Examples of this cluster are a sheet carrots, yogurt starter, grass jelly powder, propolis extract.

Cluster 3 (utilization of local resources) is characterized by the low *entry barrier* (protection products, the need for investments), the small market size (<100 million/year), and limited raw materials. Examples of this cluster are a fish snack, smoked fish, fast food of the taro, telik saga drinks, instant nutmeg juice, oyster sauce rich in omega3, mulberry juice, gravestone nuggets, drinks of *antanan*, mikroenkapsulat red palm.

B. Commercialization Strategy Analysis

The results of the identification and discussion with experts using analytic hierarchy process approach yield a structure with an effective commercialization strategy *goal* of factors (marketing, human resources, production and financial), actors (inventors, entrepreneurs, universities, and government), objectives (increase revenue, efficiency costs and long-term impact) and alternative strategies (new business, sales, licensing and joint) (Figure 5).

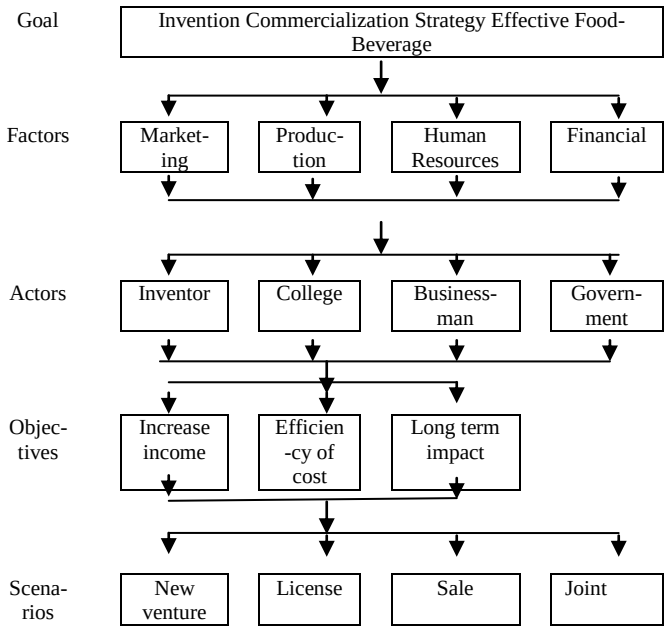

Figure 5. Structure of the General Hierarchy of Invention Commercialization Strategy of effective food-beverage

Assessment of strategic priorities was conducted by experts who are competent in their fields (Table 3). The following are the discussion about the results.

1) Clusters Commercialization Strategy for Diversified Food

Factors that are considered important by rank respectively are the marketing, human resources, financial and production. The marketing factor is 3 times of the production factor, 2.5 times of the financial factor, and 2 times of the human factor. Actors considered important respectively are the business, universities, inventors, and the government. The businessman is 6 times more important than the government, 3.5 times than the inventors, and 3 times than universities. The main objective sequentially are to increase revenue, long-term impact, and cost efficiency. The income is 3 times more important than the cost efficiency and 1.5 times than long-term impact. The scenarios sequentially are a joint, licenses, true sale, and new ventures. Priority scenario is lied on joint rather than others. It can be understood due to the reason that the role of partnership is important to develop the invention to be comersial product.

The cluster of diversified food tend to follow inherently the market mechanism because of its low entry barrier in terms of technology, capital, and the small market size (<USD 500 million/year). The role of businessman is very significant, whereas the role of the government's food security policy has not necessarily been significant. Priority of this cluster is an increase in income so that qualified product will not necessarily be developed if it is not profitable. This group will be categorized in a joint system, license, or sale, so that the product that been marketed (test market) easier on evaluation of partnership program. Otherwise it may be suggested as a license. Development of entrepreneurship can be started from this cluster, because it needs relatively small capital. Hoping the new venture is supported by the opinions of experts from universities and incubators. In this cluster, the role of university is slightly higher than the inventor.

2) Cluster Commercialization Strategy for Added Value Improvement of Food

Factors that are considered important respectively are the factors of marketing, production, human resources and finance. Marketing aspect is 4 times more important than the financial aspects, 2.5 times of human aspects, and 2 times of the production aspects. Actors that are considered important sequentially are businessmen, inventors, universities, and government. The businessman is 6 times more important than the government, 2.5 times of university, and 2.5 times of inventors. The role of university is a little higher than inventors. The main objective is sequentially to increase revenue, long-term impact, and cost efficiency. The raising of income is 3.5 times more important than cost efficiency, and 2 times of the long-term impact. In this cluster, scenario is sequentially following a *joint*, licenses, true sale, and new ventures. The priority of the *joint* strategy is 2 times more important than venture, 1.5 times of the true sale, and similarly of the license.

In this cluster, marketing aspect is very dominant factor. It has the medium *entry barrier* whether on the technology or the capital needs, and it has the medium market size (USD 500 million - USD 10 billion/year).

Businessman is relatively dominant with the objective of increased revenue. Scenario choice is more on *joint* and followed by licensing. Capital needs and market potential is rated to be medium but required a more smart computation.

3) Cluster Commercialization Strategy for Utilization of Local Resources

Factors that are considered important respectively are the marketing, production, human resources and finance. The important of marketing aspect is 4.5 times of financial aspect, 3 times the human aspect and 1.5 times of the production aspect. Actor that is considered the most important than others is businessmen. It is followed by inventors, university, and government. Businessman has 5 times more important than the government, 3 times of the university, and 3 times of the inventors. The dominant role of university is slightly higher than the inventors. The main objective is to increase revenue; it is followed sequentially by long-term impact, and cost efficiency. The objective of increased income is 3 times more important than cost efficiency and 1.5 times of the long-term impact. Sequentially, scenario is prioritized on license, *joint*, true sale, and new ventures. Priority of the license is 2 times more important than a true sale and new ventures, and slightly higher than of the *joint*.

This cluster prioritize on the factors of marketing and production rather than others. Production is impotant factor due to its role on the availability of raw materials. Businessman is more dominant role than the other actors. The main purpose of increased revenue will work better when it is applied by using licensing or *joint* strategy. Licensing or *joint* strategy can be more prioritized to apply because of not only its low *entry barrier* in terms of capital requirements/technology and having small market size (Rp <500 million/year), but also its availability of raw materials.

In general, clustering for Diversified Food programs is more suitable for food security policy and the development of micro-small enterprises. Technology packages and consultation for entrepreneurial development are preferred. Cluster for Added Value Improvement is more important to emphasize on changing the shape or performance of the product which is more related to increase time of obsolescence or other benefits. It is needed a small or middle-class investors in the development such cluster. Cluster for Resource Utilization prefer local availability of raw materials and cooperation with local entrepreneurs and local government.

Table 3. The results of the AHP process for each cluster

Goal	**Criteria**	Commercialization of Diversified Food Strategy Clusters Effective					Commercialization Strategy Cluster Effective Value Added Food					Commercialization Strategy Cluster Utilization of local resources Effective Food				
		R1	R2	R3	R4	GAB	R1	R2	R3	R4	GAB	R1	R2	R3	R4	GAB
Factor	Marketing	0.40	0.25	0.57	0.50	0.45	0.52	0.25	0.39	0.56	0.45	0.60	0.25	0.56	0.34	0.45
	Production	0.15	0.25	0.04	0.31	0.16	0.11	0.25	0.39	0.26	0.25	0.15	0.25	0.26	0.48	0.28
	Human resources	0.24	0.25	0.22	0.12	0.21	0.21	0.25	0.15	0.12	0.19	0.15	0.25	0.12	0.12	0.16
	Financial	0.21	0.25	0.17	0.07	0.17	0.16	0.25	0.07	0.06	0.12	0.10	0.25	0.06	0.07	0.11
Actor	Inventor	0.25	0.23	0.11	0.14	0.16	0.18	0.25	0.28	0.13	0.20	0.19	0.25	0.15	0.18	0.19
	College	0.25	0.11	0.22	0.22	0.19	0.22	0.09	0.24	0.24	0.19	0.20	0.09	0.19	0.20	0.17
	Businessman	0.32	0.62	0.58	0.54	0.55	0.48	0.61	0.39	0.52	0.52	0.48	0.61	0.45	0.51	0.53
	Government	0.18	0.04	0.09	0.10	0.09	0.12	0.04	0.09	0.12	0.08	0.12	0.04	0.21	0.11	0.10
Objective	Income increased	0.29	0.49	0.53	0.61	0.51	0.45	0.45	0.47	0.64	0.55	0.44	0.34	0.57	0.63	0.53
	Cost efficiency	0.15	0.08	0.26	0.24	0.17	0.17	0.10	0.12	0.25	0.16	0.14	0.14	0.13	0.26	0.16
	Long-term impact	0.56	0.44	0.21	0.15	0.31	0.38	0.45	0.42	0.11	0.29	0.42	0.52	0.30	0.11	0.31
Scenario	New venture	0.43	0.04	0.39	0.04	0.17	0.14	0.04	0.49	0.05	0.13	0.24	0.04	0.50	0.10	0.18
	License	0.06	0.52	0.25	0.30	0.28	0.28	0.52	0.16	0.13	0.31	0.19	0.52	0.19	0.28	0.34
	Sale	0.25	0.37	0.11	0.15	0.26	0.14	0.37	0.10	0.17	0.21	0.07	0.37	0.12	0.15	0.18
	Joint	0.26	0.07	0.25	0.51	0.29	0.44	0.07	0.24	0.66	0.34	0.50	0.07	0.19	0.47	0.30

Note:
R1= Incubator (Dr.Ir.Slamet Budijanto,M.Agr
R2= Inventor (Dr.Ir.Sugiyono, M.App.Sc.
R3= College (Dr.Ir.Meika Syahbana Rusli,M.Sc.Agr)
R4= Businessman (Sutie Rahyono)

IV. CONCLUSION

The invention of food and beverage products in the IPB can be categorized into three clusters, namely clusters of diversified food, added value improvement, and local resource utilization. The most important factor is the marketing aspect followed by human resources, financial and production aspects. In the cluster of local resource utilization, production factor is defined as second consideration especially due to the availability of raw materials. Actors that are most considered as important aspect is a businessman or business-minded people or setting up new entrepreneurs, while the role of university is expected to encourage greater commercialization via *spin-offs.*

The main objective of the program should be focused on and directed to the increment of revenue. It seemingly to be important due to its role as a way to enhance the motivation of the actors. Finally, the scenario should be directed more on joint strategy, especially for diversified food cluster and added value improvment cluster. Whereas the cluster of local resource utilization should be directed more on license strategy. *Joint* can be implemented if the inventors and university improve their bargaining position. Bargaining position will work well when it is done by striving for *a spin-off* organizations.

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