

**2015 3rd International Conference on Adaptive
and Intelligent Agroindustry (ICAIA)**

ICAIA 2015



August 3rd - 4th, 2015

IPB International Convention Center
Bogor, Indonesia

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Department of Agroindustrial Technology
Bogor Agricultural University
Bogor, Indonesia

Welcome Message from The General Chairs of ICAIA 2015

On behalf of the organizing committee, it is our pleasure to welcome you to International Conference on Adaptive and Intelligent Agroindustry, Bogor, Indonesia. This is the 3rd conference on the topic that is held by the Department of Agroindustrial Technology, Bogor Agricultural University, Indonesia.

The conference is expected to provide excellent opportunity to meet experts, to exchange information, and to strengthen the collaboration among researchers, engineers, and scholars from academia, government, and industry. In addition, the conference committee invited five renowned keynote speakers, i.e. Prof Irawadi from Bogor Agricultural University; Prof Kenneth De Jong from George Mason University, USA; Dr Yandra Arkeman from Bogor Agricultural University; and Dr Guillermo Baigorria from University of Nebraska-Lincoln, USA.

The conference committee also invited Prof Noel Lindsay from University of Adelaide, Australia; Kiyotada Hayashi from National Agricultural Research Center-Tsukuba, Japan; Prof Margareth Gfrerer from Islamic State University of Jakarta, Indonesia; Dr Barry Elsey from University of Adelaide, Australia; Dr Gajendran Kandasamy from Melbourne University, Australia; and Imperial College London-British, Prof Allan O'Connor from University of Adelaide, Australia; Dr Wisnu Ananta Kusuma from Bogor Agricultural University, Indonesia; and Dr Frank Neumann from University of Adelaide, Australia, as invited speakers.

This conference was organized by Department of Agroindustrial Technology, Bogor Agricultural University and Asosiasi Agroindustri Indonesia, and technically sponsored by IEEE Indonesia Section. Furthermore, it was supported by Department of Computer Science, Bogor Agricultural University; Surfactant and Bionergy Research Center; PT Bogor Life Science and Technology; Indonesian Ministry of Industry; PT Pachira Distrinusa; and PT Kelola Mina Laut.

I would like to take this opportunity to express my deep appreciation to the conference's committee members for their hard work and contribution throughout this conference. I would like to thank authors, reviewers, speakers, and session chairs for their support to participate in the Conference. Lastly, I would like to welcome you to join ICAIA 2015 and wish you all an enjoyable stay in Bogor.

Sincerely,
Dr Yandra Arkeman
General Chairs, ICAIA 2015

WELCOMING ADDRESS

Prof. Dr. Ir. Nastiti Siswi Indrasti

Head of Agroindustrial Technology Department
Faculty of Agricultural Engineering and Technology
Bogor Agricultural University

on

**3rd International Conference on Adaptive and Intelligence Agroindustry (3rd
ICAIA)**

Bogor, August, 3 – 4, 2015

Assalamu'alaikum Warohmatullahi Wabarokatuh
In the name of Allah, the beneficent and the merciful,

Distinguish Guest, Ladies and Gentlemen

Let me first thank you all for accepting the invitation to participate in this 3rd International Conference on Adaptive and Intelligence Agroindustry (ICAIA). In particular I would like to thank Rector of IPB (Institut Pertanian Bogor/Bogor Agricultural University) Prof. Herry Suhardiyanto for supporting this event as part of the series academic event in celebrating the 52nd Anniversary of Bogor Agricultural University.

We are certainly proud to have been able to assemble this event in IPB, Bogor. The range of participants and audience at this conference is precisely something I would like to stress. Participants who followed the event more than 150 people, coming from various countries including the USA, Australia, Japan, Vietnam, Philippine, Germany and Indonesia. The main goal of the conference is to provide an effective forum for distinguished speakers, academicians, professional and practitioners coming from universities, research institutions, government agencies and industries to share or exchange their ideas, experience and recent progress in Adaptive and Intelligent Agroindustry.

The 2015 3rd International Conference on Adaptive and Intelligent Agro-industry (ICAIA) is the third forum for the presentation of new advances and research results on various topics in all aspects of innovative agro-industry that highlights the development and improvement for today and tomorrow's global need for food, energy, water and medicine. The aim of the conference is to stimulate interaction and cohesiveness among researchers in the vast areas of innovative agro-industry. Innovative Agro-industry has the ability to adapt intelligently to future global challenges, i.e. food, energy, water, and medical. Global challenges needs a new breed of Agroindustry which could produce innovative products to fulfill the needs through advanced processing technology, production systems and business strategy supported by cutting-edge information and communication technology.

The topic for this event is "Empowering Innovative Agroindustry for Natural Resources, Bioenergy and Food Sovereignty". The topics clustered into four main parts:

Track 1 : Innovative Agroindustrial and Business System Engineering

Track 2 : Frontier Approaches in Process and Bioprocess Engineering
Track 3 : Frontier Approaches in Industrial Environmental Engineering
Track 4 : Intelligent Information and Communication Technology for Adaptive
Agroindustry of the Future

This event also hosts four (4) workshops: (1) Strategies for Agroindustry Development (2) LCA for Agroindustry (3) Innovation and Technopreneurship for Agroindustry and (4) Agroindustry Informatics.

Distinguish Guest, Ladies and Gentlement,
Agroindustry transforms agricultural commodities into high value-added products. Agroindustry is industry that process agricultural products to increase their value added significantly by using technology and by considering environmental aspect and sustainability. However, with changing global demand and technology advancement, innovative agroindustry is needed in order to be competitive as well as sustainable. The challenge of future agroindustry is not merely efficiency and productivity anymore, but also the challenge to appropriately apply frontier technology as well as meeting future global demands.

Agroindustry needs to deal with the application of advance technologies and cope future global issues. Current global issues which arise and expected to exist in the future are food sovereignty, renewable energy, sustainable water management and pharmacy. The ability of agro-industry to respond the future global issues and the undoubtedly substantial increase in demand in future decades will be highly dependent on the increased application of existing technologies as well as the exploitation of new and innovative technologies.

The emergence of high technology could be applied in the agro-industry are: nanotechnology, biotechnology, bioinformatics, food processing, food packaging-waste, state-of-the-art computation and many others. The aforementioned high-technology along with computation technology could greatly advance agro-industry from a traditional system into a smart-intelligent and innovative technology. Therefore, in the new millennia, adaptive-intelligent and innovative agro-industry will contribute to solutions to global problems and brings agriculture into perfection.

Hope this conference will also discuss this issue in more detail as it is an important matter for all of us. We should no more think just how to produce high value product but it is also necessarily important how to keep our live in good quality by understanding following old saying... “You do not live at once. You only die once and live every day”.

I do not to take up any more of your time with these opening remarks. Let me simply thank you once again for sharing your thoughts with us. Here’s wishing every success for the conference. May Allah bless all of us.

Thank you for your kind attention,
Wassalamu’alaikum Warohmatullahi Wabarokatuh

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AGENDA

Time	Activities
Monday, August 3rd 2015	
08.00 - 09.00	Registration
09.00 - 10.00	Opening Ceremony <ul style="list-style-type: none"> • Welcoming Address: Prof. Nastiti Siswi Indrasti (Head of DAT, Fateta, IPB) • Welcoming Speech Head of Bogor Regency • Conference Opening: Prof. Herry Suhardiyanto (Rector of IPB) • Opening Speech and Conference Opening : Minister of Industry Indonesia * • Launching Expose International program DAT
10.00 – 10.05	<i>Photo Session</i>
10.05 - 10.15	<i>Coffee break</i>
10.15 - 10.45	Keynote Speech :
10. 45 - 11.30	1. Prof Irawadi (Bogor Agricultural University, Indonesia)
11.30 – 12.00	2. Prof. Kenneth De Jong (George Mason University, USA)
12.00 – 12.30	3. Dr. Yandra Arkeman (Bogor Agricultural University, Indonesia)
	4. Dr. Guillermo Baigorria (University of Nebraska, Lincoln, USA)
12.30 – 13.30	Lunch break
13.30 – 13.50	Plenary Session 1 :
13.50 – 14.10	Prof. Noel Lindsay (University of Adelaide, Australia)
14.10 – 14.30	Dr. Kiyotada Hayashi (National Agricultural Research Center, Tsukuba, Japan)
14.30 – 14.50	Prof. Margareth Gfrerer (Islamic State University of Jakarta, Indonesia)
14.50 – 15.10	Dr. Barry Elsey (University of Adelaide, Australia)
15.10 – 15.45	Ir. M. Novi Saputra (Marketing Director KML Food Group)
	<i>Discussion</i>
15.30 – 15.45	<i>Coffee break</i>
15.45 – 18.00	Parallel session A, B and C
18.00 – 21.00	Welcome Dinner

Time	Activities
Tuesday, August 4rd 2015	
08.30 – 09.00	Registration
09.00 – 09.20	Plenary Session 2 : Dr. Gajendran Kandasamy (PhD in Physic, Melbourne University ; PhD in Innovation Imperial Collage, London)
09.20 – 09.40	Prof. Allan O'Connor (University of Adelaide, Australia)
09.40 – 10.00	Dr. Eng. Wisnu Ananta Kusuma, ST, MT (Bogor Agricultural University, Indonesia)
10.00 – 10.20	Dr. Frank Neumann (University of Adelaide, Australia)
10.20 – 10.45	<i>Discussion</i>
10.45 – 13.00	Parallel Session A, B and C
13.00 – 14.00	Lunch break
14.00 – 15.30	Parallel Workshop <ul style="list-style-type: none"> • Strategies for Agroindustry Development • LCA for Agroindustry • Innovation and Technopreneurship for Agroindustry • Agroindustrial Informatics
15.30 – 15.45	Coffee Break
15.45 – 16.15	Closing remark

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[Late-Breaking Paper]: Development of Downstream Cocoa Industry: Exploring the Role of Government and Small and Medium Industry in Partnership

Farda Eka Kusumawardana, Yandra Arkeman, and Titi Candra Sunarti

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Abstract— Although the development of the downstream industry based on the local commodities has been a government agenda, particularly in Indonesia, few studies address the development of the industry at Small and Medium Industry (SMI) level. These papers examine the role of Government and SMI in partnership to develop the downstream cocoa industry. The six participant that represent government, academia, and the industry have been interviewed to explore the current partnership in the development of the downstream cocoa industry. Findings show the stakeholders that related to the downstream cocoa industry. The collaboration between the stakeholders lead by the government can affect the partnership in the development of the downstream cocoa industry. The study findings imply the importance of government initiatives, sustainable program, database creation, market creation, research partnership, and entrepreneurial spirit as a factor that must be enhanced to increase the partnership. The empirical findings of this study can be used as a basic knowledge to improve the development of the downstream cocoa industry at SMI level.

I. INTRODUCTION

Indonesia, as stated in Presidential Decree No. 28 Year 2008 on National Industrial Policy, want to be an industrialized country in 2020. To achieve these objectives, the development of SMI based on strong local commodities is substantial. One of many Indonesian local commodities that have strong resources is cocoa.

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Indonesia is the third largest cocoa bean producers in the world [1]. It puts cocoa as an essential commodity that can contribute in sizeable economy development for the country. As one of the cocoa-producing country, the Indonesian government intend to develop the downstream industries cocoa products, by issuing policy. The policy related to the industry is Ministerial Regulation No. 67/PMK.011/2010 and updated through No.128/PMK.011/2011, which sets out the duty for cocoa beans for export that effective since April 2010. The policies aim to ensure the availability of raw materials to increase the competitiveness of domestic processing industries. This policy eventually develop the domestic cocoa industry [2].

Small and Medium Industry (SMI) play an important role in economic development, both in developing and developed countries. The role of SMI in developing country, such as Indonesia, have been more vital since they contribute to improvement in several area, such as create new employment, export growth, increase the foreign exchange, and poverty reduction.

Unfortunately, the partnership between the government and SMI still become an issues. Thus, this research aims to explore the partnership between the government and SMI in the development of downstream cocoa industry at SMI level.

The challenges present in the partnership between the government and SMI in the development of cocoa downstream industry. The challenges are related to cooperation, communication, and objectives between stakeholder in the industry including the government and the SMI [3]-[4]. Whereas, learning from others successful SMI development, partnership between government and SMI is important [5]-[7].

The research will unite different views of government, academic, and SMI to explore the partnership between the government and the SMI in the development of downstream cocoa industry. The role of government, academic, and SMI is very

important in the development of economic region[8], so, it will be interesting to identify the common ground of their views' in the development of downstream cocoa industry at SMI level before taking further action. Considering the description above, the research question is: What can we learn from the government, academic, and SMI point of view regarding the government and SMI partnership in development of the downstream cocoa industry?

As the result of the study, the government will have the several field that should be enhance to increase the partnership with the SMI in the development of downstream cocoa industry. Hopefully, this would help policy makers develop policies favoring future partnership with the SMI.

II. LITERATURE REVIEW

Cocoa value chain is the full range of tangible and intangible cocoa activities to adding a value to deliver a cocoa product from the start of cocoa tree live until the end [9]. The cocoa value chain that have been presented well in another study [10], can be seen in the Figure 1.



Fig. 1. Cocoa Value Chain

According to the Ministry of Industry [11], the upstream cocoa industry start from the production stage until the marketing stage. The intermediary cocoa industry is the result of processing stage, namely, cocoa paste, cocoa liquor, cocoa butter, and cocoa powder. The rest is the downstream cocoa industry, the industry that use an intermediary cocoa industry product as the raw material.

A study in value chain improvement for Indonesian cocoa industry have conducted [10]. The study state that cocoa industry resources and industries related to

the cocoa industry has not been optimized to support the development of the cocoa industry.

The development of the industry in SMI level is essential due to their contribution in economic development. Previous research [12]-[13] has indicated a need to develop the downstream cocoa industry to increase the industry performance. A study in policy formulation of cocoa industry [14] indicate that the partnership between the government and the industry is important in the development of the cocoa industry. However, the study does not discuss the development in the downstream industry.

The literature demonstrate that in the development of downstream cocoa industry, the research focused on improvement on the upstream industry level or the intermediate product of cocoa industry [12]-[13]. Yet, a study exploring the development of cocoa downstream industry at SMI level need to be review. Moreover, in the development of SMI level, government and SMI should have create a good partnership in order to successfully develop the industry [15]-[18]. Thus, it becomes important to conduct the research.

III. METHODS

This study took place in Bogor, West Java, Indonesia. The city of Bogor have two institutions and one SMI that can represent the government researcher, academic, and SMI. The institutions are the government research center, an Agricultural University, and two cocoa based SMI in Bogor.

To get the insight about the partnership between the government and SMI in the development of cocoa industry, the researcher conducted interviews with six participants. The sampling procedures used by the researcher was purposive sampling. The participants were selected to those, according the researcher, are the expert in the development of cocoa industry.

The data collection process took place over an eight-week time period. The data were collected through interviews. Each interview was tape-recorded for accuracy and lasted between 60 and 100 minutes.

The collected data were transcribed and categorized in terms of research questions and emergent themes. Specific interview questions were matched to answer the research questions. The researcher use Framework method to analyze the data.

IV. FINDINGS AND DISCUSSION

A. Findings

The Government and SMI Partnership: Government Researchers Views

The interview was conducted with the government researcher. The point revealed from the interview are:

1. The stakeholders in development of downstream

cocoa industry according to the government researcher have their own role in the development of the industry at the SMI level.

The SMI. Interviewees reported that the SMI is a stakeholder in the downstream cocoa industry that process the product for the consumer.

Big industry. Interviewee reported that the big industry supply the raw materials such as cocoa powder and cocoa paste for the SMI.

Government. Interviewees reported that the government act as the facilitator for the SMI. Interestingly, the government that the interviewee said is from several institution, namely, Ministry of Industry, Ministry of Agriculture, Ministry of Trade, and the local government.

Research centers and Universities. Interviewees reported that the both institution should be a partner for the SMI.

Associations. Participant 1 said that if the strategy for the development of downstream cocoa industry want to use a cluster, creating an association would be necessary.

Cooperatives. SMI cannot buy a raw materials at retail from the big industry. Participant 1 suggest there must be another institution such cooperatives that can bridge the SMI and Big industry so they can buy the raw materials.

Entrepreneurship. One strategy to develop the downstream cocoa industry is increasing the new entrepreneur. Furthermore, the new entrepreneur that have an entrepreneurial spirit.

2. From the interviews it revealed that the role of the government cover a further details.

Policy makers. To maintain the sustainability of downstream cocoa industry, the government have already make a policy from upstream to downstream industry. Participant 1 reported that in the upstream cocoa industry level, the government has been to provide a guidance for the farmers to increase the quality and quantity of cocoa beans through the ministry of agriculture. Moreover, in the downstream industry the ministry of Industry should have more role to the development of the industry.

Facilitators. Up until now, the government already have several programmed to assist the SMI. Some of the programs are research for product development, training, and providing the assistance in the form of buying a machine for the SMI.

3. The SMI role in the partnership with the government according to the government researcher are the producer.

Producer. Currently, the SMI have been already to make a contribution in the development of downstream cocoa industry. The contribution is in product diversification.

4. Learning from the government and the SMI

current partnership, the government researcher suggest the strategies to increase the partnership in the development of downstream cocoa industry.

Sustainable program. Development of downstream product of the cocoa industry should be planned well by the government. Especially in collaboration between the stake holder.

Entrepreneur spirit. It is important for the SMI to have an entrepreneur spirit because problem usually arise for the SMI.

The Government and SMI Partnership: Academic Views

The interview was conducted with the government researcher. The point revealed from the interview are:

1. The stakeholders in development of downstream cocoa industry should be interlinked to develop the downstream cocoa industry.

Government. The government must educate the consumer to consume the product that made by the local industry.

Research center. The research center including university already have a role as a partner for the government and the SMI. However, there are some factors that should be improve.

Industry. The industry role is in the manufacture of downstream products from cocoa. Participant 4 explained that:” The first downstream industry is the industry that sells cocoa butter, cocoa liquor and cocoa powder. Furthermore, the next downstream industry is an industry that sells products to consumers, most of them are multi-national companies.”

2. The government role in the partnership with the SMI according to the academics are given a trainer, assistances, and an equipment provision.

Trainer. Up until now, the SMI have been given several training by the government, like Participant 3 reported:” So far, the government has provided guidance sanitation, GMP, and registration certification.”

Assistance. The government usually give some assistance through the local government.

Equipment provision. Participant 4 reported that even though the government give equipment provision, sometime the machinery is different from what the SMI need.

3. The SMI role in the partnership with the government according to the academics are product development, and beneficiaries.

Product development. Participant 4 said that the SMI is participating in the development of downstream cocoa industry.

Beneficiaries. Participant 3 explained that the role of SMI in the partnership is as beneficiaries from the government.

4. Learning from the government and the SMI

current partnership, the academics suggest the strategies to increase the partnership in the development of downstream cocoa industry. The strategies are:

Pilot project. Currently the development of the downstream cocoa industry has not shown a tangible result. The measurement is the SMI who known as a good result from the government program.

Education. To develop the downstream cocoa industry the stakeholders should educate the consumer about the importance of cocoa product.

Third party. Because of the government cannot accommodate all the problem related to the downstream cocoa industry there are arise some institution who can act as a bridge for the SMI to communicate with the government.

Research funding assistance. It turns out that not only the SMI who cannot make a partnership with the research center, but also the local government that try to make a collaboration with the research center due to the financial regulation.

Entrepreneur. It is important to government to test the spirit of entrepreneurship of the SMI before providing some assistance, like purchasing a machinery for the SMI.

Market creation. In the development of downstream industry, sometime the SMI cannot create their own market.

The Government and SMI Partnership: SMI Views

The interview was conducted with the government researcher. The point revealed from the interview are:

1. The stakeholders in development of downstream cocoa industry according to the SMI are government, association and research center.

Government. Overall, the role of government in development of downstream cocoa industry at SMI level is need to be enhanced.

Association. The association has not able to play a role in the development of the development of downstream cocoa industry if the purpose is to export the product. The problem arise because the Indonesian chocolate composition is different from other countries.

Research center. In general, SMI have not been able to utilize the results of the research conducted by the research center. Two factors arises according to the participant. First, it is too expensive that only a big industry who can make a collaboration, next the result of the research is not applicable for the SMI.

2. The government role in the partnership with the SMI according to the SMI views are given some training and participation in exhibition.

Training. According to the Participant 5, the trainings given by the government is useful for the SMI. The SMI can have a lot of knowledge that can be

used in increasing the company performance.

Participation in an Exhibition. Participant 6 explained that the participation in an exhibition for the new enterprise is important to promote the product.

3. The SMI role in the partnership with the government according to the SMI are product development and promoting the local wisdom.

Product development. In the SMI level, the development of downstream product of cocoa industry should be start from the intermediary product of cocoa industry such as cocoa paste, cocoa butter, and cocoa powder. It is unaffordable for the SMI to produce it from cocoa beans.

Promoting the local wisdom. Besides creating the product, the SMI also inserting the local wisdom in their product, so that they promotes the local culture. The part of the product that they utilize is the packaging.

4. Learning from the current partnership between the government and the SMI, the SMI suggest there are several things that must be improved, there are:

Information sharing. It is necessary for the SMI to promote their product, one of them is on exhibition. However, since there are usually a financial issues in the SMI, the government usually have a programed to facilitate the SMI to attend the exhibition.

Special Event. It turns out that the peak season for the downstream cocoa product SMI is when there are a special event. The special event that help the SMI are, Valentine's Day, Ramadhan Event, Christmas, New Year's event, and events held by the school or campus.

Database. It is important for the government to have the SMI database. With the SMI database, the government can have the SMI training history. Using that data, the government can share the training facility equally.

Persistent. Training given by the government is the right place for the SMI to increase their knowledge. Because it limitations, sometime the knowledge sharing between the trainer and the SMI is limited. In fact, not many SMI realize that actually the training session is an event when the SMI can make a connection with the trainer. In the future the connection is important if the SMI have a problem.

B. Discussion

In this study, it is revealed that the government have a major role in the development of downstream cocoa industry. Other than the government, the stakeholders in the development of downstream cocoa industry are the big industry that produce the upstream cocoa industry product, the SMI itself, the research center, cooperatives, a consumer, and another institution as an alternative solution between the SMI and the research center. The relationship between the stakeholders, can

be describe like in the picture bellow.

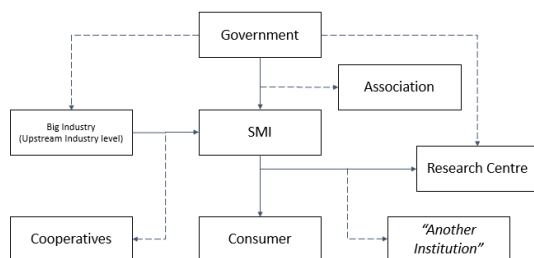


Fig. 2. The Stakeholders Relationship

According to the interview, currently every stakeholders is running independently and not collaborate well. This study also reveal that the SMI association still have less contribution in development of cocoa industry. Whereas, the SMI Association should have a role to facilitate the SMI in communicating with the government. The same condition is happened with the cooperatives, even though their existence is important in order to facilitate the SMI to order the raw material from the large Industry. This study also revealed that there are no institution who have roles as the cooperatives, so the SMI can have an advantages in supplying the raw material. It is contrary to what the government's objective in establishing associations and cooperatives [19]. Those institutions role actually an extension of government support for the SMI.

From the government side, the government realized that they should act as the facilitators for the SMI. Further actions that can be taken by the government as a SMI facilitator is to increase the role of government research center to facilitate the SMI in order to increase the SMI innovation. The previous study in the role of R&D institution [20] explained the important of research institution as a trigger for the technology absorption in the industry. Therefore, with the government support as a facilitators, the SMI can have a sustainable growth and development [16].

Interestingly, this study also revealed the existence of "Another Institution" as a bridge between the SMI and the research center. Previous research [21]-[23] already explained that this institutions come up because the inability of SMI to have access to the research center. In one hand this institutions actually helping the government to assist the SMI. On the other hand, this institution showed that the research center cannot give a good service to the SMI. In accordance to the existence of this institutions, the researcher suggest that this institutions should have make a collaboration with the research center. With this collaboration, both institution can share the service to the SMI.

To successfully develop the downstream cocoa

industry, there should be strong partnership between the government and the SMI. Since both the government and the SMI already have their role in the development process, it is necessary to increase the partnership in order to foster the development.

There are several role that we can suggest based on the analysis of the current role that the government and the SMI already done.

Sustainable program. Government program in the development of downstream cocoa industry should be planned well. From the interview, there are a condition where the stake holder should consider that cocoa is not a daily product that the consumer use. Two strategies can be proposed to overcome this situation. First is by doing an education to the consumer using a role model from the public figure. Another strategy is promoting the downstream cocoa product by creating an event.

Database creation. In the development for the SMI based on cocoa downstream industry, creating the SMI database can give some advantages to the government. First, the government can give a facilitation evenly among the SMI, then the government can monitor the result. Another proposed program for the government is to create a pilot project for development of SMI from the start until they are successfully independent [24]. If the program success, the multiplier effect will be interesting. The government can develop a franchise of the successful SMI and there will be follower that imitating the successful company.

Market creation. In the development of the downstream cocoa industry, increasing the number of the SMI in the industry is also important. The important of that is can also help the regional economic development by increasing the job opportunities. The government and the SMI can take part in this market creation. For the government, creating a policy in the market creation would be appropriate [25]-[26]. As for the SMI, they can be an agent in creating the new entrepreneur by sharing their experience.

Entrepreneurial spirit. This spirit can be known by the individual personality character such as risk-taking, persistence, good control, and have a strong motivation [27]. It is important for the government to make a test, before giving a facilities to the SMI, especially in giving a machinery. This study revealed that there are a lot of SMI's owner who failed to develop their company after they have been given some facilities. The government researcher and the academic in this interview agreed that this condition because the SMI does not have an entrepreneurial spirit. By having this spirit usually the people will not easily give up when facing the barrier. The entrepreneurial spirit also important for the established SMI in order to solve the problem in order to growth

[28].

Research partnership. Previous study [6] reported that the government support is significantly related to the innovation in SMI. From this study, the researcher found that the absence of partnership between the SMI and the government research center. The research to solve the SMI problem unaffordable for the SMI. In fact, there is evidence that research partnerships have a positive impact on the performance of firms and regions [29].

V. CONCLUSION

In the development of the downstream cocoa industry there are at least six parties involved as the stakeholders. The stakeholders are government, SMI, association, research center, consumer, big industry, cooperatives, and another institution. Based on the analysis, there are four area that should be develop in order to increase the partnership between the government and the SMI: 1) Sustainable Program; 2) Database Creations; 3) Market Creations; 4) Entrepreneurial Spirit; 5) Research Partnership. The result wishes to become a useful foundation for the future research in the development of the downstream cocoa industry.

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REFERENCES

- [1] (ICCO), 'International Cocoa Organization (ICCO) Annual Report 2012/2013', 2014.
- [2] Rifin, A , 'The Impact of Export Tax Policy on Cocoa Farmers and Supply Chain', *The International Trade Journal*, vol. 29, no. 1, 2015/01/01, 2014, pp. 39-62.
- [3] Bulkis, S , 'Penelitian Prioritas Nasional Masterplan Percepatan Dan Perluasan Pembangunan Ekonomi Indonesia 2011-2025 (PENPRINAS MP3EI 2011-2025)', 2014.
- [4] Kurniawati, T & Lestari, EP , 'The SME Development Based On Leading Commodities', *Sustainable Competitive Advantage (SCA)*, vol. 2, no. 1, 2013.
- [5] Doh, S & Kim, B , 'Government Support for SME innovations in the regional industries: The case of government financial support program in South Korea', *Research Policy*, vol. 43, no. 9, pp. 1557-1569, 2014.
- [6] Kang, K-N & Park, H , 'Influence of government R&D support and inter-firm collaborations on innovation in Korean biotechnology SMEs', *Technovation*, vol. 32, no. 1, pp. 68-78, 2012.
- [7] Li, J & Chen, J , 'Development of Chinese small and medium-sized enterprises', *Journal of Small Business and Enterprise Development*, vol. 13, no. 2, pp. 140-147, 2006.
- [8] Martini, L, Tjakraatmadja, JH, Anggoro, Y, Pritasari, A & Hutapea, L , 'Triple Helix Collaboration to Develop Economic Corridors as Knowledge Hub in Indonesia', *Procedia-Social and Behavioral Sciences*, vol. 52, pp. 130-139, 2012.
- [9] (ICCO), ICO , 'Quarterly Bulletin of Cocoa Statistics, Vol. XXXIX, No. 4, Cocoa year 2012/13', International Cocoa Organization London, UK, 2013.
- [10] Putri, AS, Sutopo, W, Prihawantara, S & Matheos, RCD , 'Value Chain Improvement for Cocoa Industry in Indonesia by Input-Output Analysis', *Proceedings of the International MultiConference of Engineers and Computer Scientists*, vol. 2, 2015.
- [11] Perindustrian, D , 'Roadmap Pengembangan Industri Kakao', Direktorat Jenderal Industri Agro dan Kimia, Jakarta, 2009.
- [12] Hasibuan, AM, Nurmawati, R & Wahyudi, A , 'Policy Analysis Of Cocoa Downstream Industry Development (A System Dynamic Approach)', 2012.
- [13] Rahmanu, R , 'Analisis daya saing industri pengolahan dan hasil olahan kakao Indonesia', 2009.
- [14] Widayanto, Y , 'A model for supporting policy formulation of cocoa industry development based on supply chain driver performance', 2013.
- [15] Ajami, RA & Bear, MM , 'The global enterprise: Entrepreneurship and value creation', *The Global Enterprise Entrepreneurship and Value Creation*, 2013.
- [16] Hussain, I, Farooq, Z & Akhtar, W , 'SMEs development and failure avoidance in developing countries through public private partnership', *African Journal of Business Management*, vol. 6, no. 4, p. 1581, 2012.
- [17] Kusmuljono, BS , 'Public-private partnership policy: System approach to microfinancing', *53rd Annual Conference of the International Society for the Systems Sciences 2009: Making Liveable, Sustainable Systems Unremarkable*, vol. 2, pp. 672-676, 2009.
- [18] Smallbone, D & Welter, F , 'The role of government in SME development in transition economies', *International Small Business Journal*, vol. 19, no. 4, pp. 63-77, 2001.
- [19] Sandee, H, Isdijoso, B & Sulandjari, S , 'SME clusters in Indonesia: An analysis of growth dynamics and employment conditions', *International Labor Office (ILO)*, Jakarta, 2002.
- [20] Lakitan, B , 'Connecting all the dots: Identifying the "actor level" challenges in establishing effective innovation system in Indonesia', *Technology in Society*, vol. 35, no. 1, pp. 41-54, 2013.
- [21] Anggraeni, AI , 'Optimalisasi Peran Lembaga Intermediasi Dalam Membangun Keunggulan Bersaing Umkm Di Era Perdagangan Bebas Dan Otonomi Daerah', *Sustainable Competitive Advantage (SCA)*, vol. 1, no. 1, 2013.
- [22] Angkasa, WI, Hubeis, M & Pandjaitan, NK , 'Strategi dan Kelayakan Pengembangan Lembaga Intermediasi untuk Meningkatkan Daya Saing Usaha Kecil dan Menengah di Indonesia', *MANAJEMEN IKM: Jurnal Manajemen Pengembangan Industri Kecil Menengah*, vol. 7, no. 2, pp. 95-101, 2012.
- [23] Prayitno, KB , 'Peran Lembaga Intermediasi (LI) Dalam Pengembangan UMKM Inovatif', 2011.
- [24] Mohd Yunus, MG , 'Building an innovation-based economy: the Malaysian technology business incubator experience', *Journal of Change Management*, vol. 3, no. 2, pp. 177-188, 2002.
- [25] Lall, S & Teubal, M , "'Market-Stimulating" technology policies in developing countries: a framework with examples from East Asia', *World Development*, vol. 26, no. 8, pp. 1369-1385, 1998.
- [26] Spencer, JW, Murtha, TP & Lenway, SA , 'How governments matter to new industry creation', *Academy of Management Review*, vol. 30, no. 2, pp. 321-337, 2005.
- [27] Ang, SH & Hong, DG , 'Entrepreneurial spirit among east Asian Chinese', *Thunderbird International Business Review*, vol. 42, no. 3, pp. 285-309, 2000.
- [28] Lewis, VL & Churchill, NC , 'The five stages of small business growth', 1987.
- [29] Pippel, G , 'The impact of R&D collaboration networks on the performance of firms: a meta-analysis of the evidence', *International Journal of Networking and Virtual Organisations*, vol. 12, no. 4, pp. 352-373, 2013.