BASELINE REPORT

SOYBEAN VALUE CHAIN AND TEMPE INDUSTRY

UNIDO

UNITED NATION INDUSTRIAL DEVELOPMENT ORGANIZATION
This report prepared by

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For

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<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>Bulog</td>
<td>State Logistic Agency</td>
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<tr>
<td>BATAN</td>
<td>National Atomic Energy Agency</td>
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<td>BBIA</td>
<td>Agro Industry Development Agency</td>
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<td>The Indonesian Tempe Forum</td>
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<td>Tofu Tempe Producers Cooperative Association</td>
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<td>GAP</td>
<td>Good Agriculture Practices</td>
</tr>
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<td>Gapoktan</td>
<td>Farmers Group Association</td>
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<tr>
<td>HACCP</td>
<td>Hazard Analisys Critical Control Point</td>
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<td>IAEA</td>
<td>International Atomic Energy Agency</td>
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<tr>
<td>Kopti</td>
<td>Tofu and Tempe Cooperative</td>
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<tr>
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<td>Indonesian Scientific Knowledge Agency</td>
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<td>Ministry of Industry</td>
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<tr>
<td>MoA</td>
<td>Ministry of Agriculture</td>
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<td>PIRT</td>
<td>House Hold Industrial Certificate</td>
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<td>Poktan</td>
<td>Farmers Group</td>
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<td>Indonesia Tempe House</td>
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<td>RSCP</td>
<td>Resource Efficient and Cleaner Production</td>
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<td>SLPHT</td>
<td>Pest Control Field School</td>
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<td>United State Soybean Export Council</td>
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<td>World Food Program</td>
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Executive Summary

Tempe is a fermented food contains a lot of protein, originally based on soybeans. It is produced through a solid state fungal fermentation process leading to a mycelia-knitted compact cake of beans.

Tempe is one of the cheapest protein sources in Indonesia. Unfortunately the condition of tempe industry and soy cultivation in Indonesia face many problems. Although Indonesia has a high amount of local soybeans variety, but in reality local farmers have not yet been able to produce soybeans to acquire the needs of consumption. From the total of local needs for 2.6 million tons/year, currently 70% of the needs of soybean in Indonesia are imported from others countries, mostly from the USA. In 2015, Indonesia was importing 1.67 million tons of soy (source: The Ministry of Agriculture 2015).

The growth of tempe sector is not balanced with the improvement of production process. Nowadays, most of the tempe producer is unable to acquire the production standard of a good production food. The usage of used oil drum for boiling the soybean, the overused of burnt wood, the minimum of sanitation in the production room, bad behavior of the worker for example smoking during the production process and the uncleanliness of the worker, also the undisciplined in handling the waste, remain the main problem.

Due to this condition, the researcher conduct soybean value chain study to support UNIDO project in revitalizing the small scale Tempe Industry to support the production of Tempe-based on products as a resource for nutrition. This project is a part of UN agencies project involving UNIDO, FAO, IAEA (Joint FAO/IAES Division), UNICEF, WFP, and WHO. The primary aim of qualitative study is to gather information regarding soybean and tempe sector in Indonesia. This study will support UNIDO in its project.

The value chain soybean and tempe sector study started in March 2016 and finished in June 2016. The study was conducted in three provinces; Lampung, West Java, and Jogjakarta. The selection of location was considered based on the input from counterparts’ program, in this case are The Ministry of Industry (MoI) and The Ministry of Agriculture (MoA). The development of soybean cluster is also become one of consideration of study area, for example the availability of soybean planting area, the existence of tempe producers and others supporting factor, such as Kopti, local government support, Tempe base industry expected to be prime beneficiaries of partnership.

The research approach will utilize a variety of methodologies in order to provide the most comprehensive picture of the existing core supply and demand of soybean sector, current relation between the market player, and potential access of soybean market player to support institutions and government facilities. The qualitative methods will be used with a bias to eliciting as much as market player’s participation and buy in early in the process; to which end a variety of participatory tools are used.

The value chain will identify all market actors directly involved in the movement of the soybean product. Started from the input supplier to end user are parts of the core value chain. Most of the challenges faced by the actors could be identified here. The core value chain describes the process of the product, and the relation between the actors. Dynamic relation that occurs between the actors
of market might create challenges, which at the end hindering mutual benefit and incentive between the actors. As we see on the core elements of value chain section, soybean business processing could be considered as one of the most complicated process, involving so many actors. In general, the problems that shows in soy and tempe sector was not caused by the actors that involved in the core chain values, but more often caused by the paralyze of the supporting function and the rules function from the actors outside the core value chain.

Based on the desk study that made and the field study result, the researcher found and divided the problems to the soybean and tempe sector into two areas, which are on farm area and off farm area. Those problems are as follows:

A. **On Farm (Soybean Cultivation)**
   1. The unavailability of soybean seed as requested by the market demand fairly.
   2. The unavailability of proper technology for the cultivation process and post harvest.
   3. Lack of Good Agricultural Practices (GAP) during the production.
   4. The unavailability of financial support.
   5. Lack of market information (specification, amount, channel, etc.).

B. **Off farm (Tempe Production)**
   1. The minimum of skill and knowledge about Good Hygienic Practices
   2. The limitations of the adoption towards technology is caused of the minimum financial support
   3. The minimum of market access for the tempe product to be processed more hygienic

Based on the above problem, researcher would like to recommend hereunder interventions:

A. **On farm intervention**
   1. Intervention #1 : Piloting high quality and affordable soybean nursery center
   2. Intervention #2 : Co-Invest with Private sector to produce and promote appropriate technology for on farm purposes
   3. Intervention #3 : Developing affordable and accessible financial scheme with existing financial institution

B. **Off farm intervention**
   1. Intervention #1: Co-invest with private sectors to build or optimise the tempe model factory
   2. Intervention #2 : Provide technical assistance in good hygienic processing practice to tempe producers
   3. Intervention #3 : Co-invest with private sector to produce and develop tempe base product
   4. Intervention #4 : Branding, promotion, and marketing of improved product to higher market segments
The Background of Study

Value chain study on soybean sector was conducted to support UNIDO project in revitalizing the small scale Tempe Industry in Indonesia in support of the production of Tempe-based products as a resource for nutrition. This project is a part of UN agencies project involving UNIDO, FAO, IAEA (Joint FAO/IAES Division), UNICEF, WFP, and WHO. The aim of this qualitative study is to gather information regarding soybean and tempe sector in Indonesia. This study will support UNIDO in its project.

The value chain soybean and tempe sector study started on March 2016 and finished in June 2016. This project started by doing the desk study and collecting secondary data in order to acknowledge the sector profile, mapping, and also the primary problem in the sector. After gathering all the secondary information, the researcher conducted the field study to collect primary data by having the interview towards the key informants and important actors involved in the value chain soybean and tempe sector in the selected areas.

The study was conducted in three provinces of Indonesia; Lampung, West Java, and Jogjakarta. The selection of location was considered based on the input from the program counterparts, in this case were The Ministry of Industry (MoI) and The Ministry of Agriculture (MoA). The development of soybean cluster was also became one of consideration of study area, for example the availability of soybean planting area, the existence of tempe producers and others supporting factor, such as Kopti, support from local government and tempe base industry which were expected to become partner and beneficiaries of the program.

To conduct this study, the researcher was supported by the colleagues from the Ministry of Industry, the Ministry of Agriculture, Gakopti, Kopti, tempe producers and the soybean farmers that had been providing the usable information and also every person involved during the information gathering period in the field.
1. Sector Profile

Yellow soybean or also called *Glycine max*. L was firstly cultivated in China on the 11th century AD, which at that time soy had become one of the primary food of China’s society besides rice, wheat, barley and millet. The extension of soy plantation began in the 18th century through Christian’s missionary by sending the soy seed from China for the first time to be planted in France, Europe. The soy expanded to the continent of America by the time China’s worker arrived to United States in the year of 1765 (source: Lance Gibson and Garren Benson, Iowa State University, Department of Agronomy, 2005).

In Indonesia, the famous soybean that had been known before the yellow soybean was the black soy which was the variety of local soybean. Nevertheless, since the yellow soybean introduced in 1750, especially in Java Island by the trader from China, along the time, the farmers started to replace the black soybean into the yellow soybean. Nowadays, the yellow soybean in Indonesia which came from China has been successfully domesticated into another 73 varieties, such as willis, kaba, sinabung, grobogan, anjosmoro, argomulyo, burangrang, detam 2, tanggamus, rajabasa, and yellow gepak.

1.1 International Context

The soybean production until 1972s was dominated by the United States, since the United States soybean production at that period of time was reaching 75 percent of the world’s soy production. During the period, the United States was the primary supplier of soybean for livestock protein, but in the 1970s there had been the lack of soybean supply for the feed of the livestock which caused the South America’s countries such as Argentina and Brazil started to develop the soybean enormously. In 2012, the market share of United States soy was declining into 46.81 percent but in the same time, the market share of Argentina and Brazil soybean market was increasing into 9.33 percent and 40.76 percent.

However, the countries that are producing and known as the biggest soybean’s exporter nowadays are the United States, Brazil, and Argentina, which are also considered have dominated the world’s soy export market since 1980. In 2015, the amount of soybean traded internationally was 125 million of tons and will be continued to increase yearly.

Recently, soybean has already known and being used nearly across all country in the world. The soybean not only has become the source of food but also has become the source of industrial raw
material, such as soybean oil industry, food and beverage industry, feed industry, chemical industry, biofuels industry, and others varieties of industries. In 2014/2015, the soybean production reached 319 million of tons and the world consumption of soybean reached 299 million of tons. In 2015/2016, assumed that the world consumption of soybean will be increasing 15 million of tons, thus, the number of the world’s soy production assumed to be in stagnation in 319 million of tons. (Source: USSEC on Grain Transportation Conference, 2016).

The countries that become the biggest importer of soybean today are China, Europe, Mexican, Japan, Taiwan and Indonesia. In 1980s, China was one of the soybean’s exporter countries, but after the year of 2000 China became soybean’s importer country since the increasing demand of soybean significantly in order to fulfill China’s need for the food industry, poultry feed industry, soybean oil industry and other industries. In 2015, China imported more than 80 million of tons of soybean from the exporter countries, for example United States and Brazil, this situation caused China’s demand of soybean could affect the world soy price.

\[\text{Picture 2 : World soybean importers (source: USSEC 2016)}\]

**1.2 Domestic Context**

Based on the data issued by the Ministry of Agriculture (MoA) in the soybean outlook in 2015, Indonesia produced 998.870 tons of soybeans which most of the soybean produced by seven provinces that are having huge contribution in producing domestic soybean for 87.40%. Those provinces are, East Java produced 396.950 tons or contributed for 39.74%, Central Java produced 140.141 tons or contributed for 14.03%, West Nusa Tenggara produced 106.379 tons or contributed for 10.65%, West Java produced 86.602 tons or contributed for 8.67%, Aceh produced 58.933 tons or contributed for 5.96%, South Sulawesi produced 49.945 tons or contributed for 5.06%, and Jogjakarta produced 31.963 tons or contributed for 3.21%.
In Indonesia, most of soybean users are the tempe and tofu industry that are 83.7%, followed by the soy sauce and tauco industry in 14.7%, poultry industry 0.4% and seed in 1.2% (Source: Indonesia Statistic Bureau, 2012).

Tempe is a traditional food made from soybean which has become main menu for Indonesian people. In Indonesia, this food has been known since centuries ago mainly in Javenese culture, especially in Jogjakarta and Surakarta In the manuscript of Serat Centhini chapter III (Serat Centhini is a script written on Javanesse ancien letter in a song from by intellectuals of the Royals of Solo. It was first initiated by Price AA Mangkunegaran III in 1814), the word of “tempe” has been found, for example by mentioning the name of food “jae santen tempe” and “kedhele tempe srundengan”.

Another historical note shows that tempe started to be produced from the black soybean, orginally came from the traditional village in Java that being developed before the 16th century.

Nowadays, tempe has become the main staple food that is consumed every day by Indonesian people especially in Java Island. The consumption average rate of tempe in Indonesia lately is 8.5 kilos/capita/year high above the meat and chicken consumption. Tempe has been also contributed for 10% from the total protein consumption in Indonesian (Astawan, 2015). For that, tempe is known as one of the main food that has a huge contribution towards the attempt of fulfilling the people’s nutrition especially for the middle low people.

Recently, based on the estimation, there are more 95.000 UKM (Micro and Small Business) tempe in Indonesia which 80% among them located in Java Island. For each year, the need of tempe industrial sector for raw material is predicted 1.5 millions of tons (source: Indonesia’s House of Tempe 2012, Entrepreneurship Training Module).

The scale of tempe industry has a lot of variation, started by the home industry that manage 10 kilos of soybean/day, followed by the scale of industry that manage more than 3 tons of soybean/day. Based on the data published by the Mercy Corps Indonesia in 2010, the sector of tempe industry in Indonesia predicted was hiring 285.000 people (40% of the amount are female worker). The sector
of tempe industry was also predicted gaining revenue for 78 million USD per year (source: Bank of Indonesia: Financing Pattern Of Small Company (PPUK) Tofu and Tempe Production Center)

The growth of tempe sector in Indonesia is not balanced with the improvement of production process. Nowadays, most of the tempe producer in Indonesia is unable to acquire the production standard of a good production food. The usage of used oil drum for boiling the soybean, the overused of burnt wood, the minimum of sanitation in the production room, bad behavior of the worker for example, smoking during the production process and the uncleanness of the worker, also the undisciplined handling of the waste trash, still became the main problem. The tempe that produced were sold in the package of plastic, banana leaves, or waru leaves which can only be lasted for one day in the room temperature. It happens because of the unclean production process that made a contamination which had shorten the shelve life of tempe.

More than 95% of tempe produced in Indonesia are sold in the traditional market by producers themselves or through the middle man (source: Kopti, 2015). Nowadays, only a small amount of tempe industry is able to compete and sold in the middle up market, such as supermarket, restaurant, hotel, and other places. This situation occurs because the smaller size of middle up market compared to middle low market that makes it less attractive for producers to enter the middle up market. Other obstacle faced by producers to enter middle up market is producers must have a P-IRT certificate (license for food home industry issued by local government health office). To get P-IRT certificate, producers must have the legalization of the company and must to attend the food security training for two days before having review their factory condition by the Health Government Officer.

1.3 Sector Dynamics

Although Indonesia has a high amount of local soybean variety, but in reality Indonesia has not been able to produce the soybean to acquire the needs of soybean in the domestic country itself. From the total of local needs of 2.6 million tons/year, 70% of the needs of soybean in Indonesia are imported from others countries, mostly from the USA. In 2015, Indonesia was importing 1.67 million tons of soy (source: The Ministry of Agriculture in the soy outlook 2015)

The productivity of soybean farmers in Indonesia recently is improving in 2014. The average level of soy production reported 1.551 tons/hectare was becoming 1.560 tons/hectare in 2015. On the contrary, the planting area was declining yearly, especially in the Java Island, which in 2015 the planting area was estimated to be declined for 1.86%. Even so, based on the data issued by The Ministry of Agriculture in 2015, overall the soy planting area in Indonesia was increasing constantly,
since the planting area outside Java Island significantly increasing, it made the total of Indonesia planting area for soy in 2015 is 640.35 thousand of hectare increased from the previous 615.69 thousand of hectare in 2014 (source: The Ministry of Agriculture in Soy Outlook 2015).

Generally, the price of soybean in Indonesia is inclining every year. But, in 2015, the price of soybean in Indonesia was significantly declining compared to the previous year that was influenced by several factors, such as the declining of the world’s price of soybean which determined by the price of CBOT (Chicago Board of Trade), the exchange rate of rupiah, and the world price of oil. The price declining of soybean and the price of world oil recently have made the cost production of soybean and the shipping cost from the export country become cheaper. This situation caused the declining of the imported soybean price in Indonesia. From January until March 2016, the price of the imported soy in the retailer level is in the range of IDR 6.200/kilos until IDR 6.800/kilos (Source: Kopti 2016). The low price of imported soybean nowadays has made the farmer unwilling to plant the local soybean, since the price of the local soybean is highly influenced by the imported soybean’s price. Recently, the soybean’s production cost in the level of farmer is higher compared to the selling price of imported soybean, this condition caused by the low productivity and the high cost of input.

A side from the low production rate compared to the other country that also producing soybean, Indonesian soybean product is still struggling with the low quality of soy. One of the quality factor is the moisture content. The average moisture content level produced by the Indonesian farmer is between 18 to 22% far above the dry level of the imported soybean which between 12 to 13%. It is suspected that the condition occurs because of the farmer does not have the facilities to dry the soybean after the cultivation process, after all, the farmer is unwilling to do the proper drier since it will decrease the soy’s “amount” in kilograms. The soy’s price which accepted by the farmer from the collector is not differentiate between the high moisture content level soy and the low moisture content level soy. That is why the improvement in the marketing system of soy bean is urgently needed in the future.

The need of soybean in Indonesia is estimated to be continuously inclining in line with the growth of Indonesia’s population. The soybean’s consumption is also influenced by the economy level and people life style. The data issued by the BPS in 2014 showed that the highest consumption of soy were occurring in 2002, which is 8.40 kilos/capita/year and in 2007 for 8.30 kilos/capita/year, where at that years the economy of Indonesia was declining that has made the people were consuming the cheaper vegetable protein source which contained in tempe and tofu, also abandoned the consumption of animals protein such as meat and chicken.
<table>
<thead>
<tr>
<th>Year</th>
<th>Soy Availability (kilo/capita/year)</th>
<th>Growth (%)</th>
<th>Consumption (kilo/capita/year)</th>
<th>Growth (%)</th>
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<tbody>
<tr>
<td>2001</td>
<td>5,76</td>
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<td>2014*)</td>
<td>8,65</td>
<td>-2,04</td>
<td>7,13</td>
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<td><strong>Average</strong></td>
<td><strong>9,07</strong></td>
<td><strong>1,67</strong></td>
<td><strong>7,62</strong></td>
<td><strong>-1,15</strong></td>
</tr>
</tbody>
</table>

**Table 1.** The Growth of Soy Consumption and Soy Availability per capita in 1993-2004 (Source: BPS and Ministry of Agriculture)
1.4 Sector Map and Its Description

Picture 5. Value chain map on soybean and tempe sector in Indonesia
1.4.1 Core Value Chain

All market actors directly involved in the movement of the soybean product. Started from the input supplier to end user are parts of the core value chain. What are the most challenges faced by the actors could be identified here. The core value chain describes the process of the product, and the relation between the actors. Dynamic relation that occurs between the actors of market might create challenges, which at the end hindering mutual benefit and incentive between the actors. Soybean business process, as we see on the core value chain section, could be considered as one of the most complicated process, involving so many actors. In general, the problems that are showed in soy and tempe sector is not caused by the actors that involved in the core chain values, but more often caused by the paralyze of the supporting function and the rules function from the actors outside the core value chain.

1.4.2 Supporting function

At the top of the core value chain, we can see the supporting actors, which ideally providing support for the market actors in the core value chain. Similar to other agriculture commodity in Indonesia, most of the underlying causes/root cause of the problem faced by soybean actors are not the core value chain, but in the supporting function section. For example, as stated on the dynamic sector, one of the problems faced by the soybean processors is soybean moisture contain (MC). The process doesn’t have access to proper drying infrastructure. There might be technology supplier which could provide them with the technology, but the processors are lack of access to: 1) information on where they could purchase the appropriate drying machine, 2) financial product which enable them to procure the technology.

1.4.3 Rule Function

At the bottom of the core value chain, we can see other determinant factors which could improve the capacity of market actors in the value chain, but on the other hand, could also become barrier for the actors.

The research will be focusing on the effort to identify problems in the soybean business process, which include the input process, production process, processing process, and trading process. The research will then identify underlying causes of the problem, to enable researcher to provide recommendations which area of intervention could be undertaking to eliminate problems faced by the soybean market actors.
2 Methodology

The research approach will utilize a variety of methodologies in order to provide the most comprehensive picture of the existing core supply and demand of soybean sector, current relation between the market player, and potential access of soybean market player to support institutions and government facilities. The qualitative methods will be used with a bias to eliciting as much as market player’s participation and buy in early in the process to which end a variety of participatory tools are used.

2.1 Desk Study

Extensive Desk review will be conducted to obtain background information on the assessment areas, including local character and socio-cultural aspects. Such information will also be used to identify the district where which in depth field research will be undertaken. The main sources for data were national policy documents, research studies as well as papers published by the provincial government. In addition to national reports, smaller, sub-national studies will be reviewed and conclusions carefully interpreted when applied to the assessment context.

2.2 Sector Survey

The qualitative data will be collected through a survey conducted in selected areas, covering the entire supply chain of soybean sector. The survey tool will be designed to serve as a baseline study covering existing input supply, soybean cultivation, growing, and harvesting process, farmers existing sales and income, farmers existing market channel, idle farmers production capacity, middle man roles, cost structures and existing relation between core market players and supporting system i.e financial access, research development, government role and regulation, and other potential partners both public and private sectors.

2.3 Key Informant interview

Interviews will be conducted with representative of soybean core market players, local government authorities, coordination and also development service bodies. The key informant interview component will collect existing information on input supply, soybean cultivation, growing, and harvesting process, farmers existing sales and income, farmers existing market channel, middle man roles, cost structures, local and export/import trading company’s role, and existing relation between core market players and supporting system i.e. financial access, research development, government role and regulation, and other potential partners both public and private sectors. The interviews and meetings will also enable us to gain insight into the various market actor’s incentives, capabilities and existing and potential relationship within the target market.

2.4 Group meeting

Group meeting will be organized with local leaders, private sectors, input suppliers, and community members, including a special focus on women and vulnerable groups related to the soybean and tempe sector. Through the group component, qualitative data will be collected with an emphasis on the qualitative aspect and contextual information.
Finally, site visits and observations will take place in all target areas, including future project locations, and informal discussions will be conducted with authority officials, and other soybean market players in the areas.

2.5 Validity

Triangulation will be achieved through comparing information from the qualitative survey with the result from Group Discussions and Key Informant Interviews. When possible, this data will be crosschecked with available literature as well as country and province statistics.

2.6 Outcome

It is expected that the information collected through this assessment will provide rigorous diagnostic tools of the existing soybean sector market system, underlying cause of the sector’s stagnancy, and finally the potential systemic intervention that lead to the systemic change on the sectors, which will create positive growth for the soybean sector.

Expected outcomes will include:

- Key indicators related to the soybean farmers, tempe producers and others value chain actors
- Analysis of systemic constraint (perceived and tangible) that inhibit communities access and ability to run successful businesses
- Recommendations for mid-to longer-term program interventions

Utilizing the information that has been collected during the desk study, field assessment, and stakeholders’ meetings, the researcher will conduct sector analysis to see underlying causes in the stagnancy of soybean sector. Based on the finding of the researcher finally develop intervention plan recommendation to enhance soybean market development in Indonesia.

2.7 Location for primary data collection

Based on the desk study and the consultation with the Ministry of Industry and the Ministry of Agriculture, considering the soybean development potential in the selected area and also the existence of supporting function in the surroundings, such as the existence of Kopti and the existence of the research foundation. The researcher will do the study in three provinces, those are West Java, Jogjakarta, and Lampung. For the West Java area are Bogor and Cianjur, for the Jogjakarta area is Gunung Kidul, and the Province of Lampung are Bandar Lampung and Central Lampung.

2.8 Study limitation

Based on the resources and time limitation, this study is conducted using the approach of deep qualitative analysis. Data collection is conducted in three provinces that agreed by the UNIDO and its counterparts, which are West Java, Jogjakarta and Lampung.
3. Baseline Survey Result

3.1 Profile of Soybean Farmers

To gain the information from soybean farmers, researcher conducted focus group discussion with soybean farmers group and deep interview with key informants in three areas are: Gunung Kidul, Cianjur, and Central Lampung.

Generally, the soybean farmers are small farmers with the land area used less than 3,000 m², where the soybean is usually planted in the land with minimum irrigation. The limited planting area made soybean from farmers has a vary quality with difference specification and its made local soybean has not similar quality.

The farmers are usually planting the soybean in November until February or March until August depended on the rainfall season. Most of the farmers are planting the soybean by using the mix crop system, which combine soybean with others plants that exists in the same season, such as cassava and maize. This planting pattern is being doing by the farmers to gain more profit since the revenue from the soybean is not as good as others commodities.

In doing the soybean planting, the farmers are mostly only using the simple equipment with the simple planting technique without having a good agriculture technique such as land processing and planting distance setting. The situation is unbalanced compared to the farmer’s ability to access the information needed. The observation result in Central Lampung, Cianjur, and Gunung Kidul, finds that 90% of the farmers are having the access towards information regarding the proper agricultural technique. Those information accesses could be gained by the farmers through the field officer that is conducted by the government under the coordination of local Department of Agriculture. Currently the government is also involving the military (Babinsa) to guide the farmer concerning the cultivation process, specifically on “paddy”, maize, and soybean.

The soybean farmers do not have the most up-to-date information how to implement new technique and technologies. Since their profit margins tends to be quite small because of the amount of crop yield is insufficient and their soybean will only be bought with the cheap price. To survive on that situation some farmers in several area such as in Cianjur harvested the soybean on unmatuer condition (60 days after planting) and sell they soy to consume as vegetables. This situation causes most of the farmers are lacked of their serious attention in planting the soybean and assuming that planting the soybean is only to complement between rice planting time.

3.1.1 Business Information of Soybean Farmers

3.1.1.1 Land ownership

The land ownership has become a classic problem in Indonesia. According to the data released by the department of agriculture in 2015, stated that the amount of the land agriculture area in the Java Island is shrinking each year for 1-2%. It happens because of the growth sector of non-agricultural field is increasing fast, such as property and industrial sector.
From the interview result with the soybean farmer in the study area, gained the information that the land ownership status is different in each area. The farmers in Cianjur, West Java, who are using their own land is only 40% and the farmers who are using rented land is 60%. This condition is not the same with the condition found in Gunung Kidul whereas 70% of the farmers still own the land area and 30% is renting from the landlord. This condition is also occurred in the province of Lampung, which 80% of the land that planted by the soybean are owned by themselves and 20% of the land are renting from others.

The land ownership status will effect to the farmer’s business plan, since if the land that they planted is the rental land, usually the farmer will only be doing the short time business planning, such as plant rotation and depended on the use of instant chemical input. This situation is understandable because by the rent status, there is possibility that the land will be taken back by the owner. It will be different with the farmer who owns their own land, where they generally will be easy to do the business planning for long term such as land structure improvement with the minimum use of instant chemical input.

3.1.1.2 Access to Input Supply

The soybean farmers in the study area seems to have better access towards the input supply such as organic or chemical fertilizer, pesticide, fungicide and others. Those things can be found in the local agricultural store or the agricultural store owned by Gapoktan (farmers group association) but not with soybean seed. At this moment whether in Java nor outside Java, is not available hi-quality seed in the agricultural input stores. The farmers said that the seeds can be obtained from the local growers or the government support. In the using of seed, the study result showed that 90% of the farmers are using the seeds from the rest of the previous cultivation and only 10% of the farmers that are using the seeds obtained from the local growers where most of the seeds do not have quality assurance certification. According to them, the superior certified seeds can only be obtained if the government is having and distribute the subsidy seeds.

3.1.1.3 Yield

The crop yield that the farmers get each hectare of land is varied, depended on several things, which are:

- Aplication level of good agricultural practices (Cultivation, Harvesting and Post Harverst)
- The quality of seeds
- The quality of soil
- Weather
- Pest or desease

From the field study, most of the farmers are doing the mix crop planting patterns. The crop yields result can be seen in the table below:
The crop yields that gained by the farmers in Gunung Kidul is the highest crop yields compared to in Cianjur and Central Lampung area. The researcher found that one of the determinant factor is that soybean cultivation is still the main revenue considered as the main source of revenue and the source of livestock feed that needed by the farmers. This situation is different with Cianjur and Central Lampung, where the farmers in those two areas are only assuming the soybean as a temporary plant to fertilize the soil. Besides, the price of the soybean in Central Lampung and Cianjur is quite low, that caused the farmers is not serious to cultivate it.

This study could not show the total production data that resulted by the farmers in the selected area, because the soybean is a short time plant and the total production number of soybean will be very influenced by the subjective decision in selecting the commodity that will be planted by the farmers and will difficult to measure. That is why the use of productivity/yield data will be more proper to use as the baseline.

### 3.1.1.4 Production Cost

From the study result, the production cost issued by the farmers to plant the soybean is also varied, depended on several things, such as:

- **Labor wages**
  
  Labor wages in each study area is different and influence by minimum regional wages that determined by the government and also the work’s difficulty level done by the farmers. The farmers’ labor wages in Gunung Kidul is in average of 50,000 rupiahs each day. While in Central Lampung and Cianjur area, the farmers’ labor wages are between 35,000 to 40,000 rupiahs a day.

- **Planting methods**
  
  Planting methods is also affected towards the soybean production cost, whereas the farmers of Gunung Kidul are doing the planting method that more intensive although done by the mix crop system. But the farmers in Central Lampung and Cianjur are doing it differently. Generally, they do it not in a proper way because they tend to do the seed spreading planting method without doing the land processing first.
The pest disease attack and the weather

The pest and disease attack and the extreme weather are very affecting the soybean production cost. Farmers will have to spend more cost to buy pesticide if there is the pest disease attack to the soybean or they will lose their crop yields.

Averagely, the production costs of the soybean for each hectare in the field study are as follows:

![Cost/hectare in IDR (000)](image)

**Picture 7**: The production cost of soybean for each hectare in 3 study areas

Based on the study result, can be found that the highest production cost is in Gunung Kidul since the farmers in Gunung Kidul are doing the soybean planting using the intensive planting pattern, where they use the better agriculture practices compared to two others areas. For example, the farmer in Gunung Kidul is doing the soil processing, distance plant setting, and pest control. They can produce higher crop yields compared to the two others field study.

The complete production cost composition can be seen in the table 2 below:

<table>
<thead>
<tr>
<th></th>
<th>Seed</th>
<th>Organic fertilizer</th>
<th>Chemical fertilizer</th>
<th>Organic pesticide</th>
<th>Chemical pesticide</th>
<th>Labor</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cianjur</td>
<td>720</td>
<td>600</td>
<td>375</td>
<td>125</td>
<td>60</td>
<td>1.780</td>
<td>3.660</td>
</tr>
<tr>
<td>Central Lampung</td>
<td>750</td>
<td>300</td>
<td>575</td>
<td>100</td>
<td>200</td>
<td>2.425</td>
<td>4.350</td>
</tr>
<tr>
<td>Gunung Kidul</td>
<td>360</td>
<td>420</td>
<td>775</td>
<td>180</td>
<td>160</td>
<td>6.050</td>
<td>7.945</td>
</tr>
</tbody>
</table>

**Tabel 2**: Total of Production Cost (000) in 3 study area

The table above showed that the biggest component of cost is labor, which is in between 50-70% of total cost. This number showed that the agricultural technique done by the farmers in the field study was still relying on labour started from the land preparation process, maintenance until harvest time. The Gunung Kidul area was the area with the highest labor cost, because of the intensive planting pattern that took more labor in each cultivation steps. It is different with the area of Central Lampung and Cianjur which the soybean cultivation steps done by the spreading pattern without the adequate treatment.
3.1.1.5 Selling Price

The selling price of soybean at farmer level very fluctuate and influenced by the quality and the price of imported soybean. During the study was conducted from March to June 2016, the average price of imported soybean in the retailer level was 6.200 to 6.800 rupiahs for each kilo, therefore the average price of soybean accepted by the farmers was highly varied.

The selling price of soybean by the farmers in Cianjur and Central Lampung was only reaching 5.500 rupiahs to 6.000 rupiahs for each kilo. Meanwhile, for the Gunung Kidul area the farmers selling price for soybean was reaching 7.000 rupiahs for each kilo.

The soybean selling price in Gunung Kidul could be higher than the selling price of imported soybean because most of the soybean becomes the favorite for tofu producers but not for the tempe producers. The volume of tofu production could be higher by using local soybean since it contains higher protein than imported one. On the contrary, for the tempe industry, the producers do not like the size of the local soybean which is relatively smaller than the imported soybean, so their volume of tempe production is smaller by using local soybean.

The buyers of soybean are usually done by the collectors whereas the strongest bargaining position is on the collectors who determine the price of the soybean. In Gunung Kidul most of soybean farmers are not sell their soybean on same time, many of them keep their soybean and will sell when they need the cash money.

3.1.1.6 Income

Based on study, soybean farmers in Gunung Kidul received higher net income compared to others in Cianjur and Central Lampung. Gunung Kidul farmers received 1.155.000 rupiahs for each hectare. Meanwhile, the Cianjur farmers were only getting the income 840.000 rupiahs for each hectare and the farmers of Central Lampung were only getting 425.000 rupiahs for each hectare. In Central Lampung on this planting season the farmers faced the extrem weather that impact to their income because they should spend more cost on chemical fertilizer and pesticide.
The higher income of farmers Gunung Kidul is caused by the higher amount of crop yields for each hectare even though the production cost is also quite high. The income of soybean farmer is still far behind the income of the paddy or maize farmers since the crop yield for each hectare of maize and paddy planting are much more than soybean planting, meanwhile the production cost and the time of planting are relatively the same. This condition causes the farmers are unwilling to plant the soybean and they prefer to plant other plants. Although the soybean has the selling price above the commodity of paddy and maize, but the amount of yields crop of soybean is still far behind paddy and maize. Those differences have made the profit that farmers received are below compared to paddy and maize farmers, which is described as follows:

![Graph showing income per hectare for 3 main commodities]

**Picture 9**: Income per hectare for 3 main commodities

### 3.1.2 Gender perspective

#### 3.1.2.1 Man and Woman Role

Women participation in the agriculture sector especially soybean is very high, and in the area of Java whether it is located in Cianjur or Gunung Kidul, the women’s involvement is even higher and dominant. Women involve in the activities of planting, crop maintenance and harvesting, while the men involve in the activities of land preparation, pest spraying, harvesting and transportation. In the area of Gunung Kidul, the women will decide the variety of commodities to be planted and highly involved in the agricultural financial planning. In the Central Lampung area, the men are still dominating the agricultural activities since Central Lampung is the transmigration areas whereas the distance between land and the village is quite far, therefore the women tend to choose work on the land around the village or housing area.

#### 3.1.2.2 The wages

The wages that accepted by the women farmer in three areas tend to be lower than the wages accepted by the men farmers, since the work burden of the women farmer considered to be lighter.
compared to the work of the men farmer. The picture below shows the wages comparison between the wages accepted by the women and men farmers.

![Picture 10: The different wages between woman and man (in IDR)](image)

### 3.2 The Profiles of Tempe Enterprise

The consumption need of soybean for tempe producers in Indonesia is highly varied, started from 10 kilos to 3000 kilos for each day. Nevertheless, according to Kopti in 2012, 80% of tempe producers needed soybean below 150 kilos for each day. Since most of the business scale in Indonesia is small producers, the needs of labor in tempe sector in average is 3 persons for each small-middle business including the business owner. Therefore majority of tempe production mostly done in house that involve the whole family member.

Related to the study of tempe producers, the data collection was done in 3 areas, which are Bogor for West Java, Gunung Kidul for Jogjakarta, and Bandar Lampung for the Province of Lampung.

#### 3.2.1 Business Information of Tempe Enterprise

##### 3.2.1.1 Production Capacity

The production capacity of tempe industry is counted based on the need of soybean as raw material, instead of production outputs. Since the tempe producers do not sell their product based on weight instead of subjective dimension/measure according to consumer’s request. Besides, the tempe output produced by the producer is also high varied depends on the production method that used although using the same amount of soybean.

The study result that has been done in three areas shows the producers average production capacity is as follows:
On the study result shown the average capacity of tempe production influenced by the market character, work culture and the type of tempe produced by the producers. Lampung is the area which most of tempe producers came from Central Java and East Java, such as Pekalongan, Semarang, and Malang. They have a culture of working harder compared to local producers. With lower competition between producers in Bandar Lampung, the producers could have a big capacity of tempe production. In Bandar Lampung, average tempe production is 70 kilos a day.

In Bogor, most of tempe producers came from Pekalongan Central Java, but they could not have the high tempe production capacity because of the higher competition level compared to Bandar Lampung. The average tempe production capacity in Bogor is 60 kilos a day.

Tempe producers in Gunung Kidul mostly came from the local people of Gunung Kidul. The average tempe production in Gunung Kidul is only 20 kilos a day, because of the high competition level between tempe producers and also most of them only produce tempe sumpil (small tempe wrapped with banana leaves) that needed more time in packaging so they have a limited time in production.

3.2.1.2 Production Cost

The production cost of tempe is highly depended on soybean price, production capacity, and the labor cost. Based on the research result, the production cost in the 3 field study areas, Bogor, Central Lampung, and Gunung Kidul, is as follows:

![Picture 11: the average production capacity in three areas.](image)
The production cost in Bandar Lampung is higher compared to another two areas because the soybean price is more expensive 200 rupiahs compared to the one in Java Island. The input cost such as fuel and labor relatively are also higher compared to other field study areas.

Meanwhile in Gunung Kidul area, the production cost is quite high because the variety of tempe that produced smaller and wrapped by banana leaf and called sumpil. They need more labor to overcome the wrapping process even though the production capacity is only 15 to 20 kilos of soybean each day.

The cost of production in Bogor is lesser compared to other field study due to lower raw material prices and just need minimum labor, especially in packaging process that takes only fewer labors - since tempe is packaged in big size with plastic.

### 3.2.1.3 Income

The income gained by the tempe producers in the field study is varied, influenced by the tempe selling price, production cost and competition level.

The gross income that obtained by the tempe producers in the field study is as follows:
These net incomes are shown the level of competitiveness among tempe producers in several cities, since the only way for them to compete is by giving the lower price from their competitor. Tempe producers in Bandar Lampung received higher net income compared to producers in Bogor and Gunung Kidul. Amount of tempe producers in Bandar Lampung is less than in Bogor and Gunung Kidul, therefore competition between tempe producers in Bandar Lampung are not as tight as the above study areas. Meanwhile the producers in Bandar Lampung could sell their product with higher price than tempe’s price in Bogor and Gunung Kidul.

![Tempe producer average net income a day](chart)

**Picture 14:** Tempe producer average net income a day

Based on the field study, the average revenue of tempe producers in Bandar Lampung is reaching 280,000 rupiahs a day. Most of them have bigger production capacity. The competition of tempe market has not been as tight as in Java Island since the tempe producers in Bandar Lampung are not as many as those in Java Island, although the production cost is more expensive, nevertheless, with the bigger amount of their production, the producers could gain bigger profit each day.

In Gunung Kidul area, most tempe producers have smaller business scale that produce tempe sumpil (small tempe wrapped by banana leaf). Their wrap processing is more complicated that need more labor than other vary of tempe and takes more cost for the labor. Even though the product has more expensive price compared to other vary of tempe, but since the production capacity is smaller, which are only 15 to 20 kilos for each day, the average revenues for producers is only 108,000 rupiahs for each day.

In Bogor, the producers have a highest production capacity with the average revenues is 147,700 rupiahs for each day. In Bogor, mostly tempe package in a big size with plastic packaging that does not take too many labor for the packaging process. But the industrial competition is quite tight in Bogor, the huge amount of the tempe producers caused them competing in determining the price, it makes their revenues are not as much as those in Bandar Lampung.
3.2.1.4 Sales and Marketing

Generally, the tempe producers in the field study do the direct selling to the consumer with several ways, which are:

1. Having their own store in the market
2. Delivering their tempe to the consumer including restaurant, small store, and other places.

Only a small numbers of producers sell their product through the third parties or the middle man. The pie chart below is showing the comparison between the direct selling with the middle man selling.

![Pie Chart: Marketing Channel of Tempe Selling]

**Picture 15:** Marketing Channel of Tempe Selling

Tempe producers prefer to sell directly selling in order to gain maximum profit. Most of them are selling their product for the middle low customers and most of them do not have brand or their own product labels to strengthen their product. Based on group discussion with tempe producers, they are not interested to sell their product to middle up market such as supermarket since the payment method are taking too much time within 30-45 days after delivered. They also shared that the supermarket demand is not as big as the tradional market demand.

3.2.1.5 Soybean preferences

Most of the tempe producers in the field study are using the imported soybean for several main reason that become consideration of the tempe producers in using the imported or local soybean are as follows.
<table>
<thead>
<tr>
<th>Imported Soybean</th>
<th>Local Soybean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Similar size</td>
<td>Has not similar size</td>
</tr>
<tr>
<td>Similar color and the level of maturity</td>
<td>Has not similar color and the level of maturity</td>
</tr>
<tr>
<td>Low moisture content</td>
<td>High moisture content</td>
</tr>
<tr>
<td>Good appearance of tempe</td>
<td>Not good appearance of tempe</td>
</tr>
<tr>
<td>Normal taste of tempe</td>
<td>Tempe’s taste is a little bit sweet than normal</td>
</tr>
<tr>
<td>Longer shelf life</td>
<td>Short shelf life</td>
</tr>
<tr>
<td>Cheaper price</td>
<td>More expensive price</td>
</tr>
<tr>
<td>Available anytime</td>
<td>Not available anytime</td>
</tr>
<tr>
<td>Stable quality</td>
<td>Unstable quality</td>
</tr>
</tbody>
</table>

Table 3: Producers preferences regarding imported and local soybean

3.2.1.6 Type of technology used

The technology used by most of the tempe producers nowadays is highly traditional and has not fulfilling the food standard processing. These are several equipment used by most of the tempe producers.

<table>
<thead>
<tr>
<th>Process</th>
<th>Equipment’s used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boiling</td>
<td>Used oil drum</td>
</tr>
<tr>
<td>Soaking</td>
<td>Plastic drum</td>
</tr>
<tr>
<td>Peeling</td>
<td>Soybean peeling machine</td>
</tr>
<tr>
<td>Washing</td>
<td>Plastic drum</td>
</tr>
<tr>
<td>Packaging</td>
<td>Candle/fire</td>
</tr>
<tr>
<td>Fuel</td>
<td>Fire wood</td>
</tr>
</tbody>
</table>

Table 4: The Type of Technology Used by Tempe Producers

Most of the tempe producers that located in the field study areas have not yet using the stainless steel production tools which are the standard tools for food production. Even though, all the producers aware of the importance of using these stainless steel as the food production tools.

The main consideration of tempe producers is to use traditional tools, is the price of the tools. Although stainless steel tools supply is available in the market but they prefer to choose cheaper tools which are not recommended to be used in food production.

3.2.2 Access to cleaner production practices
3.2.2.1 Level of awareness cleaner production practices

Tempe producers in each area are having the different awareness level regarding the importance of using stainless steel in food production. In Bogor and Gunung Kidul, the producers’ awareness level is higher compared to those in Lampung area, since Bogor and Gunung Kidul are the areas that have
ever been involved by the Mercy Corps program through technology promotion events or media and other channels (Mercy Corps Indonesia had been running the tempe development program for 6 years since 2009 to 2015. The main objective of program was to cut the carbon emission from tofu and tempe sector by promoting the new hi-efficiency equipment and better production method in several provinces in Indonesia)

This table below is showing the awareness level towards the tools.

<table>
<thead>
<tr>
<th>Location</th>
<th>Aware</th>
<th>Unaware</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bogor</td>
<td>95%</td>
<td>5%</td>
</tr>
<tr>
<td>Gunung Kidul</td>
<td>80%</td>
<td>20%</td>
</tr>
<tr>
<td>Bandar Lampung</td>
<td>60%</td>
<td>40%</td>
</tr>
</tbody>
</table>

Table 5: The producers’ awareness level through stainless steel product for food production

The following are several medias which also are influenced the awareness level of the tempe producers:

1. Mass Media (TV, Radio, Printed Media, Internet, Social Media, etc.).
   By the time the Mercy Corps was doing the program to tempe and tofu sector, the information regarding the stainless steel tools for food production were spreading massively through television, radio, newspaper. The information could reach tempe producers from others areas that had not been reached by Mercy program assistance before, such as Bandar Lampung.
2. Word of mouth
   The use of word of mouth was quite useful to accelerate the information’s spreading from one producer to another. The strategy was done by inviting the producers’ leader to visit the Indonesia Tempe House to observe the application of the new stainless steel tools.

The high level of awareness from the producers towards the new production tools are not always correlated with the technology adoption level, several things that hinder the farmers from adopting the new technology are:

1. No market incentive available towards tempe product that is made through more hygienic process. The consumers do not aware regarding the use of stainless steel tools in food production process. Eventhough, the producers are still using the traditional tools instead of stainless steel tools, the consumers will keep buy the producers’ product.
2. The expensive price of the tools. Stainless steel tools’ price are still quite expensive for the producers.
3. The minimum capital access. The producers have not access to get bank loan.

3.2.2.2 Access to equipment supplier and financial institution

At this moment the availability of tools for tempe production seems easy to find in several areas, mainly Java island. The tools could be obtained in stores and several Kopti. Recently, Kopti for the area West Java, Central Java and Jogjakarta, are the tools supplier and able to acquire the needs of the tempe producers. Kopti, in this case Kopti Bogor District, has been able to design its own production tools based on the need of the tempe producers.
Generally, the purchase of tools production in Kopti paid by cash. The unavailability of financial institution to fulfill the capital needs for the producers, has become the problem for them to adopt the new tools. Most of the producers have no access to financial institution.

<table>
<thead>
<tr>
<th>Area</th>
<th>Access to Equipments Supplier</th>
<th>Access to Financial Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bogor</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Gunung Kidul</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Bandar Lampung</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

**Table 6 : Producers Access to Financial Institution**

The difficulty access for the tempe producers to gain the capital from the financial institution is influenced by several factors, are:

1. Most of tempe producers do not have the business legalization. Most of producers do their tempe production in their house area. They do not have bussiness legalization as one of requirement to propose bank’s loan.
2. Tempe producers do not have warranty to get loan from bank
3. Tempe producers do not have financial administration that cause the feasibility business analysis is unable to be observed by the bank

### 3.2.3 Gender perspective

#### 3.2.3.1 Role of men and women

Most of the tempe producers are the small producers with the home industry business scale, where the involvement of entire family member become highly dominant. Most men are the owner of the business and main labor, meanwhile, women in this case, the wives are helping their husband’s work. The role between men and women in the tempe business is very obvious, as described in this table below:

<table>
<thead>
<tr>
<th>Women’s Role</th>
<th>Men’s Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packaging process, selling in the market, financial business management</td>
<td>Boiling, washing, cleaning, inoculating, fermenting, and transportation</td>
</tr>
</tbody>
</table>

**Table 7 : Men and Women Role in Production Process**

The number of women who are involved in the tempe industry is quite a lot. From the study result, could be inferred that 35% of the workers involved in tempe industry are women (including the family member).
3.2.3.2 The wages

From the aspect of wages, there is different amount of wages accepted by men and women since there is the different burden work level between men and women. The determination of wages is also counted based on the habits applied in one area. The table below, shows the wages comparison accepted by the men and women workers in the field study.

<table>
<thead>
<tr>
<th>Area</th>
<th>Man</th>
<th>Woman</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bogor</td>
<td>70000</td>
<td>40000</td>
</tr>
<tr>
<td>Gunung Kidul</td>
<td>60000</td>
<td>50000</td>
</tr>
<tr>
<td>Lampung</td>
<td>70000</td>
<td>30000</td>
</tr>
</tbody>
</table>

*Picture 16: Wages of man and women on study area*

Based on three study areas, the women are responsible in packaging process. They do not work in production process since it takes more men power to do production process that are still running manually. The woman workers in Gunung Kidul receive higher income than two study areas since the woman in Gunung Kidul do more complicated work. They have to wrappe tempe in small size with banana leaf that takes time in packaging process and need special skill. In Lampung and Bogor, tempe are wrapped in bigger size with plastic package that is more simple process of packaging.

3.3 Business Intermediaries

3.3.1 Agriculture Input Provider

Recently the agricultural input availability, such as fertilizer and agricultural medicine are available in stores that owned by the farmers group or individual. Stores network that provides this agricultural input has come to every village that serves well by the producer company of fertilizer and medication. But different things with soybean seeds, nowadays, the availability of qualified seeds of soybean cannot be found in the agricultural stores. For Cianjur and Central Lampung area, the farmers are getting the soybean seed by put aside the crop yields and make it as seed for the next planting season. Meanwhile, to obtain the certified soybean seed, the farmers do not have a good access unless if there is government program that provides free seeds.
In Gunung Kidul, the researcher found several actors that are able to provide soybean seed, such as Gapoktan (farmers group union) Sido Maju that focusing on becoming soybean seed growers and Balai Benih Induk Gunung Kidul (Seed center of Gunung Kidul) that is a government agency under Ministry of Agriculture.

Several problems that faced by the soybean seed provider recently are as follows:

1. There is limited time to keep the soybean seed, which can only be kept not more than 90 days. According to soybean seed Growers Farmers, if the soybean’s seed are being kept too long, it will decrease the quality of seed that will effect to the declining of production level. This obstacle lead to limited marketing area for soybean seed.

2. The differences of soil character that owned by the soybean farmers will cause the difference of production result although it already uses the same variety of seed therefore standardization of soybean’s quality is difficult to cope. Besides, every farmer has their own favorite towards several varieties soybean that makes them have to provide several varieties of soybean for every planting season.

3. The decreasing of farmer’s interest to plan the soybean. According to “Soybean Seed Growers Farmers”, during the planting season in 2016, the amount of farmers who are planting the soybean is declining, since the soybean cultivation is assumed unable to give an interesting profit for the farmers.

Aside from the lack of farmer’s access to the qualified seeds, the farmers also do not have the access to get the proper technology in soybean cultivation. At this moment, soybean cultivation is done traditionally by using many labor started from the land processing process towards to the harvest and post harvest. The process was done manually that makes the production cost become higher. The unavailability of the tools is caused by the minimum technology supply for the soybean farmers, since the technology producers have not seen farmers’ demand.

3.3.2 Government, Kopti and NGO role

**Government role**

*On farm*

The government role, in this case is The Ministry of Agriculture, in soybean sector is very crucial because government as a regulator will be very capable to fixing the Indonesian soybean farmers towards competitiveness. Recently, the government has a self-sufficiency program for several primary plants, such as rice, corn, and soybean, which are targeted in 2019 that all needs towards these commodities will be able to be fulfilled in our own country. From the field observation, could be seen that the activity given by government field officer to increase the production of rice, corn, and soybean were still based on project approach and did not focusing on sustainability aspect. Several programs that have been given by the government based on the field research are:

1. The soybean planting area expansion
2. Free in providing soybean seed, fertilizer, plant medication to the farmers
3. Providing the Field School program, which consist of Integrated Pest Control Field School (SLPHT), URBA Field School (soybean cultivation), and Local Wisdom Application in Agricultural
In running the programs, there was crucial thing that had not been touched by the government that was the soybean marketing aspect. It often happens when the farmers were being forced to plant soybeans, but there was no marketing channel prepared for them to sell their product. The impact of this condition was the fast declining of the soybean price produced by the farmers because there was no access to the market. The farmers became unwilling and having traumatic to plant the soybean since they did not get profit.

In the interview with the farmers, the main difficulty that is faced by them right now is the marketing aspect. Although, by the information from the farmers that Bulog has been given assignment by the government to cope the soybean crop yields with the price 7.500 rupiahs/kilo, but in reality, the strategy does not work.

According to the interview with The State Agency of Logistic (Bulog), currently, they do not absorb the local soybean because the low imported soybean price, which is 6500 rupiahs/kilo. Bulog is not capable to set on the local soybean by the price 7500 rupiahs/kilos because there will be no tempe and tofu producers who are interested to buy it without some subsidy given by the government. By the subsidy concept, assumed that Bulog will buy the soybean from the farmer for 7.500 rupiahs/kilo and will sell the local soybean with the assumption price is 6.500 rupiahs/kilos to the market, it means the government will bear the subsidy of IDR 1000 for one kilo. Assuming that in 2016, the soybean production in Indonesia will reach 1 million of tons, then the subsidy issued by the government was 1 trillion rupiahs/year to buy local soybean. Bulog is predicting that by the pattern of President Jokowi’s government, the subsidy policy is not easy to get the approval because occasionally considered not solving any problem.

For this reason, to cultivate soybean require the reformulate the government program and also select-modelling approach that determined by the government in order to get better result. Besides, the cooperation between ministry and the government agency is quite low because of the lack of communication between them, such as Bulog and Agricultural Institution. The ego-sectoral and lack of communication is still hown by each government institution.

**Off farm role**

The government, in this case, the Ministry of Industry becomes the main actor in supporting the soybean off farm sector that is part of tempe production sector. Nowadays, in Indonesia, the ministry that has actively supported tempe sector is the Ministry of Industry through Middle Small Business or Agroindustry General Directorate. Support that given by the ministry of industry often through the production tools support and food production training, but still in a very limited frequency and duration. The limitations of the financial and sector priority often become the problem that hindering the involvement of the ministry of industry to support the tempe producers in Indonesia.

**Kopti role**

Indonesia Tempe and Tofu Producers Cooperative or we have known as Kopti is one of the actor that holds the main role in tempe sector in Indonesia. Kopti is the cooperative established by the government in 1978 until 1980 which the main duty is to ditribute soybeans in Indonesia. Until 1997, there are more than 340 Kopti in Indonesia established by the government with the number of
member which is still active more than 115,000 tempe and tofu producers. Nowadays, the number of active Kopti in Indonesia is predicted only 80 Kopti since in 1998 the government was opening the imported soybean channel for the general importer. The inability of Kopti in competing and running the institution has become the main reason of the numerous closing Kopti in Indonesia. Aside from that, the tempe and tofu producers whose were used to buy the soybean to Kopti now prefer to buy the soybean to the private soybean distributor, for the cheaper price. Several things that became the weakness of Kopti now are:

1. No competitiveness that makes the member resigning from Kopti
2. The awkward management and full of bureaucracy organization
3. Limited human resources whereas the Kopti managers are elderly managers

Only a few Kopti who can survive until now, they have done several improvement in their management and also their business differentiation, such as opening the equipments production business unit, transportation business, saving and loan business, asset rental, tempe production unit.

Several potentials factors that are still able to be used by Kopti in supporting tempe producers now, are:

1. Relationship between the Kopti network in Indonesia. Currently there is Gakopti as the Kopti association in all over Indonesia and its function as the advocate to the other stakeholders such as government or soy importers
2. There are still many tempe producers that become the loyal member of Kopti which are reachable by Kopti

Some Kopti are potential to be project partners in future project are:

1. Kopti Cianjur
2. Kopti Bogor City
3. Kopti Bogor District
4. Kopti South Jakarta
5. Kopti Bandung
6. Kopti Bandar Lampung
7. Kopti North Lampung
8. Kopti Gunung Kidul
9. Kopti Sleman
10. Kopti Kulon Progo

**NGO (Non-Governmental Organization) role:**

Currently, there are only few of NGO who involved in improving soybean and tempe sector in Indonesia. After Mercy Corp program finished in 2015, at this moment Indonesia Forum Tempe (FTI) who still supports tempe sector project. Indonesian Forum Tempe (FTI) is a non-profit institution who is focusing in improvement of tempe production process through application of hygienist standard on production and campaign regarding the benefit of consumes tempe for people’s health to society in Indonesia. FTI cooperates with RTI (Indonesia Tempe House) as a role model of tempe
factory in Indonesia. FTI also cooperates with university, nutrition practitioner and society of nutrition practitioner in promoting tempe widely.

### 3.3.3 Technology provider for tempe producer

Currently, the availability of the tempe production equipments can be obtained at equipments stores in several places such as Jakarta, Bandung, Bekasi, Surabaya and Malang. Those equipments stores are usually providing the soybean peeling machine and other production equipments. Besides in the equipments stores, Kopti network is also providing the production equipments for tempe producers, mostly, those equipments are produced by Kopti of Bogor District and distributed by Kopti in West Java, Central Java and Jogjakarta. In order to increase the access of tempe producers towards the more efficient production tools, there are a few things required a solution to get improvement, those are:

1. The high price of the tools production because of the expensiveness of the raw material
2. The unfairly distribution and the unavailability of equipments in every area, especially in the area outside Java island
3. The unavailability of financial mechanism to support tempe producers to adopt the new equipments

### 3.3.4 Financial Institution

The financial institution plays an important role to support the development of soybean and tempe industry in Indonesia. But in reality, until now, there have not been many financial institutions that give opportunities to small micro business, especially the farmers and tempe producers to get financial support.

Several requirement are needed by the financial institution, in this case bank, in order to serve farmers and tempe producers are as follow:

<table>
<thead>
<tr>
<th>Farmers</th>
<th>Tempe Producers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmer legality</td>
<td>Producer legality</td>
</tr>
<tr>
<td>Bussines legality</td>
<td>Bussines legality</td>
</tr>
<tr>
<td></td>
<td>Financial report</td>
</tr>
<tr>
<td></td>
<td>Colateral</td>
</tr>
</tbody>
</table>

**Tabel 8:** Bank requirements to process the loan for farmers and tempe producers

The entire requirements asked by the bank are not easy to be provided especially by the tempe producers because the tempe industry are basically home industry that have no business legalization and never preparing the business administration.

Some bank such as BRI, BNI and Mandiri usually are more accessible to the farmers and tempe producers since these banks have a branch in to village level. Currently only the big farmers and big producers can acces to bank loan facility but not with the small one since there are not available the special loan for small farmers or small tempe producers that need only less than 5 million rupiah.

### 3.3.5 Soy flour user
The usage of tempe flour as the raw material now has already been done by few enterprises just several years ago. The soy flour users started their business in commercial level since they got a quality tempe from advance tempe producers is Rumah Tempe Indonesia in Bogor or Rumah Tempe in Gunung Kidul. Several products that are produced from tempe’s flour as its ingredient and have been commercialized are:

<table>
<thead>
<tr>
<th>Product type</th>
<th>Produce by</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tempe biscuit</td>
<td>CV.Nutri Local Food, base on Depok City</td>
<td>Product brand are Caroma, Catema, Temma and Bisma. This company got supply of tempe flour from PT. HBM Bogor</td>
</tr>
<tr>
<td>Tempe cereal</td>
<td>PT.Harapan Bunda Mandiri (HBM), base on Bogor</td>
<td>This company got tempe supply from Rumah Tempe Indonesia Bogor and produced tempe flour and tempe cereal</td>
</tr>
<tr>
<td>Baby porridge</td>
<td>PT.Kalbe Farma</td>
<td>This company got tempe supply from Rumah Tempe Indonesia Bogor and still develop product base on tempe</td>
</tr>
<tr>
<td>Food Suplement</td>
<td>LIPI Gunung Kidul, Jogjakarta</td>
<td>This was a research agency and got tempe supply from Rumah Tempe Gunung Kidul</td>
</tr>
</tbody>
</table>

**Tabel 9 : Existing tempe flour users**

Several few products are still being developed, such as the development product made by LIPI in Gunung Kidul. The usage of tempe flour for biscuit or tempe cereal is 30% from the product weight that is produced. And to producing one kilo tempe flour needs 3 kilos of fresh tempe. If this processing sector could be strengthened and scale up, it will be a potential market from the tempe product that has been produced within the hygienic ways.
4. Problem Analysis and Underlying Causes

4.1 Problem Analysis

Based on the desk study and the field trip result, the researcher found and divided the problems of the soybean and tempe sector into two areas, which are on farm area and off farm area. Those problems are as follows:

On Farm (Soybean Cultivation)
1. The unavailability of soybean seed as requested by the market demand fairly. To provide the need of seed, most of the soybean farmers kept some of their crop yield to be planted in the next season of planting, some of them were buying the seed from the retail farmer. These situations was occured because the unavailability of superior soybean seed whether in store or in agricultural input selling place.
2. The unavailability of proper technology for the cultivation process and post-harvest. Now, generally, the soybean farmer is only using the farmer tools that existed, such as hoe and other simple tools, that makes the use of human labor is still dominant, causing the high of production cost. The minimum of tools availability because there is no supply technology from the industry or the tools workshop.
3. Lack of Good Agricultural Practices (GAP) during the production. During the primary data collection process in three different areas, researcher identified different agriculture practices. The agriculture practices have also been determined by the level of the maturity of the market. In Jogjakarta, where the market is more mature, the competition is hard, which cause the farmers to conduct better agriculture practice with the hope to have more efficient cost, hence receiving better profit.
4. The unavailability of financial support. Currently, agricultural sector is not interested in dealing with bank because it is assumed to have a high risk. There is not a regulation to help farmers to get the access to bank.
5. Lack of market information (specification, amount, channel, etc.). Most of the soybean farmers in study areas never knew about the requirements of soybean specification for tempe production.

Off farm
1. The minimum of tempe producers’ skill and knowledge about how to produce a proper food (Good Hygienic Practices), from the cleanliness aspect of factory area, product processing, also the cleanliness of the worker.
2. The limitations of the adoption towards technology is caused of the minimum of funding access, which the producers are difficult to get the capital support in order to improve the tempe production, from the aspect of proper tools provision to produce the food and also to improve the production work area.
3. The minimum of market access for the tempe product to be processed more hygienic and the unavailability of incentive that could be obtained by the tempe producers who produce the qualified tempe since there is low awareness of customers regarding hygienic food production.
**Problem analysis matrix**

From the problems identified, researcher then identifies root causes of the problem. The objective of identifying the root causes of the problems, we could provide intervention recommendation for future programming.

<table>
<thead>
<tr>
<th>Problems</th>
<th>Impact</th>
<th>Underlying causes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>On Farm</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Lack of access to affordable, good quality seedling</td>
<td>The farmers are retaining seeds which has been used for years</td>
<td>Not clear business case/business feasibility for seed company to invest</td>
</tr>
<tr>
<td>2. Lack of access to appropriate technology</td>
<td>High production cost, low competitiveness</td>
<td>Not clear incentive for technology supplier to invest and promote appropriate technology</td>
</tr>
<tr>
<td>3. Lack of Good Agriculture Practice</td>
<td>High production cost, low competitiveness</td>
<td>Lack of incentive for farmers to conduct good agriculture practice</td>
</tr>
<tr>
<td>4. Lack of access to financial products</td>
<td>Low quality, low competitiveness</td>
<td>Banks are not convinced with farmers’ prudence</td>
</tr>
<tr>
<td>5. Lack of market information</td>
<td>Not meet the demand requirement</td>
<td>No linkages between market players</td>
</tr>
<tr>
<td><strong>Off Farm</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Lack of hygienic business process</td>
<td>Low quality, low competitiveness</td>
<td>Lack of information on good hygienic processing, Lack of incentive</td>
</tr>
<tr>
<td>2. Lack of access to appropriate processing technology</td>
<td>Low quality, high production cost, low competitiveness</td>
<td>Lack of access to finance and incentive for adopting new appropriate technology</td>
</tr>
<tr>
<td>3. Lack access to market for improved (hygienic ) products</td>
<td>Low margin, low incentive for producers to adopt the new technology</td>
<td>Lack of information to access higher market segment</td>
</tr>
</tbody>
</table>

Table 10: Problem Analysis Matriks

### 4.2 Potential intervention recommendation

Based on the above problem and underlying has caused matrix, researcher would like to recommend hereunder interventions:

#### 4.2.1 On farm intervention

Theory of Changes: By providing farmers affordable high quality soybean seedling, appropriate technology, affordable financial product and market information, it is expected that production cost of local soybean cultivation process will be reduced, hence improving farmers’ competitiveness against imported raw material.
Intervention #1: Piloting high quality and affordable soybean nursery center

Rationale: Demand of new high quality seeds is growing. Farmers are looking for alternative variety which has better quality, accessible, and affordable. Despite of that further feasibility study on nursery business calculation needs to be conducted, a controlled nursery center will give a strong business case for the stakeholders to consider using local product and cut some delivery cost, therefore farmers will see clearer the incentive to continue growing soybean.

Nursery center has to be managed professionally, operated by private sector or farmer group association, to ensure the availability, the wide coverage of area, and good distribution system.

Proposed business model:

The project will work directly with private sector or farmer group union and provide the clear business plan of nursery center. Some activities must be conducted by project to build the capacity of private sector or farmers group union to running the nursery business such as training on business management, soybean cultivation, agriculture technology and others. Project will support and co-invest to build some facilities such as green house, equipment for cultivation and post harvest equipments. On these business model the nursery center will provide the seed and technical assistance to the farmers group on cultivation to increase the yield.

On this intervention the nursery center also become a marketing agent to sell the soybean from farmers to potential buyers such as tofu tempe cooperative or soybean traders. To minimize the marketing gap the nursery center must build the market information system to connecting the supply and demand information.

Intervention #2: Co-Invest with Private sector to produce and promote appropriate technology for on farm purposes
Rationale: One of the most effective interventions to reduce production cost, is to apply appropriate technology. This intervention will provide proper cost and benefit analysis for private sector to produce prototype of appropriate and affordable technology, to be offered to farmers.

Proposed business model:

The project will work directly with farmers group union and technology provider and will be overing the clear business model and business plan. Project will facilitate the business linkages between technology provider and farmers group union to develop and promote the suitable technology for soybean farmers. The technology must be developed based on local need and it must be proven its quality before promote it to the farmers. The technology must be used to decrease the production cost, increase the yield and improve the soybean quality. The technology provider will sell the technology to farmers group union and distribute it to farmers group through loan mechanism. On farmers group level, the equipment will be rented to the farmers since the technology can be used collectively. This business model will also cover the gap of marketing information on the market chain. The project will work with farmer group union to distribute the information about soybeans’ demand to the farmers and share the quality and quantity of farmer’s soybean information to the soybean buyers. The farmers group union can be collaborated with Kopti in its area and develop business linkage.

**Intervention #3: Developing affordable and accessible financial scheme with existing financial institution**

Rationale: Existing financial products are considered to be inaccessible for the farmers. Existing regulation is not in favor for the farmers. This intervention will develop common understanding between market actors (farmers, input suppliers, and financial institution) to develop appropriate product. Involvement of relevant government agencies and government owned banks (BRI, BNI, Mandiri) will be imperative.
Proposed business model:

The project will be work to facilitate the business linkages with Bank and farmer group union. The clear business plan should be developed that meet with farmers needs. Bank will provide the capital for soybean cultivation through farmers group union. This capital will be used by farmers group union to provide the input supply and services to farmers through farmers group. To pay the input supply and services to farmers group and farmer group union the farmers will use the soybean and calculate base on updated price. Strengthening the role of farmers group union is the success key of this intervention.

4.2.2. Off farm intervention

Theory of Changes: By providing access to information on production improvement process, access to appropriate technology, and higher market segments, it is expected that processors will increase their quantity and quality of their products, diversify their market, and receive higher profit.

Intervention #1: Co-invest with private sectors to build or optimise the existing tempe model factory

Rationale: Tempe producers have unique characteristic, since they have a low education. To promote the new production standard and technology to them need an real example through build a model factory. The model factory will demonstrate and produce tempe with new production standard, new equipment and the new potential market. This facility also will be used to train the existing tempe producers or new tempe producers to adopt new standard. The intervention will collaborate with Kopti and another private sector to build or optimize existing model factory and create the incentive for all involved stakeholders.
Proposed business model:

The Project will work with Kopti and private sector (can be soybean trading company or technology provider) to build or optimize the Rumah Tempe as the tempe model factory. Colaborated with Kopti can be useful to reach more tempe producers. Building the model factory on Kopti asset will avoid the individual claim of the facility ownership since Kopti is belong to tempe producers. We expect that the private sector partner will invest on model factory and maybe use this facility for publication activities and educate the tempe producers about their product. On this intervention, the project also will contribute to build and optimize the model factory by cover some equipments cost or another infrastructures that can’t supported by another parties.

Intervention #2: Providing technical assistance in good hygienic processing practice to tempe producers

Rationale: Embedded service provided by private sector (Kopti or other) to the tempe producers will provide incentive for both producers and the private sector. The intervention will provide clear business case (cost and benefit analysis) for the private sector if they are willing to invest in providing embedded service to the processors. The intervention will cover some risks faced by the supplier in developing initial business model.

Proposed business model:
In this intervention, the project will work directly with FTI (Indonesia Tempe Forum) and Kopti. Project will co-fund FTI to provide the capacity building on Good Hygiene Practices (GHP) and give technical assistance to Kopti to build or optimized Rumah Tempe as the model factory. Kopti will provide service, assistance and technology for tempe producers through Rumah Tempe and that will be an embedded service to Kopti members.

**Intervention #3 : Co-invest with private sector to produce and develop tempe base product**

Rationale: To push and open new market for tempe with a better production process, the co-invest with existing manufacturers who produce product based on tempe, can be scaling up and expand the market for many kind of product based on tempe. The intervention will provide clear business model for private sector to enter the new market. Some linkages with tempe producers, tempe flour producer and market for product based on tempe will be built and will supported by project and some risks will be covered by the intervention.

Proposed business model:

On this intervention the project will be co-invest with selected private company who produce the product based on tempe. The main objective of this intervention is to scale up the business size and pull demand of quality tempe. Project will support the private sector to build the knowledge on business management, marketing, production technology and others.

**Intervention #4: Branding, promotion, and marketing of improved product to higher market segments**

Rationale: both domestic and international demand for soybean products is increasing. The growth of the market is not merely for mid-low market. Healthy life-style behavior has been adopted by mid-level market. Market size of healthy and improved soybean based product is big. The intervention will identify the market, and provide support to market actors (processors) to brand their product, and link them with appropriate markets.
Proposed business model:

Project will also support the Rumah Tempe and private company who produce product based on tempe and conduct several promotion through business gathering, advertising activities, consumers education and exhibition. The aim of this business model is to strengthen the image of tempe and introduce the product based on tempe to potential consumer and prepare the project partners to manage the marketing activity.
Annex 1

Contact list of potential partners

<table>
<thead>
<tr>
<th>No</th>
<th>Contact Person</th>
<th>Institution</th>
<th>Phone/email</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mr. Sukhaeri</td>
<td>Kopti Bogor District</td>
<td>(+62)81317435000</td>
</tr>
<tr>
<td>2</td>
<td>Mr. Mochtar Satrie</td>
<td>Kopti Bogor City</td>
<td>(+62)87870264496</td>
</tr>
<tr>
<td>3</td>
<td>Mr. Sutaryo</td>
<td>Kopti South Jakarta</td>
<td>(+62)85695357669</td>
</tr>
<tr>
<td>4</td>
<td>Mr. Asep Nurdin</td>
<td>Kopti Bandung</td>
<td>(+62)81321590278</td>
</tr>
<tr>
<td>5</td>
<td>Mr. Hugo</td>
<td>Kopti Cianjur</td>
<td>(+62)8122353852</td>
</tr>
<tr>
<td>6</td>
<td>Mr. Triharjono</td>
<td>Kopti Gunung Kidul</td>
<td>(+62)81802747034</td>
</tr>
<tr>
<td>7</td>
<td>Mr. Naryo</td>
<td>Kopti Sleman</td>
<td>(+62)8121596067</td>
</tr>
<tr>
<td>8</td>
<td>Mr. Heri</td>
<td>Kopti Kulonprogo</td>
<td>(+62)2747133707</td>
</tr>
<tr>
<td>9</td>
<td>Mr. Rivai</td>
<td>Kopti Kendal</td>
<td>(+62)81329045209</td>
</tr>
<tr>
<td>10</td>
<td>Mr. Alim</td>
<td>Kopti Bandar Lampung</td>
<td>(+62)8127899350</td>
</tr>
<tr>
<td>11</td>
<td>Mr. Supri</td>
<td>Kopti North Lampung</td>
<td>(+62)81369706619</td>
</tr>
<tr>
<td>12</td>
<td>Mrs. Mien Karmini</td>
<td>PT. Harapan Bunda Mandiri, Bogor</td>
<td>(+62)811110936</td>
</tr>
<tr>
<td>13</td>
<td>Mr. Endang</td>
<td>Rumah Tempe Indonesia, Bogor</td>
<td>(+62)81220584666</td>
</tr>
<tr>
<td>14</td>
<td>Mrs. Fathmah</td>
<td>Rumah Biskuit, Depok</td>
<td>(+62)8129998139</td>
</tr>
<tr>
<td>15</td>
<td>Mrs. Sherly</td>
<td>FKS Multi Agro</td>
<td>(+62)811808160</td>
</tr>
<tr>
<td>16</td>
<td>Mr. Singgih</td>
<td>PT. Jakarta Cereal</td>
<td>(+62)811103922</td>
</tr>
<tr>
<td>17</td>
<td>Mr. Sumari</td>
<td>Gapoktan Sido Maju, Gunung Kidul</td>
<td>(+62)81328060814</td>
</tr>
<tr>
<td>18</td>
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Annex 2

Documentation photo

Quality seed produced by farmers group union in Gunung Kidul, Jogjakarta

Soybean cultivation in Gunung Kidul. Mt of farmers in study area applied the mix crop mechanism

Kiosk belong to farmer group union in Lampung used to distribute the input supply to the farmers

Farmer in Gunung Kidul drying the soybean using the traditional method
Comparation of local and import soybean: A Local soybean variety rajabasa. B Local soybean variety grobogan. C Import soybean US #1. D Import soybean US#2

Farmers in Cianjur is selling the unmature soybean to use as vegetable for consumption

Group discussion with farmers group in Wonosari Gunung Kidul, Jogjakarta

Researcher met farmers from farmers group in Central Lampung
Woman workers are doing packaging activities on small tempe factory in Lampung

Woman workers on small tempe factory in Gunung Kidul is wrapping tempe with banana leaf

Cooking equipments are using used oil drum to cook soybean in Lampung and same condition in another study areas

Male workers is washing the soybean on poor sanitation condition tempe factory in Bogor

New technology and new equipment used to produce tempe in Rumah Tempe Indonesia Bogor
Workers in Rumah Tempe Indonesia are using the uniform and applied the Good Manufacturing Practices procedure.

Tempe flour made by LIPI Gunung Kidul, used for additional food for children under 5 year.

Tempe biscuit made by Rumah Biscuit in Depok, this product has been sold to supermarket in Jakarta, Depok and Bekasi.