Value stream and Waste Analysis in the Tempe Production System in Trenggilis Kauman Surabaya

Soffia Pudji Estiasih[1], Lulus Margiati[2], Tri Titut Rahayu Ningsih[3], Rahaju Saraswati[4]

[1,2,3]*Postgraduate Program University of WR Supratman Surabaya, Indonesia*

[4]*Industrial Engineering University of WR Supratman Surabaya, Indonesia*

Abstract: **As Indonesia's favorite food, Tempe-making centers can be found in almost every region. No exception in Surabaya, East Java. One of the biggest tempe centers in the City of Heroes is in the Tenggilis District. Tenggilis Kauman, an area in the east of Surabaya, has been a long time until now many of its citizens produce tempeh so that the area is known as a village of tempe. It is estimated that there are approximately 20 MSMEs (Micro, Small and Medium Enterprises) that produce tempe. The problem often faced by tempe entrepreneurs in Trenggilis Kauman is an inefficient production system, there is still a lot of waste and non value added activity that occurs in the tempe value chain flow. Waste waiting, defective products, excess production and inventory still occur frequently. Because of this condition, researchers conducted lean manufacturing studies and tempe business models to revitalize the small-scale Tempe Industry in Trenggilis Kauman Surabaya. The purpose of this study is to identify wasteworkshop and minimize activities that have no added value to the tempe production system in Trenggilis Kauman Surabaya.**

The method used in this research is Waste workshop identification, Value Stream Analysis Tool (VALSAT) and Canvas Business Model. Waste workshopquestionnaire is used to identify the type of waste that often occurs in the process of production of tempe in the village of Tempe Trenggilis Kauman Surabaya. Value Stream analysis Toll is used to determine the mapping tool that will be used to map activities, lead time, demand, production quantities, defective products in the tempe production system. While the CANVAS business model is used to restructure the tempe business process in Trenggilis KaumanSurabaya.

Based on the workshop waste questionnaire, it is known that the most frequent waste in the tempe production system in Trenggilis Kauman Surabaya is the type of waste waiting and excessive transportation activities.Based on the process activity mapping in the tempe production process above it is known that the value-added activity is 62.5 %, while the non-value added activity for the tempe production process in Trenggilis Surabaya is 37.5 %.For the tempe business model in Trenggilis Kauman Surabaya, it is necessary to continuously innovate to adjust to the conditions of the Tempe business competition level both in Indonesia and in the World

Keywords: **tempeindustry, waste, VALSAT, tempe business model**

I. INTRODUCTION

The value chain concept is a concept developed by Porter in 1985 (Dagmar Recklies, 2001) (O'Brien & Maracas, 2011) which views a company as a series or network of basic activities that add value to products or services and add value margins to both for the company and its customers. Value chain analysis describes activities in and around the organization and relates them to the strength of corporate competition (Dagmar Recklies, 2001) (O'Brien & Maracas, 2011). As Indonesia's favorite food, tempe-making centers can be found in almost every region. No exception in Surabaya, East Java. One of the biggest tempe centers in the City of Heroes is in the Tenggilis DistrictTenggilis Kauman, an area in the east of Surabaya has been a long time until now many of its citizens produce tempeh so that the area is known as a village of tempe. It is estimated that there are approximately 20 MSMEs (Micro, Small and Medium Enterprises) that produce tempeh. Nearly 80% of tempeh produced in Trenggilis Kauman Surabaya is sold in traditional markets by the producers themselves or through middle people. At present, only a small number of tempe industries in Tenggilis Surabaya can compete and sell in the upper middle market, such as supermarkets, restaurants, hotels and other places. One of the reasons is that the tempe product value chain has not been optimal and there is a gap between soybean demand and supply in Indonesia for decades which has triggered dependence on imported soybean (Nur Hasan Erma Suryani & RullyHendrawan, 2015) With the onslaught of modern food types today, making industry tempe is increasingly facing a high level of competition, so the main problem facing the tempe industry in Tenggilis Surabaya is how to create high value in tempe products so that it attracts many consumers, and can compete in the global competition era as it is today. Because of this condition, researchers conducted a soybean supply chain, waste workshop study and tempe business model to revitalize the small-scale Tempe Industry and to support the production of Gender-based Tempe in Tenggilis Kauman Surabaya.

II. LITERATURE REVIEW

Profile of Tempe Companies in Indonesia

Tempe is a fermented food that contains a lot of protein, which is based on soy. Tempe is one of the cheapest sources of protein in Indonesia. In Indonesia, this food has been known for centuries, especially in Javanese culture, unfortunately, the condition of the tempe industry

and soybean cultivation in Indonesia faces many problems. Although Indonesia has a large number of local soybean varieties, in reality, local farmers have not been able to produce enough soybeans to meet consumption needs. Of the total local needs of 2.6 million tons/year, currently, 70% of soybean needs in Indonesia are imported from other countries, mostly from the United States. In 2015, Indonesia imported 1.67 million tons of soybeans (source: Ministry of Agriculture 2015). It is estimated that there are more than 95,000 tempe SMEs in Indonesia, of which 80% are in Java. Every year, the needs of the tempe industry sector for soybean raw materials estimated at 1.5 million tons (source: Rumah Tempe Indonesia 2012, Entrepreneurship Training Module).

Tempe industrial scale has many variations, started by the home industry which manages 10 kilograms of soybeans/day, followed by an industrial scale that manages more than 3 tons of soybeans/day. Based on data published by Mercy Corps Indonesia in 2010, the tempe industry sector in Indonesia is estimated to employ 285,000 people (40% of that number are female workers). Because most of the tempe business scale in Indonesia are small producers, the average workforce needs in the tempe sector are 3 people for each small and medium business including the business owners themselves. Therefore, the majority of tempe production is mostly done at home and involves all family members.

Lean Thinking

The main purpose of lean thinking is how to reduce waste in the supply chain, for that, the first critical step that needs to be taken is to equalize the vision and perception of waste that will be able to reduce waste as a whole. In a production system, there are seven types of waste with the characteristics of each waste is as follows:1. Over productions can also be interpreted as overproduction, namely making or producing products excessively due to poor information flow and physical flow.2. Waiting or delayNamely inefficient use of time and waiting too long for the next process this waste occurs when goods are not moving or not being worked on.3. Excessive transportation number of transportation activities, namely the movement of people, material that is too excessive causes a waste of time, effort and cost.4. Inappropriate processing namely the process is not appropriate due to the work process using tools or machines that do not match the capacity and ability of an operation.5. Unnecessary inventory is unnecessary inventory due to excess goods stored which causes the cost of supplies to swell6. Unnecessary motion namely the movement is less necessary. workplaces and equipment that are not ergonomic cause operator difficulties which will eventually lead to fatigue resulting in low productivity and quality.7. Defect or product defects that often occur due to errors in workmanship, product quality problems, and poor product delivery speaking of waste, there are 3 types of activities in an organization related to waste, these activities are classified as follows:1. Value-adding activity involves changing the processing of raw materials/semi-finished products using manual labor. These activities such as sub-assembly parts, forging raw materials, painting bodywork and so on 2. Non-value adding activity is waste that involves unnecessary actions that are eliminated in a production process. These activities are like waiting time, accumulation of intermediate products, double handling, and so on. 3. Necessary non-value adding activity is an activity where consumers do not make a product/service more valuable but necessary because if it is not done then the Supply process will be disrupted. This waste is more difficult to minimize in the short term but must be minimized for long-term targets. An example of this activity is going a long way to get parts, unpacking, deliveries, moving tools and hand to hand.

Business Model

Business Model Canvas (BMC) is the same language for describing, visualizing, evaluating, and changing business models (Osterwalder and Pigneur, 2012). This concept can be a language for sharing ideas that enable describing business models easily and manipulating business models to create new alternative strategies. Osterwalder and Pigneur (2010), dividing the business model into nine main components, then separated again into the right component (creative side) and left (logic side). Just like the human brain. The nine components are as follows, (sorted from right to left). Customer Segments, Value Propositions, Channels, Customer Relationships, Revenue Streams, Key Resources, Key Activities, Key Partnerships, Cost Structure.

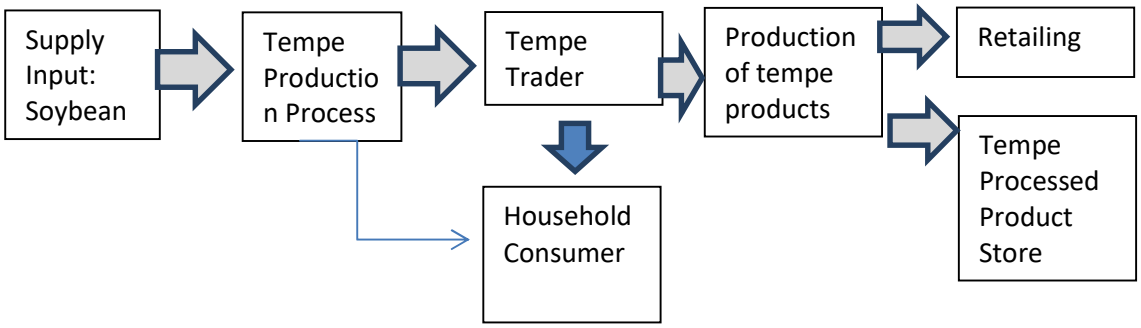
Several components should be in the business model (Hermawan, Aji and Rachel, 2013): (1) Value sent to customers: customer segments, the value proposition, the specific "job to be done", what it is sold and what to be sold, (2) How does the value reach customers: critical internal resources and process as well as internal partnerships, (3) How to collect revenue: the pricing model and form of monetization, (4) What is the company's position between industries others: the company's roles and relationships across the value chain. then a financial analysis can be performed, namely Revenue Stream, namely main income and other income. The second Cost Structure is the cost of production (Ardiana, 2014).

IV. RESULTS AND DISCUSSION

Big Picture Mapping

Big picture Mapping is used to map the tempe supply chain system in Trenggilis Kauman Surabaya. Based on the mapping, it can be known globally that activities have added value and activities that do not have added value in the supply chain of tempe products. Soybean big picture Mapping (Tempe) for Trenggilis Tempe Industry,

Mapping the soybean value chain (tempe) starting from the supply and production of soybeans (soybean farmers), Collection (traders), Processing (tempe production, tempe chips), and Retailing (markets local boundaries, supermarkets, restaurants) (Figure 2)



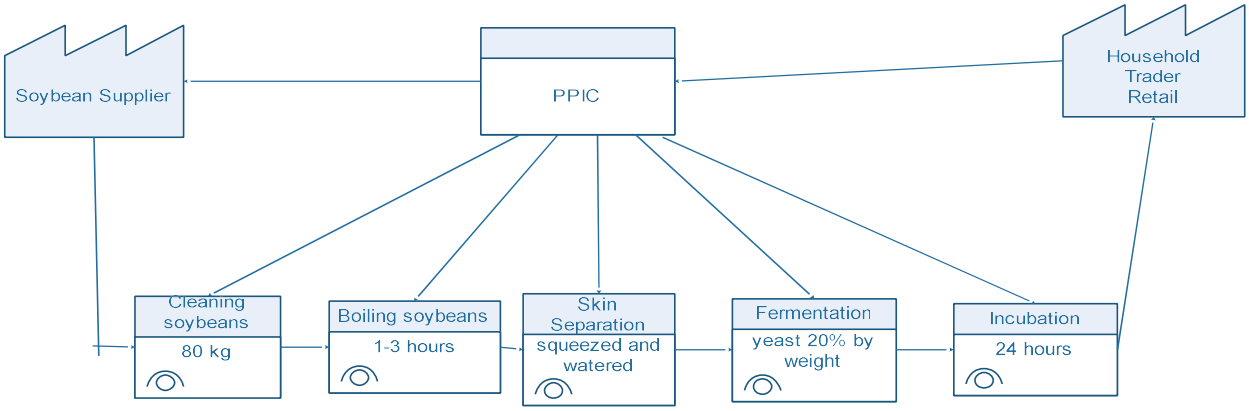


Figure 1 Big Picture Mapping

Waste Workshop Identification

Value Stream Analysis begins by analyzing the Waste Workshop on the tempe production system in Trenggilis Kauman Surabaya, the analysis method used to obtain as much input as possible about the waste that occurs in the tempe value chain system or the tempe production system. The main objective and Waste Workshop is to equalize perceptions about waste to obtain a common goal that will facilitate improvement in the tempe production system in Trenggilis Kauman Surabaya.

In this research, the identification of Waste Workshop is conducted by interviewing by filling out questionnaires on personnel who are considered to represent the Value Stream tempe production system in Trenggilis Kauman Surabaya. The personnel read the description of each waste and gave a score for each waste according to what they observed at the tempe production site. Questionnaire or list of questions compiled to determine the weight of waste by considering the intensity factor of the waste. The waste identification results are as follows:

Table 1. Results of the Waste Workshop Questionnaire

No	Waste	Scores
1	*Over Production*	1
2	*Waiting*	3
3	*Excessive Transportation*	3
4	*Inappropriate Processing*	2
5	*Unnecessary Inventory*	1
6	*Unnecessary Motion*	2
7	*Defects*	2

Information :

1. Explanation of types of waste

- Over Production: Overproduction
- Waiting: Use unnecessary time
- Excessive transportation: The number of transportation activities
- In Appropriate process: an improper process
- Unnecessary inventory: Unnecessary inventory
- Unnecessary motion: Unnecessary movement

- Defect: Product defect

2. Explanation of Assessment

- 1 = Small Amount of Waste
- 2 = Medium amount of waste
- 3 = Amount of Waste Many (often happens)

Value Stream Analysis Tools (VALSAT) Tempe Production System

This value stream analysis tool is obtained from the multiplication results between the scores of each type of waste from the workshop waste identification results, with the correlation value between the tools and the waste that occurs, such as the following table:

Table 2. Correlation of Waste to Tool

Waste	Tools						
	Process Activity Mapping	Supply Chain Response Matrix	Production Variety Funnel	Quality Filter Mapping	Demand Amplification matrix	Decision Point Analysis	Physical Structure
Over Production	**L**	**M**		**L**	**M**	**M**	
Waiting	**H**	**H**	**L**		**M**	**M**	
Transport	**H**						**L**
Inappropriate Processing	**H**		**M**	**L**		**L**	
Unnecessary Inventory	**M**	**H**	**M**		**H**	**M**	**L**
Unnecessary Motion	**H**	**L**		**H**			
Defects	**L**						
Overall Structure	**L**	**L**	**M**	**L**	**H**	**M**	**H**

Catatan: *H : High Correlation, M: Medium Correlation, L : Low Correlation*

Table 3 VALSAT

Waste	Weight	Tools						
		Process Activity Mapping	*Supply Chain Response Matrix*	*Production Variety Funnel*	*Quality Filter Mapping*	*Demand Amplification matrix*	*Decision Point Analysis*	*Physical Structure*
Over Production	1	1	3		1	3	3	
Waiting	3	27	9	2		9	9	
Transport	3	27						9
Inappropriate Processing	2	18		6	2		2	
Unnecessary Inventory	1	6	9	3		9	3	1
Unnecessary Motion	2	18	2		18			
Defects	2	2						
Total Bobot		99	23	11	21	21	17	10
Ranking		**1**	**2**	**6**	**4**	**3**	**5**	**7**

So based on the VALSAT (Value Stream Analysis Tool) method, the mapping tool used is Process Activity Mapping, Supply Chain Response Matrix, and Demand Amplification Matrix. The Process Activity mapping for the soybean production process is as follows:

Tabel 4. *Process Activity Mapping*Tempe Production System

No.	Phase	Activity	Activity Types					Machine /Tools	Distances (m)	Time (hours)
			O	T	I	S	D			
1	1 Warehouse (Storage of Raw Materials)	Transport of soybean		T					3	3
2		Quality inspection of raw materials (soybeans)			I					1
3	Production Process of tempe	Transport of soybeans		T					2	0,20
4		Cleaning of soybeans	O							2
5		Boiling of Soybeans	O							3
6		Separation of the skin	O							3
7		Fermentation	O							2
8		Incubation	O							24
Total Operation			5	2	1					38,2
% Value Adding			0,625	0,25	0,125					

Based on the process activity mapping in the tempe production process above it is known that the value-added activity is 62.5 %, while the non-value added activity for the tempe production process in Trenggilis Surabaya is 37.5 %

Cause and Effect Analysis

Cause and Effect Analysis (fishbone diagram) is a tool that can be used to identify the root cause of a problem. Fishbone diagrams in this study are used to analyze the root causes of waste that occur in the tempe production system in Trenggilis Kauman Surabaya. The filling of the waste questionnaire is aimed at employees who really know the conditions of the tempe production process. The results of the questionnaire are in the form of critical waste from 7 waste that occurred. From these results can be built a cause and effect analysis to identify the impact and root causes. Cause and effect analysis in this study can be seen in the picture as follows

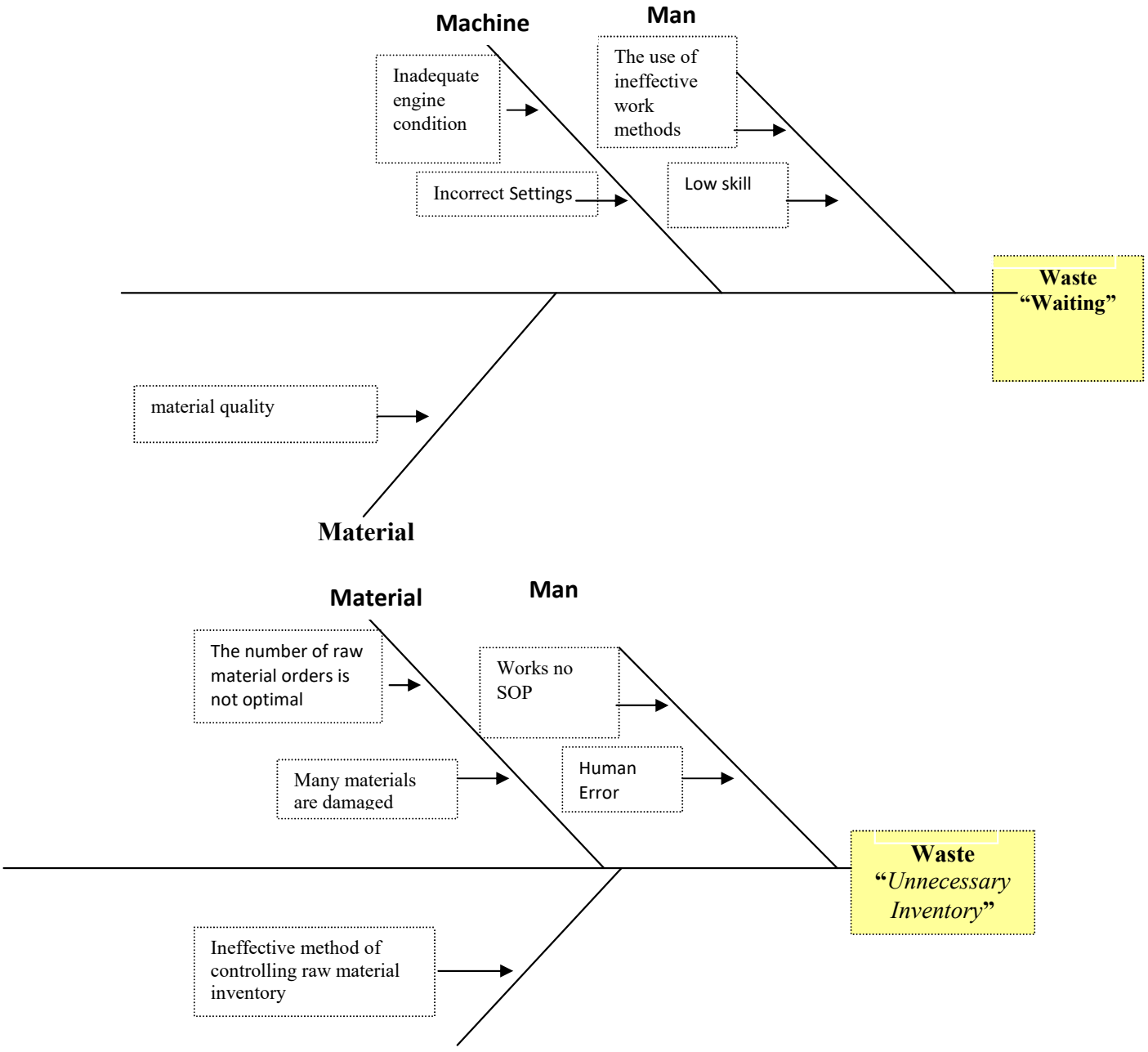


Figure 2 Fishbone diagram for waste waiting and excess inventory

The following table shows the results of problem brainstorming and impacts for excessive types of transportation waste, unnecessary movements, waiting times, improper processes, excessive production, product defects, and inventories that are not essential for tempe production systems.

Table. 5 Recapitulation of Problem and Impact Values for the seven types of waste

Waste	Problem	Impacts	Scores				
			1	2	3	4	5
Excessive transportation	Workplace layout that is not optimal	Cause many material handling activities					*
Unnecessary movement	System and work methods that are not ergonomic	Fatigue and work inconvenience			*		
Waiting time	Ineffective and efficient production processes	Manufacturing Lead Time becomes longer, Losing customers					*
Inappropriate Process	Inappropriate Process	Many defect products, low machine utility					*
Overproduction Process	Inappropriate Process	Many scrap				*	
Defects	Inappropriate Process	Manufacturing Lead Time becomes longer				*	
Unnecessary Inventories	Ineffective and efficient production process	WIP increases			*		

Development of Tempe Business Model in Trenggilis Kauman Surabaya

For the development of the tempe business model, the CANVAS business model was used in this study. The CANVAS business model is a method for developing or innovating a business model on one page of paper, which includes the components as key partners, key activities, value prepositions, customer relationships, customer segments, key resources, channels, cost structure, and revenue streams.

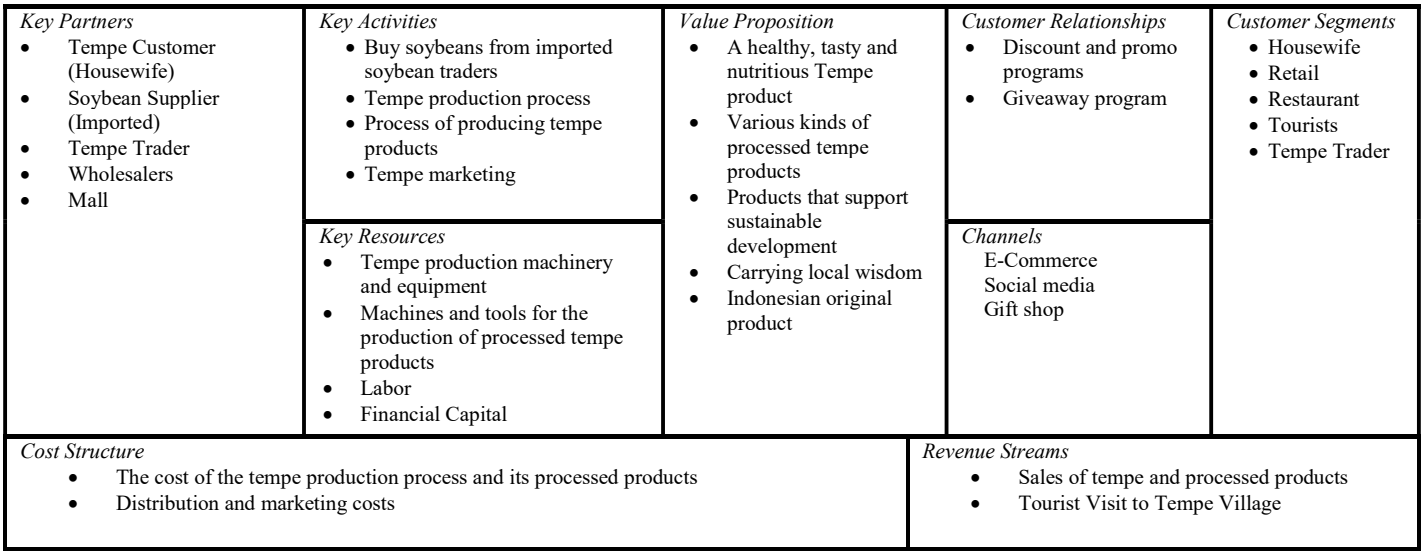


Figure 3 Tempe Canvas Business Model

V. CONCLUSION

Based on the workshop waste questionnaire, it is known that the most frequent waste in the tempe production system in Trenggilis Kauman Surabaya is the type of waste waiting and excessive transportation activities.Based on the process activity mapping in the tempe production process above it is known that the value-added activity is 62.5 %, while the non-value-added activity for the tempe production process in Trenggilis Surabaya is 37.5 %.

REFERENCES

[1] Asem-Bansah, C. K., Sakyi-Dawson, O., Ackah-Nyamike, E. E., Colecraft, E. K., &Marquis, G. S. (2012). Enhancing backyard poultry enterprise performance in the tech man area: A value chain analysis. African Journal of Food, Agriculture, Nutrition and

Development, 12(1), 5759-5775. [Online] Available: http://www.ajol.info/index.php/ajfand/article/view/74830/65428

[2] Adriana. 2014. Innovation Business Canvas Model Pada Produk Dholpine Yang Ramah Lingkungan. Jurusan Teknik Industri. Universitas Muhammadiyah Surakarta.

[3] Bask, A. H., Tinnila, M., & Rajahonka, M. (2010). Matching service strategies, business models and modular business processes. Business Process Management Journal, Vol. 16 Iss 1 pp. 153 - 180 Retrieved March 5, 2015, from www.bus.iastate.edu/NILAKANT/MIS538/.../Bask%20et%20al2010

[4] O'Brien, J. A., & Maracas, G. M. (2011). Management Information Systems. New York: McGraw-Hill/Irwin.

[5] Dagmar Recklies. (2001). Reckless Management Project GmbH. Germany: Dagmar Reckless.

[6] David, F. (2011). Strategic Management: Concept and Cases (13th ed.). New Jersey: Pearson Education.

[7] Dijk, M. v., & Trienekens, J. (2011). Global Value Chain: Linking Local Producers from Developing Countries to International Markets. Amsterdam: Amsterdam University Press

[8] Hermawan, Aj dan Rachel Jessica Pravitasari. 2013. Business Model Canvas (Kanvas Model Bisnis). (Retrieved from accelerate.id/media/Materi_13_-_Business_Model_Canvas.pdf/ 15-02-2015)

[9] Liebowitz, J. & Beckman, T. 2008. *Moving Toward A Knowledge Management Maturity Model (K3M) for Developing Knowledge Management Strategy and Implementation Plans*. In: BECERRAFERNANDEZ, I. & LEIDNER, D. (eds.) Knowledge management: an evolutionary view. M.E. Sharpe

[10] Nur Hasan, Erma Suryani&RullyHendrawan, (2015). Analysis of Soybean Production And Demand to Develop Strategic Policy of Food Self Sufficiency: A System Dynamics Framework Procedia Computer Science 72 (2015) 605 – 612

[11] Reyes, H. G., & Giachetti, R. (2010). Using experts to develop a supply chain maturity model in Mexico. Supply Chain Management: An International Journal, 415-424

[12] Osterwalder, A. & Pigneur, Y. (2010). Business Model Generation. Jakarta: Gramedia Pustaka Utama

[13] Osterwalder, A., dan Pigneur, Y. 2012. Business Model Generation: Membangun Model Bisnis. Jakarta: Elex Media Komputindo.

[14] Pearce, J., & Robinson, R. (2011). Strategic Management: Formulation, Implementation, and Control (12th ed.). New York: McGraw-Hill.

[15] Porter, M. (1985). Competitive Advantage: Creating and Sustaining Superior Performance. New York: The Free Press.

[16] Porter, M. (2008). Competitive Strategy: Techniques for Analyzing Industries and Competitors. New York: The Free Press.

[17] Rota. A. International Fund for Agricultural Development (2009): Livestock Thematic Papers, Value chains, linking producers to the markets

[18] United Nation Environmental Program (2009): Poverty alleviation in Swaziland

[19] Walters, D., & Lancaster, G. (2000). Implementing Value Strategy Through The Value Chain. Emerald.