

# Exploratory case study of wheat flour and rice packaging in Indonesia

## Proposals to develop paper-based packaging system

YESSICA DWI ARIESTA

**MASTER'S THESIS**

Packaging Logistics  
Lund University





This Master's thesis has been done within the Erasmus Mundus Master Course FIPDes, Food Innovation and Product Design.

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# Abstract

<b>Title:</b>	Exploratory case study of wheat flour and rice packaging in Indonesia - Proposals to develop paper-based packaging system
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<b>Division:</b>	Packaging Logistics, Department of Design Sciences, Faculty of Engineering, Lund University
<b>Supervisor:</b>	Annika Olsson and Daniel Hellström
<b>Issue of study:</b>	Looking at the lack of strong fibers to form strong paper packaging in Indonesia, there are potentials to introduce Scandinavian long-fibered strong paper bag packaging in Indonesia. Two basic food categories, wheat flour and packaged rice, are chosen as the consumption rate is increasing in Indonesia. Indonesia is tropical country with high temperature and humidity level. In addition, the logistical conditions in Indonesia are not optimum which add certain constraints on the packaging system being introduced in Indonesia. Indonesian manufacturers are not aware of integrated supply chain evaluation for packaging development. It will be advantageous to use the holistic evaluation to introduce new paper-based packaging system in Indonesia.
<b>Purpose:</b>	The purpose of this thesis is to evaluate the packaged rice and wheat flour supply chain in Indonesia and develop an overall paper-based packaging solution from systemic (manufactures to consumers) point of view.
<b>Method:</b>	A case study approach with qualitative analyses on the supply chain and consumers were chosen. The data collected from direct observation, interviews and indirect observation (packaging scorecard) are used to analyze current packaging system weaknesses and the improvement potential of paper bag packaging system proposals.
<b>Conclusion:</b>	Paper bag packaging needs to have extra barrier layer in order to be properly functional in tropical climate of Indonesia. The holistic supply chain evaluation is beneficial in pointing out which packaging system will fulfill the product, logistical, environmental, and marketing requirements from different actors. The consumer insights lead to packaging functional features that simplify consumers' storage and usage of the product. The case study for two basic products, wheat flour and packaged rice, concludes to two unique proposals in applying new paper-based packaging.
<b>Key words:</b>	paper-based packaging, packaged rice, wheat flour, supply chain evaluation, Indonesia

# Executive summary

## Abstract

Evaluation of current supply chain and consumers insights of wheat flour and packaged rice in Indonesia were done to introduce sustainable and functional paper-based packaging solution to Indonesian market. After considerations on the product, logistics, marketing, environmental, and consumers' requirements, two paper-based packaging proposals for wheat flour and packaged rice were developed.

## Introduction

Indonesia as tropical country do not produce strong and long paper fibers like the ones produced in four-seasons country. The lack of raw materials to produce strong paper bag packaging can be solved with the involvement of BillerudKorsnäs as paper supplier from Sweden.

The logistical challenges in Indonesia (poor infrastructures and vast land distance) and the tropical climate (high temperature and humidity) pose challenges especially in applying paper-based packaging. Manufacturers in developing countries have a tendency to reduce costs while developing packaging without knowing the probable negative economic impacts along the supply chain. To evaluate the overall supply chain and get customers insights are beneficial in developing a functional and effective packaging system.

## Objective

The purpose of this thesis is to evaluate the packaged rice and wheat flour supply chain in Indonesia and develop an overall paper-based packaging system solution from holistic (manufacturers to consumers) point of view.

## Method

The method being used is case study with two embedded analysis units, wheat flour and packaged rice. Different analysis types are summarized on the table below.

**Table 1. Thesis methodology summary**

Types of analysis	Qualitative analysis of supply chain (SC) actors			Qualitative analysis on consumers
Method	Direct observation (POEMS method)	Indirect observation (packaging scorecard)	Semi-structured interview	Direct observation with structured interviews
Objective	Explore, describe and explain how each SC actor interacts with packaging	Evaluate the performance for the packaging within a supply chain	Explain the importance of packaging design for each SC actor	Evaluate the the usage habit of the product related to the packaging

The supply chain actors and consumers being analysed are summarised in Figure 1.

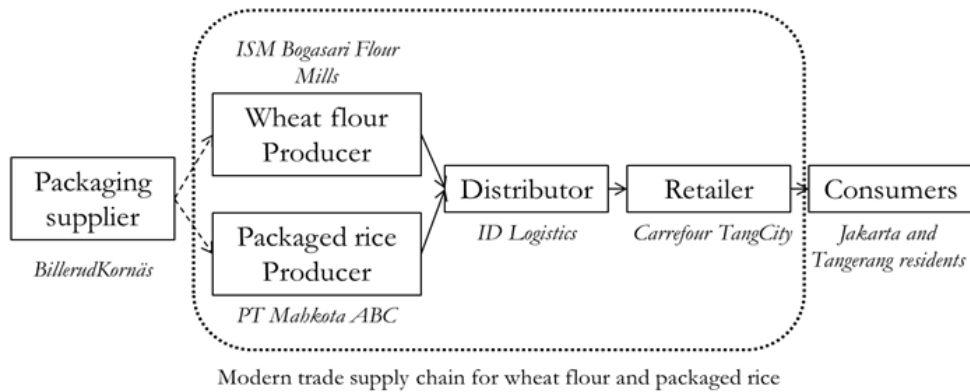


Figure 1. Study focus on supply chain and the consumers of wheat flour and packaged rice

## Results and discussion

Modern trade Supply chain of modern trade is simpler with single manufacturer, distributor and retailer (Figure 1). The case study for two different products, wheat flour and packaged rice shows two different manufacturer types. Wheat flour manufacturer, PT ISM Bogasari Flour, is the biggest wheat flour producer in Indonesia. Bogasari initiates environmental marketing campaign and new packaging formats. Packaged rice manufacturer, PT Mahkota ABC, is one of the many packaged rice producers in Indonesia with most being local producers. Mahkota ABC produces modern retailers' private label products and tends to follow the packaging trend in the packaged rice category. The distributor, ID Logistics, is the distributor for Carrefour retailer. The retailer in focus is Carrefour store in Tangerang City Mall. The packaging system level (primary packaging as the packaging being bought by customer, secondary packaging as a group of primary packaging, and tertiary packaging as pallet) interaction with the logistics activities along the supply chain can be found below.

Table 2. Packaging system and logistics activities interaction along the supply chain

Product	Supply Chain Members	Manufacturer		Transport	DC			Transport	Retail Outlet		Reuse and Recycle
	Packaging System (row) \ Logistics Processes (column)	Filling process	Warehousing process		Receiving process	Picking process	Shipping process		Receiving	Replenishing process	
Wheat flour	Primary	X								X	
	Secondary	X		X	X	X			X	X	X
	Tertiary	X	X			X	X	X	X		X
Rice	Primary	X		X	X	X			X	X	
	Tertiary	X	X			X	X	X	X		X

The primary packaging for packaged rice is 5kg LDLPE and nylon bag and for wheat flour is 1kg PE bag. The secondary packaging for wheat flour is double fluted cardboard box with 12 primary packages. The tertiary packaging for the wheat flour is internal plastic pallet with 50 secondary packages on it. Sixty rice bags are stacked to the internal wooden pallet as its tertiary packaging, without the use of secondary packaging. Transportation for the packaged rice from the manufacturer to the distribution centre was done by stacking primary packages on the transportation truck without the use of tertiary packaging.

The direct observation, semi-structured interviews, and packaging scorecards of the supply chain actors found that the manufacturers have the most concerns about the packaging, with modularity among packaging system levels and over-stacking as main concerns. The distributor arranges mixed-products pallets according to the stores' orders. The distributor feels that this method is correct and causes 0.03% loss due to packaging breakage during transportation to stores. The current 1kg wheat flour and 5kg packaged rice products need more time to be displayed in the store shelves. The stores feel that the handling ability and display ability of the products can be improved.

The consumers store certain amount of rice as each Indonesian consumes around 500 grams of rice per day. The consumers are influenced to consume more western foods such as cake and bread which drives the consumption of wheat flour. Indonesian consumers stores the rice in rice boxes, in various containers, or in its own packaging. The storage of wheat flour are normally in its own packaging with rubber band to secure the opening or in an air-tight container to keep the wheat flour from clumping.

## Proposals

The supply chain actors feel that the introduction of paper bag packaging for wheat flour and packaged rice is potential, but certain measures such as barrier ability of the packaging and the modularity within the packaging level are enough to protect the products during the transportation in less than ideal infrastructures and in the humid tropical climates. The supply chain actors and their needs are taken into consideration in developing new paper-bags packaging system. The holistic analysis approach and integrated packaging development can optimise the packaging system to gain more logistical efficiency, especially where the logistics expenditure can be up to 14% of total production costs.

The packaging solutions implementations can be faster if they are based on manufacturer financial ability and innovation involvement, consumers' usage habits, and negotiation position with the modern retailers. The solutions still need to answer to product, logistics, marketing, and environmental requirements. Two different paper-based packaging solutions are proposed to cater to the wheat flour and packaged rice products. The primary packaging proposals can be found on Figure 2. The secondary packaging of the wheat flour (corrugated box) is dimensionally modular with the primary and tertiary packages. The box has tearable section and is ready to be displayed in modern retail shelf. The secondary packaging of the packaged rice will be cardboard tray and plastic shrink wrap. This will be modular with the retail display shelf and the pallets in the factory and during distribution.

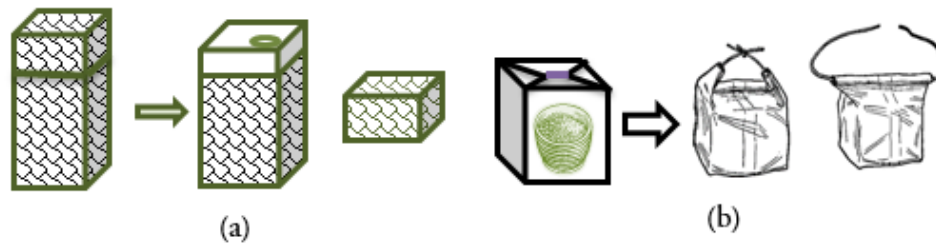


Fig 1. (a) Primary packaging of wheat flour based on FibreForm with easy-to-pour spout and reclose able. The cap can be used as measurement device (cup or 100gram)  
 (b) Primary packaging of rice with easy-to-carry feature that doubles as resealing tool

## Conclusion

The study of current modern trade supply chain of wheat flour and packaged rice in Indonesia shows how the plastic packaging adapt to the different requirements to packaging and where the improvements can be done. Proposals on laminated paper bags that can withstand Indonesia logistical conditions and fulfil supply chain and consumer requirements were drawn.

## References

- C. Olsmats and C. Dominic, "Packaging scorecard - a packaging performance evaluation method," *Packaging Technology and Science*, vol. 16, pp. 9-14, 2003
- V. Sohrabpour, D. Hellström and M. Jahre, "Packaging in deveoping countries: identifying supply chain needs," *Journal of Humanitarian Logistics and Supply Chain Management*, vol. 2, no. 2, pp. 183-205, 2012

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# 1. Introduction

## 1.1. Background

Paper bags or sacks that are made of long fibres (normally sourced from coniferous trees such as spruce, larch, fir, hemlock, and pine) have superior strength compared to the ones from tropical broadleaved trees [1]. Paper bags are used for cereals, flour, and sugar in the Swedish market. The bags contain product with considerable weight, keep it dry and sanitary, and simplify the handling from the factory, transportation, retail, and to the end customers.

Local paper producers in Indonesia do not grow raw materials to make high-strength bags. Thus, an opportunity to explore new uses of paper bags or sacks in Indonesia for several dry food products was spotted.

## 1.2. Problem discussion

There are two big problems for the dry food producers in Asia in using paper bag packaging. The first problem is the current filling machines are not compatible with paper. The second one is the producers are not aware of food-grade Kraft paper that are strong enough to contain large amount of weight [2].

Manufacturers in Indonesia feel reluctant to invest in new packaging machineries. The common packaging for products such as wheat flour and rice is plastic bag. For successful packaging conversion from plastic to paper bag, there should be economic and sustainability gain in the long term. To evaluate this, a study on overall supply chain and packaging system levels is needed.

Packaging interacts with the different logistics activities from each supply chain actor [3]. After knowing each supply chain actor's needs and calculate the economic and environmental trade-offs, a good packaging system that impacts positively to overall supply chain can be developed. Integrated development of several packaging levels can optimise the packaging system [4] to gain more logistical efficiency. The gain along the supply chain in the distribution, storage, and warehousing costs and the fulfilment of product, logistics, marketing, and environmental requirements are necessary to justify the significant changes from the plastic-based packaging to paper-based packaging system.

The trend of *sembako* or nine basic foods (defined by the Ministry of Trade in 2009 such as vegetable oil, rice, and sugar) is shifting to the packaged food instead of

being sold in loose or in bulk at traditional stores or markets [5]. This is because there are continuous penetrations of modern retailers in the form of hypermarkets, supermarkets, and convenience stores that carry a wider range of products beyond the traditional markets. Because of those trends, there might be opportunities to use paper bag packaging with certain level of strength for customer products such as wheat flour and rice in Indonesia. Wheat flour consumption of Indonesians are low compared to the world average [6] and there is a potential of big consumption growth as Indonesians are more exposed to Western wheat-based food such as bread and pasta. Rice is the staple food of Indonesians [7] and the consumption is shifting towards the packaged rice rather than the loose or bulk rice. These two products have good growth trend in Indonesia.

The humidity level in tropical part of Asia is relatively higher compared to Europe. In Indonesia, relative humidity ranges between 70 to 90 percent with variations due to dry and rainy seasons [8]. The strength characteristics of paper reduce drastically with significant change in the relative humidity. For paperboard, the increase of relative humidity from 40% to 90% results in a loss of about 50% of case stacking strength [1].

The different types of food product have different requirements on the packaging. Some intrinsic factors of dry food products that affect the product quality significantly are water activity ( $A_w$  or available water), natural micro flora in final products, and product formulation (including preservatives). The extrinsic factors affecting the packaged dry food quality is temperature, relative humidity (RH), exposure to light during storage and distribution, and composition of gas atmosphere within packaging [9]. The chosen dry food product types as focus in the exploratory case studies are very important in deciding the product requirements on the packaging.

To offer a strong Kraft paper bag packaging solution to the manufacturers, some analyses need to be made. Observation on the current packaging machine and/or packaging line, mode of transportation, different actors handling the products, ease of transporting and displaying, and customer habits or requirements need to be noted. Cross referencing the evidences during the study case with literature are necessary to result in proposals to introduce paper bag packaging for two staple products, rice and wheat flour, in Indonesia.

### 1.3. Purpose and objectives

The purpose of this thesis is to evaluate the packaged rice and wheat flour supply chain in Indonesia and develop an overall paper-based packaging system solution from holistic (manufacturers to consumers) point of view. The solutions will be customized to the producer capabilities and supply chain in Indonesia. The objectives of the thesis are to:

- explore the current conditions of the packaging and supply chain for each product,
- evaluate the product and logistics requirements on the packaging,
- evaluate the consumers' buying, consumption and storing habits to identify the marketing and consumer requirements on the packaging,
- and develop several paper-based packaging proposals that can help in implementing paper-based packaging solutions in Indonesia.

### 1.4. Delimitations

The market is limited to modern retail in Indonesia for packaged rice and wheat flour. Sohrabpour and Hellström's paper on developing countries shows that traditional trade in developing market has multiple intermediaries (distributors and wholesalers) in between producer and end consumer [10]. The modern trade is chosen because of relatively simpler, specific distribution channels (distributor and modern retailers in between producer and consumer) that can be seen in Figure 1. There will be a focus on one actor in each stage of the supply chain.

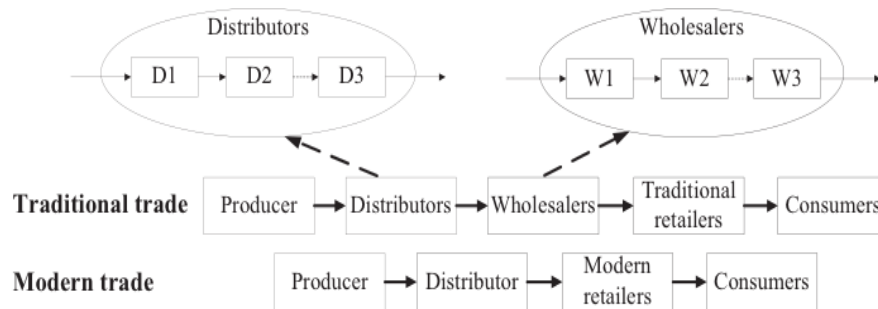


Figure 1. Traditional trade and modern trade supply chains in developing countries (adapted from [10])

## 2. Methodology

### 2.1. Overall approach and rationale

The overall methodology of this paper is based on case study method. Yin [11] explained that case study method enables holistic and meaningful characterization of real-life events. The case studies can be exploratory strategy, but also descriptive and explanatory. This research will address descriptive questions of what is happening along the modern-retail supply chain and what are the consumer usage habits during buying, consuming, and storing of the two products, packaged rice and wheat flour. The analytic generalization will be done to seek working proposals to introduce paper packaging for both products.

A single-case design with two embedded unit of analysis, packaged rice and wheat flour, are chosen. The rationale in choosing this design is to reveal the significance of packaging from the producers to the consumers especially for 5 kg packaged rice and 1 kg wheat flour in Indonesia. There are risks of misrepresentation by choosing single-case, but the case study evidence can be trusted with careful case study design. The two embedded unit of analysis were chosen as both of them are basic food and the sales are growing in Indonesian market (refer to packaged rice and wheat flour sections in the case description).

To get a holistic overview of the effect of the packaging on the supply chain actors and consumers, a methodology based on qualitative analyses was developed. For the supply chain actors, qualitative analyses are done based on direct observation method, indirect observation method by packaging scorecard, and semi-structured interview with the decision-makers in each supply chain stage. Direct observations by making structured interviews with Indonesian consumers are done to know the usage and storage habits of packaged rice and wheat flour. The different analysis methods were applied to get more confidence on the findings of supply chain. By analysing the packaging holistically from the manufacturer to consumer, systemic view of the requirements on the packaging can be obtained. The summary of the methodology can be seen in Table 1. These observations are done directly in Indonesia by visiting each supply chain actor and consumers with the transportation allowance allocated by BillerudKorsnäs. The analysis results will be used to synthesize packaging solution proposals particularly for the supply chains of packaged rice and wheat flour in Indonesia.

**Table 1. Thesis methodology summary**

Types of analysis	Qualitative analysis [12] of supply chain (SC) actors			Qualitative analysis on consumers
Method	Direct observation (POEMS method [13])	Indirect observation (packaging scorecard [4])	Semi-structured interview	Direct observation with structured interviews
Objective	Explore, describe and explain how each SC actor interacts with packaging	Evaluate the performance for the packaging within a supply chain	Explain the importance of packaging design for each SC actor	Evaluate the the usage habit of the product related to the packaging [14]
Participants	Manufacturer, distributor, retailer for wheat flour and packaged rice			10 Indonesian wheat flour and rice consumers

Packaging scorecard is a systematic evaluation method on the contribution of packaging to the efficiency and value creation in the product supply chain [15]. It can identify the strengths and weaknesses of the packaging system according to different participants in the supply chain. This method generates better overview and understanding of the packaging system performance throughout the supply chain. Semi-structured interviews are used to generate qualitative data within relevant topic areas, which allows the researcher to pose follow-up questions or further clarification to develop the overall discussion during the interviews [16].

## 2.2. Research design quality assurance

To ensure the validity of the case study, several measures described by Yin in Case Study Research are taken [11]. The first measure is the use of multiple sources of evidence. By doing direct observation, interviews, and indirect observation, the data collection has wide base and cover the subject more holistically. Data triangulation between the primary data gathered and secondary data from reports on Indonesia supply chain and consumer habits is done. The secondary data are used to corroborate the facts or phenomenon composed on the primary data collection. Convergence of evidences establishes the facts concerning rice and wheat flour packaging that will be used for proposals generation. Second measure is establishing chain of evidence by putting the notes and photographs into the result and appendix sections. The reports on manufacturers and distribution centre were reviewed by the



interviewees ahead of this report writing. The third measure is having the key informants to review the draft case study report.

To confirm the reliability of the results, the procedures done are documented well [11]. Even though the interviews were done in Indonesian, they are translated in English for documentation purposes. The observations done are described in the report, while the pictures taken during observation are used on the report. The semi-structured interviews result in more information being drawn out compared to the question outline. However, the question outline is enough to get the information needed to analyse the supply chain.

### 2.3. Case description

BillerudKorsnäs as paper bag packaging supplier has an interest to develop business in Indonesia. This study's evaluation and packaging proposals might help the packaging supplier. Two products were chosen as the focus of this study; wheat flour and packaged rice. A brief consumer insight is done to know the habit of storing and using the products at home. The case description summary can be found in Figure 2. There are 2 manufacturers (each for wheat flour and packaged rice), one distribution center and one retailer being visited. The wheat flour manufacturer is PT Indofood Sukses Makmur (ISM) Bogasari Flour Mills which is located in Jakarta. Bogasari is the number one wheat flour producer in Indonesia. Packaged rice producer is PT Mahkota ABC which is located in Tangerang. Mahkota ABC produces both own brand and private label products. The distributor is ID Logistics of PT Trans Retail Indonesia (known with Carrefour stores). The distribution centre is in Bekasi. ID Logistics cater to all Carrefour stores spanning across 4 big islands of Sumatra, Java, Borneo and Sulawesi. It also distributes to small islands of Bali and Batam. The retailer is Carrefour hypermarket store in Tangerang City Mall. The consumers live in Jakarta and Tangerang area. There are only 10 consumers being interviewed and observed as brief examination on Indonesia consumers' habits.

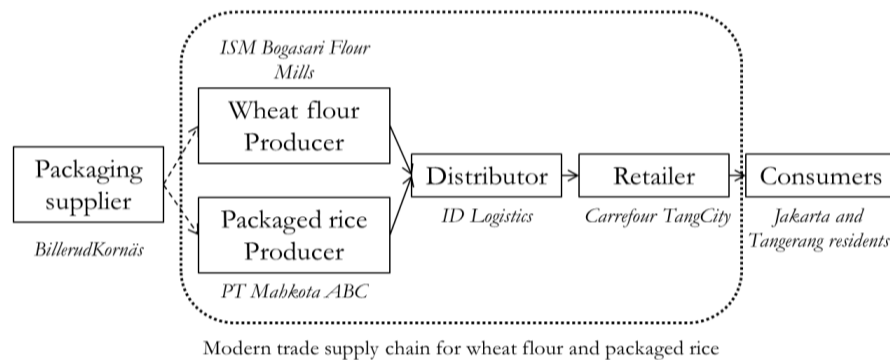


Figure 2. Case description of analysing the wheat flour and packaged rice supply chains and consumers in Indonesia to ease the application of paper bag packaging supplied by packaging supplier

### 2.3.1. BillerudKorsnäs

BillerudKorsnäs is one of the world's leading supplier of high-quality packaging materials based on primary fibre [17]. The wood raw material comes from responsibly managed forests and manufacturing takes place at the Group's own environmentally efficient and integrated production units.

BillerudKorsnäs purchases its wood raw material from responsibly managed forests, primarily in Sweden, Norway, Finland, and the Baltic. BillerudKorsnäs provides high-performance materials with solution services to its customers, whether they are packaging manufacturers, brand owners or supermarket chains. BillerudKorsnäs innovates to produce smart packaging for a sustainable future.

The Sweden-based company has its major sales in Europe (74%) with expanding markets in Asia (14%), Africa (5%), Middle East (3%), South America (2%), and other regions (2%). Total net sales of BillerudKorsnäs in 2013 was SEK 19.5billion, with SEK 1.1 billion of operating profit. The net sales by business area and market segment can be found in Figure 3.

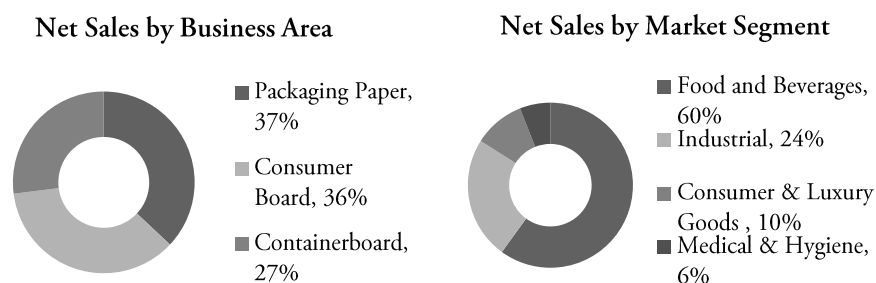


Figure 3. Net sales of BillerudKorsnäs by Business Area and Market Segment in 2013

Packaging paper business area, which consists of kraft paper and sack paper, is targeted to grow 0-4% per year with selective growth strategy (growth targeted on selected segments and balancing of further competing capacity). BillerudKorsnäs is the leading producer of strong, high-quality kraft paper from primary fibre in Europe. Sixty percent of kraft paper from BillerudKorsnäs was used for packaging (e.g. for flour, sugar, grain), open bags (e.g. for bread), carrier bags, flexible packaging, and formable packaging. One third of sack paper sold by BillerudKorsnäs was used for food and animal food.

The trend of paper being more sustainable than fossil plastics gives a competitive advantage to BillerudKorsnäs solutions. Growing middle class, demand for increased packaging performance and function, and interest in packaging design as a way of differentiating the product and strengthening the brand were the drivers that increased the 2013 sales.

The Bag Solutions business segment offers materials and solution for containing dry food such as flour, sugar, and grain. The uncoated kraft paper, which contributes strength and stiffness, is also available for laminated paper packaging solutions. BillerudKorsnäs FibreForm® is transformable non-plastic solution that can be embossed to simply and cost-effectively differentiate its packaging in terms of shape and designs. It is made from paper with high elasticity, which can be shaped to produce thermoformed and deep-drawn food and consumer packaging such as trays or blisterpacks. This new concept was established with Italian machine supplier, Curti, and will be brought to market in autumn 2014. This solution is primarily aimed at dry foods such as sugar, salt, and flour, but also snacks, tablets, and vitamins

### **2.3.2. PT Mahkota ABC**

PT Mahkota ABC is a rice producer that produces both own brand and private label brands. It produces products for Lotte, Giant, and Carrefour supermarkets with Lotte wholesale. Mahkota ABC own brand includes Cap Kembang (lowest quality of rice), ABC Asli, ABC Spesial, and Indo Extra Fragrant Rice (highest quality of rice). There are 2 kilograms bags of red and brown rice, 5 kg bag and 10, 20, 25 kg sacks for own brand and private label supermarket brands, and 50 kg sack to be sold in wholesale. The packaging designs are done by the packaging managers of each retail stores and the own brand packaging designs are done by packaging designer appointed by owner. There was no marketing research for the packaging. The

designs tend to follow the currently available packaging designs in the packaged rice category.

The business operation includes buying rice in bulk (50 kg sacks) from farmers and Bulog (*Badan Urusan Logistik* or the Bureau of Logistics), mixing rice, and packing the rice in different packaging formats. It has blending machine with 100 tonnes capacity. After blending, the rice is packaged to different format packaging.

The plastic woven sacks are made from LPE (linear polyethylene). The plastic bags are made by LDLPE (low density linear polyethylene) and nylon. The packaging comes to PT Mahkota ABC being fully-formed with side and upper seals.

The rice is blended in big silo. The rice comes down to 1 of 2 automatic weighing machines and to the open bag. The operator takes the filled bag and weigh it as weight control. The operator pass the bottom part of the bag through the sealing machine (Figure 4). Another packer stack the bags on a pallet. This packer has a small device with several needles to poke through the plastic bags so the bags are flat and easier to stack. There are four personnel manning the 2 packing lines.



Figure 4. Filling machine and manual sealing of 5kg rice in plastic bag

The pallet is transferred to storage room by a forklift. Before distribution, the plastic bags are transferred to the truck without pallets. There can be up to 20 bags stack on top of each other on the truck. The supplier does not have any data on the percentage of broken bags during transportation. Mahkota ABC has the policy to exchange the broken packages with good ones or reducing the broken packages from the purchase order. The amount of products being returned and replaced or *tukar guling* is not significant to cause any steps to be taken.

### 2.3.3. Rice in Indonesia

Rice is the staple food of Indonesians. Indonesian eats approximately 165 kg of rice per capita per year [7]. Indonesians have the habits to purchase loose rice from traditional retail. The store owner places the various different rice types in open store display and people can choose and the seller will pack them according to the size requested [5]. This practice continues to be strong in rural areas, while urban areas have been shifting to shopping at modern grocery retailers which have products being packaged in fixed sizes and with correct labelling, including BPOM's registration number to ensure their safety. In a bid to improve hygiene practices, the Government has been increasingly encouraging the shift to packaged staple food product rather than selling loose product. The unpackaged product is popular among low-income consumers, especially with rising commodity, fuel, and utility prices during the first half of 2013.

According to Euromonitor [18], the sales volume of packaged rice from 2012 to 2013 increased by 4.0% to 7.3 million tonnes. While the sales value increased by 14.5% to 62,411.8 billion Rupiah or 35.6 billion SEK.

According to publication of Ministry of Agriculture [19], there are different types of rice grain. *Beras kepala* or head grain is a healthy/ defective grain with more or equals to 75% of the intact grain size. *Beras patah* or broken grain is a healthy/ defective grain with more than 25% up to 75% of the intact grain size. *Butir menir* or grit grain is a healthy/ defective grain with less than 25% of the intact grain size. *Butir kapur* or chalky grain is rice grain with half or more part being chalky white in colour and with soft texture due to physiological damage. *Butir kuning* is head grain, broken grain, or grit grain which has yellow or yellowish brown colour. The rice quality requirements according to Standar Nasional Indonesia (Indonesian National Standard) SNI 6128:2008 can be seen in Table 2.

Table 2. Rice quality requirements according to SNI 6128:2008 [20]

Quality Component	Unit	Class	Class	Class	Class	Class
		I	II	III	IV	V
Milling degree (min.)	%	100	100	95	95	85
Water content (max.)	%	14	14	14	14	15
Head grain (min.)	%	95	89	78	73	60
Broken grain (max)	%	5	10	20	25	35
Grit grain (max)	%	0	1	2	2	5
Yellow grain (max)	%	0	1	2	3	5
Chalky grain (max)	%	0	1	2	3	5
Foreign matter (max)	%	0	0.02	0.02	0.05	0.20
Unhulled grain (max)	Grain/100g	0	1	1	2	3

The quality class of polished rice will serve as guideline for producers and sellers to target different market segments. The rice quality preference is determined by consumer's subjective factors and depending on location, ethnicity, surroundings, education, and socio-economic status. In Indonesia, the rice variety (setra ramos, rojolele, pandan wangi, IR) and area of origin (Cianjur, Delanggu, Solok) are closely associated to rice quality [21].

The physicochemical traits of rice grain is closely related to the taste of cooked rice [21]. The amylose content has positive correlation to the rice aroma and firmness, with negative correlation to the viscosity, colour, and shine. High amylose content rice results in dry and flaky cooked rice, while low amylose content rice results in fluffy and sticky rice. The fat content affects the quality of rice especially during storage.

To keep the quality of rice, the storage condition needs to be optimized. Rice placed in an air stream with constant temperature and relative humidity will equilibrate to a constant moisture content. High relative humidity cause high rice moisture contents and vice versa [22]. Figure 5 shows psychrometric chart at sea level atmospheric pressure.

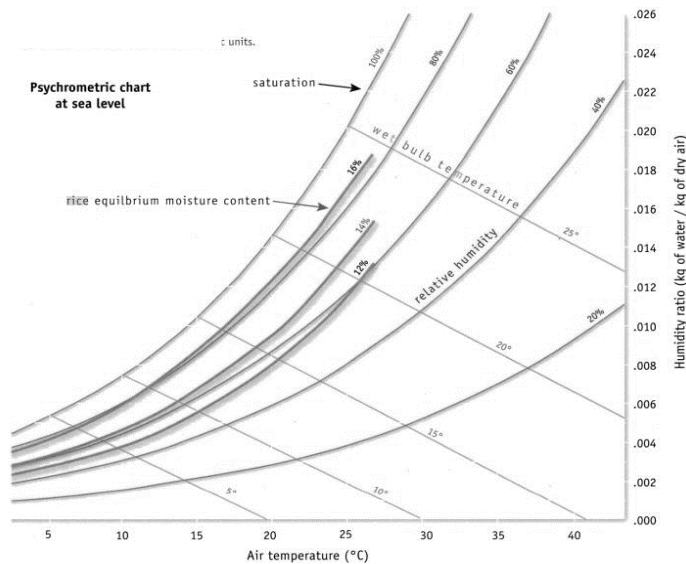


Figure 5. Psychrometric chart with rice equilibrium moisture content, air relative humidity and wet bulb temperature [22]

Air temperature is the temperature recorded by a thermometer placed in the open air and shielded from the sun. Humidity ratio is the water vapour content of the air

in mass of water vapour per mass of dry air (kg/kg). Relative humidity is the amount of water vapour in the air divided by the maximum amount of water vapour the air could hold if it were saturated. This is a good measure of conditions that allow mould and bacterial growth. The relative humidity is 100 times the water activity ( $a_w$ ) of food. Uncooked rice normally has 0.80-0.87  $a_w$  level [23]. This water activity level is supportive of yeasts (0.80-0.85) and mould (0.85-0.90) growth on food material. Wet bulb temperature is temperature measured by a glass thermometer covered by a water-soaked cotton wick. This is valuable in describing drying and aeration process. Dew point temperature describes the air temperature at which water vapour begins to condense out of the air. The condensed water might drip to the stored rice.

With Indonesia relative humidity of 71-80% and average temperature of 23-28°C, rice grain is normally dried before being stored to increase the storage life. After being packaged and stored, the rice moisture content might change because the environment water content is higher. Thus, packaging that minimize the exposure of stored rice with higher moisture content environment will be preferred.

#### 2.3.4. PT ISM Bogasari Flour Mills

PT Indofood Sukses Makmur (ISM) Bogasari Flour Mills is wheat flour mill that produces both bulk and customer packaging. It is the biggest wheat flour producer in Indonesia. It is located in Jalan Raya Cilincing No. 1, Jakarta Utara. In 291,316 m<sup>2</sup> area, it has sixty 3,000 tonnes/unit silos and eighty 2,800 tonnes/unit silos of wheat [24]. In the location, the wheat is milled and divided into wheat flour and other by-products. The bulk wheat flour is packaged in 25 kilograms degradable plastic sack (Figure 6). For B2B (business to business) clients, Bogasari provided flour-tank truck which can transport up to 25 tonnes of specialized flour directly to the client factory.



Figure 6 Degradable packaging advertisement on ISM Bogasari Flour Mills website

The customer packages are divided into 3 categories. First category is econo-pack flour which are packaged in minimally-printed transparent plastic bags of 500 g, and 1kg. These are distributed in traditional retail outlets (Figure 7a). It is called econo-pack because it is more economical compared to the premium products as the packaging is simpler and no additional fortification of the wheat flour (on top of the compulsory wheat flour fortification stated by The Indonesian National Standard). Second category is premium wheat flour from Bogasari (Figure 7b). These are distributed in traditional and modern retail outlets. There are 3 different flour type based on the content of protein in the flour. Segitiga Biru is Bogasari's brand for all purpose flour, Cakra Kembar for high-protein flour which is good to make noodles and bread, and Kunci Biru for low-protein flour which is good to make cookies, cakes, pastry, and doughnuts. It is considered premium because of the additional vitamin A, B3 and D which are not specified by Indonesia National Standard for wheat flour, but are recommended to be added to wheat flour by WHO, US Agricultural department, and Flour Fortification Initiative (FFI). Third category is flour catering to community needs. The brand they have now is Taj Mahal for the Indian community. With high fiber, this flour is good for making Indian bread.



Figure 7. a. Econopack wheat flour from Bogasari b. Premium wheat flour from Bogasari (taken from Bogasari website) c. Taj Mahal brand for Indian community

From the interviews with different personnel (interview transcription with production plant manager can be found in Appendix 1) in ISM Bogasari Flour Mills in Cilincing, the packaging is designed and developed by the internal marketing team. The Quality Assurance sets up the quality parameters (thickness, raw materials, ink, degradability, etc.) of the packaging. The design and quality parameters are sent to the sister companies (such as PT Inti Abadi Kemasindo in Citeureup, Bogor) in charge of packaging production. The packaging arrived in the factory and being stored there before being utilized in the production site.



### **2.3.5. Wheat flour in Indonesia**

Indonesia does not grow wheat. In 2013, Indonesia imported 7.2 million tonnes of wheat from Australia (71%), Canada, and USA. In 2010/11 [25], Indonesian annual per capita wheat flour consumption rate was 18 kg. According to Rabobank [6], the wheat consumption per capita in Indonesia is 26kg in 2013, which is relatively low compared to the world average of 76 kilogram. Relatively stable macro-economic conditions have allowed for more middle and upper-middle income consumers to diversify their diets from the ordinary staple of rice. Changing Indonesian dietary habits include more western style foods like bread and pasta. Rather than eating rice for all three daily meals, many Indonesians have switched to eating bread or noodles for breakfast. Eating out culture is also driving demand for wheat-based food products. The number of high-end bakeries is continuously growing, mainly in major Indonesian cities such as Jakarta, Surabaya, Medan, and Bandung.

The price of instant noodles is currently cheaper than rice and many more lower and middle income consumers substitute instant noodles for breakfast or dinner. As a result, the noodle industry continues to be a rapidly growing sector and consumes 60 percent of Indonesia's wheat flour. The bakery industry follows with 20 percent consumption of flour, while household and the commercial biscuit producers each make up the balance with 10 percent consumption respectively. According to APTINDO (Asosiasi Produsen Tepung Terigu Indonesia or Indonesian Wheat Flour Producer Association) in 2013, 4.6% of wheat flour is consumed by household consumers.

In the beginning of 2013, there are 23 Indonesian flour millers (Figure 8) with total installed capacity of approximately 9.7 million metric tonnes per year [26]. The flour mills location around Indonesia can be found on the figure below. The flour millers are organized in APTINDO with Bogasari Flour Mills director as the chairman of the association. The retail price of medium protein wheat flour in Jakarta market was reported at Rp. 7.663/kg in March 2013 [25].

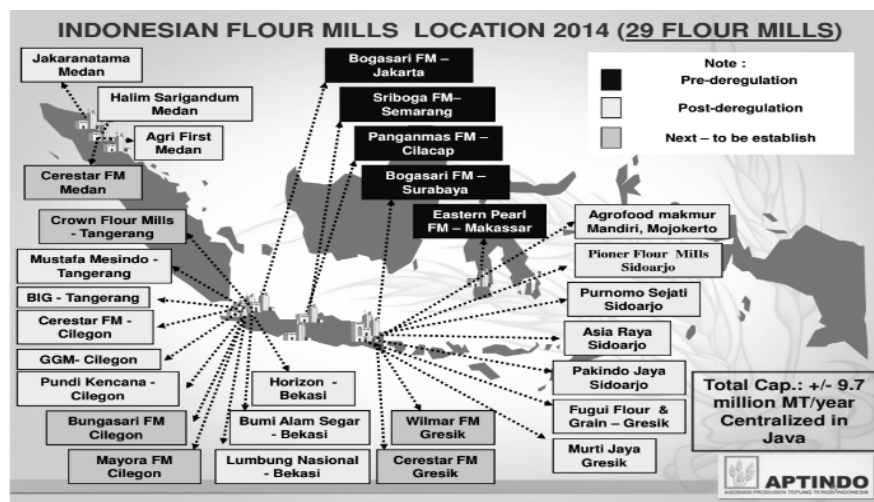


Figure 8. Indonesian Flour Mills Location 2014 (Welirang, 2014)

Wheat flour in Indonesia needs to be fortified with iron. The Indonesian National Standard (*Standar Nasional Indonesia* or SNI) specifies that the iron content needs to be minimum 50 mg iron per kg flour. Other additional fortifications that are not mentioned in the SNI can be considered as nutritional claims. The complete standard for wheat flour as food can be found in table 3.

Table 3. Standard of wheat flour as food (SNI 3751:2009)

Quality Component	Unit	Requirement
Form	-	Powder
Smell	-	Normal (free from foreign smell)
Colour	-	White, typical flour
Foreign matter	-	None
Insect in all stadium form and visible pieces	-	None
Refinement, through 212µm (mesh No. 70)	%w/w	min. 95
Water content	%w/w	max. 14.5
Ash content	%w/w	max. 0.70
Protein content	%w/w	min. 7.0
Acidity	mgKOH/100g	max. 50
Falling number (with basis of 14% water content)	second	Min. 300
Iron (Fe)	mg/kg	min. 50
Zinc (Zn)	mg/kg	min. 30
Vitamin B1 (thiamine)	mg/kg	min. 2.5
Folic acid	mg/kg	min. 2

**Table 3. continued**

Quality Component	Unit	Requirement
Metal Contaminant		
Lead (Pb)	mg/kg	max. 1.0
Mercury (Hg)	mg/kg	max. 0.05
Cadmium (Cd)	mg/kg	max. 0.1
Arsenic contaminant	mg/kg	max. 0.50
Microbe contaminant		
Total Plate Count	colony/g	max. $1 \times 10^6$
E.coli	CFU/g	max. 10
Mould	colony/g	max. $1 \times 10^4$
Bacillus cereus	colony/g	max. $1 \times 10^4$

## 3. Theoretical framework

### 3.1. Paper packaging

Kraft paper is strong, translucent or opaque, and can be rigid or flexible depending on the grade and thickness. In the uncoated form, it has limited gas-barrier properties and is sensitive to moisture. The liquid and gas barrier properties can be improved by coating or laminating it with resins, wax, polymers such as polyethylene or aluminium foil. For applications in wet or humid conditions, the agents can be added to improve tear resistance [27].

RISI [28] did a study on world sack kraft and wrapping paper with forecast from 2013 to 2018. Chinese net imports of unbleached sack craft increased almost 5 times in 10 years leading to 2012. Even though China maintained a growing domestic supply, the heavy reliance on high quality virgin kraft papers imports from Western Europe will continue. Demand growth in India, Indonesia, South Korea and Taiwan will surpass 3.2% China growth rate over the next 5 years.

### 3.2. Indonesia and Indonesian population

Indonesia consists of a group of archipelagos with 5 large islands of Sumatra, Java, Borneo, Sulawesi, and Papua. Jakarta is the capital city (see Figure 9). Presidential election will be held in July 2014.



Figure 9. Map of Indonesia

The temperature in Java Island varies from 18.2°-33.5°C, with average temperature of 23.4°-28.5°C. The relative humidity in Java varies from 71.5-81.0%. There are

165-215 rainy days per year across Java, with 1141-2285mm of rain precipitation in 2011. Duration of sunshine varies from 60.9-69.1% [29].

Indonesia is the fourth most populous country in the world with 244.2 million people in 2012 with 1.31% population growth [29]. The population median age is 28.5 years old with fertility rate of 2.1 births per female. Figure 10 shows the 2012 age pyramid with 2030 prediction. Around 60% of total population lives in Java island [30].



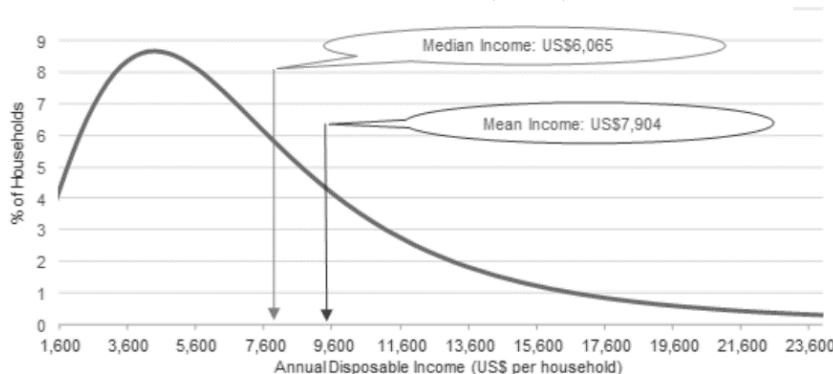
Figure 10. Indonesia Age Pyramid in 2012 and 2030

Indonesia 2012 GDP is US\$ 878,335 million, with 6.2% real growth. The inflation accounts to 6.7% (2013). Agriculture employs 35.2% of work force. Indonesia is the world's third largest producer of rice and the leading producer of palm oil. Manufacturing accounts for 23.8% GDP and employs 13.0% of work force. Service sector accounts for 38.3% of GDP. Indonesia domestic demand accounts for nearly two-thirds of GDP, the export was only 21.6% of GDP in 2012. Euromonitor predicted that by 2030, the middle class in Indonesia should represent 80% of total population.

Since Indonesia has relatively low income level, food and non-alcoholic beverages still make up the largest part of total expenditure across all income level [31]. In 2011, the 30-34 age groups enjoyed the highest average gross income in Indonesia. As those in their thirties usually have families, much of their spending is focused on household-related items, such as clothing, foodstuff, household durables and transport. Being increasingly influenced by Western lifestyles, Indonesia's top earners in their thirties represent good opportunities for marketers of high-end products and services owing to their rising demand for luxuries.

Rising income level and significant size of Indonesia's middle class continues to offer numerous opportunities for marketers of various products and services, ranging from packaged food to household appliances and transport. However, two third of Indonesians are living below the mean income level. Chart 1 illustrates the household income distribution curve.

Chart 1 Indonesia household income distribution (in US\$) 2011



Slow development of infrastructure (such as transport and telecommunication, networks, electricity, and water supply) is the main constraint on economic growth. Costs of transport, warehousing, and distribution are about 14% of total production costs due to bad infrastructure quality and vast land distance [31]. Indonesia's road density is two-thirds that of China's and less than half that of Malaysia's, and 40% of its roads are unpaved [32]. Congestion is common in large cities. Indonesia has only half the railway lines per person compared to China, Malaysia, and Thailand. The population is spread across the archipelago which serves specific constraints on the logistics system in Indonesia.

### 3.3. Retail in Indonesia

International Food Policy Research Institute conducted a survey in 2012 to 1180 households in 3 different cities about food retailing habits of Indonesian customer [33]. The modern retail were divided into hypermarket (with 10 or more cash registers, such as Carrefour, Giant, Makro, Hypermart), supermarket (2-9 cash registers, such as Hero, Matahari, Asia, Yogya), and minimarket (1-2 cash registers, such as Alfa and Indomart). The traditional retail were divided into semi-permanent stand (vendor who sells from a table, stand, cart, or stall that stayed for one working day), small shop (small store in a building or part of a house, often located in a residential area), traditional market (collection of numerous food vendors in one

location), and peddler (small scale vendors operating on foot, bicycle, with a cart, or from a car/truck who move around an area during the day). Traditional market is considered to sell products with low price/value. While the other traditional retail outlets and minimarket were preferred due to the ease to access their services. Hypermarket and supermarket were preferred due to proximity to entertainment (normally located in a shopping mall complete with cinema, game alley, and restaurants), provides discounts, high quality food, and good sanitary condition.

From the analysis of food shopping patterns, only 19% of food spending were spent in modern retail outlets. Only 3% of household buy rice in modern retails. Small shops (31%) and traditional markets (24%) are the most important food outlets in term of consumer spending. The richest 10% of urban households spends twice as much in traditional retails than they do at modern retails. The analysis predicts a 25% share of urban food spending to modern retailers over the span of 10 years. While taking into account the urban population growth of 2.5% and income growth of 5.5%, the modern retail sales will increase about 9% per year. However, during the survey it is apparent that the households still prefer to buy fresh produce in traditional retail channels. This trend was spotted before by CPIS (1994) that the goods sold in the two markets are complementary, with traditional retails proving fresh foods and supermarkets selling processed food and non-food goods.

These findings were backed by Euromonitor report on consumer lifestyles in Indonesia [34]. The consumers have a preference for minimarkets and hypermarkets over supermarkets. Hypermarkets with wide range of budget-priced products have become more popular for families making their weekly or monthly shopping trips as price is more important than convenience for large shopping trips. Minimarkets with ever-increasing number of outlets (increase of 63% from 2008 to 2011) offer good, competitive pricing of essential daily products in convenient location. Another trend is called top-up shopping in minimarkets for young middle-income consumers who are living life on the go. Minimarkets in Indonesia sell staple food such as rice, noodles and cooking oil with ready-to-eat meals, food cooked in the premises (such as hotdog), and snacks. The increase in packaged-food purchases likely responds in part to urban consumers' need for time-saving convenience and desire for variety [35].

Indonesian women are the key influencers in both modern and traditional retail outlets. As newly middle-class female Indonesian consumer becomes better aware of her shopping prowess, she cares about choice, price and promotions. Majority of trip missions are planned and occur daily. The best way to merchandise premium

categories to the discriminating Indonesian shopper is to visibly show price tags to aid comparison spending, giving high class image, and superior packaging that self-advertise on the shelf. Winning practices will include good, better, and best pricing tiers, pack-sized incentives that meet daily-shopping needs and a differentiated value proposition that sets products apart [36].

There is a growing willingness amongst Indonesian customers to spend more on products from socially-responsible companies from 56% in 2011 to 66% in 2013 [37]. This indicates high citizen expectations on corporate social responsibility. From the claimed purchase behaviour, 56% Indonesian customers demonstrate commitment to products and services from socially-responsible companies. Consumers who are more socially-conscious have more trust in cause marketing advertisements found on social networks compared to the global consumers [38].

The staple foods that are normally bought as loose products (sold in traditional stores and packaged in transparent flexible plastic without any labelling) are increasingly bought as packaged food by customers in urban areas [5]. The packaged staple foods are perceived as more hygienic and allows longer storage. As newly urbanized market, there is increasing demand for securing safe, affordable, convenient, and tasty foods [35].

Winning brands excel at continuously developing new insights into evolving consumer behaviour and adjusting the value propositions by tailoring the approach to innovation and the 4 Ps of marketing (product, price, promotion, and place) [32]. Market leaders use consumer insights to determine the right mix of above-the-line and below-the-line marketing and activation levers. In categories where consumers show strong loyalist behaviour, marketers should strive to establish their product as the preferred brand and to create high switching costs. In categories with low engagement, companies should concentrate on recruiting and re-recruiting new consumers every day at the point of sale. In-store visibility and distinctiveness along with outstanding outlet execution are critical.

Different distribution methods are adopted by different companies. Several multinational companies develop exclusive contracts with large local distributors and leading Indonesian brands that can afford it often develop their own distribution networks (Figure 11).



Coca-Cola Amatil leveraged its long-term presence in Indonesia to build a broad network through a mix of exclusive agreements with several hundred independent distributors and about 1,200 owned delivery trucks from over 100 distribution centres nationwide. It is necessary to develop tailored distribution strategies to ensure success in different channels. For example, in traditional trade it is critical to establish robust distributor-management practices that align incentives and maximize coverage and that ensure consistent in-store execution. In modern trade, it is critical to develop strong relationships and robust account-management practices

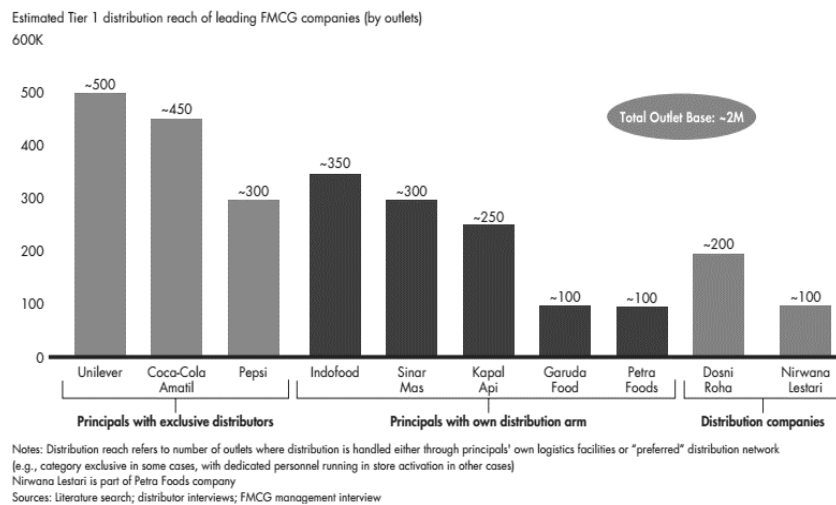


Figure 11. Leading producers have achieved broad reach with different models [32]

with leading retailers [32].

### 3.4. Forestry in Indonesia

Decline in global forest areas can be attributed to the constant increase of wood consumption. The developing countries in Africa, South America, and Asia have significant problems in this area. South East Asia exhibits the second-highest rate of deforestation [39]. Indonesia has a history of high forest loss in excess of 1 million hectares per year [40]. The state-induced official conservation rules are considered ineffective in a study of Sulawesi protected area forests [41]. There are lack of sufficient boundary demarcations and congruence between rules and local conditions. There were several programs migrating citizens from Java Island and they do not respect the indigenous, traditional social and spiritual importance of the conservation area. The community around the area converted the conserved land to

farming area due to financial constraints. A solution that integrates state law and community welfare needs to be implemented for forest conservation in Indonesia. Continuous local improvements are needed to improve the sustainability of raw materials harvested in Indonesia.

Of the globally harvested timber, more than 50% is used in industry and from that around 40% is for pulp and paper industry [39]. It is important for future sustainability that the growth in paper industry will not impact negatively to the conserved forest areas in Indonesia.

### 3.5. Packaging and packaging system

Packaging is a coordinated system of preparing goods for safe, secure, efficient, and effective handling, transport, distribution, storage, retailing, consumption, and recovery, reuse or disposal combined with maximizing consumer value, sales, and hence profit [42]. The packaging needs to fulfil complex functions [43] and requirements. The essential functions of packaging are protection, containment, preservation, machine performance, convenience, and eco-friendly [44]. The packaging needs to satisfy the requirements from the product, logistics, marketing (which is mainly for consumer) and environment point of views [45]. The overview of packaging roles can be seen in Figure 12.

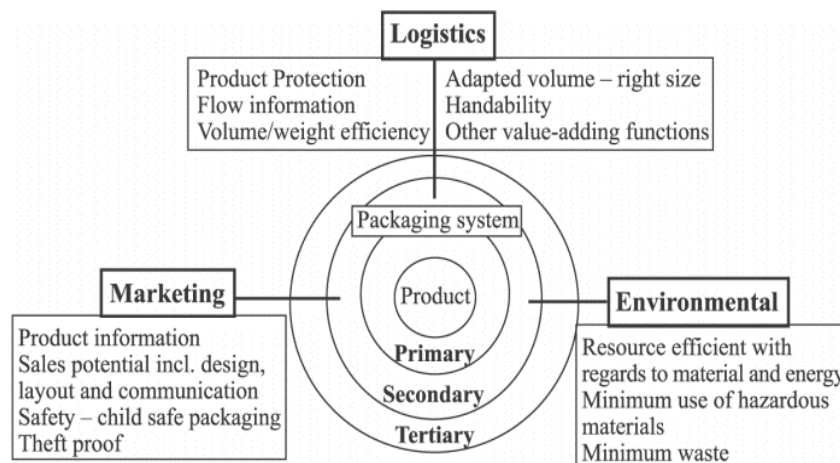


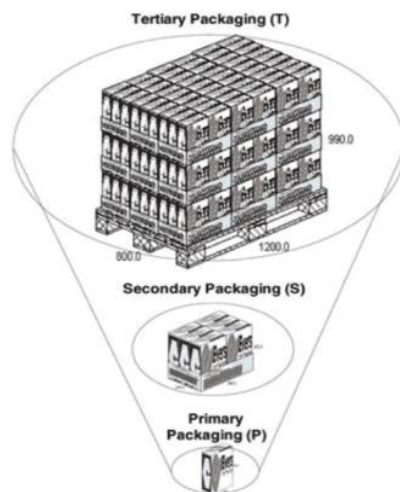
Figure 12. Logistical, marketing, and environmental roles of a packaging system [45]

The packaging can serve to reduce the risk of hazards being done to the product it contains especially during distribution. Distribution components include transport and storage. The hazards and characteristics can be seen in table 4.

**Table 4. Types of hazards in distribution [44]**

Type of hazard	Characteristics
Mechanical	Static forces: stacking, pressure, compression Dynamic forces : vibration, inertia, impact, fatigue
Climatic	Temperature, humidity, sunlight, wind, rain
Chemical	Chemical pollution from air and water
Biological	Fungi, bacteria, insects
Miscellaneous	Dust, sand, electrostatic field, electromagnetic field, microwaves

Packaging system is the three hierarchical levels of packaging (Figure 13). Primary packaging is in contact with the product and usually it is taken home by the consumer. Secondary packaging is designed to contain several primary packages. Tertiary packaging is used when a number of primary or secondary packages are assembled on a pallet or roll container. Packaging system approach highlights the interaction between different packaging levels and facilitates an understanding of their interdependence [43].



**Figure 13. Packaging system levels [43]**

There are trade-offs to be made in order to choose the most satisfactory packaging solution that fulfils the three roles and ensure the quality of the product [45]. To use one packaging system solution for one supply chain means that the supply chain actors need to be willing and have capabilities to implement the solution. There is a balancing act of trade-offs along the supply chain to achieve a functional solution. Integrated packaging development approach that combines requirements along supply chain is the preferred method to optimize costs and functions.

To have an integrative packaging development process, four factors are needed to be explored and satisfied [46]. The four factors are product characteristics (physical characteristics and features related to value and demand), packaging requirements (prioritize the requirements to control the cost of packaging), logistical conditions (optimized for efficient transport and loading/unloading), and environmental efforts. Packaging has direct environmental efforts connected to the packaging itself (raw materials, production) and an indirect environmental impact connected to its effect on the packaged product (transport efficiency and product loss). Most of the companies involve logistics late in the process or use logistics as a confirmation procedure of already developed packaging solutions. Figure 14 shows how different factors contributed to the packaging development process elements

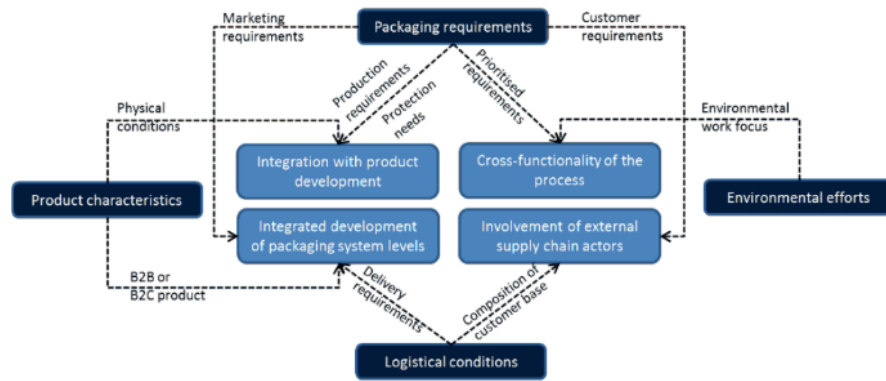


Figure 14 Summary of eco-efficient packaging development process [46]

### 3.6. Packaging and sustainability in Indonesia

Sustainability aspects are important in today's economy because of customer requirements, economic calculations, and as cross-sector competitive factors. Cross-sectorial challenges faced by paper producer nowadays are global warming, environmental pollution, shortage of resources, cost effects on the raw material and product influencing profitability, emission and pollution of air, water, and soil, social challenges and demographic developments, and increased ecological sensitization of society [47].

There is a potential in using packaging to minimize food waste during distribution and consumption phases. According to FAO [48], 28% of food produced in the world is wasted. The later in the life cycle a product is wasted, the greater the environmental impacts of its useless production and transformation. Indonesia is on Region 6 of South and South East Asia where around 32% of food wastage happens during distribution and consumption phases (Figure 15). The report shows that the cereals (including rice and wheat) wastage in region 6 is the top 3 total food wastage (almost 8%).

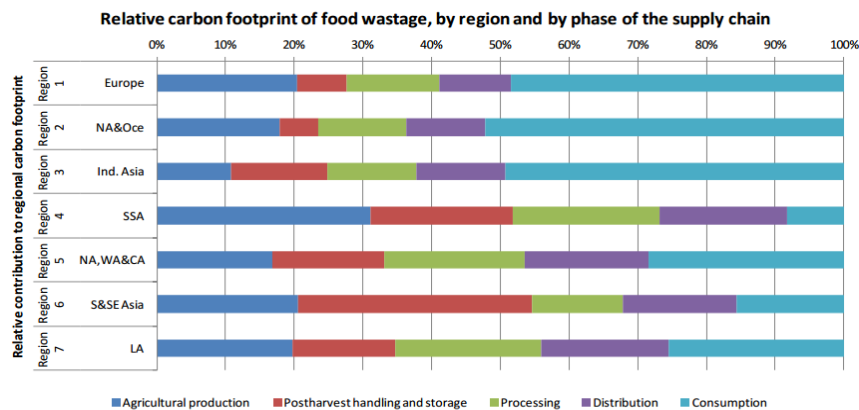


Figure 15. Relative food wastage by region and by phase of the food supply chain (FAO, 2013)

The most significant environmental impacts associated with the use of paper packaging are the loss of biodiversity at the forestry level, the fertilizers used during the tree growing, the chemicals used in paper production, and emissions generated and water used during production [27]. The environmental impacts of paper products are assessable by using evaluation tools such as Product Carbon Footprint (PCF), Water Footprint (WF), Eco-Efficiency Analysis (EEAs), or Life Cycle Assessments (LCAs) [47]. Eco-labels can be used by the customers to consider buying products that give environmental added value.

Muller and Dernel (2013) divided eco-label into 2 big groups. The first group is raw material labels or certification systems that guarantee the wood as original raw material come from sustainably managed forests. Sustainable forestry initiatives, such as the Forest Stewardship Council (FSC), aim to minimize the environmental, social, and economic impacts of forestry activities by setting forestry management guidelines and providing third-party accreditation and auditing to those guidelines [49]. The second group is product labels which confirm that the products conform to defined ecological requirements (minimization of emissions and energy

consumption, ecological raw materials). The most well-known representatives of product labels are the Blue Angel (Germany), Nordic Swan and the EU Eco-label. Different eco-labels and the criteria comparisons can be found in Figure 16.






Criteria					
Minimization of emissions (air, water, soil)	0	0	++	+++	+++
Minimization of energy consumption during processing	0	0	++	+++	+++
Gentle treatment of resources	++	+	+++	++	+++
Consideration of aspects concerning human health	0	0	+++	+	++
Use of chemicals/pesticides/ fertilizer	++	+	+++	+++	+++
Responsible treatment of forests	+++	++	++	+	++
Consideration of sustainability aspects	+++	++	+++	++	+++
Use of recycled material	++	+	+++	+	++
Accessibility of award criteria and procedures	+++	+++	+++	+++	+++
Importance for German paper industry	++	++	+++	+	+
Reliability/Impartiality	+++	++	+++	+++	+++
Consideration of land use (resource m <sup>-2</sup> )	0	0	0	0	0
Holistic view	+	+	++	++	++

Figure 16. Matrix Overview of eco-labels and selected criteria (taken from Muller and Dernel, 2013)

There are different methods of sustainable packaging that were summarized by Dharmadhikari [50]: minimizing packaging amount (weight and volume due to design or material innovation) or using recyclable, biodegradable, or reusable material for packaging. The choice on the method depends on product physical characteristics, availability of recycling centres, volume of packaging wastage, recyclable content, and the overall recycling cost.

One emerging trend among modern retailers in Indonesia is a move toward more eco-friendly practices, as consumers become increasingly aware of global environmental issues [51]. For instance, supermarkets like Giant and Hero are encouraging consumers to use cartons and biodegradable plastic bags. The consumer trend toward eco-shopping is expected to continue, as consumers, especially those in the middle and upper classes, increasingly look for environmentally-friendly options. Environmental issues have yet to be a widespread concern when purchasing consumer goods; however, the growing international attention paid to the

environmental issues related to palm oil expansion and rapid deforestation, may contribute to heightening consumer awareness at the national level.

Indonesian Ministry of Environment published Permen LH No. 02 Tahun 2014 about the Indonesian Eco label [52]. There are 2 types of logo that can be put on the product (Figure 17). The first type is Indonesian Eco label logo (Logo Ekolabel Indonesia). It is given to products which comply with the comprehensive multi-criteria standard applying the life cycle assessment from the raw materials, production, consumption, until end-of-life phase. The certification will be done by Eco label Certification Agency (Lembaga Sertifikasi Ekolabel or LSE) which is accredited by National Accreditation Committee (Komite Akreditasi Nasional or KAN). The second type is Voluntary Eco label logo (Logo Ekolabel Swadepklarasi). It will be put in products that comply with the company's set of environmental criteria. The verification will be done by Eco label Verification Agency (Lembaga Verifikasi Ekolabel or LSE) which was registered to the Ministry of Environment. The copyright for the logos is owned by Ministry of Environment.



Figure 17. Indonesian (type 1) and Voluntary (type 2) Ecolabel logo from Ministry of Environment

APP or Asia Pulp Paper is one of the biggest paper and paper packaging industry in Indonesia. Indonesian paper producers cannot get FSC certification because the plantation forests in Indonesia were developed after 1994. However, APP try to work with other environmental (Programme for the Endorsement of Forest Certification or PEFC) and social sustainability (Free Prior Informed Consent or FPIC, developed by the NGO Forest People Programme) criteria [53] which will be completed by 2020. Since consumers' awareness on environment issues is low, the eco-labelling or environmental certifications are driven by companies and the developed market demands on environmentally-friendly products.

## 4. Supply chain and consumer habits analysis

### 4.1. Product and packaging system

#### 4.1.1. Wheat flour

According to Indonesia National Standard for wheat flour as food product that can be seen in Table 3 of theoretical framework, the important things to be noted are the form needs to be powder with certain refinement, no insect in all stadium form and visible pieces, maximum moisture content of 14.5%, maximum limit of microbe contamination, minimum limit of fortified minerals and vitamins, and maximum limit of metal contaminant. These are the product requirements on the packaging. The wheat flour packaging needs to maintain the good condition of wheat flour in high humidity (71-81% relative humidity) and high temperature (average temperature 23-28 °C) Indonesia. The packaging needs to be sanitary, contains enough barrier prowess against humidity and oxygen (to minimize the chance of insect growing), and relatively stable under high temperature (28 °C) storage.

The focus of this thesis is the premium wheat flour 1kg plastic bag packaging. The 1,000 meter material rolls of PP (polypropylene) are received by the plant receiving division. It is then transformed by the packaging machine into bags while being filled with flour. The packaging line has eight machines. Two machines are low speed, while the other six are high speed machines with productivity rate of 55 pieces flour bags per minute. During observation, there are 2 different products being done in the same shift.

The bags are transferred along the conveyor belt to one of two manual secondary packaging stations. Twelve 1kg premium flour bags are packaged into corrugated box as secondary pack. The box is transferred to shrink-wrap station. A worker with waist and wrists support stacks the boxes on a pallet. There are 50 boxes per pallet. There are empty areas in the pallet because there was no coordination between two packaging levels during the packaging development. There is potential to improve the interaction among packaging levels in the packaging system of wheat flour in Bogasari. The compatibility between packaging systems can be found in Table 5



where modularity, filling rate efficiency, and stability was not observed in Bogasari premium flour secondary and tertiary packaging levels.

Table 5 Compatibility between packaging systems for packaged flour and rice (based on [34])

Compatibility between primary and secondary package	Compatibility between secondary and tertiary package
Stability	Stability (type of stabilisation and stacking style)
Protection	Protection
Filling rate (volume and area)	Efficiency in filling rate (volume and area)
Weight / ergonomics	Storage (on certain conditions)
Image and promotion	Standardised packaging types
Handling efficiency (shape, shelf adaptation, opening feature)	Modularity
Economical	Economical

However, the pallet is used only internally during transportation from production line to finished-product storage (Figure 18) and from storage to the loading dock. The boxes are stacked on the truck without pallet in between. There can be 8-12 boxes stacked on top of each other, even with clear indication on the box that



Figure 18. Bogasari flour products during storage maximum stacking is 5 boxes.

#### 4.1.2. Packaged rice

Rice under different classes have different quality components attached to them (SNI 6128:2008, refer to Table 2 in theoretical framework chapter). The most important quality standards are the water content of rice, percentage of head grain

and broken grain, and the number of yellow or chalky grain that signifies prolonged storage in high humidity and high temperature. A good packaging needs to preserve the quality of rice it packaged even under high humidity and temperature environment in Indonesia. Rice packaging needs to be sanitary, contains enough barrier against humidity, and gives enough protection so breakage of head grains are minimized during transportation along the not-so-good infrastructures of Indonesia. The summary of the packaging systems for premium 1kg flour and 5 kg rice can be seen on the table below. The internal pallets are used for easy transportation from the production area to storage area and to delivery area. It is only used internally as normally return system for pallets are not done in Indonesia.

Table 6 Packaging system of 1 kg wheat flour and 5 kg rice

Packaging system	1kg wheat flour	No. of primary package	5kg rice	No. of primary package
Primary	1kg PE bag	1	5kg LDLPE and nylon bag	1
Secondary	Double fluted cardboard box	12	-	-
Tertiary	Internal plastic pallet	600 (12x50)	Internal wooden pallet	60

According to Sohrabpour and Hellström's paper on packaging in developing countries, there is apparent focus on direct cost of packaging with no or small considerations on the optimisation of packaging in reducing the overall supply chain costs [10]. The lack of secondary packaging for 5kg rice bag and no pallet being used during transport from factory to distribution centre might cause damage in the products along the supply chain. The existence of exchanging broken products with new ones means that some plastic bags are not strong enough to withstand the distribution mechanical hazards.

## 4.2. Logistics system description

During the research, there is a focus on one actor of each supply chain stage. There is a focus on modern retail with PT Trans Retail Indonesia's Carrefour store as preferred retail store. The wheat flour producer chosen is PT ISM Bogasari Flour Mills with Cilincing factory, North Jakarta. The rice producer is Mahkota ABC with its factory in Karang Tengah, Tangerang. The distribution centre (DC) is ID Logistics distribution centre in Pondok Ungu, Bekasi. The retail is Carrefour store

in Tangerang City, Tangerang. Figure 19 shows the geographical positions of each supply chain.



Figure 19. Geographical locations of manufacturers (red), DC (blue), store (green) (map made by Google maps)

The distance between the flour producer and the DC is 19km and 42km between the rice producer and DC. The distance from the DC to the store is 57km. The distribution trucks cannot go through Jakarta inner toll road from 05.00-22.00. The only possibility is to use Jakarta outer ring road during these hours. Jabodetabek (Jakarta, Bogor, Depok, Tangerang, and Bekasi) can be considered the metropolitan area of Jakarta with dense suburbanized zone.

Each Carrefour store will make replenishment purchase order that are summarised by the central EDI (electronic data interchange) software. Suppliers will get a centralized purchase order to be fulfilled by delivery to DC Pondok Ungu.

After unloading, the incoming products are checked by the handheld terminals with radio frequency technology. The planning for each stores (loading draft) is loaded into the handheld terminals. The manual pickers organize products into pallets designated to specific stores. After a mixed-product pallet is done, it is wrapped with plastic to fix the formation of products on the pallet. The pallets are organized into the truck in one level (no stacking). Smaller stores with less volume order are clustered together and will be served by multi-drop truck. For bigger stores, one truck transported products from DC to one store. The filling rate or truck loading rate is 98%.

The receiving in the Tangerang City Carrefour store check the conditions and the number of products being delivered. If there are any defect products, the products need to be reported. Around 0.03% products were broken due to transportation reason. Depending on the capacity of workers in the receiving area, the empty pallets need to be returned with the outgoing truck back to the DC or with the next

truck. The truck might go to suppliers' sites along the way back to DC if the suppliers signed up for DC product pick-up service.

The products from the mix-products pallet will be organized to the store display. The store employees or company sales people will do the shelving. Each of them has a pocket razor knife which comes in handy in opening up secondary packages in order to display the primary packages correctly on the shelves.

The interactions between packaging system and logistics processes for wheat flour and packaged rice can be seen on Table 7. Since there is no secondary packaging for 5kg rice, it is not included in the interaction.

**Table 7. Interactions between packaging system and logistics processes for wheat flour and packaged rice**

Product	Supply Chain Members	Manufacturer		Transport	DC			Transport	Retail Outlet		Reuse and Recycle
	Packaging System (row) \ Logistics Processes (column)	Filling process	Warehousing process		Receiving process	Picking process	Shipping process		Receiving	Replenishing process	
Wheat flour	Primary	X								X	
	Secondary	X		X	X	X			X	X	X
	Tertiary	X	X			X	X	X	X		X
Rice	Primary	X		X	X	X			X	X	
	Tertiary	X	X			X	X	X	X		X

### 4.3. Packaging system evaluation by supply chain actors

Packaging scorecard is a systematic evaluation method on the contribution of packaging to the efficiency and value creation in the product supply chain [15]. It can identify the strengths and weaknesses of the packaging system according to different participants in the supply chain. This method generates better overview and understanding of the packaging system performance throughout the supply chain.

Different actors in the supply chain were asked to fill in the packaging score card with multi-criteria evaluation for each package levels handled. For each criteria, the supply chain actor needs to assign scores on how relevant each feature is (0 to

100%) and how satisfied they are with the current solution (0-4, with 1 being not satisfied at all and 4 being satisfied completely). The data can be found in Appendix 8.4.

There is a unique condition in the packaging system of Indonesia. The tertiary package (pallet) that is handled by the manufacturer are not the same tertiary package being handled by the distribution center and retailer. Manufacturer has internal palletization system while the DC and retailer deal with mixed-products pallet. This condition will explain the similarity between DC and retailer result for tertiary packaging.

These data were then analysed in two ways; vertical analysis and horizontal analysis. Vertical analysis is done for each actor in the supply chain and for every part of the packaging system. It is done by calculating the overall score based on the relative importance of packaging level for that particular actor. Horizontal analysis is to analyse the importance of particular parts of the packaging system. This is done by calculating the importance and score of each particular feature across the entire supply chain. The vertical and horizontal analyses results are cross-referenced with the results of interviews and observations to have an insight on the lacking aspects of current packaging.

#### 4.3.1. Vertical and horizontal analysis of wheat flour packaging system

After calculation, it can be seen at Figure 20 that the manufacturer is more inquisitive and critical on all packaging level with most concern on the primary level (3.36 weighted score), followed by the tertiary level (3.77 score), and the secondary level packaging (3.88). The distribution center is satisfied with the packaging levels that are being handled (the secondary and tertiary levels). The retailer has concern on the primary packaging with 3.63 weighted satisfaction score, while the secondary and tertiary packaging levels have perfect scores.

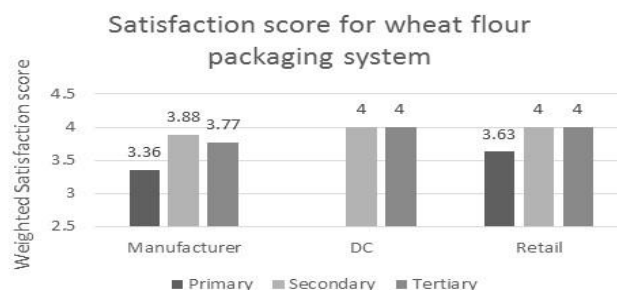


Figure 20. Graph of weighted satisfaction score for current wheat flour packaging system by

To analyse deeper, horizontal analyses are done on each packaging level. Primary package has a lot of criteria that are considered important by the manufacturer. Manufacturer has main concerns (score 0-2 of the criteria) on stacking ability and the reduced use of resources for the current PE bag (dark bars on Appendix 8.6.1). Based on the interview, the primary packaging is stacked manually inside the secondary package box. There are concerns about the air in the primary packaging that makes the packaging have pillow-like shape. This reduces the stacking efficiency inside the secondary packaging. Bogasari has environmental focus with the other packaging unit in the factory using bio-degradable plastic sack. The consumer packaging unit factory manager has concerns about the current PE bag that is produced from fossil fuel and not bio-degradable. To ensure that Bogasari is ahead of environmental regulations set by the government, measures on making the primary packaging more environmental friendly must be taken soon. Smaller concerns (with score 3) from the manufacturer are on the unwrapping, packaging cost, safety, and volume weight efficiency.

Small concerns from the retail store on the 1kg flour bag are on the stacking ability, selling capability, and handling ability. Since the product has puffy dimension, the store organizes the products in floor basket display. This display is preferable than organizing the bags on standing shelves. Other concern is on the selling capability because the products are stacked horizontally on the floor basket, while there are no product information being visible on the side of the basket (products need to be displayed to make the floor basket display more attention-grabbing, can be seen on figure 21). The plastic bag is quite hard to be displayed on the retail shelves. If the shelf is filled with products, the product facing is fully displayed. If the shelf is not full, the products collapse with less presentable display. This also cause concerns on handling ability because shelving needs more time.



Figure 21. 1kg flour bags in floor basket display

The only secondary packaging small concern is on manufacturer side for unwrapping criteria (Appendix 8.6.2). The concern is linked to the tape that closes the cardboard box and the shrink wrap around the box. It is not considered perfect because sometimes the shrink wrap is not applied correctly to the box and easily broken. This will negate the effect of applying shrink wrap.

The wheat flour boxes are stacked to the internal pallets in the manufacturer side. The product is delivered in secondary package during transportation from manufacturer to distribution centre. At the distribution centre, the boxes are organized in mixed pallets and being distributed to retail store. The distribution centre and retail store feel that the mixed pallets are good enough with no concern (Appendix 8.6.3), while the manufacturer has main concern on the volume and weight efficiency. During the interview, the factory manager raises concern that the boxes are not modular with the pallet. There are empty spaces on the pallet as the boxes are not designed to match the pallet capacity.

#### 4.3.2. Vertical and horizontal analysis of rice packaging system

After analysing the data collected with packaging scorecard method, manufacturer is not so satisfied with the primary packaging of 5kg LDLPE and nylon bag (2.99 satisfaction score) and the tertiary packaging of wooden internal pallet (2.86 score). DC is satisfied for both packaging levels. Retail store has concerns on the primary packaging and is satisfied for the tertiary packaging. The results can be seen at Figure 22.



Figure 22. Graph of weighted satisfaction score for current rice packaging system by different supply chain actors

To analyze for each packaging level, horizontal analysis of the packaging scorecard is done. For the primary package, manufacturer has main concerns (score 0-2 or dark

bars in Appendix ) on the packaging cost, volume and weight efficiency, and machinability. During the interview with Mahkota ABC director, the packaging cost is fluctuative according to the price of fossil fuel. The volume and weight efficiency was considered a main concern because during festive period (Lebaran or festival when Moslems give out gifts to more unfortunate people) there are demands for 2.5kg packaged rice, while it is more difficult to be packaged manually (the weighing machine can weight minimum 5kg). Machinability has low score because the weighing is automatic, while the sealing is done manually. Manufacturer is satisfied for the spout design, safety, and product information. There is no specific spout design on the current packaging, customer needs to open the packaging by cutting the upper part of the bag. Manufacturer feels that since the other packagings available in the market are similar, there is no need to be concerned about the spout design.

Distribution center is satisfied on the current primary package. Retail store has main concern on the stacking ability of the primary package. The product has pillow-like form and more difficult to be stacked on the shelf. It is normally not stacked on the display shelf (figure 23). Small concern is on the handling ability as each product needs to be shelved in standing position, so more care is done in shelving.



Figure 23. Rice display in hypermarket (upper shelves are for 2.5 or 5kg bag, while the lower shelves are for 10kg sacks)

Rice bags are stacked on wooden pallet for storage in the manufacturer side. Manufacturer has small concern on the product protection as sometimes the products from lower layers of the stack leak. Rice bags are transported by stacking on a truck to the distribution centre. During receiving in the distribution center, the incoming packages are inspected. The broken packages are being reduced from the purchase order report. The bags are stacked into mixed pallets in the distribution



centre to be transported until retail store. Distribution centre and retail store feel that the mixed pallet serve its purpose well. This reflects well on the very small percentage of broken products being received in the stores (only 0.03% of total sent products, based on the interview with DC manager). However, this percentage does not include the returned rice packs that are received as broken packages in the stores. The cost of distribution and the renewing with good packs are paid by the manufacturer.

## 4.4. Consumer behaviour analysis

### 4.4.1. Consumer behaviour towards wheat flour

Wheat flour is purchased both during the big monthly purchase and during top-up purchase. Some consumers feel that stocking wheat flour is important, while the other consumers feel the need to purchase only when wheat flour is needed for cooking or baking. After big monthly purchase, consumers might take the purchase home by using private car, public transport (bus or van), or motorcycle (private or motor taxi). Top-up purchase is done from mini markets around the house. They will take the purchase by foot or by motorcycle. Top-up small purchase due to daily necessity is backed by the report from Euromonitor [34].

Most of the interviewees do not have flour available in their houses. The ones who have flour, they use the original packaging (not displacing the flour into a container), bind it with rubber band, and putting it in air-tight containers (Figure 24). One interviewee wraps the flour with rubber band and store it in the refrigerator. The containers can be stored on kitchen table, kitchen cupboard, or refrigerator.



Figure 24. Flour bags being stored in air-tight containers

Even though there is an increase in flour consumption in Indonesia, this is mostly because of the increase in the small business number (bakeries, pizza restaurants, flour-based snacks) and higher consumption of instant noodles [25]. Indonesia loves deep-fried food, the flour is used by households as batter coating. Others use the flour to make pancakes, doughnuts and cakes.

The flour becomes cakey during storage. Indonesians have the habits to sieve through flour before usage as food ingredient. The flour is less prone to caking if it is kept in air-tight container. During prolonged storage, flour ticks can be observed.

#### 4.4.2. Consumer behavior towards packaged rice

Rice was traditionally considered as low involvement, bulk, and non branded products with certain price range indicating the quality of rice. Brand loyalty is not strong as the biggest brand only contributes to 2% of total packaged rice being sold in the modern retail [18].

Rice is bought during big monthly purchase from hypermarket, supermarket, or trusted rice seller (traditional retailer). Consumers use motorcycle (balancing on the space between the handlebar to the driver sitting place or on the space behind the driver), public transport (bus, van, or motorcycle), or private car to bring the packaged rice home.

The consumers have different ways of storing the rice. One way is to put in rice boxes or rice dispensers (Figure 25). The rice boxes' volume starts from around 10kg to 38kg. On some of the big types, there are drawers that dispense rice in 3 different settings, 150, 300, and 450 grams. On the small types, the drawer will dispense 150 grams of rice. This is around 1 cup of rice that can result in 2 portions of cooked rice. The consumers who store the products in these dispensers are normally bigger families with at least two members being older than 35 years old.



Figure 25. Rice boxes or rice dispenser 10.5 - 38kg

A single-person family consumer stores less than 1 litre of rice in a plastic jar (Figure 26, left image). It is common for young Indonesians from medium and high-income households being unable to cook basic meals as eating out is relatively cheap and there is a maid who prepares the meal for the family [34]. Other families store rice in plastic box container (Figure 26, right image). The storage containers are normally put on kitchen table or kitchen floor.



Figure 26. Rice storage in plastic containers

Some consumers use the packaging (figure 27 left and middle) to store the rice. Other consumers are using other containers, such as pail or cooking pot. These consumers are young families and families with grandparents aged more than 60 years old.



Figure 27. Rice storage in pails and cooking pot with scooping devices

There are scooping devices which is normally plastic or metal cups that is used to measure the rice before cooking. The use of rice cooker with keep-warm option is widely spread in Indonesia. Since rice can be eaten for the three meals of the day, rice is cooked in big volume and kept warm in the rice cooker. Mini rice cookers can cook 0.6 litres of rice, while the normal rice cookers' capacities are 1 litre or 2 litres.

From interviews, most of the customers are buying bulk/loose rice from preferred sellers. Some customers have retailer's credit cards with weekend deals. Packaged rice can be discounted up to 50% during the weekend deal. The customers normally

take the deal by buying the rice variant close to what they normally buy. Even though there is a trend to do top-up food shopping from small supermarkets [34], most of the interviewees keep a check on the amount of rice in the house and buy it during the monthly or big shopping journey.

During the observation, the current packaging has holes to assist in carrying the product (figure 26). This feature is deemed not helping as the holes are cutting through the fingers especially because of the 5kg weight.



Figure 28. Private label 5kg rice with holes on top to assist carrying

## 5. Discussion and proposals

### 5.1. Meeting supply chain needs

According to the analyses on the supply chain actor's needs, there are certain shortcomings of the current packaging options. Bogasari as the biggest wheat flour producer in Indonesia is innovative and maintain its position as market leader by launching innovative products. Bogasari launches an environmental campaign by using biodegradable sack for 25kg bulk flour. Thus, there is a concern of consumer-packaging factory manager to use more environmentally-friendly packaging. The product safety is important too, the packaging solution should not contain hazardous substances. The manufacturer is satisfied for the recyclability of the secondary packaging.

For the packaged rice, the cost of packaging is the main concern of the manufacturer. The changes on packaging system need to be cost effective too. Supply chain actors need to think of the overall gain, not only the cost-cutting on their side. Suppliers to the modern retailers usually are not paid immediately for their sales but required to wait, often up to 20 days, for payment. Efforts to boost efficiency and cut costs in modern supply chains have met some resistance from suppliers as the sacrifice on meeting the payment term [35]. This trend spotted in literature, is apparent especially in the packaged rice supply chain. The manufacturer is a follower with less negotiation position with modern retailer as it is not the market leader. The cost of leaking packaged rice packaging is tackled by the manufacturer (exchange leaked products with good ones). Bogasari is market leader with wheat flour products that can be considered customer-magnets and the leaked products are considered as the cost for retailer. Even though both products are staple foods, due to the difference in manufacturers' leverage on negotiation, the flexibility to change in the packaging system is different too.

A more detailed discussion on the investment of packaging machines and the long-term gains need to be done with the packaged rice manufacturer as a growing company. Mahkota ABC has faster and more effective production due to investment on automatic weighing machines. By automatizing the packaging machines, the production rate will be higher. The manufacturer can cater to more demand of both own brand and retail store's private label brands.

For the packaging system of wheat flour, the primary packaging of PE bag has puffy shape that is not volume efficient in secondary packaging and harder to be stacked in the store display of floor basket (horizontally) or shelf (vertically). Current design is very identifiable with colour codes. However during the floor basket, products need more care to be displayed as when it is stacked horizontally, the facing is not consumer friendly. Besides that, the store associate needs to take out the products from secondary packaging and stack it one by one to the basket.

Packaged rice is displayed on standing shelves. The bags are not designed for this display. A better solution that can increase the display and handling ability in the retail is needed.

The wheat flour manufacturer feels that the efficiency of primary packages while being stacked inside secondary package and stacking of secondary to tertiary package can be enhanced. Currently the bags are stacked manually to the secondary box. A primary package solution that can be stacked automatically to the secondary and tertiary package is preferred, especially to cater to ever-increasing demand of wheat flour from Indonesia consumers. To assist the store in displaying the product by reducing the work hours needed to display, a tertiary or secondary packaging that is ready or easy to display can be developed. This should not compromise the protection of the product especially through the subpar infrastructures in Indonesia. This is agreed upon by Sohrabpour and Hellström [10] that the packaging system needs to endure rough transport conditions. The application of shrink wrap plastic around wheat flour corrugated box is good in ensuring the protection of the product against water during distribution which is good considering an average of 165-215 rainy days in Indonesia [29].

The current secondary packaging solution can endure the stacking during transportation from manufacturer to the distribution centre without the help of palletisation. Secondary packaging or packaging level being used during transportation need to withstand high stacking. During observation, there are 8-12 boxes of wheat flour stacked on top of each other in the transporter truck even though there is a caution on the box saying maximum stacking of 5 boxes. The primary packaging of rice need to have the strength to withstand stacking and transport during distribution as there is an absence of secondary packaging. The habit of high stacking in truck during distribution in developing countries is prevalent [10].

## 5.2. Meeting customer requirements

Staple food category continues to benefit from the increasing preference of Indonesians for products in convenient and practical packaging [18]. For example, Indonesian children are increasingly attracted to breakfast cereals in single-use portable Styrofoam bowls, which offer a high degree of practicality. The popularity of spreads and condensed milk packaged in a pouch format with nozzles is also increasing. This packaging format tends to be more convenient and is lower priced than products in more traditional bottle packaging.

Indonesians do not consume wheat-based foods as staple food yet. To introduce the lifestyle of consuming wheat-based foods, it will be interesting to launch convenient and practical packaging of wheat flour. As a new example, the portioned cake-mix brand of Bogasari, Chesa, has good sales targeting time-conscious and practical urban consumers.

The colour of a packaging matters when consumer perception is examined with light packaging colours being preferred when low involvement products are considered [54]. While the new packaging had to be distinctive, it is not supposed to be too futuristic and is still recognisable as its family category product. This can be applied for packaged rice that is considered to have low involvement with consumers being very price and discount oriented. A distinctive graphical design needs to be established to increase the consumer awareness on the brand and quality of the product. There are six stages before the consumer decide which product that they want to buy: awareness, knowledge, liking, preference, conviction, and purchase [55]. Good packaging options will be distinctive packaging and still show that it comes from packaged rice category. This will win the consumers during the first moment of truth [14]. According to the director of Mahkota ABC, the consumers use the packaging window to ascertain the quality of the rice they are buying. This is due to big varieties of rice quality and kinds available in the market. If there is no window, it is necessary for a packaging graphic that is indicative of the quality of the rice being produced. By doing this, the consumers will have good second moment of truth [14] and being more engaged to the brand and repeat the buy.



### 5.3. Packaging proposals

Based on the exploratory case study on the packaging being used by wheat flour and rice in Indonesia and based on previous literature on developing packaging system for developing countries [10], there are some general proposals that can be drawn. The proposals are drawn to see the needs of the supply chain and consumers in Indonesia and to push the development of paper-based packaging in Indonesia.

First general proposal is that different products from different manufacturers can use different paper packaging development approaches. The approach is based on the manufacturer financial ability and innovation involvement, consumers' usage habits, and negotiation position with the modern retailers. The solutions still need to answer to product, logistics, marketing, and environmental requirements.

Bogasari as the market leader with high negotiation position with modern retailers, good financial ability to invest on new packaging machines, good handling on overall distribution systems, innovative, and good concerns on environmental issues are very likely to apply new paper-based packaging system. The new system might be innovative and cater to urban consumers of Indonesia more. These consumers have more buying power with desires for practical and convenient goods. A good primary packaging can be based on BillerudKorsnäs FibreForm® with PE lamination for around 1kg volume. Using such differentiated paper packaging with focus on environment sustainability, the profit ratio can be increased. The product can be introduced first to modern retailers. The primary packaging can be in cylinder or cubic form with reclose able seal. This will ensure that the relative humidity of the flour during storage is constant. An idea of the primary packaging can be seen below. However, the highly distinctive colour codes and product logos need to be prominent on the graphic design of the primary packaging.

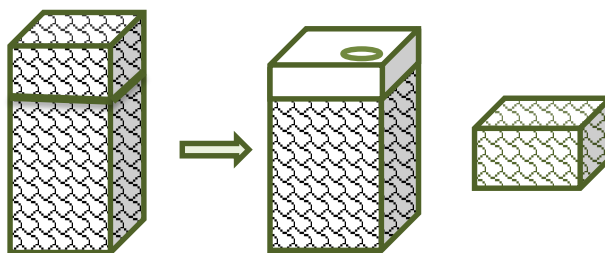


Figure 29. FibreForm based solution with easy-to-pour spout and reclose able. The cap can be used as measurement device (cup or 100gram).

The primary packages can be organized efficiently to secondary packaging of corrugated box. These boxes can have easy-to-display property with tearable section and the height is good to be displayed directly in modern retail shelves. Since it is easier to display in retail stores, a negotiation on the payment term or other retail conditions can be done. The primary packaging height is similar with the secondary packaging, during stacking the pressures are evenly distributed and less leakage or damaged packages can be found. The dimension of primary, secondary, and tertiary packaging should be considered during the packaging development so the volume and weight efficiency is optimized.

Mahkota ABC is packaged rice producer for both own and private label brands. For private label brands, the negotiation terms are more balanced as the modern retailers also need constant production of private label products. It is easier to change the packaging of the private label brands because retailers are more ready for change especially for environment sustainability causes. Private label products have more access on the shelf display planogram as the negotiations are done internally in retail chains. Private label products do not have marketing budget, most of the marketing is done on the display of retail stores. High distinction of products are very valuable for private label products. However, the product is very price sensitive, so cost-efficient packaging option is necessary without compromising the product and logistics needs.

Paper bag like the flour or sugar packaging that are widely available in Sweden can be adapted to pack 5kg of rice in Indonesia. BillerudKorsnäs' sack solutions are able to reduce paper use by up to 30% and increase productivity during filling by up to 25% [17]. Lamination of PE is needed to maintain the 14% moisture level of rice in the package. The graphic design needs to be representative of the rice contained inside if no plastic window is considered for the solution. There is a feature to simplify carrying the packaging as can be seen in Figure 29. This feature doubles as resealing device (wrap the extra paper around and retie). The primary pack can be easily store on the kitchen floor, cupboard, or table. The rice can be transferred to rice boxes or rice dispensers too.

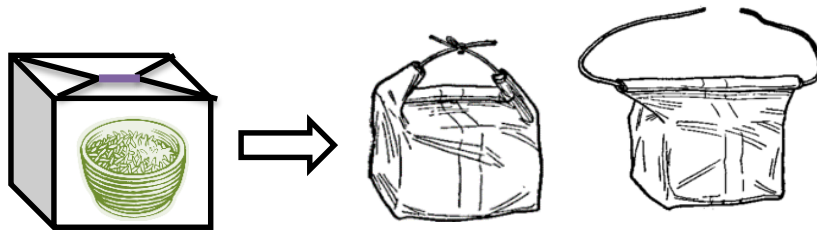


Figure 31. Primary packaging of rice with easy-to-carry feature that doubles as resealing tool (2 right images are taken from about.com)

To simplify the displaying and to spread the pressure during stacking, the primary packages are arranged on corrugated cardboard tray and will be shrink wrap with plastic. The trays will assist in distributing the pressure during stacking along distribution. The plastic shrink wrap will ensure that the primary packages are safe even in wet environment. This secondary package needs to be modular with the retail display shelf and the pallet in factory and distribution. However, primary and secondary packages are strong enough to withstand stresses during transportation if the transportation goes as per today without the use of pallets in the truck.

A second general proposal is that a holistic approach of packaging development needs to be taken during the packaging development. This will cause cost effectiveness and increase packaging performance along the supply chain. Current packaging development in Indonesia manufacturers relies on the packaging manager with focus in marketing aspects of packaging.

There will be hesitation to implement the paper-based packaging solution especially due to initial investment on new packaging line. The observations along supply chain and cross-referencing with literature sources point out that logistics in developing countries focus on the strength and agility of secondary packaging [10]. This is because sub-optimisation of packaging stacking during distributions.

For this case study, the focus is only on big modern retail. For traditional retail, the logistics supply chain is more complex due to bigger number of distribution levels (intermediaries) and number of distribution points [10]. Even in the modern retail chain, the use of packaging to overcome the bad transportation infrastructures is significant in Indonesia. To reduce the cost of transport, warehousing, and distribution from 14% of total production costs [31], optimized and multi-functional packaging system needs to be introduced. Current packaging development is done by the marketing side with no or minimum regards on the supply chain needs. The paper-based packaging system that can be applied in

Indonesia needs to answer the product, logistics, marketing, and environmental requirements.

BillerudKorsnäs has the knowledge of packaging's systemic evaluation and the technology to apply the correct packaging solution to specific supply chain. Using that knowledge to contribute in the packaging development process will be strategic in penetrating Indonesian market.

Third general proposal is that contacting the correct divisions of manufacturer who have responsibility on packaging development decision is very important. Communicating the advantages of using paper-based packaging from virgin long fibres of sustainable forest to decision makers are important. To supply paper-based materials, it is preferable to contact packaging suppliers as they cater to different producers in Indonesia.

According to experience during the case study, big subsidiary company like PT ISM Bogasari Flour Mills has big organizational structure with very specialized sections. The factory manager and quality manager has a say in the final decision of packaging development. However, the marketing section and the packaging designers are the ones developing packaging solution for the company. Bogasari is a business unit of PT Indofood Sukses Makmur. PT ISM has packaging division under consumer branded products business unit. The packaging materials are produced by sister companies of the Salim Group, with PT Surya Rengo Containers producing corrugated packaging. Indofood has annual or biannual packaging and quality trend spotting. Besides, the tender of packaging are done by the purchasing division of Bogasari. The paper-based packaging materials and solutions that can be supplied by BillerudKorsnäs need to be exposed to Bogasari business unit or Indofood as the leading packaged food producer in Indonesia.

For smaller producers such as Mahkota ABC, the owners still have a big say on the packaging decision. The private label producer might send the idea to the merchandise section of modern retail. If the decision to be more environmentally sustainable is made by the decision makers of retailer, the project to implement paper-based packaging solutions can be done swiftly.

There are very well-known packaging suppliers like TetraPak for paper cartons or Nippon for plastic pouch to whom producers and retailers prefer to get the packaging from. Modern retailer normally employs internal packaging manager. The packaging manager might instruct the suppliers to contact the preferred

packaging suppliers. Contacting the packaging managers of modern retail can be done too.

## 6. Conclusions

Due to the humid nature of Indonesia and the unavailability of long fibered paper raw material, there is slight motivation to use paper bag as dry food products packaging. A potential was spotted for the application of high strength paper bag packaging in Indonesia. BillerudKorsnäs can supply high strength paper bag packaging from trees growing sustainably in the Nordic forests.

Packaging system interacts with actors and the activities they do along the supply chain. An analysis with a focus on modern trade supply chain of wheat flour and packaged rice gave an insight on the current plastic packaging and how it interacts with different actors. For current supply chain, the producer of wheat flour (ISM Bogasari Flour Mills) gave low score for the modularity of their secondary packaging with the tertiary packaging and the sustainability of the primary packaging. The producer of packaged flour (PT Mahkota ABC) scored the primary packaging as good enough for the product protection, but analysis showed that the primary packaging acts as transport packaging from the manufacturer to the distributor. This practice is common for packaged rice products in Indonesia where the manufacturer becomes responsible for the broken packages. However, Mahkota ABC does not keep track on the returned broken packages and how much money they loses on this. The distribution center of ID Logistics is quite effective in re-arranging the products into mix-products pallet that would be delivered to each store. Carrefour store manager commented that the existing rice packaging is quite hard to be displayed as it is not supposed to be displayed as standing on the shelf. The wheat flour packaging display is on floor-basket display which needs to be organized stably. The consumers of wheat flour and packaged rice in Indonesia has their own know-hows to transport the products home and store them at home. Retail stores are growing even into small towns in Indonesia, it is easier for consumers to reach modern retail stores either by foot, on motorcycle, car, or public transport. It will be better to put easy-to-handle features on products like the 5kg packaged rice so that customers can bring it home easily while they are on foot or balancing it on their motorcycle. Wheat flour with its packaging is normally closed with rubber band, put into an air-tight container or put in the fridge to keep the flour dry. Rice can be stored into the rice box or in its own packaging into a pail or container. Resealing feature is still a novel feature in current Indonesian products, but this feature was reviewed as necessary during the case study.

Producer of wheat flour is the market leader and launches innovative wheat-based products. ISM Bogasari Flour Mills is willing to invest on new packaging and new packaging format. PT Mahkota ABC is small packaged rice producers, just like most of local rice producers in Indonesia. This producer has good connection with private label of different retailers. Projects on private label products focusing on sustainability can be voiced out by PT Mahkota ABC with the proposal solution.

The study of current modern trade supply chain of wheat flour and packaged rice in Indonesia shows how the plastic packaging adapt to the different requirements to packaging and where the improvements can be done. The inputs from supply chain actors and consumers during the interviews, observations, and packaging scorecard were valuable to draw some improvement proposals. This thesis contributes to an development at packaging in Indonesia by using holistic overview of the packaging and co-creation which is not currently in practice.

The proposed solutions for each wheat flour and packaged rice integrate the product, logistics, marketing, and sustainable requirements based on the inputs collected during the case study. The wheat flour is packaged in FibreForm packaging with innovative visual and texture. The cap can be used for measuring out of the wheat flour. The cap serves as resealing device that can keep the flour dry. Primary packages will be put in a cardboard box which has a tearable section so the packaging can be easily displayed in retail, even in the floor-basket display. Tertiary packaging will be filled modularly with the boxes.

The proposed solution for 5kg rice is a cube-like bag packaging with a handle that assist consumers when they transport it home. The handle will act as resealing device during storage at home. The secondary packaging is a cardboard tray with plastic shrink wrap that ensures the protection of the product during transport. The shrink wrap can be easily peeled by the retailer and slide the secondary package straight into shelf. Tertiary package is an integrated pallet, but the secondary and primary packages are strong enough to withstand transportation without pallet, as customary now.

Laminated, long-fibered paper bags are suitable to humid, tropical climate of Indonesia. Product, logistics, marketing, and environmental requirements were thought of to draw general proposals that are particular to Indonesia modern supply chain of wheat flour and packaged rice. The insight of current supply chain and consumer needs are essential to know how to approach Indonesian market. The knowledge of holistic and co-creation approaches of packaging development that

BillerudKorsnäs, as this thesis' industrial partner, has will be the unique selling point to future Indonesian partners as these are considered new approaches in Indonesia.



## 7. Future research recommendations

This research is done on the modern retail supply chain. However, staple food is mostly distributed in traditional retail in Indonesia. Modern retail outlets are positioned around cities, while the traditional retail outlets were established to reach the small towns. Exploratory studies on how the packaged rice and wheat flour are distributed in traditional retail will be interesting to be done. The comparison between the packaging of packaged products and the general packaging of bulk or loose products can be done too.

Next step of this research might be to narrow down packaging suggestions and get feedback from supply chain actors and consumers to pick the optimal and feasible (cost and logistics-wise) packaging solution. Quantitative comparison on costs of packaging, transport, distribution, and warehousing among different packaging suggestions can be made to choose the final choice.

Indonesia has numerous paper producers which use tropical broadleaved trees with shorter fibre. There is good potential to cooperate with a local paper producer to make FiberForm package.

## 8. Bibliography

- [1] A. Riley, "Paper and paperboard packaging," in *Packaging technology Fundamentals, materials and processes*, Cambridge, Woodhead Publishing, 2012, pp. 178-239.
- [2] P. Bosander, Interviewee, *Business Development Director*. [Interview]. 21 November 2013.
- [3] M. Saghir, "The Concept of Packaging Logistics," in *Second World Cconference on POM and 15th annual POM Conference*, Cancun, 2004.
- [4] C. Olsmats and C. Dominic, "Packaging scorecard - a packaging performance evaluation method," *Packaging Technology and Science*, vol. 16, pp. 9-14, 2003.
- [5] Euromonitor, "Packaging Industry in Indonesia," Passport , UK, 2013.
- [6] P. Hemphill, "Weekly Times Now Australia," 12 March 2014. [Online]. Available: <http://www.weeklytimesnow.com.au/commodities/grain-and-hay/rabobank-report-suggests-indonesia-will-reach-the-10-million-tonne-mark-for-wheat-imports-within-five-years/story-fnker6ee-1226851329305>. [Accessed 1 May 2014].
- [7] S. Mohanty, "Trends in global rice consumption," *Rice Today*, pp. 43-45, Jan-March 2013.
- [8] Weatheronline, "Indonesia Climate," April 2009. [Online]. Available: <http://www.weatheronline.co.uk/reports/climate/Indonesia.htm>.
- [9] H. Brown, J. Williams and M. Kirwan, "Packaged product quality and shelf life," in *Food and beverage packaging technology (second edition)*, Oxford, Blackwell Publishing, 2011, pp. 59-84.
- [10] V. Sohrabpour, D. Hellström and M. Jahre, "Packaging in deveoping countries: identifying supply chain needs," *Journal of Humanitarian Logistics and Supply Chain Management*, vol. 2, no. 2, pp. 183-205, 2012.
- [11] R. K. Yin, *Case Study Research: Design and Methods*, California: Sage Publications, 2002.
- [12] L. M. Ellram, "The use of the case study method in logistics research," *Journal of Business Logistics*, vol. 17, no. 2, pp. 93-138, 1996.
- [13] A. Larsson, *Need Finding Lecture*, Lund: Lund University, 2013.
- [14] M. Lofgren, "Winning at the first and second moments of truth: an exploratory study," *Managing Service Quality*, vol. 15, no. 1, pp. 102-115, 2005.
- [15] C. Olsmats and C. Dominic, "Packaging scorecard - a packaging performance evaluation method," *Packaging Ttechnology and Science*, vol. 16, pp. 9-14, 2003.
- [16] H. Arksey and P. T. Knight, *Interviewing for Social Scientists: An Introductory Resource with Examples*, London: SAGE Publications, 1999.
- [17] BillerudKorsnäs, "Annual Review 2013," BillerudKorsnäs, Stockholm, 2013.
- [18] Euromonitor, "Packaged Food in Indonesia," Passport, UK, 2014.
- [19] R. Soerjandoko, "Teknik Pengujian Mutu Beras Skala Laboratorium," *Buletin*

*Teknik Pertanian*, vol. 15, no. 2, pp. 44-47, 2010.

- [20] Badan Standardisasi Nasional, Standar Nasional Indonesia Beras Giling SNI 6128:2008, Jakarta: Badan Standardisasi Nasional, 2008.
- [21] Haryadi, Teknologi Pengolahan Beras, Yogyakarta: UGM Press, 2006.
- [22] R. G. Mutters and J. F. Thompson, Rice Quality Handbook, Oakland: ANR University of California, 2009.
- [23] US Food and Drug Administration, "Safe Practices for Food Processes," IFT, Silver Spring, 2001.
- [24] Bogasari, "History of Bogasari," Bogasari, [Online]. Available: <http://www.bogasari.com/tentang-kami/sejarah.aspx>. [Accessed 16 May 2014].
- [25] USDA Foreign Agricultural Service, "Indonesia Grain and Feed Annual Report 2013," Global Agricultural Information Network, 2013.
- [26] F. Welirang, "Global Grain Events," 12 March 2014. [Online]. Available: <http://www.globalgrainevents.com/pdfs/Franciscus%20Welirang,%20Grain%20Asia%202014.pdf>. [Accessed 15 May 2014].
- [27] K. Vergese, E. Crossin and M. Jollands, "Packaging Materials," in *Packaging for Sustainability*, London, Springer, 2012, pp. 211-250.
- [28] RISI, "World Sack Kraft and Wrapping Paper Study," 2013. [Online]. Available: [http://www.risiinfo.com/Marketing/EA/2013/wrapping\\_paper/2013\\_World\\_Sack\\_Kraft\\_and\\_Wrapping\\_Paper\\_Study\\_flyerA4\\_withoutCM.pdf?source=PR1401SPPR](http://www.risiinfo.com/Marketing/EA/2013/wrapping_paper/2013_World_Sack_Kraft_and_Wrapping_Paper_Study_flyerA4_withoutCM.pdf?source=PR1401SPPR). [Accessed 23 January 2014].
- [29] Badan Pusat Statistik Indonesia (Statistics Indonesia), "Statistical Yearbook of Indonesia 2013," BPS, Jakarta, 2013.
- [30] Badan Pusat Statistik (Statistics Indonesia), "Hasil Sensus Penduduk 2010 : Data Agregat per Provinsi," BPS, Jakarta, 2010.
- [31] Euromonitor International, "Indonesia : Country Profile," Euromonitor International, Singapore, 2013.
- [32] N. Elkhweet, M. Booker and J.-P. Felenbok, "Winning on the next frontier: five rules for reaching Indonesian shoppers," Bain & Company and Kantar Worldpanel, 2013.
- [33] N. Minot, R. Stringer, W. Umberger and Wahida, "Urban shopping patterns and implications for high-value agriculture," 28 March 2013. [Online]. Available: <http://www.adelaide.edu.au/global-food/documents/urban-shopping-patterns-indonesia-implications.pdf>. [Accessed 11 May 2014].
- [34] Euromonitor, "Consumer Lifestyles in Indonesia," Passport, UK, 2012.
- [35] J. Dyck, A. E. Woolverton and F. Y. Rangkuti, "Indonesia's modern retail sector : interaction with changing food consumption and trade patterns," U.S. Department of Agriculture, 2012.
- [36] Nielsen, "Meet the new Indonesian consumer class of 2020," Nielsen, Jakarta, 2014.
- [37] Nielsen, "Consumers who care and say they'll reward companies with their wallets,"

- Nielsen, Hongkong, 2013.
- [38] Nielsen, "The global socially-conscious consumer," Nielsen, Stockholm, 2012.
  - [39] FAO, "Global forest resources assessment," FAO Forestry Paper, Rome, 2005.
  - [40] D. A. Holmes, "Indonesia: Where Have All the Forests Gone," The World Bank, Washington DC, 2002.
  - [41] M. Mehring, C. Seeberg-Elverfeldt, S. Koch, J. Barkmann, S. Schwarze and S. Stoll-Kleemann, "Local institutions: Regulation and valuation of forest use- Evidence from Central Sulawesi, Indonesia," *Land Use Policy*, no. 28, pp. 736-747, 2011.
  - [42] M. Saghir, *Packaging Logistics Evaluation in the Swedish Retail Supply Chain*, Lund: Lund University, 2002.
  - [43] D. Hellström and M. Saghir, "Packaging and Logistics Interactions in Retail Supply Chains," *Packaging Technology and Science*, vol. 20, pp. 197-216, 2007.
  - [44] S. Natarajan, M. Govindarajan and B. Kumar, *Fundamentals of Packaging Technology*, New Delhi: PHI Learning Private Limited, 2009.
  - [45] M. Jahre and C. J. Hatteland, "Packages and physical distribution : implications for integration and standardisation," *International Journal of Physical Distribution & Logistics Management*, vol. 34, no. 2, pp. 121-139, 2004.
  - [46] K. Molina-Besch and H. Pålsson, "Packaging for eco-efficient supply chains - exploring factors in the packaging development process," in *25th NOFOMA Conference*, Göteborg, 2013.
  - [47] G. Muller and I. Demel, "Environmentally Friendly Paper and Board Production," in *Handbook of Paper and Board*, Weinheim, Wiley-VCH, 2013, pp. 1021-1033.
  - [48] FAO, "Food Wastage Footprint : Impacts on natural resources. Summary Report," FAO, Rome, 2013.
  - [49] Forest Stewardship Council, "Strengthening forest conservation, communities and markets: the global strategy of the Forest Stewardship Council," FSC International Center GmbH, Bonn, 2007.
  - [50] S. Dharmadhikari, "Eco-friendly Packaging in Supply Chain," *The IUP Journal of Supply Chain Management*, vol. IX, no. 2, pp. 7-18, 2012.
  - [51] Agriculture and Agri-Food Canada, "The Indonesian consumer: behaviour, attitudes and perceptions toward food products," International Markets Bureau, Ottawa, 2011.
  - [52] Ministry of Environment of Indonesia, "Ministry of Environment of Indonesia," 27 March 2014. [Online]. Available: <http://www.menlh.go.id/menlh-keluarkan-peraturan-tentang-ekolabel/>. [Accessed 20 May 2014].
  - [53] APP, "Asia Pulp Paper," 04 September 2012. [Online]. Available: [http://www.asiapulppaper.com/system/files/120906-APP-Sustainability-Roadmap-FAQs-PDF\\_0.pdf](http://www.asiapulppaper.com/system/files/120906-APP-Sustainability-Roadmap-FAQs-PDF_0.pdf). [Accessed 3 May 2014].
  - [54] T. Rynnänen and A. Hakatie, "Low involvement, low price and low quality image renegotiated - a case study of staple food package design," *The International Review of Retail, Distribution and Consumer Research*, vol. 23, no. 2, pp. 204-219, 2013.

- [55] P. Kotler and G. M. Armstrong, Principles of Marketing, New Jersey: Pearson Prentice Hall, 2010.
- [56] M. Lofgren and L. Witell, "Kano's theory of attractive quality and packaging," *Quality Management Journal*, vol. 12, no. 3, pp. 102-115, 2005.
- [57] Euromonitor, "Income and Expenditur: Indonesia," Passport, UK, 2013.

## 9. Appendix

### 9.1. Interview with flour producer (English translation)

1. What is your background?
  - a. name, Gender, Age  
Amir Jamaludin, male, 45 years old
  - b. title  
Flour Mixing and Packing Manager
  - c. years of experience  
From March 1996
  - d. previous experience  
OrangTua Group, Tango Wafer
  - e. educational background  
Magister Management
2. Please tell me more about your company
  - a. Name  
ISM Bogasari Flour Mills
  - b. base (factory, sales office)  
Cilincing factory with the sales office. The corporate office is in Indofood Tower.
  - c. main clients (who, where)  
Premium consumer pack to modern market, econopack to traditional market, bulk to industry (specialty flour), and special communities such as Indian communities (Taj Mahal flour)
  - d. core products  
Wheat flour, Chesa (mix, bake, cake) that are sold to modern retails or special outlets to female customers who has with oven or microwave and prefers convenient products.  
Main competitors: 28 other flour manufacturers (consumer pack or B2B).
3. I would like to know more about the current packaging you are using in the factory.
  - a. What are the different packaging you are producing? (size, materials)  
1kg premium packs, 500 gram and 1kg econopacks
  - b. How many packaging lines you are using? mechanized/ semi mechanized/ number of workers per line  
There are 2 low-speed packaging machines and 6 high-speed packaging machines that transformed plastic sheets on rolls to plastic bag filled with wheat flour. The flour bags are rolled along the conveyor belt to workers who arrange the bags into secondary packaging of corrugated boxes. The econopack in corrugated boxes are then arranged on a pallet by a worker equipped with waist support. The premium packs in corrugated box is then covered in shrink wrap plastic before being arranged on a pallet. On May/June the 2 low-speed machines will be replaced with 2 high speed

- machines. On September, the arranging of primary package to secondary package will be automated with box case erector and case packer. There are 3 operators for 8 machines and in total there are 18 packers. The rolls consist of 1000m sheets. The downtime to change to another plastic roll is normally 30 minutes.
- c. When did you start using the machines and current packaging options?  
The machines were bought in the 1980s.
  - d. Why do you package your product in those dimensions? (influence from other producers, packaging supplier, customer studies)  
Specifications were set the Quality Assurance (thickness, colour), during purchasing incoming, QC will check the quality of the packaging sheets. Non-conformed raw materials will be rejected or returned to supplier.
  - e. How did you design your packaging?  
It was based on marketing research (in adherence with the company track record) and aligned with the product group (design changes according to trends). It needs to be commercial, with good product recognition and shows the core identity with the flour type logo and colour.
  - f. How much was the investment estimate on the machine?
  - g. How important the packaging is for your product?  
Very important, the quality is being closely watched. There is hourly leakage control. Other tests including hardness, inflatable, stacking, and storage tests. The packaging needs to be free from toxic chemicals and also environmentally friendly. Currently, the packaging being used is made from degradable plastic. It is important to have a packaging that the consumers will recognise instantly.
4. I would like to know more about the distribution from your company to distributor
    - a. How do you distribute your products?  
Through our distributor sister company, Indomarco. Some big distributors for outside of Java come with their own trucks to get the products too.
    - b. How do the packages being uploaded to the vehicle?  
The boxes are going to be stacked on top of each other with no pallets.
  5. Any complains about current packaging? Limitations on changing the packaging?  
Some of the sheets are too easy to tear or too slippery, as it is supplied from different vendors/suppliers that might cause inconsistency in quality. Causing too many broken packages (due to machine settings or the packaging sheets are too slippery). Not much complains about the thickness or colour or other parameters set by QA as it is checked first by QC, all the QC pass packaging sheets are then transferred to production line.  
Downtime from 1 roll to another roll nearly 30 minutes (according to the workers in production line). Normally, the roll is almost finished when we need to change to another roll. Normal downtime is 15 minutes. There is a plan to purchase rewinding machine to reuse the leftover sheets on the rolls into 1 whole roll. Unfinished roll was caused by the sheets become too slippery. Downtime periods

are reported, anomalies can be pinpointed in the report. Performance of production line (per line per minute) is to fulfil the purchase order issued in the beginning of the shift by PPIC (for section chief), output or broken pack counts (for operator). Evaluation on the performance at the end of the month or the year that might correlate to the individual worker performance by 10-20%.

6. If we are using paper packaging, do you think it is feasible for your factory and your product?

There is a plan for special outlets or foreigners or premium segment markets or environmentally friendly customers. There will be 1 line, vendors are being approached now. The future packaging line needs to fit into 10m<sup>2</sup> room.

There is a paper packaging line in the export section catering to clients abroad, open mouth 25kgs paper bag with inner plastic lamination.

Chesa line is quite compact, the factory will be organized only with more packaging lines and more capacity. There is capacity planning that relates the consumer demand and the factory capacity. If the capacity is nearing 85%, expansion needs to be done. This is a long term planning. Besides that, automatization at the end of packaging line (aligning primary packages into secondary package of corrugated box and sealing the box with shrink wrap plastic) will be done too with this optimization design plan.

## 9.2. Interview with rice producer

1. What is your background?
  - a. name, Gender, Age  
Diana Rahardjo, F, 52
  - b. title  
Director
  - c. years of experience  
19 years, founder
  - d. previous experience  
Secretary and assistant buyer in Makro wholesale
  - e. educational background  
Diploma degree in secretary from Tarakanita
2. Please tell me more about your company
  - a. Name  
Mahkota ABC
  - b. base (factory, sales office)  
Karang Tengah, Tangerang. With a sales agent in Bekasi
  - c. main clients (who, where)  
Retailer (private label products), restaurant, agents in Jabotabek, Central Java, Aceh (red rice, sent by expedition per container).
  - d. core products  
All type of rice excluding black rice. The total volume is 15,000 tonnes per month.



3. I would like to know more about the current packaging you are using in the factory.
  - a. What are the different packaging you are producing? (size, materials)  
2kgs (for red rice), 5, 10, 20, 25, 50 kgs (only sold in wholesale) with LPE woven sack or LDLPE- nylon bag
  - b. How many packaging lines you are using? mechanized/ semi mechanized/ number of workers per line  
There are 2 machines with automatic weighing machine. The closing of the packaging and the arranging on the pallet is then done manually.
  - c. When did you start using the machines and current packaging options?  
The automatic weighing machine was bought 5-6 years ago
  - d. Why do you package your product in those dimensions? (influence from other producers, packaging supplier, customer studies)  
Following the market demand, never made survey about the consumer preference for packaging
  - e. How did you design your packaging?  
It is designed by the retailers' packaging manager or by own design
  - f. How much was the investment estimate on the machine?  
Around 150 million Rupiah (around 86,000SEK) per machine
  - g. How important the packaging is for your product?  
It is important, transparent window is important because consumers want to see what quality they are getting
4. I would like to know more about the distribution from your company to distributor
  - a. How do you distribute your products?  
With own truck, the agents sometimes come and pick up with the products
  - b. How do the packages being uploaded to the vehicle?  
On pallets.  
If there are leaky packages, the consumers can return the packaging and exchange with a new packages. If the product is broken during the exchange, the number of broken packages will be reduced from the PO
5. Any complains about current packaging? Limitations on changing the packaging?  
The side sealing is not strong. The packaging arrives in bulk (without the bottom sealing). When it is filled with rice, the side sealing detached itself, or when it is stacked, there are leaks from side sealing. Most probably because faulty sealing mechanism in the supplier side. The front side of the packaging is thin and brittle, it is suddenly torn. Increasing the thickness will increase the cost of packaging, and it is not profitable. The plastic price is fluctuating with the world oil price. According to the quality of rice, the packaging quality is different.
6. If we are using paper packaging, do you think it is feasible for your factory and your product?  
I am not sure. For consumers, the rice price is the most important. The next point is the consumers would like to see the product. The packaging needs to be important, but they need to see the product. Rice is crop product whose quality

changes according to weather and the consumers need to see the product to confirm the quality.

In the old time, consumers will get small plastic filled with rice sample attached to the upper part of plastic/gunny sack. Normally, it is not representative enough because rice is processed with a cyclone, so the smaller rice grains tend to fall first, followed by bigger grains. This might work with premium products which are sieved, so the rice sample will be representative. This will also increase the cost of the production.

### 9.3. Interview with retailer DC

1. What is your background?
  - a. name, Gender, Age  
Tony Simanjuntak, M, 33 years old
  - b. title  
Pondok Ungu DC Manager
  - c. years of experience  
4 years
  - d. previous experience  
OSS Manager, Carrefour Karawang
  - e. educational background  
Bachelor of Management
2. Please tell me more about your company
  - a. Name  
Trans Retail Indonesia
  - b. base  
Distribution Center (DC) for dry products is in Pondok Ungu (and Juanda, planning), DC for fresh and frozen products is in Cibitung
  - c. main clients (who, where)  
84 Carrefour stores around Indonesia, mostly in Java, Sumatera (Medan, Batam, Palembang), Kalimantan (Pontianak), and Sulawesi (Makassar)
  - d. core products  
Dry food and non-food products (fresh and frozen products are handled in other DC).
3. How do you distribute your products?
  - a. Taking it from the producers?  
The DC operates in cross dock system. The trucks from suppliers come and being unloaded, while in the other end of the building trucks designated to specific stores are loaded with mixed-products pallets. The incoming products are received by using the radio frequency technology (hand held terminal). The products are picked into pallets allocated to different stores manually. The trucks will come back to DC with the empty pallets or empty pallets from the previous delivery or with products during backhauling from the suppliers.

- b. Distribution strategy? (mixing or dedicated vehicles for each product or destination)  
Mixed trucks dedicated to specific destinations (stores).
  - c. Fullness of each distribution fleet?  
The filling rate or truck loading rate is 98%, with each truck for each super/hypermarkets. For small supermarkets that are quite near to each other, there is a multi-drop function in which the truck is filled with small volume orders from different nearby stores. There is only 1 layer of pallet per truck, the height of the products in the pallet match with the height of the truck.
  - d. How do you fill a fleet? (software help/ personal observation)  
The truck is filled according to planning made by software to the hand held terminals (loading draft). After picking of products to the pallet is over, the pallet is then plastic wrapped before being transported inside the truck.
4. Do you have any complains for current packaging?
- a. Do you encounter burst or defective packaging during distribution? How many percent are defective?  
Yes, there are 0.03% from the total sent products
  - b. Who is accounted responsible for defective products due to packaging?  
This is investigated by the receiving in the store whether the defective products are due to distribution or because inadequate packaging. If it is due to distribution, the defect will be covered by insurance. If it is because of inadequate packaging, complains and purchase order (PO) reduction will be sent to the supplier.
  - c. How about the health and welfare of your workers? (complain of back pain, absences due to health)  
Not much, the filled pallets are transported with forklifts.
  - d. Do you discuss about any problems of the packaging to the producers?  
If there are any occurring and frequent problems, yes.
  - e. Are you consulted if there are any packaging changes? Have any packaging changes done based on your input?  
Not so much, because the changes may appear directly to the software (regarding the SKU and the minimum order unit per store) or directly during receiving in the DC, the packages are changed into the current ones.
5. If we are changing the packaging to paper, do you think it will affect your operation? (link to humidity and challenges during distribution)  
Since the pallets are wrapped tightly in plastic during distribution, humidity or vibration during distribution might not affect much even when the product is in paper packaging. As long as it is robust enough and modular to be put on a mixed-products pallet.

## 9.4. Current wheat flour scorecard result by supply chain actors

### 9.4.1. Manufacturer scorecard for primary packaging level

Criteria	Weight	Normalized Weight	Satisfaction
Machinability	100	7.30%	3
Product protection	100	7.30%	4
Volume & Weight efficiency	100	7.30%	3
Right amount and size	90	6.57%	4
Handling ability	100	7.30%	4
Product information	100	7.30%	4
Selling capability	100	7.30%	4
Safety	100	7.30%	3
Reduced use of resources	90	6.57%	2
Minimal use of hazardous substances	100	7.30%	4
Packaging cost	100	7.30%	3
Stackability	100	7.30%	2
Unwrapping	100	7.30%	4
Spout Design	90	6.57%	3
Weighted average packaging score			3.36

### 9.4.2. Manufacturer scorecard for secondary packaging level

Criteria	Weight	Normalized Weight	Satisfaction
Product protection	90	10%	4
Flow information	100	12%	4
Handling ability	100	12%	4
Product information	20	2%	4
Reduced use of resources	90	10%	4
Minimal use of hazardous substances	10	1%	4
Minimal amount of waste	50	6%	4
Packaging cost	100	12%	4
Unwrapping	100	12%	3
Stackability	100	12%	4
Weighted average packaging score			3.88

#### 9.4.3. Manufacturer scorecard for tertiary packaging level

Criteria	Weight	Normalized Weight	Satisfaction
Product protection	100	11%	4
Flow information	80	9%	4
Volume & Weight efficiency	100	11%	2
Right amount and size	80	9%	4
Handling ability	100	11%	4
Product information	80	9%	4
Reduced use of resources	80	9%	4
Minimal use of hazardous substances	100	11%	4
Minimal amount of waste	80	9%	4
Packaging cost	80	9%	4
Unwrapping		0%	
Weighted average packaging score			3.77

#### 9.4.4. DC scorecard for secondary packaging level

Criteria	Weight	Normalized Weight	Satisfaction
Product protection	100	14%	4
Flow information	100	14%	4
Volume & Weight efficiency	80	11%	4
Right amount and size	80	11%	4
Handling ability	90	12%	4
Product information	30	4%	4
Reduced use of resources	70	10%	4
Minimal use of hazardous substances	50	7%	4
Minimal amount of waste	50	7%	4
Stackability	80	11%	4
Weighted average packaging score			4.00

#### 9.4.5. DC scorecard for tertiary packaging level

Criteria	Weight	Normalized Weight	Satisfaction
Product protection	100	15%	4
Flow information	100	15%	4
Volume & weight efficiency	100	15%	4
Right amount and size	80	12%	4
Handling ability	100	15%	4
Reverse handling	100	15%	4
Unwrapping	100	15%	4
Weighted average packaging score			4.00

#### 9.4.6. Retailer scorecard for primary packaging level

Criteria	Weight	Normalized Weight	Satisfaction
Product protection	100	12%	4
Volume & Weight efficiency	80	10%	4
Right amount and size	80	10%	4
Handling ability	100	12%	3
Product information	100	12%	4
Selling capability	100	12%	3
Reduced use of resources	50	6%	4
Minimal use of hazardous substances	100	12%	4
Stackability	100	12%	3
Weighted average packaging score			3.63

#### 9.4.7. Retailer scorecard for secondary packaging level

Criteria	Weight	Normalized Weight	Satisfaction
Product protection	90	12%	4
Flow information	100	13%	4
Right amount and size	50	6%	4
Handling ability	100	13%	4
Product information	80	10%	4
Minimal use of hazardous substances	70	9%	4
Minimal amount of waste	90	12%	4
Unwrapping	90	12%	4
Stackability	100	13%	4
Weighted average packaging score			4.00

#### 9.4.8. Retailer scorecard for tertiary packaging level

Criteria	Weight	Normalized Weight	Satisfaction
Product protection	100	15%	4
Flow information	100	15%	4
Volume & weight efficiency	100	15%	4
Handling ability	100	15%	4
Minimal amount of waste	100	15%	4
Reverse handling	80	12%	4
Unwrapping	100	15%	4
Weighted average packaging score			4.00

## 9.5. Current rice flour scorecard result by supply chain actors

### 9.5.1. Manufacturer scorecard for primary packaging level

Criteria	Weight	Normalized Weight	Satisfaction
Machinability	100	9%	2
Product protection	100	9%	3
Flow information	50	4%	3
Volume & Weight efficiency	80	7%	2
Right amount and size	80	7%	3
Handling ability	100	9%	3
Product information	50	4%	4
Selling capability	80	7%	3
Safety	100	9%	4
Minimal use of hazardous substances	100	9%	4
Packaging cost	100	9%	2
Stackability	100	9%	3
Unwrapping	80	7%	3
Spout Design	20	2%	4
Weighted average packaging score			2.99

### 9.5.2. Manufacturer scorecard for tertiary packaging level

Criteria	Weight	Normalized Weight	Satisfaction
Product protection	100	16%	3
Flow information	100	16%	4
Volume & Weight efficiency	100	16%	4
Right amount and size	50	8%	4
Handling ability	100	16%	4
Product information	20	3%	4
Reduced use of resources	20	3%	4
Minimal use of hazardous substances	20	3%	4
Minimal amount of waste	20	3%	4
Packaging cost	100	16%	4
Weighted average packaging score			3.84



### 9.5.3. DC scorecard for primary packaging level

Criteria	Weight	Normalized Weight	Satisfaction
Product protection	100	15 %	4
Flow information	100	15 %	4
Volume & Weight efficiency	50	8%	4
Right amount and size	100	15 %	4
Handling ability	100	15%	4
Reduced use of resources	50	8%	4
Minimal use of hazardous substances	50	8%	4
Stackability	100	16%	4
Weighted average packaging score			4.00

### 9.5.4. DC scorecard for tertiary packaging level

Criteria	Weight	Normalized Weight	Satisfaction
Product protection	100	26%	4
Flow information	100	26%	4
Volume & weight efficiency	80	21%	4
Right amount and size	10	3%	4
Handling ability	20	5%	4
Reverse handling	70	18%	4
Weighted average packaging score			4.00

### 9.5.5. Retailer scorecard for primary packaging level

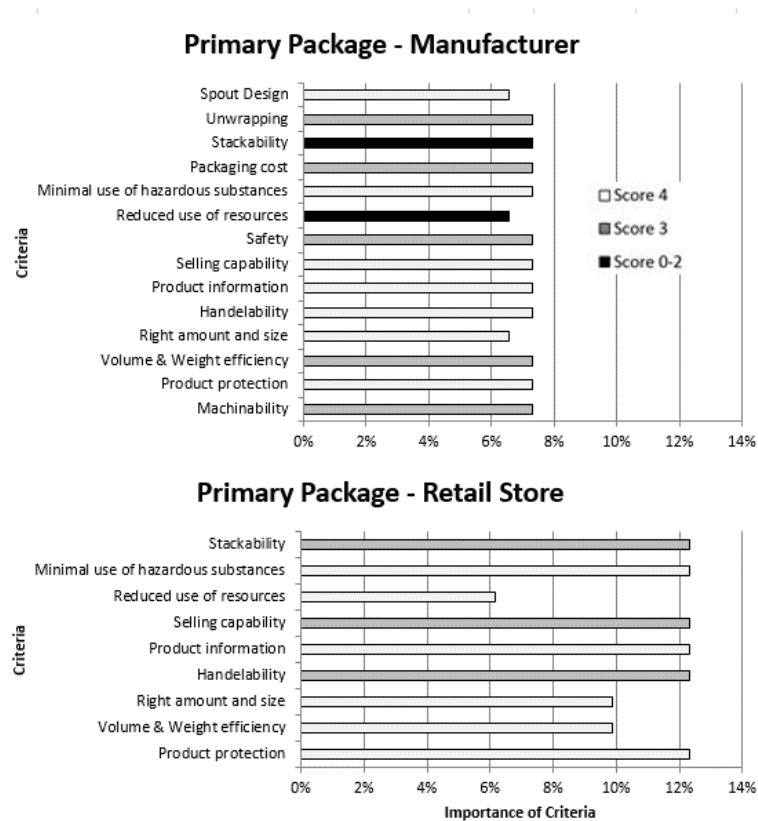
Criteria	Weight	Normalized Weight	Satisfaction
Product protection	100	12%	4
Flow information	100	12%	4
Volume & Weight efficiency	50	6%	4
Right amount and size	100	12%	4
Handling ability	100	12%	3
Product information	50	6%	4
Selling capability	100	12%	4
Reduced use of resources	50	6%	4
Minimal use of hazardous substances	100	12%	4
Stackability	100	12%	2
Weighted average packaging score			3.65

#### 9.5.6. Retailer scorecard for tertiary packaging level

Criteria	Weight	Normalized Weight	Satisfaction
Product protection	100	15%	4
Flow information	100	15%	4
Volume & weight efficiency	100	15%	4
Handling ability	100	15%	4
Minimal amount of waste	100	15%	4
Reverse handling	80	12%	4
Unwrapping	100	15%	4
Weighted average packaging score			4.00

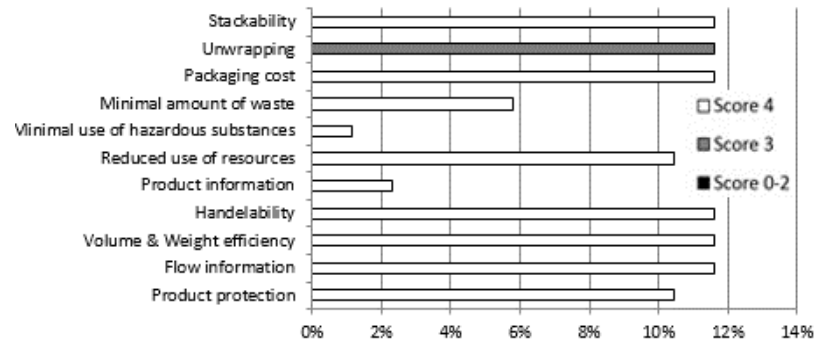
## 9.6. Graph of the importance percentage and the score of wheat flour packaging criteria

### 9.6.1. Primary Package

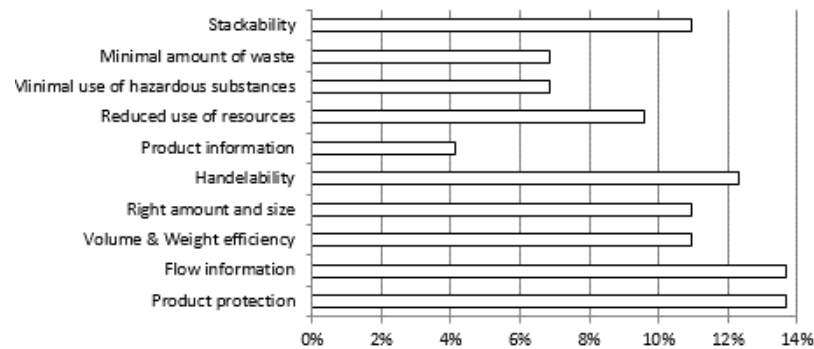


## 9.6.2. Secondary Package

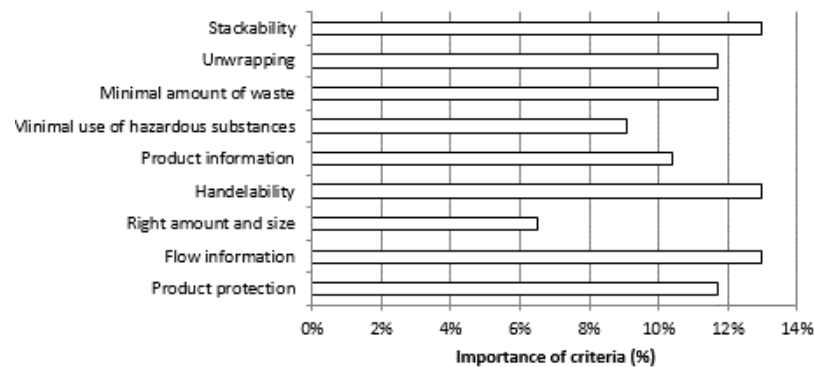
### Secondary Package - Production



### Secondary Package - Distribution Centre

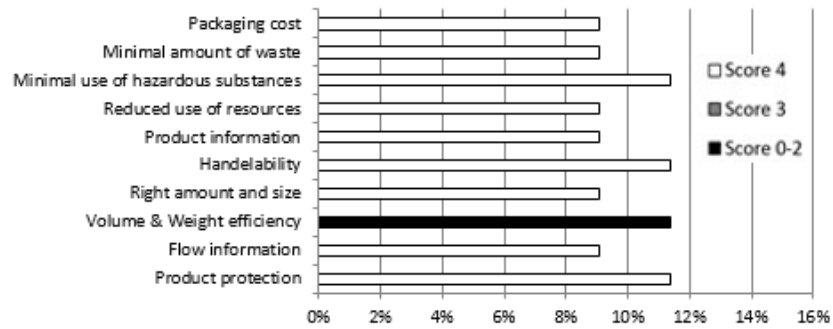


### Secondary Package - Retail Store

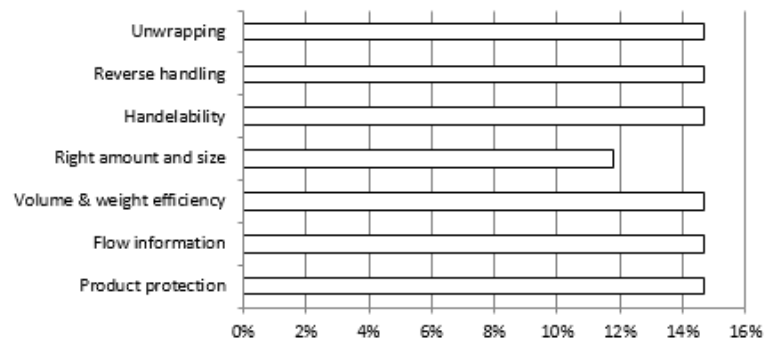


### 9.6.3. Tertiary Package

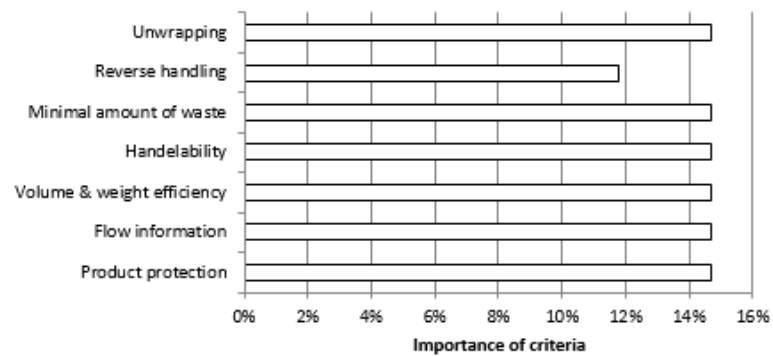
**Tertiary Package - Manufacturer**



**Tertiary Package - Distribution Centre**

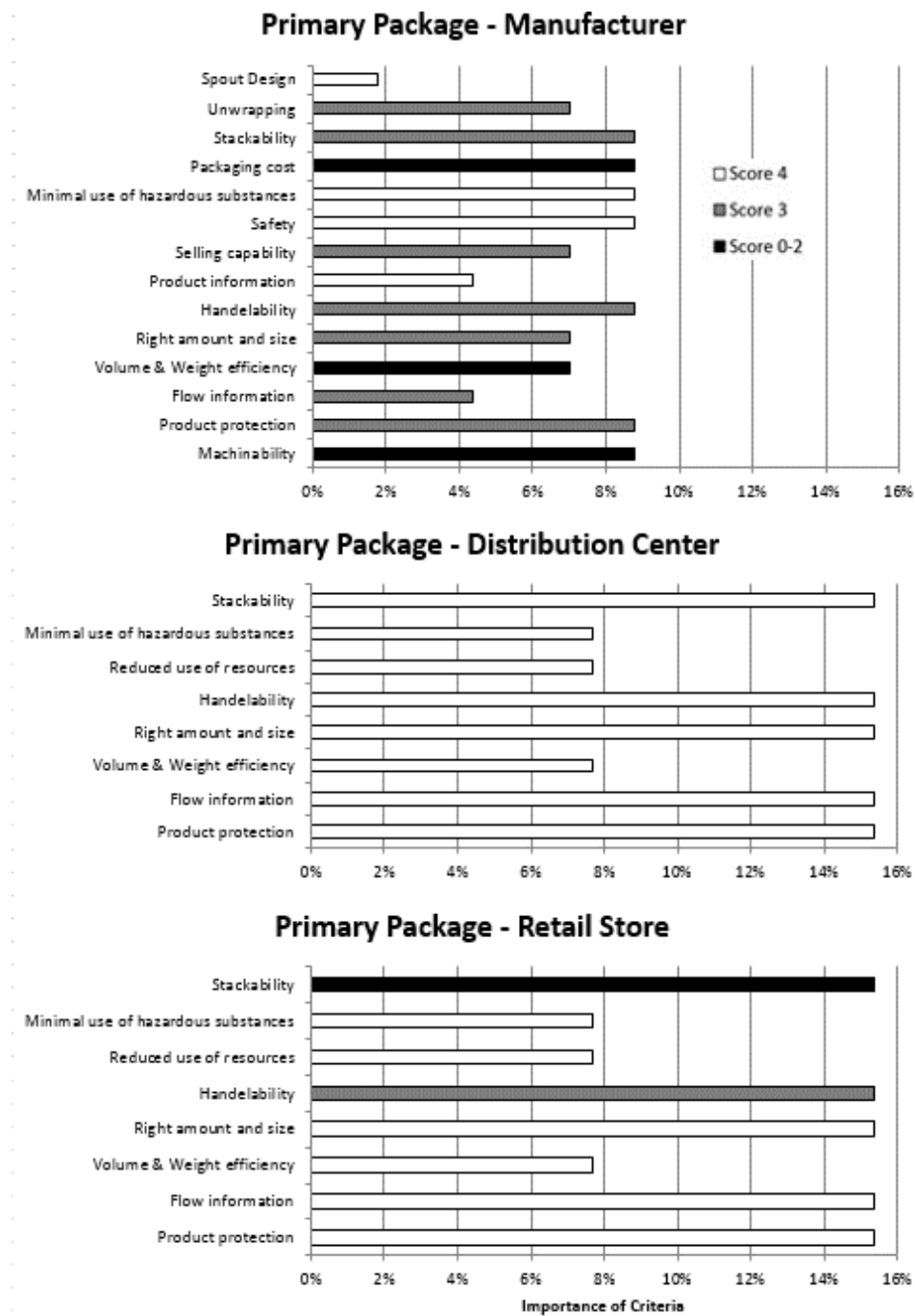


**Tertiary Package - Retail Store**



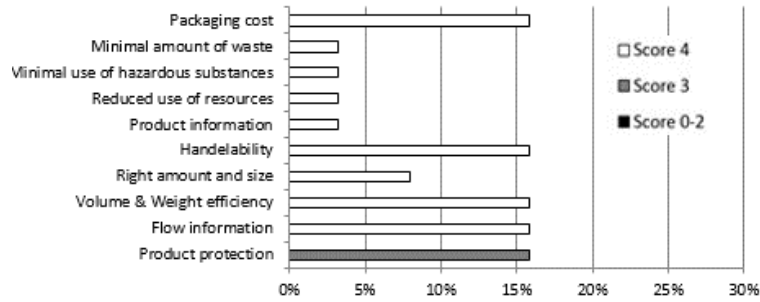
## 9.7. Graph of the importance percentage and the score of rice packaging criteria

### 9.7.1. Primary Package

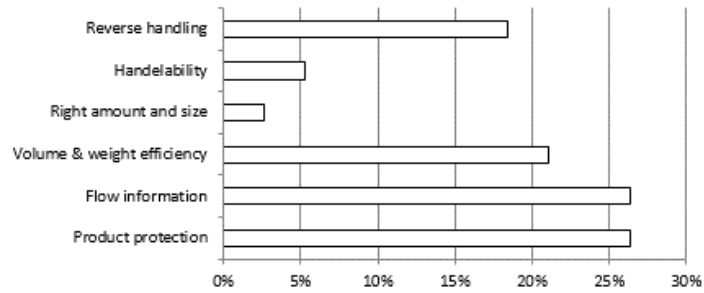


## 9.7.2. Tertiary Package

**Tertiary Package - Manufacturer**



**Tertiary Package - Distribution Centre**



**Tertiary Package - Retail Store**

