Kenneth's Healthy Options: Boosting the Calamansi Industry in ZamPen[i]

One Saturday morning in March 2015, Kenneth Lim had just returned from a business trip in Cebu, Philippines, and he was exhausted. Lim was the marketing manager for his father's firm, Wellson Foods Inc., a dairy and tropical juice distributor based in Maguikay, Mandaue, Cebu City. The company had penetrated markets in Mindanao and neighboring countries like Malaysia, Indonesia, and Thailand. Kenneth had convinced his father, William Lim, the CEO of Wellson Foods Inc., to expand into the tropical juice beverage processing business after the company's Bangladeshi tropical juice beverage supplier terminated its relationship with Wellson Foods.[1]

Kenneth felt exhausted because he faced a big challenge: he needed to select the most appropriate preservation technique for a calamansi juice beverage, which the company was planning to produce and introduce to its current markets. He also wanted to differentiate the company's juice product, and he thought that the preservation method could be a way to do that. The question was how to accomplish it. He wanted to employ a preservation process that would capture the phytochemicals[ii] present in the

[i] The Zamboanga Peninsula or ZamPen for short is Mindanao's smallest region. It consists of 958 island and islets and makes up the diadem of the Philippine south. Two bodies of water form a ring around it — the Sulu sea to the northwest, the Moro Gulf to the south.

[ii] Phytochemicals are biologically active compounds found in plants and may have health benefits that are protective (such as being anti-bacterial or antioxidant)

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calamansi[iii] fruit. There were many preservation methods to choose among, however, all with different properties, costs, and different effects on the juice. There were also various food manufacturing certifications that Wellson could pursue to ensure product quality. He couldn't pursue them all, due to the time and expense involved in achieving a certification, but each certification offered the benefit of entering a specific market, so he had to choose which certification would be the most worthwhile. Kenneth summarized the decisions on a piece of paper: 1) choose the most appropriate preservation technique for a calamansi juice beverage that would also differentiate the product and offer health benefits; 2) choose among the various food manufacturing certifications to select the one(s) that offered the best advantage to entering a new market. He had much research and thinking to do.

Wellson Foods Inc.

Wellson Foods, Inc. dated back to the 1930s when Benwin Lim, the father of William Lim, ran a family business called Hoc Bee Trading that imported and distributed goods from China to Cebu. During the 1970s to 1990s, Hoc Bee Trading grew to include three additional branches — two in the Zambonaga Peninsula region and one in the Panay region. Hoc Bee Trading imported products from China, Malaysia, Thailand, and Bangladesh. Most of the goods the company imported were food products, food ingredients, food packaging, and household products like detergents, toothpaste, and shampoo. Hoc Bee was also the first company to build hotels in Zamboanga City, namely the Young's Tower and Imperial Hotels.[2]

The early 2000s were a period of restructuring for Hoc Bee; the company stopped selling slow-moving brands and concentrated on those with household names. As a result, the company decided to create four divisions: trading and distribution, hotels and restaurants, feed milling, and manufacturing of plastic packaging. The company continued to grow during the late 2000s, and the trading and distribution piece of the business was renamed Wellson Foods Inc.. The company distributed food brands Dairy's Best, Cows Bell, Pyran UHT juices, White Rabbits and SnowBear candies, as well as other food products that were sold at wholesale and retail markets.[3]

From the company's beginnings, Wellson Foods focused on importing products that were affordable to the middle class and low-income customers. William said, "We want every Filipino to be able to buy their needs at a very affordable price and within their budget. Affordable, yet they will enjoy the quality of the products they are buying."[4]

Major Players in the Beverage Industry

Del Monte Foods, Inc., or simply Del Monte Foods in the Philippines, had a cannery located in Bugo, Cagayan de Oro City and received its first ISO 9000:2000 certificate on June 26, 2006.[5] In 2014, Philippines-based food and beverage company Del Monte Pacific, controlled by Filipino Beatrice Campos and family, bought its U.S. affiliate, the California-based Del Monte Foods' U.S. consumer food business, in a transaction worth $1.675 billion.6 The deal gave Del Monte Pacific, which was listed on both the Singapore Exchange and the Philippine Stock Exchange, access to U.S. and South American markets and

[iii] Calamansi, also known as the Philippine Lemon (Citrus madurinces), is indigenous to the Philippines and is considered a major fruit crop of the country. It is explained further in the Calamansi Industry section below.

the right to sell processed foods under the brands Del Monte, S&W, Contadina and College Inn brands in those markets. Through holding company NutriAsia, the Campos family controlled 67% of Del Monte Pacific. Beatrice Campos' son, Joselito, ran the aggregated company.7 Del Monte Foods was the leading supplier, producer and distributor of different pineapple juice beverage in the country.

Coca-Cola FEMSA Philippines, Inc. (formerly **Coca-Cola Bottlers Philippines, Inc.**) was a Philippines-based company engaged in bottling and distribution of Coca-Cola soft drink brands. It was among the ten biggest Coca-Cola bottlers globally and one of the top 100 Philippine corporations. It operated 23 plants and 42 sales offices with over 7,800 direct employees and offered the widest selection of beverages like soft drinks, water, juices, teas, sports and energy drinks. The company was founded in 1981 as Coca-Cola Bottlers Philippines, Inc. and was renamed Coca-Cola FEMSA Philippines, Inc. on January 25, 2013 after becoming jointly owned by Mexico-based Coca-Cola FEMSA, S.A. de C.V. and The Coca-Cola Company.[8]

Profood International Corporation, founded in 1980, was a Philippines-based, Filipino-owned company engaged in processing tropical fruits. The company was a leading producer of dried fruits, purees, concentrates, and juices.[14] Justin Uy, president of Profoods, established the company in 1978 with only 12 factory workers but by 2015, the company employed 800 regular workers and during peak season the company hired an additional 2000-3000 factory workers on contractual basis depending the volume supply of fruit harvests. The company had become the leading producer and exporter of various dried tropical fruits, preserves, purees, concentrates and juices. The leading brands that the company distributed both locally and internationally were: Philippine Brand, Tampico, Ju-C Juice, Profoods, Happy Brand, Golden Mangoes, Grace Brand and Company J.[9]

Preservation Techniques in the Fruit Juice Beverage Industry

Traditional Methods of Processing Juice Beverages

Juice beverage processing commonly employed two types of preservation techniques: the thermal processing and the non-thermal processing. Juice pasteurization was best achieved by low temperature short time (LTST), high temperature short time (HTST) or ultra-high temperature short time (UHT) treatments. Nonetheless, there were certain components of the fruit, such as phytonutrients that were sensitive to heat. Food scientists and researchers therefore created techniques to retain these important components. These non-traditional methods included: high hydrostatic pressure (HHP), high pressure homogenization (HPH), pulse electric field (PEF), ultrasound (US), ultraviolet light, and membrane filtration. Chemical preservatives and natural enzymes, spices and herbs could also be used.[10]

Non-traditional Methods of Processing Juice Beverages

High hydrostatic pressure (HHP) processing uses pressures up to 1000 Mpa,[iv] with or without heat, to inactivate harmful microorganisms in food products. In 1990, the first HHP processed fruit jams were sold in the Japanese market. Subsequently, HHP processed commercial products including fruit juices and beverages, vegetable products, among others, have been produced in North America, Europe, Australia, and Asia. [11] High pressure processing has an advantage over thermal processing because it significantly lowers the processing time. Furthermore, because HHP only uses electrical energy and does not generate waste by-products, this method of preservation is environmentally friendly.[12]

[iv] MPa is a unit of measure, short for "megapascal"

Pulsed electric field processing (PEF) applies short bursts of high voltage electricity for microbial inactivation and causes no or minimal effect on food quality.[13]

Ultrasound (US) is a non-thermal method of preservation that differs from diagnostic ultrasound due to its use of a lower frequency range of 20 to 100 kHz and a higher sound intensity of 10W/cm^2. The working principle behind this method – and what makes it effective in preserving food -- is that the ultrasonic transducers convert electrical energy to sound energy and then ultrasonic waves are dissipated in liquid form, consequently forming small bubbles which shrunken thousands of times per second.[14] High-power, low-frequency ultrasound is normally used to alter the properties of a food material. It does this through physical, chemical and microbial effects. Ultrasound can bring desirable effects to food properties but is commonly used in combination with other processing technologies to improve the efficiency of the process.[15]

Ultraviolet light *(UV-light)* at specified wavelengths has long been used in industrial food processing and drying applications and has been proven to be effective in damaging the cell walls of microorganisms such as bacteria, yeasts and mold. As a food preservation method, the commonly used wavelength for fruit juice and beverage is 254 nanometres. As a non-thermal preservation method, it has an advantage of very little energy required when compared to traditional thermal methods. Another advantage of this treatment is its unique feature of no toxic by-products being formed during the treatment. UV-light treatment has been successfully employed to achieve fresh-like fruit juices and nectars. The UV dosage depends on the type of medium, whether the juice is clear and light or thick like in the case of puree and concentrate. The dosage level used for clear apples is 230 joules per litre whereas higher UV dosage is needed for cloudy citrus juices like orange juice and tropical juices.[16]

High pressure homogenization (HPH) has become the most promising non-thermal processing that is applicable to fruit juice and beverage industry. This method governs the process whereby a combination of 3D pressure, high velocity gradients, turbulence, impingement, cavitation and viscous shear which encourage disruption of microbial cells and desirable changes in food components during the HPH process. This method was tested in fruit juices including orange juice, apple juice and apricot juice and was found to be effective in extending the shelf life of the juices. The success of this method depends on many factors which includes processing conditions like pressure, temperature, the type of juice to be processed, and the initial microbial load of the medium prior to processing. [17]

Membrane filtration is a type of non-thermal method of food preservation used in combination with other processing techniques such as reversed osmosis and osmotic distillation to effect optimum food safety and quality. The widely-used membrane filtration methods in the fruit juice and beverage processing industry are ultrafiltration (UF) and microfiltration (MF). These two membrane filtration methods are used commercially for the clarification of fruit juices. Using this technique, juice quality is superior to thermally processed juice products. Again, the efficiency of this method is influenced by many processing factors, such as: the types of membrane, pore size, transmembrane pressure, the type juice being processed, and the microorganisms present to be eradicated. In the processing of apple juice, processors in the US utilized the ultrafiltration unit with polysulphone membranes of 10kDa and 50kDa pore size and a transmembrane pressure of up to 155 kilo Pascals. Another example whereby membrane filtration is specifically used to achieve the desired properties of the finished product is in the processing of carrots and citrus juices. A notable difference in color is observed for processes utilizing larger pore membrane treatment.[18]

Chemical Processing Methods of Juice Beverages

Apart from thermal methods and non-thermal methods, some chemical preservatives, enzymes, spices and herbs have also been used to extend shelf-life of fruit juices with emphasis on consumer safety, nutrition and convenience.[19]

The most commonly used preservatives are potassium sorbate and sodium benzoate. However, consumer demand for natural origin, safe, and environmentally-friendly food preservatives is increasing. Natural antimicrobials such as *bacteriocins, lactoperoxidase*, herb leaves and oils, spices, chitozan and organic acids have shown feasibility for use in some food products. Some of them have been considered as Generally Recognized as Safe (GRAS) additives in foods.[20]

Bacteriocins are antimicrobial proteins produced by bacteria that inhibit the growth of other bacteria such as the pathogenic and spoilage causing bacteria. Lactic acid bacteria are known to produce diverse bacteriocins and among these is nisin, which the only widely-used food preservative. Nisin is used in the dairy processing and in the preservation of fruits and vegetable juices. It is listed and permitted by the USFDA as among the Generally Recognized as Safe (GRAS) additives and preservatives. [21]

Lactoperoxidase is an oxireductase enzymes that can be isolated from the colostrum, milk of bovine cows and other bodies. This enzyme is found to have a bactericidal effect on some spoilage and pathogenic bacteria. Recent application of this enzyme was for the preservation of tomato juice and mango juice. [22]

Herbs, spices and flavor oils are potential antimicrobials because they contain essential oils that inhibit growth of pathogens and spoilage causing microorganisms. They contain natural phenolic compounds which include caffeic, ferulic, gllic acids, oleoropien, thymol and eugenol, which are known to be effective antimicrobial compounds. There are many herbs and spices that have these compounds, including: sage (*Saliva officinalis*), rosemary (*Rosemarinus officinalis*), cloves (*Eugenia aromatic*), coriander (*Coriandum sativum*), garlic (*Allium sativum),* and onion (*Allium sepa*). The compounds extracted from these herb plants are known to be effective to inhibit or kill food pathogenic microorganisms which include *Campylobacter jejuni, Salmonella enteritidis, Escherichia coli, Staphylococcus aureus, and Listeria monocytogenes*. Gram negative bacteria were found to be more sensitive to plant essential oils. The use of herbs and spices are widely studied and have been applied in the juice preservation. Using 0.3% of ground cinnamon is proven effective to extend the shelf-life of apple juice, apple cider and fresh cut apples. Herbs and spices caught attention of many researchers and juice processors with the desire to come up with organic food products and avoiding the use of chemical preservatives.[23]

Calamansi Industry in the Philippines

Calamansi, also known as the Philippine Lemon (Citrus madurinces), is indigenous to the Philippines and is considered a major fruit crop of the country. The plant has wing-like appendages on the leaf stalks and produces white or purple flowers. The fruit has a spongy or leathery rind and has a juicy pulp that is divided into sections. The calamansi fruit has an average diameter of 25 - 35 mm and can be produced year - round. Peak season is between the months of July and October, while lean season is from November to May. Farmers harvest and sell the fruits in its unripe, green form.[24]

The Philippine lemon gained recognition because of its unique properties of desirable sour-sweet taste and high Vitamin C content. Similar to other citrus fruits, *Calamansi* fruit has been widely utilized

or processed into puree, concentrates, syrups and ready-to-drink juices. The pure juice extract of this fruit was also part of Filipino cuisines as condiments or sauce dip, marinade sauce, meat and fish tenderizer and sometimes used as alternative to vinegar. Extraction of the juice was done either manually by cutting the tip crosswise with caution not to cut the seed because of the high amount of limonin content found in the seeds, which would cause a bitter taste. Calamansi ready-to-drink juice was very well known in the country. The drink was sweetened with either honey or sugar.[25]

Calamansi was indigenous to the Philippines and not generally produced outside the country. Table 1 presents production statistics from the Food and Agriculture Organization (FAO) of the United Nations. The production data shows total production of citrus fruits and shows that the Philippines was ninth in the world in terms of volume of citrus production, producing 1.4% of total global production.[26]

Table 1

Top 10 Producers of Citrus Fruits in the World in 2012

Rank	Countries	Production (MT)	% Share
1	China	5,571,000	43.4%
2	China, mainland	5,500,000	42.8%
3	Nigeria	3,900,000	30.4%
4	Colombia	765,000	6.0%
5	India	600,000	4.7%
6	Guinea	240,000	1.9%
7	Angola	199,988	1.6%
8	Syrian Arab Republic	185,000	1.4%
9	Philippines	178,507	1.4%
10	Mexico	147,000	1.1%
	Total	12,840,318	100%

Source: www.fao.org

The table did not disaggregate calamansi production, but cross referencing the FAO data with Bureau of Agriculture Statistics (BAS) data revealed that calamansi accounted for 178,507 metric tons of the citrus fruits produced by the Philippines in 2012.[27]

Calamansi farmers in the region were not formally organized into calamansi farmer's organizations, but most of them were members of various farmers associations. Farmers in the barangays were organized into barangay farmers associations that comprise the municipal farmers associations. The Department of Agriculture (DA) reported that calamansi production slowly brought recognition and that farmers given assistance by the government and Siay, Zamboanga Sibugay Province became the largest producers of Calamansi in the region.[28]

Calamansi Processing

There were nine (9) calamansi processors in Zampen that produced sweetened calamansi extracts (concentrate) and juice (ready to drink) but, these producers only processed less than 0.02% of the available supply of calamansi in the province. The method of preservation that was commonly employed by these processors was usually a combination of conventional or traditional technique and the use of preservatives or additives. Among these processors, only one (1) processor did largescale processing and had established a processing facility. The majority of the processors in the province were doing manual juice extraction, and production was intermittent would depending on outstanding orders. Traders typically controlled the price of calamansi. The big processor (Mrs. Hao) whose processing plant was

located in Sta. Maria Zamboanga City, bought calamansi direct from the traders during peak season. Only green, mature, unripe calamansi were used for processing.[29]

Table 2

Volume Production of Calamansi in the Philippines by Region in 2012

Rank	Regions	Production (MT)	% Share
1	MIMAROPA Region (IV-B)	102,628	57.5%
2	CALABARZON (IV-A)	14,382	8.1%
3	Central Luzon (III)	10,366	5.8%
4	Davao Region (XI)	8,838	5%
5	SOCCSARGEN (XII)	7,120	4%
6	Cagayan Valley (II)	6,896	3.9%
7	Zamboanga Peninsula (IX)	6,341	3.6%
8	Western Visayas (VI)	5,340	3%
9	Caraga (XIII)	4,310	2.4%
10	Ilocos Region (I)	3,370	1.9%
11	Eastern Visayas (VIII)	2,510	1.4%
12	Bicol Region (V)	2,176	1.2%
13	ARMM	1,379	0.8%
14	Northern Mindanao (X)	1,314	0.7%
15	Central Visayas (VII)	1,117	0.6%
16	CAR	420	0.2%
	Total	178,507	100%

Source: Bureau of Agricultural Statistics http://countrystat.psa.gov.ph/?cont=10&pageid=1&ma=A60PNV0P

The processors technically produced sweetened calamansi extracts that were mislabelled as sweetened calamansi concentrates. The labels also did not show any of nutrition facts required by FDA labeling regulations. More important, most of the processors in ZamPen did not have an FDA registration or License to Operate (LTO) yet. [30]

Quality varied among the processors, and the juice products were generally of inferior quality compared to the existing juice beverages available in the market. Local processors did not have stardardized procedures for calamansi juice processing. They also lacked technical knowledge on how to improve the quality of the juice. Some calamansi juices sold in the market had a dark brown color and with a bitter aftertaste, which indicated faulty processing. The processors did not have standard corrective measures to prevent undesirable characteristics. The majority of the processors lacked training on the technology of processing juice and beverage. Processors who had freezers, refrigerators and chillers also produced ready-to-drink (RTD), sweetened calamansi juice by mixing calamansi extracts with sugar and water. RTD calamansi needed to be refrigerated to prolong its extremely short shelf-life.[31]

Citrus Juice Beverage Challenge: Utlizing Waste for Health Benefits

Citrus industries in the world produced an estimated 14 million tons of waste per year. The wastes came from peels and refining pulp from the juices. Yet, if this waste was processed, it was possible to obtain products useful against aliments and used by pharmaceutical industries as pectin, mucilage, flavonoids and feed for animals. In particular, lemon peels could be utilized to obtain good quality pectins instead of the orange peels and juice pulps that were used for the production of fodders. From lemon juice pulp, it was possible to draw mucilage and flavonoids.[32]

Many juices and soft drinks available to consumers contained chemicals and additives that could harm people's health if they drink too much. Furthermore, the Department of Education (DepEd) had

issued a memorandum to ban the sale of carbonated drinks in schools, particularly elementary schools. Beverage processors thus faced the challenge of coming up with healthier juice drinks that would suit the demand and taste of the buying public.

Food Quality and Safety Management System (FQMS) for Juice Beverage Processing

Given the dangers of foodborne illness from contaminated food --. product recalls, litigation, brand damage or even order of closure from government regulatory agencies -- food processors around the globe have recognized the need to strengthen food safety activities by implementing Food Quality and Safety Management System (FQMS) to establish quality standards, meet consumers' expectations, provide consumers with a high level of confidence in the product they purchase, and comply with necessary regulatory requirements set by the government.[33]

One of the challenges for the food industry in the recent years has focused on the wide selection of FQMS from which choose. Many standards, requirements and certification schemes have been introduced by internationally recognized standard-setting bodies, regulatory and legislative authorities, and other industry-driven organizations.[34]

ISO 9001:2008

ISO, the International Organization for Standardization, developed international management standards that ensured that products and services are safe, reliable and of good quality.[35] Companies that went through the steps to obtain ISO 9001:2008 certification gained international recognition for achieving those rigorous, documented quality processes. The benefits of 9001:2008 certification included access to new markets, but achieving certification could be costly and lengthy due to the rigorous processes required.

British Retailers Consortium (BRC)

The BRC food safety standard was a leading global brand standard adopted by more than 18,000 suppliers in 100 countries around the globe.[36] The standard was designed to establish Good Manufacturing Practices (GMPs) so that all food processors could produce safe, legal products that meet the quality levels expected by customers.[37] Although the BRC food safety standard began in the UK, it had become recognized as a global standard, and therefore companies considering exporting their products to Europe gained benefits with BRC accreditation.[38]

Kosher Check Certification

For over 30 years, Kosher Check had been widely recognized as an accepted Orthodox kosher certification agency. "Kosher" referred to a religious dietary practice, particularly among observant Jews.[39] Kosher Check certification had been introduced for those manufacturers that wanted to promote no only their kosher compliance but their commitment to food safety as well. The majority of the consumers who bought certified kosher products did so because of perceived quality and safety rather than religious resasons, therefore a key benefit of Kosher Check certification was increased product sales.[40]

Hazard Analysis Critical Control Points (HACCP)

HACCP wass an approach to food safety recommended by the Codex Alimentarius Commission, the United Nations International Standards Organizations for food safety. HACCP was a vital framework in the

international food safety legislation and for food manaufacturing processes for the food industry**.** It was a universally accepted tool in preventing food safety hazards. It was a mandatory quality control system of activities relating to production, adminstration and marketing of foods. It consisted of applying a series of control procedures of the activities properly documented but not necessarily certified. This system could be implemented independently or included in the control systems adopted by the company.[41]

Halal

Halal was an Arabic term meaning allowed, lawful, legal or permissible under the Shariah (Islamic Law). Halal certification was a certificate of compliance to the religious requirements observed by muslims worlwide, and therefore the benefits of certification were access to the muslim market. In the Philippines, certification could be achieved through the Islamic Dawah Council of the Philippines, Inc. (IDCP), which was a recognized Halal Certification Authority in the Philippines under G.R. no. 153888 dated July 9, 2003.[42]

Good Manufacturing Practices (GMP)

Good Manufacturing Practices (GMP) were part of the entire Hazard Analysis Critical Control Points (HACCP) food safety system in food business. GMP were operational requirements to be complied with by a food business in order to produce safe foods. There was strict emphasis regarding compliance on GMP in all relevant legislation and customer certification stndards. [43]

Kenneth's Decisions

Bearing in mind the trends in food and beverage products, Kenneth had a number of things to consider before realizing his proposed project with Wellson Foods Inc. First, he had to

choose the most suitable preservation technique for calamansi juice processing. The method had to be effective in retaining the important phytochemicals present in the calamansi so that Wellson could position the juice beverage with a significant distinction from competitor brands by offering a "Health and Wellness" mark, which was the second top food and beverage trend. Second, Kenneth had to decide which Quality Assurance (QA) system tool would be appropriate for the start-up plant for sustainable production but could still compete on the market demands for healthy options.

Kenneth was very motivated by idea that he would be expanding the family business into another dimension and significantly improving ZamPen's economy, because Wellson Foods would be giving job opportunities as well as boosting the calamansi production in ZamPen. The company would be tapping the farmers' cooperatives to have a sustainable supply of raw materials and at the same time be helping farmers by giving them a reasonable price for their harvests. As had been reported in recent years, farmers had just been throwing away parts of their calamansi harvests because of very low farm gate prices.[44]

Kenneth also noted that local processors had no technology or strategy on the utilization of wastes (peels, pulp and seeds) from calamansi juice processing, yet these wastes could be used as preservatives in juice processing. Kenneth had a lot to think about as he made his decisions, but he was very determined to find the ways and means to materialize his plans.

Exhibits

Exhibit 1

Photographs of various Calamansi products

Source: www.dti.gov.ph

Exhibit 2

Map of Zamboanga Peninsula (Zampen) Region

Source: https://www.google.com.ph/search?hl=en&site=imghp&tbm=isch&source=hp&biw=1366&bih=677&q=ZAMPEN+map&oq=ZAMPEN

Exhibit 3

Zamboanga Peninsula Integrated Agricultural Research Center

Source: Photograph courtesy of Mr. Roger Bagaporo, Research Head of Department of Agriculture-ZAMPIARC

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