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**NEW PRODUCT DEVELOPMENT IN LEATHER INDUSTRY
(YAK LEATHER)**

Case: Kokkolan Nahka Oy

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ABSTRACT

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<p>The goal of this thesis was to develop a new product in the leather industry which is yak leather and the production process for the company Kokkolan Nahka Oy. The main products are Nordic elk and deer for the company Kokkolan Nahka Oy. Most popular product is Nordic elk (Moose).</p> <p>Elk provides a limited supply of raw material because the hunting of moose is under strict control of the government. Mostly elk is hunted for the meat and to keep the elk population at a sustainable level is why it is under control by the government. Kokkolan Nahka Oy is not getting a sufficient supply of raw materials to produce elk leather and to execute a continues production process, therefore, they started producing yak leather as their production process is almost the same.</p> <p>The product development and continues production process has been worked out as well and included into the current work to complete the author’s goal to produce yak leather and to improve the production process. The work was planned in the way to provide information and documentation about the yak leather and the production process.</p>		
Key words New product development, Yak leather, Production process		

ABSTRACT
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1 INTRODUCTION

Before coming to Centria University of Applied Sciences my aim was to study some industry related subject. In 2012 I have started my studies in Industrial Management. I was very curious to learn how all big and small companies organize their production process, logistics and business process. I was interested some strategies and methods of running their business as daily routine and that time when their business falls under stress of recessions or other unfavourable economic impacts. During my studies in some courses I have had many opportunities to visit some companies to know about their production and business process and so on. During my studies, I started working in the leather industry (Kokkolan Nahka oy) as a part-time worker. They manufacture leather products. As a worker at Kokkolan Nahka Oy I was doing different task with leather in production line.

The leather and leather products industry plays a prominent role in the world's economy. World population grew dramatically in the 20th century and it continues to grow at present. This growing population and the general increase in wealth have led to increases in the demand for meat, which in turn have kept the supply of leather raw material constant. (Source: United Nations Industrial Development Organisation. Viena,2010).

The company`s, Kokkolan nahka Oy, main materials are Nordic elk and deer. Most popular material is Nordic elk (Moose). They are processing about 60,000 elk hides in a year. Elk provides limited supply of raw material because the hunting of moose is under strict control of the government. Mostly elk is hunted for their meat and to keep the elk population at a sustainable level is one reason why it is under control by the government (Asia Pacific Leather Fair 2016.) My idea came from the fact that elk can't supply sufficient raw materials. For continuous production process of Kokkolan Nahka Oy, they started producing yak leather as production process is very similar. Yak leather has similarity with the elk hides but with more durability and tensile strength. They processed around 5,000 yak hides last year and it's gradually increasing. Here my goal is to develop yak leather, using better technology which will be economically beneficial for the company.

2 OVERVIEW OF KOKKOLAN NAHKA OY

Kokkolan Nahka Oy was established in 1957 and is located at Kokkola in Finland. It is one of the biggest leather industry companies in the Nordic country, also the most trusted and reliable company for their customer. Production equipment represents the latest technology. From 1957 to 1983 the company name was Rukkastuote Oy. In 1984, the company changed its name from Rukkastuote to Kokkolan Nahka Oy. This company was started by Jorma Örnberg, he is grandfather of current managing director Juha Örnberg. Around 35 employees work in this company. They are exporting their product overseas to over 25 countries. Main products are Nordic elk and deer leather. The most popular product is Nordic elk leather which has a richness that makes it stand out among all other leathers.

Kokkolan is a Traditional, third-generation family tannery that combines the skills and methods of preparing leather that have been passed down from one generation to the next, with the latest technologies and experience gained from abroad.

Finland-based Kokkolan's flagship product is Nordic elk leather. Elks are wild animals. They find all their needed resources in the clean nature. These wild animals naturally grow in the forest area all over the Nordic countries. Kokkolan Nahka Oy collects elk hides from Finland, Sweden and Norway. When they buy the skins from hunting clubs they use the money to pay for hunters' cost occurring during hunting season. Hunters usually keep the meat for themselves and Kokkolan Nahka Oy gets the skin. The skins are bi-products that means they would go to waste.

Mainly elk (moose) hunted for the meat and it is under the strict control of the government. The reason is to keep the elk population at sustainable levels and provides a regular supply of skins. Kokkolan sources the hides locally, process them in their two tanneries, before exporting them to more than 25 countries across the world. They process about 60,000 elk hides per year.

Elk skin has a richness that makes it stand out among all other leathers. "Despite its thickness, elk leather is extremely soft. It has unique fiber structure which provides powerful insulation against cold weather and its breathe very well in summer. That is why it makes the ideal material to produce shoes as well as casual and industrial gloves, which explains the continuing success of Kokkolan Nahka Oy with both Finnish and international markets. Still, not content to rest on its laurels, recently they diversified and

turned its interest towards a different type of leather. The following Picture 1 shows that the way grown up elk in Nordic countries are naturally in the forest area.



PICTURE 1: Nordic Elk (Kokkolan Nahka Oy)

Elk provides a limited yet exclusive supply of raw material so they can always find their place in the market. However, lately they have wanted to extend their product line with a leather similar to the elk hides, but with more durability and tensile strength. That is yak leather. (Örnberg 2017.)

3 GENERAL PROCESS OF LEATHER PRODUCTION

3.1 Production process planning at Kokkolan Nahka Oy

The leather manufacturing process can be divided into sub-processes: Preparatory stages Tanning, Crusting and surface coating.

3.1.1 Preparatory stages

When the raw hides come to the BEAM HOUSE, the preparatory stage starts. During the preparatory stages, many of the unwanted raw skin components are removed. Below the chart of preparatory stage:

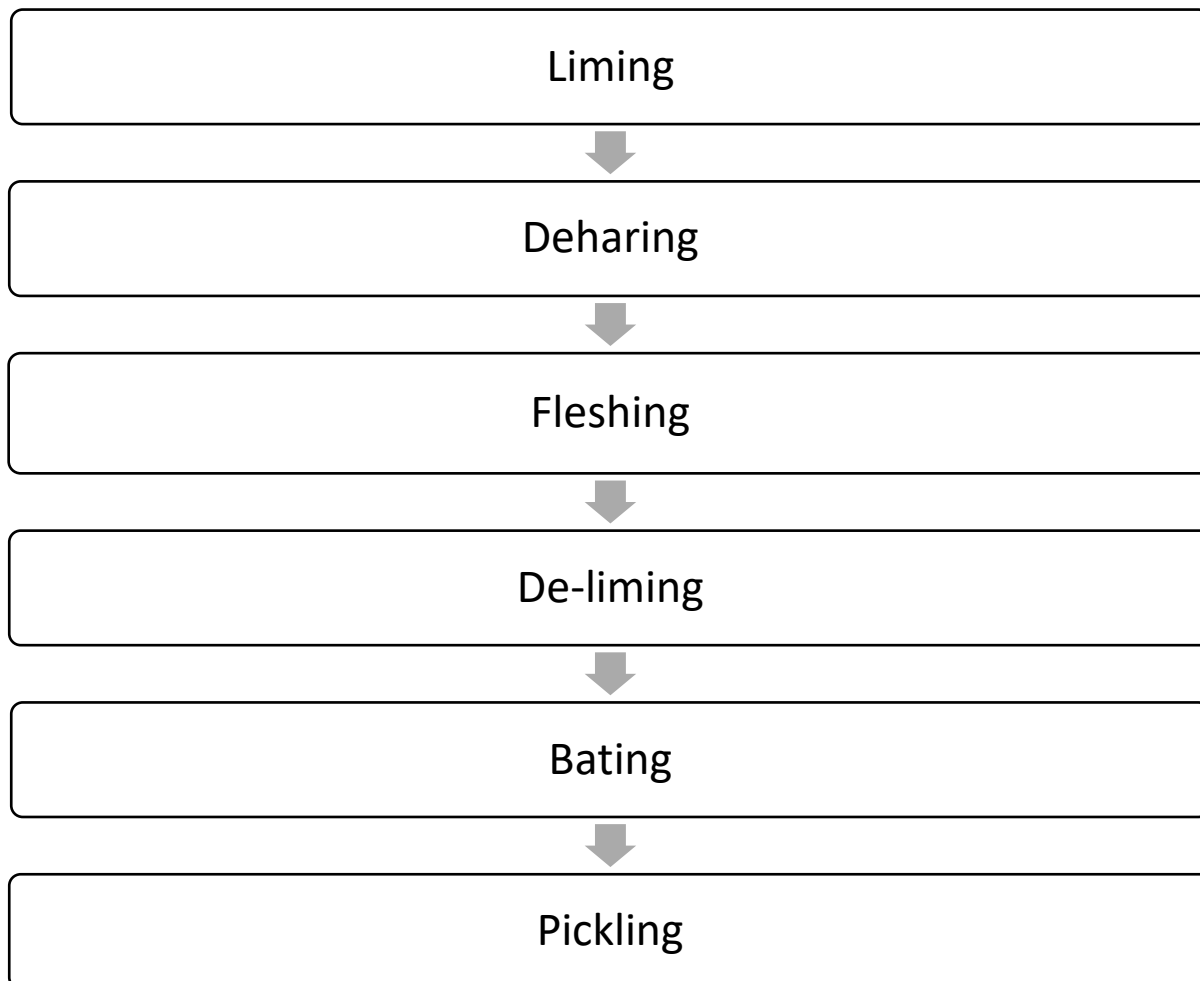


FIGURE 1: Leather process at preparatory stage (Kokkolan Nahka Oy 2017)

Liming

Lime is the solution in which the skins to be made into leather are soaked before removing the hair. This causes the breakdown of keratin, the main protein of hair, as well as dissolves the hair root and epidermis. Liming does not damage the collagen or dermis portion of the skin, but it does remove the fibrillary proteins and causes osmotic and lyotropic swelling and plumping. In effect the dermis becomes swollen and engorged with water, opening the fiber bundles for a more thorough penetration of the tanning materials. (Burch 2002.)

Dehairing

The most common way process is the chemical process which uses lime and sodium sulphide. So, the hair is removed chemically.

Fleshing

This is one of the most important steps. All fat, meat and membranes must be removed from the flesh side of the skin.

De-liming

This process brings to removal of alkali from the pelt with the consequent deswelling of the fibers and helps lowering of the pH to the values used in the bating process. It is carried out with slightly acidic chemicals. Liming and un-hairing chemicals are removed from the pelt.

Bating

Bating is an operation to complete the de-liming process, by eliminating residues of other substances and loosen the fibers of the skin, in order to smooth the grain and achieve a soft and flexible leather.

Pickling

Lowering of the pH value to the acidic region. This must be done in the presence of salts. Pickling is normally done to help with the penetration of certain tanning agents, e.g., chromium (and other metals), aldehydic and some polymeric tanning agents. Pickling acidifies the skin and kills bacterial growth. Pickling can also be used to hold the skin safely for storage. Pickling is a temporary preservative. (Örnberg 2017.)

3.1.2 Tanning

Tanning is the process that converts the protein of the raw hide or skin into a stable material which will not putrefy and is suitable for a wide variety of end applications. The principal difference between raw hides and tanned hides is that raw hides dry out to form a hard-inflexible material that can putrefy when re-wetted (wetted back), while tanned material dries out to a flexible form that does not become putrid when wetted back. Many different tanning methods and materials can be used; the choice is ultimately dependent on the end application of the leather. The most commonly used tanning material is chromium, which leaves the leather, once tanned, a pale blue colour (due to the chromium), this product is commonly called “wet blue”.

The acidity of hides once they have finished pickling will typically be between pH of 2.8-3.2. At this point the hides are loaded in a drum and immersed in a float containing the tanning liquor. The hides are allowed to soak (while the drum slowly rotates about its axle) and the tanning liquor slowly penetrates through the full substance of the hide. Regular checks will be made to see the penetration by cutting the cross section of a hide and observing the degree of penetration. Once an even degree of penetration is observed, the pH of the float is slowly raised in a process called basification. This basification process fixes the tanning material to the leather, and the more tanning material fixed, the higher the hydrothermal stability and increased shrinkage temperature resistance of the leather. The pH of the leather when chrome tanned would typically finish somewhere between 3.8-4.2. (Örnberg 2017.)

3.1.3 Crusting

Crusting is when the hide/skin is thinned, re-tanned and lubricated. Often a coloring operation is included in the crusting sub-process. The chemicals added during crusting should be fixed in place. The culmination of the crusting sub-process is the drying and softening operations. Crusting may include the following operations:

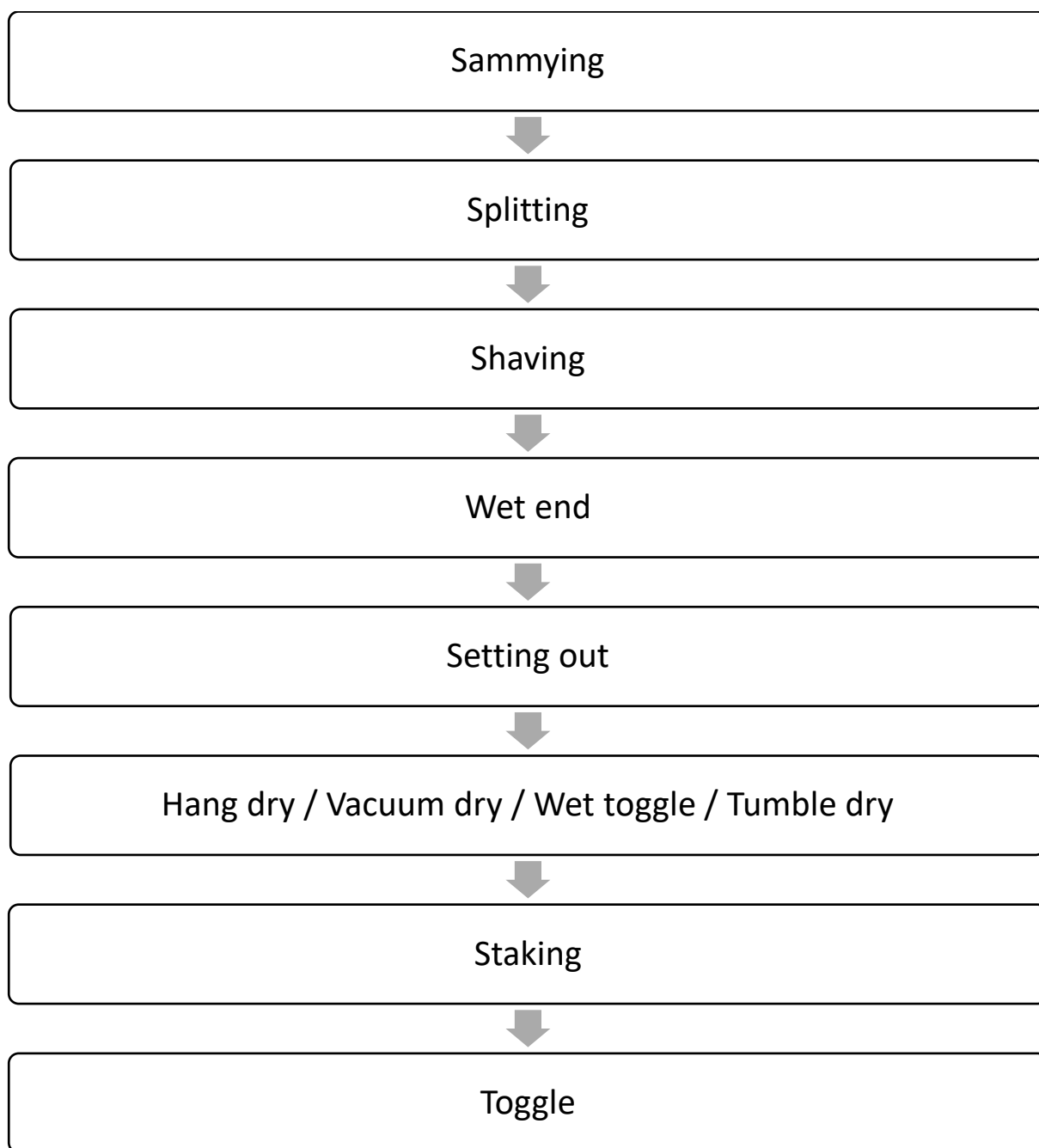


FIGURE 2: Leather crusting process (Kokkolan Nahka Oy 2017)

3.1.4 Surface coating

Tanners refer to this as finishing. Finishing leather operations may include roller coating, ironing, milling, spraying, conditioning (Örnberg 2017).

3.2 Environmental and social performance of Kokkolan Nahka Oy

Kokkolan Nahka Oy is doing its best to improve our environmental and social performance.

A) Water

Water is the most valuable resource in the world. Finland is the land of the lakes, so they take clean water very seriously, (Finnish Environment Institute). Tanneries have a special responsibility for actively reducing water pollution because leather production requires large quantities of water comes into the contact with many highly active substances. (Tesařík & Vostrčil 1972.)

All the water used in the beam house is collected and purified in the company's own water purification plant. Harmful substances are filtered both mechanically and chemically. Residual materials such as chromium and sulphides are collected or converted in sedimentation tanks. All organic residues and bioproducts are taken to a nearby biogas plant. Investments in state -of-the-art machinery further reduces water consumption.

B) Energy

Our society's energy consumption releases huge amount of CO₂. That damages our environment and endangers our climate. That is why 100% of the electricity used by Kokkolan Nahka oy is from regenerative.

C) Transportation

The transportation of people and goods results in the emission of CO₂. For their products, they work together with their employees and business partners to create optimal logistics, thereby protecting the environment. Together with their logistics partners, customers and suppliers, they are constantly working on making their logistics as ecological as possible.

Their raw materials are coming from the Nordic countries and straight from their own forests and are delivered fresh. That not only helps the environment, it also ensures excellent quality hides.

D) Chemicals

The production of leather requires the use of chemicals to tan the hides, dye them and then finish them. This is true for all tanning all over the world. They take a very careful look at the kinds and amounts of chemicals that they use in production and their place of origin. They buy chemicals from the European Union who also have to abide to the high European environmental standards.

E) Raw-materials

To reduce the amount of chloride in our rivers and streams, they are using a special filtering system that purifies the polluted water, so that it comes out cleaner than it has been led in. Kokkolan Nahka Oy refers to the EU regulations of sustainable hunting. Kokkolan agrees to the terms of Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Elk is a local produce so emissions of transport is significantly reduced. And the Yak, they usually order in big quantities at once so transport from Mongolia follows only twice a year.

F) Social Aspects

Their highly trained employees are their most important capital. They know what responsibilities they have towards them. According to the European standards, the social security is extremely high when compared to other countries around the world. Each one is in a pension plan and has accident, unemployment, and nursing care insurance. (Labour Law.)

They invest in the training and continuing education of our employees and exceed the high level of social insurance offered by European laws. Their exceptional performance, the care they take and the vast experience that each and every employee adds to the production process leads to the creation of an exceptional product Made in Finland. As it comes to yak, the raw hides are directly bought from the herders. There is no middleman, in this way they ensure that the money goes directly to the herder's family. We also assured through a signed agreement that there is no child labour under 16.

Kokkolan Nahka Oy respects the UN convention on the rights of a child. A child must not carry out work that is harmful to them and shall be protected from economic exploitation and from work which may be dangerous to their health. Work provided by children under the age of 16 is forbidden. (Örnberg 2017.)

3.3 Quality management systems based on ISO 9001

ISO (International Organisation of Standardisation) 9001 is a standard focused on quality management and the World's most popular quality management system standard and is all about keeping the customer satisfied. ISO 9001 contains all the requirements which an organization must address within their Quality Management System if the organization's wish to be certified according to the standard. It is very important to evaluate and enforce quality management system. It specifies the requirements to successfully implement a quality management system to monitor and improve the performance of an organisation, regardless of the size of the industry, whether that means driving down costs, increasing productivity or improving customer satisfaction. To meet the requirements of this standard will provide quality management systems that will be real benefit to an organization to help manage the business effectively. (ISO 9001)

The company Kokkolan Nahka Oy also got certificate from the Suomen Asiakastieto Oy which is a company that creates power for the economic future. The company has achieved a high rating Alfa classification by Suomen Asiakastieto, which is only achieved by every tenth company in Finland. (Kokkolan Nahka Oy)

Below the Picture 4, shows the company certified by ISO 9001



PICTURE 2: Quality System Certificate (Kokkolan Nahka Oy)

4 NEW PRODUCT DEVELOPMENT (YAK LEATHER)

4.1 In general new product and product development strategies

There are many attempts to classify new products into certain categories. Very often the distinction between one category and another is one of degree and attempting to classify products is subject to judgement. However, only 10% of all new products are truly innovative. These products involve the greatest risk because they are new to both for the company and the marketplace. Most new product activity is undertaken to modify and improve the company's existing products.

The following classification (Booz, Allen & Hamilton, 1982) identifies the commonly accepted categories of new product development.

New to the world products

This represent a small proportion of all new products introduced. They are the first of their kind and create a new market. They are inventions that usually contain a significant development in technology, such as a new discovery or manipulation of existing technology in a different way, leading to revolutionary new designs etc.

New product lines (new to the firm)

Although this is not new to the marketplace but these products are new to the particular company. They provide an opportunity for the company to enter an established market for the first time. For example, Kokkolan Nahka Oy started manufacturing yak leather. Though it is not new in the market but it is new for the company.

Adding to existing lines

This category is a subset of new product lines. The distinction is that while the company already has a line of products in this market, the product is significantly different from the present product offering but not so different that it is a new line. The distinction between this category and the former is one of degree. For example, Hewlett-Packard's colour ink-jet printer was an addition to its established line of ink-jet printers.

Product improvements

These new products are replacements of existing products in a firm's product line. For example, Hewlett-Packard's ink-jet printer has received numerous modifications over time and which each revision, performance and reliability have been improved. Also, manufacturing cost reductions can be introduced, providing increased added value. This classification represents a significant proportion of all new product introductions.

Cost reductions

This category of products may not be viewed as new from a marketing perspective, largely because they don't offer new benefits to the customer other than possibly reduced costs. From the firm's perspective, they may be very significant. The ability to offer similar performance while reducing production costs provides enormous added-value potential. Improved manufacturing processes and the use of different materials are key contributing factors. The effect may be to reduce the number of moving parts or use more cost-effective materials.

Repositioning

These new products are essentially the discovery of new applications for existing products. This has more to do with customer perception and branding than technical development. (Trott 2005)

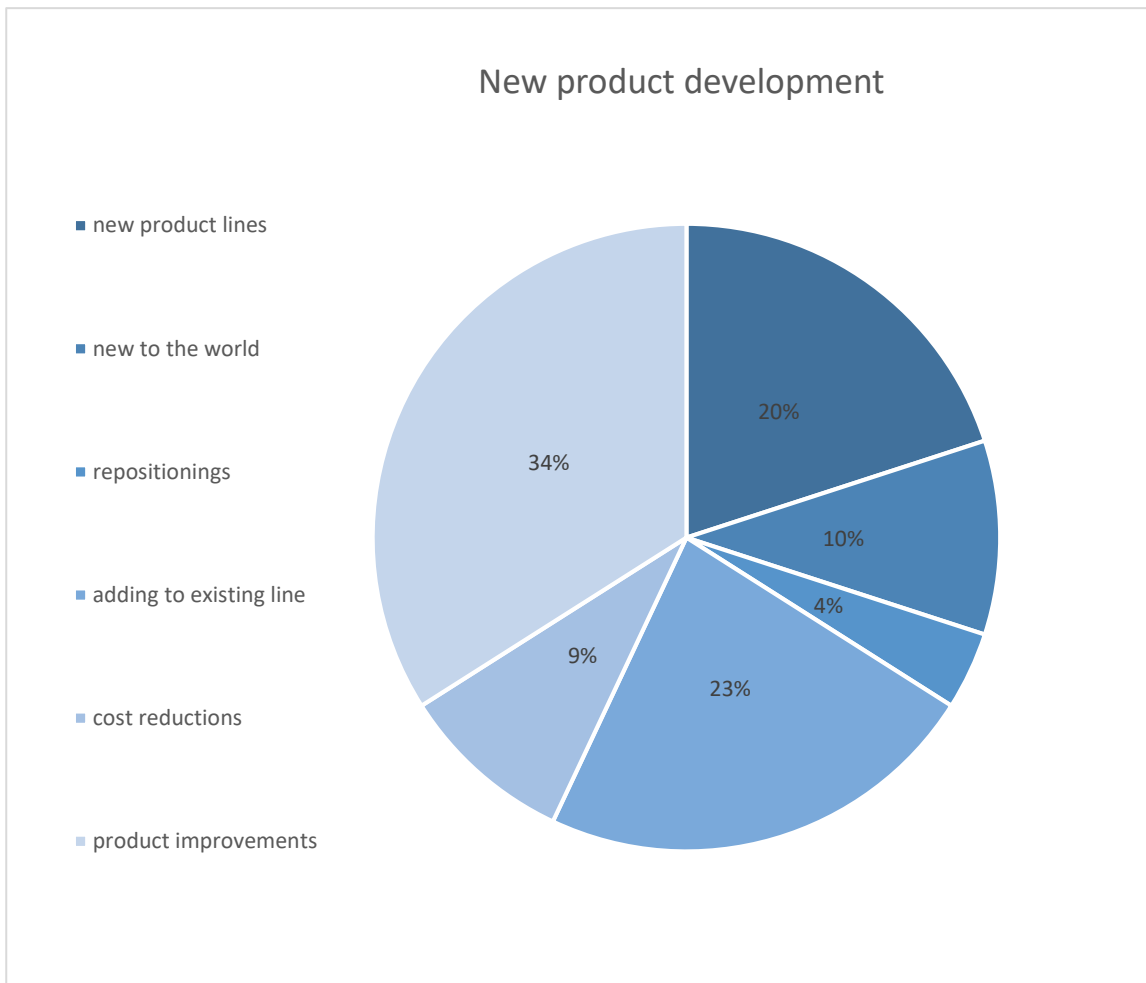



FIGURE 3: The average new product portfolio (Adapted from Griffin 1997)

A development of Ansoff's directional policy matrix was Johnson and Jones's (1957) matrix for product development strategies (see table 1). This matrix replaces Ansoff's product variable with technology. It builds on Ansoff's matrix by offering further clarification of the range of options open to a company contemplating product decisions. The range of product development strategies that are open to a company introduces the notion that a new product can take many forms.

TABLE 1: New product development strategies (Johnson & Jones 1957)

Increasing technology newness 

Product objectives	No technological change	Improved Technology	New technology To acquire scientific knowledge and production skills new to the company
No market change	Sustain	Reformulation To maintain an optimum balance of cost, quality and availability in the formulate of present products	Replacement To seek new and better ingredients of formulation for present company products in technology not now employed
Strengthened market To exploit more fully the existing markets for the present company's products	Remerchandising To increase sales to customers of types now served by the company	Improved product To improve present products for greater utility and mechanizability to customers	Product line extension To broaden the line of products offered to present customers through new technology
New market To increase the number of types of customers served by the company	New use To find new classes of customers that can utilise present company products	Market extension To reach new classes of customer by modifying present products	Diversification To add to the classes of customer served by developing new technology knowledge

4.2 Yak in nature

Yak leather is so strong because the yaks live under such extreme conditions. These harsh living circumstances and the influence of insects makes the leather have an appearance marked by age. The yak lives in an altitude of 3000 meters. At such an altitude the temperatures may vary severely and can be extremely low (-40°C). The compact hide of the yak protects the animal against these extreme temperatures and this makes the leather very strong and durable.



PICTURE 3: Mongolian Yak (Kokkolan Nahka Oy)

Yak leather is mostly used in the production of shoes and bags. The tensile strength of the skins makes them most popular because they make long lasting products. At Kokkolan Nahka oy, they make the yak skins water repellent and this makes them suitable for all seasons. Yaks are farmed / semi-domestic for their meat since it's the main food type in countries like Mongolia and Tibet. The hides from the slaughtered are collected and salted properly before storage to prevent degradation. The hides are then transported to the beam house where de-hairing and tanning takes place. The skins are also processed with a mould protection agent because they are packed in a plastic bags which are leak-proof ready to be shipped. Kokkolan outsources the buying of yak from Mongolia and the management personally supervises the selection, tanning and transportation of yak hides.

Once the hides arrive at Kokkolan, they undergo another selection process whereby they sorted according to grade and size. Depending on the preferences of the customer, they tan, dye to the appropriate colour and do a finishing on the skins. Since Kokkolan is taking steps to make sure the environment is kept clean, the yak has been made eco-friendly. Yak skins being processed are now free

of chrome. Chrome (III) is considered not safe since chrome (VI) may form after oxidization occurs on the skins and could be harmful to the customers. Since chrome has a characteristic of making hides soft and supple. The chrome tanning process relatively cheap, chrome also increases the propensity of the leather to take up dyestuffs. Chrome (III) is used in the tanning process for chrome tanned leather and if the tanning processes are carried out correctly then the resulting leather will be completely safe to use. Kokkolan has developed new tanning ways to get even better skins without the use of chrome. (Örnberg 2017.)

Vegetable tanning (wet white) is a natural process, relying on trees and water. It is a method in which natural ingredients such as the bark of chestnut trees are used to tan the leather. Plant extracts are used for tanning in this process. By vegetable tanning, wet white tanning refers to organic tanning methods. The biosynthetic is used to tan the leather, which result in a semi-finished leather that looks white tinted. This new method of tanning has been gaining popularity, due to increase concern of water treatment systems and environment. No harmful chemicals are used when dyeing the hides. Vegetable tanning is known for the natural colors and fibers of the hide. After years of use, vegetable tanned leather caramelizes with a beautiful patina that only enhances its rich and naturally beauty. On the other side, Chrome tanning relies on chromium salts and tanning liquors. About 90% of leathers in the world are tanned by chrome tanning, because of lower cost. It's a very quick process. By chrome tanning, wet blue is the tanning process where chromes are used to process the leather from raw hides to finished leathers. This process causes the semi-finished to look blue tinted. It is easy to produce, usually takes up a day. (Carry 2015.)

The table below shows the differences between vegetable tanned leather and chrome tanned leather.

TABLE 2: Chrome vs vegetable tanned leather (Carry 2015)

Vegetable tanned leather	Chrome tanned leather
<ul style="list-style-type: none"> • The way it is tanned, the colours of vegetable tanned leather are usually rich and deep in natural earthy tones. • It has great durability and strength. If well cared for – potentially last several lifetimes. • Deeper scratches can be seen easily but shallow scratches can be buffed out. • Has a distinctive fragrance – the sweet, earthy fragrance probably associate with leather is the smell of vegetable tanned leather. • Vegetable tanned process relatively expensive. • Environmentally friendly, can be recycled. 	<ul style="list-style-type: none"> • Is available in a huge variety of colours. • Is softer and suppler than vegetable tanned leather. • Is resistant to water, stains and heat. • The fibers of chrome tanned leather are not able to show through the same way they do vegetable tanned leather. • It is cheaper than vegetable tanned. • It is bad for the environment.

4.3 Production process of Yak

The yak and elk skins have similarities in the production process. The yak hide comes from Mongolia, therefore the primary stages of process are done there. For example, for raw hides, they do Liming, Dehairing, Fleshing, De-liming, Bating and Pickling. Pickling acidifies the skin and kills bacterial growth. Pickling can also be used to hold the skin safely until it can be conveniently shaved, degreased, washed and rinsed or tanned. Returned the skin to the pickle between steps and prior to placing in the tanning solution. Pickling is a temporary preservative. They do the primary stages in Mongolia because after that it is easy for transportation from Mongolia to Finland.

Below the Figure 4, Kokkolan Nahka Oy`s yak skin handling process in Finland.

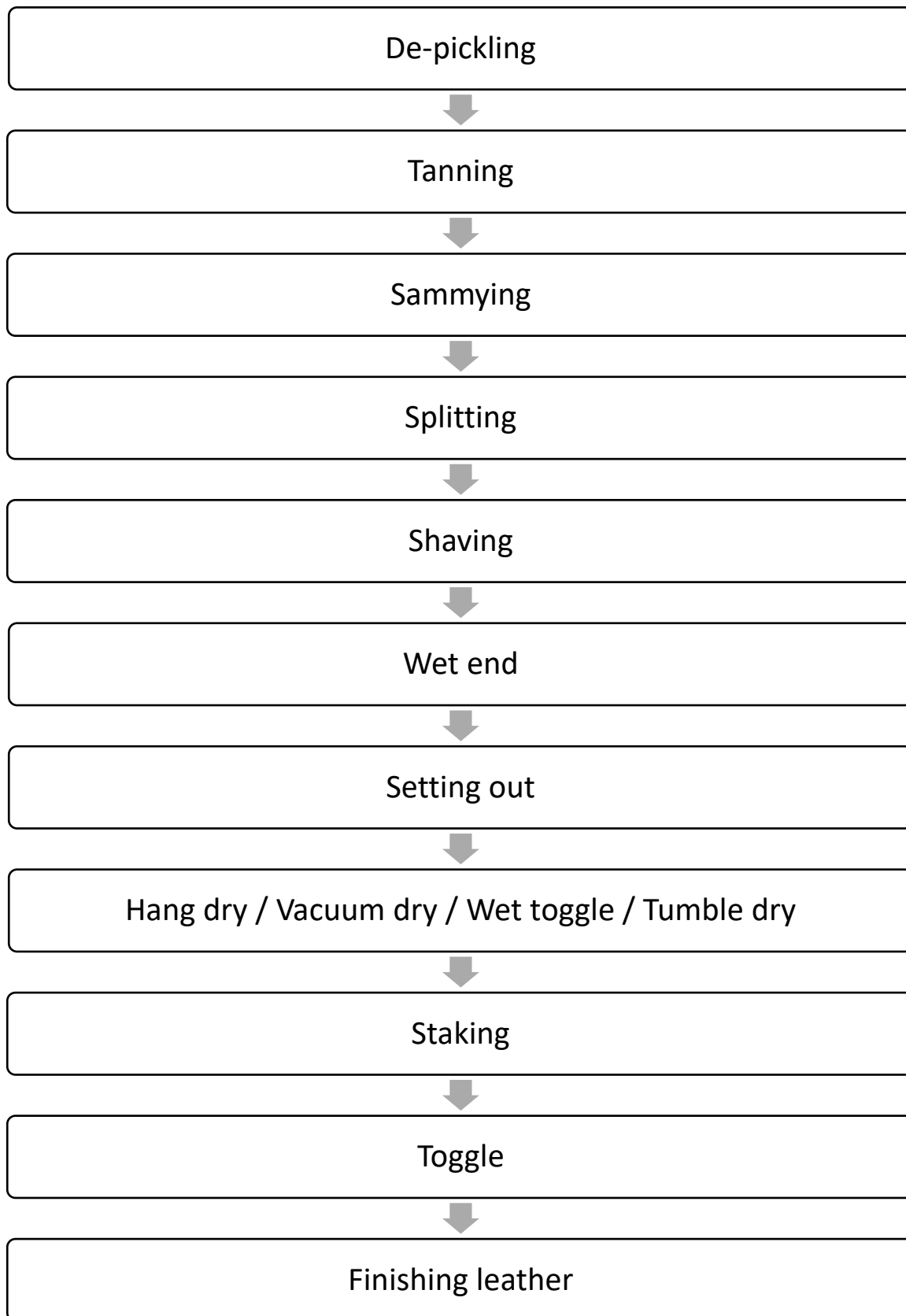


FIGURE 4: The process of yak leather (Kokkolan Nahka Oy 2017)

De-pickling

Raising of the pH out of the acidic region to assist with penetration of certain tanning agents.

Tanning

Tanning is the process that converts the protein of the raw hide or skin into a stable material which will not putrefy and is suitable for a wide variety of end applications. The principal difference between raw hides and tanned hides is that raw hides dry out to form a hard-inflexible material that can putrefy when re-wetted (wetted back), while tanned material dries out to a flexible form that does not become putrid when wetted back. Many different tanning methods and materials can be used; the choice is ultimately dependent on the end application of the leather.

Sammying

70%-50% (m/m) water is squeezed out the leather.

Splitting

The grain- the outer surface of the hide is mechanically separated horizontally from the spilt (the lower part). The leather is split into one or more horizontal layers.

Shaving

The leather is thinned using a machine which cuts leather fibres off. Thick skins or thick areas of some skins are commonly shaved on the back side to create more uniformity and make it easier for the chemicals to penetrate.

The following Picture 4 showing the way it works.



PICTURE 4: Shaving Machine (Kokkolan Nahka Oy 2017)

Wet end

Neutralisation - the pH of the leather is adjusted to a value between 4.5 and 6.5. re-tanning - additional tanning agents are added to impart properties. dyeing - the leather is coloured. fat liquoring - fats/oils and waxes are fixed to the leather fibres, fats/oils and waxes are added between the fibres.

Setting out

Grain flatness is imparted and excess water removed.

Drying

Different kinds of drying for different processing. For example: hang dry, vacuum dry, wet toggle, tumble dry. The leather is dried to various moisture levels (commonly 14-25%).

Staking

After drying the leather, it comes to staking machine to make it soft and flat.



PICTURE 5: Staking Machine (Kokkolan Nahka Oy 2017)

Toggle

Toggling is for drying the leather. Tension and flatness of toggled leather meets company specifications for the leather type and quality required. After toggling, the edges of skin are cut and made ready for surface coating. (Örnberg 2017.)

Finishing leather

Finishing leather is surface coating. It is the final stage and most complex process, which includes all operations to be carried out on dried skins to change the surface effect. Finishing leather operations may include:

A) Roller coating

Roller coating is for painting the skins. Kokkola Nahka Oy has the GEMATA (Megastars) which is new technology for the company. The machine Gemata can hide the scratches on the skins because the paint covers the skins well. It gave the company an easy way to improve the production process which saves time and reduces production cost. Now company can produce more product in the same time, by that way company can deliver their product in time to the customer. Megastar is an innovative machine for the finishing leathers. Coating is intended as the application of water-based chemical products for colouring, coating, stucco filling and giving density to the hides.

It is possible to spread uniformly on the whole leather surface from 2.5 to 40 grams per square foot of any kind of chemical product on any kind of leather. The machine has 3 rollers which is using different purpose for the different skins. The operator gets the machine ready, put the pigment (paint) inside the machine and checks the desired leather color with the sample, which is ordered from the customer. Sometimes the crust has a different look after dyeing but it does not change the color because when leather is painted by this machine it covers the whole skin very well. Getting right color on the surface of the leather depends on the right pigment (paint) to put in the machine.

Below the Picture 6, showing the machine Gemata Megastar:



PICTURE 6: Gemata Megastar (Kokkolan Nahka Oy 2017)

B) Ironing



PICTURE 7: Machine Rotopress (Kokkolan Nahka Oy 2017)

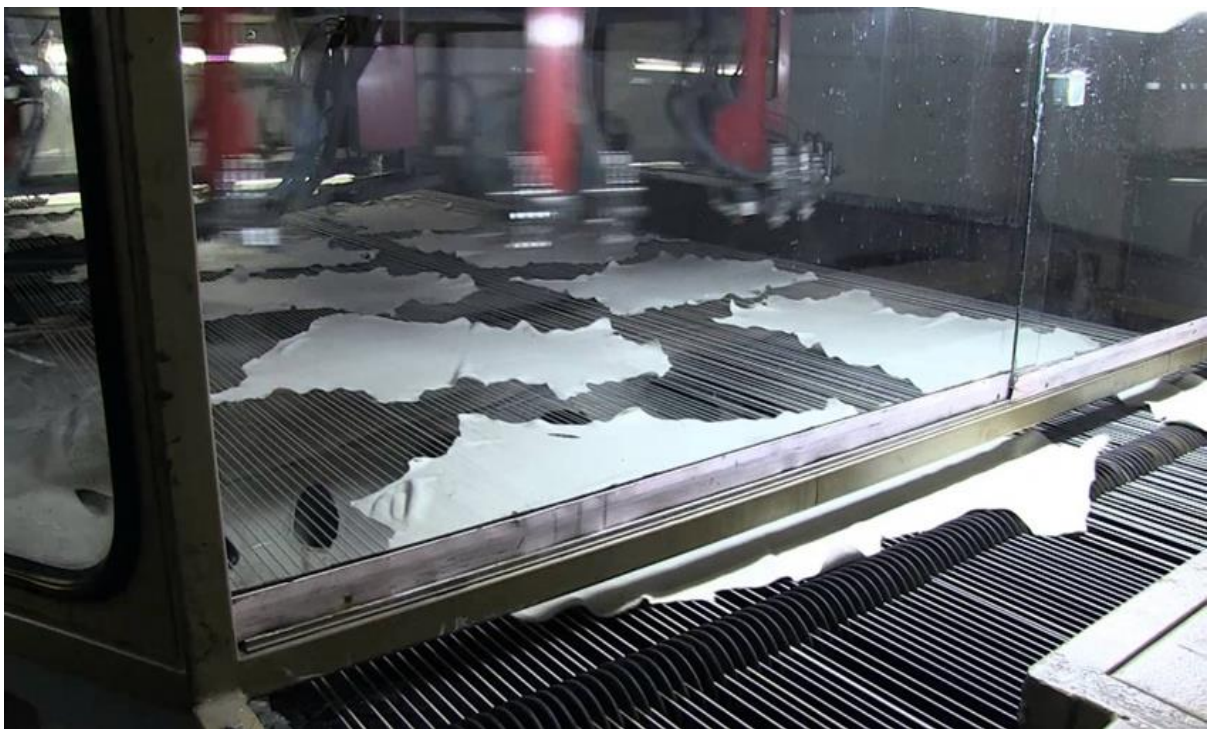
- **Polishing-** this is a process mostly done on ready leather to enhance the look. It involves a machine with two brush rollers rotating at high speed and in opposite direction to each other. After oil or wax has been applied to the leather, positioning leather in between the rollers with slight circular movements to facilitate the polishing effect.
- **Plating-** this process is done when the result required is a smooth, flat and sealed surface. It also brings up the natural look and feel of leather. Traditional and modern methods of achieving this result are more or less the same where by leather is passed through a heated steel plate. Plating refers also to glazing.
- **Embossing-** depending on the requirements of the customer, Kokkolan has different kinds of steel templates that can be printed on leather. They are attached on to a machine then heated up to 100-

200 degrees and when leather is pressed against them an imprint is left on the grain (ref. figure machine rotopress)

C) Milling

The leather is tumbled or milled in a large drum to produce a softer more pliable product. After dry milling, the leather has achieved softness and dust elimination. The leather normally stay in the drum for 4 hours.

D) Spraying



PICTURE 8: Spray machine (Kokkolan Nahka Oy)

i) Base coat- This coat is applied to leather in a few instances. When hides are dyed, a spray coat is applied on the surface. Defects are hidden, correct colour matching is achieved and the surface is sealed from the elements for example water and fire. With a good base coat leather can last a lifetime.

ii) Top coat- In order to protect the basecoat and also to achieve the desired touch, a gloss or matt top coat is applied to the leather. It's a thin film that sits on top of the grain and acts like glue and depending on the consumer needs, it is applied according to its purpose for example for water proofing or fire repellent.

iii) Finishing (Polishing) coat- polishing coatings are basically oil or waxes that can be brushed in order to achieve a certain gloss or a two-tone effect. The leather after undergoing this process come out with an antique effect. (Taruru 2017.)

E) Conditioning (DYNAVAC)

It is used for stretching the finished leather. It also makes possible getting 1 to 8% of increment more of the skins. After conditioning, the leather is ready for measuring and packing for the customer. (Örnberg 2017.)

4.4 Profitability of new product (Yak)

Profitability is the primary goal for all the business ventures. Without profitability, the product will not survive in the long run. It is very important to measure current profitability and projecting or future profitability of the product. Product profitability is the difference between the revenues earned and total costs associated with a product over a specified period of time. It helps the company in determining the entire product costs (including fixed costs) and the actual profitability of the product that is added to company's portfolio.

Below the table shows the average raw material cost, production cost and selling price of Yak leather per square meter:

TABLE 3: Expected production cost and selling price of yak (Örnberg 2017)

Yak leather	Price (euro)	Size (SQ.M.)
Raw material	15 euros	PER SQ.M.
Wet-end process	8-13 euros	PER SQ.M.
Finishing process	4-8 euros	PER SQ.M.
Break-even	27- 36 euros	PER SQ.M.
Selling Price	35-50 euros	PER SQ.M.

Rejected skins and low selection skins are not calculated into the break-even price, those skins are sold at a discount price.

5. ECONOMIC ANALYSIS

5.1 Cash inflows

Cash inflows include the transfer of funds to a company from another party because of core operations. Such cash inflows include payments to the company by customers. Kokkolan Nahka Oy produce leather when they get order from customers. As they introduce the new yak product, product sales increases, and therefore revenues increase at the same time.

5.2 Cash outflows

Cash outflows include the transfer of funds by a company to another party. Such cash outflows include payments to business partners including employees, suppliers or creditors. Cash outflows also occur when long-term assets are acquired, investments are purchased, or settlements and expenses are paid.

One time development cost

Fixed cost for set up new advanced technology machine for long term production. For example, Gemata megastar which saves working hours and makes good quality of leather.

Production cost

Using chemical for the production and labour cost which are cash outflows for the company.

On-going production cost

The company must pay suppliers for the raw materials. And as the working machine running more, the maintenance cost of machines has increased.

Marketing and support cost

The company participates in the Hong-Kong leather fair every year where they display their product and getting new customers around the world.

6. CONCLUSIONS

The accomplished study was aimed to develop a new product and process in leather industry which is yak leather and production process. This was a case study of the Kokkolan Nahka Oy. The main and most popular material is Nordic elk for the company Kokkolan Nahka Oy and the problem arises for the company when there is a lack of raw material elk hides. They have started to move into new product development in the company for the continuous production process. There is wide range of activities to develop new product in the company such as marketing, financing and engineering. Every year thousands of euros are being spent on research and development for new products development. This investment is necessary as new products are the only means of survival for a firm. New product development provides several advantages to the enterprise. For example, it helps in providing maximum customer satisfaction, take advantages of new technology, to maintain / increase market share with competitive advantages, to fill gap in the market and so on.

The company Kokkolan Nahka Oy has always been passionate of leather. They have tanned elk leather successfully over 50 years. The use of wild animals` hides can be challenging due to availability and handling. However, they have created practices that allows to provide this unique wild animal leathers to anyone who values the natural beauty. They wanted to extend their production line same from the elk to the yak, which is hide is even stronger. They buy the yak hides directly from the herders without any middleman from Mongolia. Using their advance knowledge and tanning elk leather, they have developed their own yak tanning process together with Mongolian tannery. In Finland they re-tanned, dye and finish the leathers. The yak hides they receive from Mongolia are generally of high quality. They do the final process and quality check here to ensure that their customer receives only the best possible leathers. The actual interest of the author was to develop yak leather and the production process and which could be implemented into business start-up.

The result of the product development is a set of production process and structured product description supported by the reasoning about the materials selection. The leather process activities helped the author to approach the production process of Yak leather in a systematic way that has resulted in the detailed overview of the product description and the way of production.

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