



Master's degree thesis

LOG950 Logistics

Transportation Capacity Utilization at Ekornes AS

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Preface

This master thesis has been the last project of a two year long exciting journey as MSc student in logistic Analytics at Molde University College. It was performed during the winter of 2022 and spring of 2023.

This research has been done with a close collaboration with Ekornes As. The project gave me insight and understanding that in rapidly changing world and competitive situation among companies, how a big company can survive with prompt decision by any changing in the sales situation and strategies of company must be adjusted according to the market. I have learned that transportation could be one of the critical areas which could help companies for cost optimization and finally, there are several ways for companies to improve the shipments capacity utilization and gain competitive advantage by optimized process and less cost.

I would like to thank Ekornes company and Logistic Director Jan Robert Lyngvær for assigning me to this project. It is highly appreciated, the significant help and time given to us during this project.

Finally, a big "thank you" to my supervisor, Professor Arild Hoff at Molde University college for his great support, guidance, dedication, and effort through this project and last but not least, my appreciation goes to Homayoun Shabaani as the PHD student at Molde University college and assistance of supervisor in this thesis for his valuable comments and support during this thesis.

Molde, May 2023

Ehsan Alisaeedi

Summary

Being survive in the global market is exceedingly difficult and need to gain competitive advantage. In the global marketplace companies should have proper strategies and implement it better than other companies. The furniture industry has witnessed tremendous growth over the years due to the factors such as globalization, the rise of e-commerce, and increasing demand for customized furniture. Shipping plays a vital role in bringing raw materials and finished products from various parts of the world. The efficient use of shipping containers can help furniture businesses to transport more items at lower cost.

Ekornes is a Norwegian furniture company that has been manufacturing high-quality furniture for over 80 years. Ekornes produces a range of furniture items, including sofas, recliners, and chairs, which are known for their comfort, durability, and innovative design. Ekornes is a global company with distribution network across the world.

After covid pandemic and changing in customers behaviors, sales trend has been undertaken of changes. Accordingly, Ekornes need to adjust new strategies to keep the market share and profit with lower cost. The purpose of this thesis is investigating the current situation of transportation in Europe and particularly route of Norway to Germany in terms of container's capacity utilization and introduce some recommendation which can be applicable for the company to improve capacity.

Literature studies in such areas as logistic cost, transportation, supply chain management and capacity utilization were made. The empirical study was based on the information provided by Ekornes. A Meeting and continues conversation through calls and emails contributed to the effective research design development.

One dataset which included all transportation data belongs to 2022 of company with all destinations in central and northern Europe was analyzed with consideration of seasonality patterns and demand fluctuations. In addition, other studies were studied to find out what was is the best practice in the world for transportation capacity utilization specifically furniture product and how could improve it. finally, some recommendation was written in the thesis that can be helpful for the company.

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1.0 Introduction

1.1 Introduction

Ekornes is the biggest furniture producer in the Nordic countries and sells its products under three varied brands, Stressless, Svane and IMG (Ekornes,2023). It has a wide sales and logistics network which are expanded Globally with 10 factories in 5 different countries and more than 3200 employees working in this company.

The goal of this thesis is investigation, analysis, and measure of the current situation of outbound shipments for the company Ekornes in terms of capacity utilization. Although they have factories out of Europe as well, in this thesis we are going to check the process of transportation in Europe. Currently, the process of orders distribution in Europe is that they are being sent from factories in Norway to the central hubs in Europe and then are being distributed to the final customers by truck. While there are several distribution hubs in Europe which located in France, Spain, Germany and so on, in this thesis transportation utilization from Norway to the Hamburg as the central hub for northern of Europe will be investigated. Normally, Trucks and containers are not fully loaded. In this thesis, we are going to analyse different shipping utilization with respect to trucks and containers capacity and logistics cost and customers delivery time.

1.2 Background Issue

During the pandemic Ekornes faced increasing sales growth and had to adjust its operations and logistics to cover the demand. They had a dramatic increasing sales trend which reached a top in 2022. After the pandemic, the sales experienced a dramatic reduction in 2021 and 2022, and hence, they need to reduce their costs to be more efficient and to keep the profit margin. As a result, they are looking for ways to optimize the operation and logistics process in order to work effectively and focusing on cost reduction and keeping the level of customers satisfaction. One of the reasons behind increasing furniture sales is that during pandemic many countries set limitation for travelling, so many of people could save devoted money which supposed to be spent for travelling and spent it on the modernizing of their homes with modern furniture. Ultimately, change in customers behaviors led to the more production and sales. After pandemic, it went to the normal situation, so the operation must

be adjusted effectively to work in a satisfactory manner and optimize the cost and finally keep the expected margin.

1.3 Ekornes Presentation

Ekornes main factory located in Sykkylven on the west part of Norway. All their production categorized under the brands Stressless, Svane and IMG. is one of the world's most well-known furniture brands, while the brand Svane are most famous in Norway. IMG is being sold in the USA and Australia. (Ekornes,2023a)

Ekornes opened with three employees and machines made in Germany in 1934. Furniture production equipment established in Sunnmøre. In 1947, wooden furniture components for sofa production established for the first product. First foamed plastic manufactured in 1959 also first Stressless chairs went to the Norway market in 1971. By the end of the 1983, the number of employees increased from 795 to 1,585. In 2000, Ekornes increased turnover in all markets, and group turnover reached to NOK 1,535.9 million and Ekornes launched new web pages in several languages. Production Capacity in the Stressless factory improved from 900 to 1,100 seats per day over the course of the year. New showrooms, "Ekornes Bua" opened in Ålesund in March 2001. The Group turnover exceeds NOK 3 billion in 2015. In 2018, In competition with 27 other upholstered furniture manufacturers, Stressless came in first place in the large-scale German consumer survey, the survey asked which brands, companies and service providers consumers prefer, and publishes a ranking based on the replies of around 60,000 customers and eventually new vision and values introduced to Ekornes's employees. (Ekornes, 2023b)

Vision: "We improve everyday living"

Values: "Honest, authentic, enthusiastic, adaptable"(Ekornes, 2023c)

Ekornes is globally active in 48 markets. Ekornes has 19 sales office which located in 13 countries with 4000 sales points around the world. It had annual turnover more than 3 billion NOK in recent years. Ekornes has 10 factories located in Norway, USA, Thailand, Vietnam, and Lithuania respectively with around 3,200 employees (Ekornes, 2023a).

They constantly try to combine smart functionality and attractive design - precisely to maximize the level of comfort in armchairs, sofas, dining furniture and beds. They believe that a good night's sleep and the opportunity to charge the batteries create energy in everyday life. Family and friends visiting for dinner bring joy and quality of life. A moment of

relaxation frees up time for good reflection and makes you better equipped to face the next everyday challenge (Ekornes,2023a).

Stressless is one of the world's popular brands in the furniture industry globally. Stressless is Ekornes' largest product area, and one of the most powerful furniture brands in the world with 74% market share of Ekornes. The Stressless products contains different product type, Stressless chair, Stressless Dining, Stressless Office and Stressless sofa, all of which are high-quality premium products. After Stressless, IMG and Svane has the second and third position in terms of making revenue with 19% and 7% respectively. The distribution between Ekornes product groups is shown in Figure 1 (Ekornes,2023a).

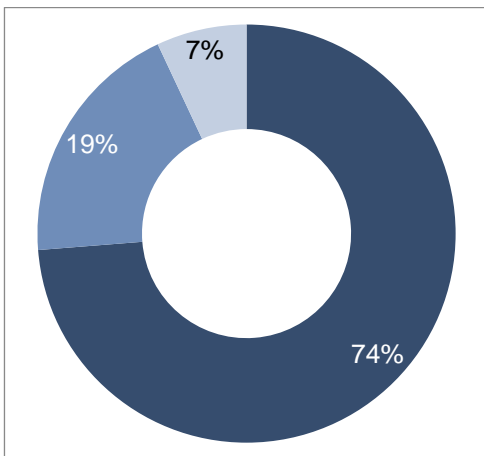


Figure1: Division of sales between Ekornes product groups (Source: Ekornes)

IMG is being managed independently but it is part of the Ekornes holding group. As the company, they focus on premium quality of product, with the Scandinavian design taste. As a discovery brand, they sale their product in a variety of markets and collaborate with many retailers to provide customers with long-lasting comfort. Development, production and sale of mattresses and beds takes place through the subsidiary Ekornes Beds AS under the Svane brand. The start-up of Svane in 1937 happened only a few years after Ekornes was started. The brand is one of the best known within the Norwegian furniture market (Ekornes,2023a).

In 2021, Ekornes had the total revenue equal to 4.315m NOK all around the world based following portion. (Figure 2)

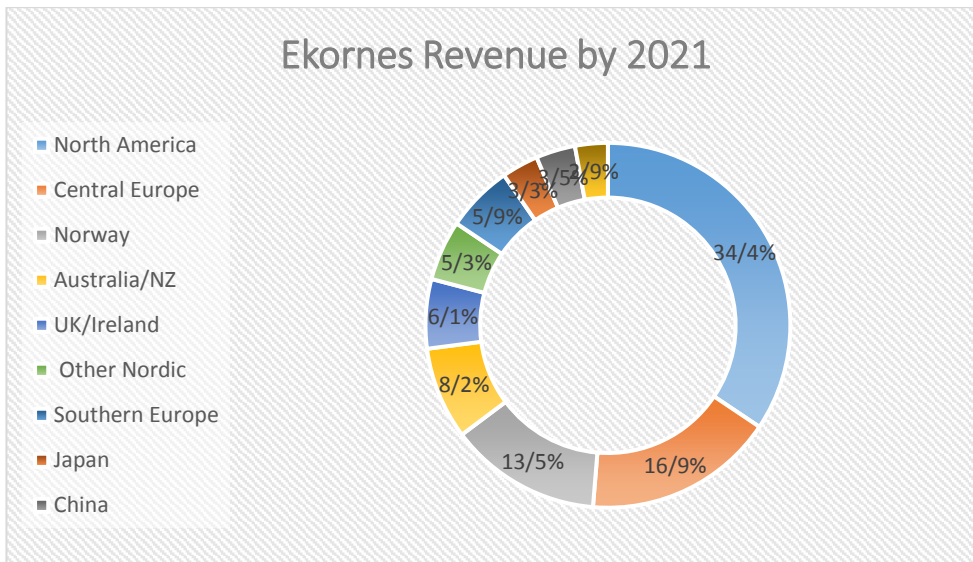


Figure 2 Ekornes Revenue 2021 (Source: Ekornes)

North America with more than 34% has the first position and after that central Europe with around 17% stand in the second position.

1.4 Problem Definition

Supply Chain disruptions coming as an effect of the pandemic have had an extraordinary impact on increasing costs both on materials and logistic. During the pandemic Ekornes have experienced a massive demand on their products and with that had record high outputs from its factories, this have given strong financial results because the fixed costs have been apportioned to a higher output. After the pandemic, the demand is going back to normal and to a pre-pandemic level, while the variable costs are still at a prominent level and the fixed cost base the same. This gives a significant pressure on Ekornes' profit margin. Logistic cost base is now a 10% share of the revenue and therefor a significant factor with potential of costs savings. Ekornes has been reduced 150 workforces in the operation area to reduce headcount cost and stable their operational situation as it was before pandemic, while it has not been enough, and they need to be more efficient in operation.

1.5 The purpose of this Thesis

Hamburg in Germany is the central hub for the product distribution of Ekornes in central and northern of Europe. In terms of revenue, central Europe had the second position with 17% of total revenue in 2021 after North America. This thesis will try to analyse the current situation of outbound shipments from Norway to Germany, based on the data records, and

check whether there are some possibilities in terms of shipment capacity utilization. It should be said that there are many more possibilities process optimization but with consideration of limited time for writing a master thesis, we will go forward with one part which is applicable and further research, and more optimizations can be proposed at the end of this thesis.

1.6 Research Questions

Regarding what has been described the questions of the research will be as following:

1. What is the current capacity utilization rate for the Ekornes shipments?
2. What is the effect of changing shipment frequencies?

For sure there is some side effects in terms of orders lead time and logistic cost when shipment frequencies will be changed, here some recommendations will be proposed, that can be used by the Ekornes management when considering changing the current policy.

1.7 Limitations

The most important limitation for this thesis is that in the limited time, we could just focus on the one part of logistic operation which is the transportation from Norway to Hamburg and there were more opportunities to do some more research in other areas of logistics, but we had to concrete in one area to complete it on the desired time.

2.0 Literature review

2.1 Furniture Industry after pandemic

Kristianto et al (2021) mentioned in their research that all businesses and activities must adapt themselves after corona pandemic. One of the areas is education and learning system. Changing in the learning system from traditional education to online learning and reverse directly affect the furniture production and accordingly wood processing process. As the result, in order to be survive new business models and framework must be created.

PEST is the analyses framework to examine the impact of external factors on the organization or company, moreover, it can predict the future situation of company in terms of major parameters like market and competitiveness.

They examined the situation after Covid-19 based on PEST analysis and mentioned that how can create value for the businesses according to the 4 main factors: 1. Political factor 2. Economic factor 3. Social factor 4. Technological factor.

Some results of this research can be summarized as below:

1. Digitalization is going to be replaced with old business models.
2. Business processes are going to be healthier than before.
3. Human resource needs to be adopted with new conditions.
4. Quality assurance will be more important after covid pandemic.

According to this research and the observations in Indonesia:

1. Southern Asian countries will improve their economic situation and see the China as the leader.
2. It is very necessary to adopt supply chain processes more effective and faster.
3. The market for workforce is not in a proper situation because the decreasing demand in the market even 70% to 80%.

Learning process is one of the main parts of the market for the furniture industry. It includes schools and universities and many other educational centers. Therefore, any changes in this big section affects furniture industry and Ekornes as well.

2.2 European Furniture Industry

Oblak, L. et al (2020) have investigated that the biggest production and market sector is central of Asia and Europe has the second position. In last decade we had a great advancement in terms of innovative use of materials, quality, and design. These changes include shape and design of furniture, modern technologies for producing of furniture and the most important one is innovative business models. While Asian furniture market is bigger than European market, in terms of the of the designment, environmental aspect, sustainable natural material usage, more effective furniture and high-technology production, the European is the leader in the market. Totally Europe is producing a quarter of all furniture product in the world. The competitive advantages of the European furniture companies are innovative production process, environmental aspect, decreasing lead times, export into emerging markets, and communication strategy.

The authors conclude that in 2018, The total value of furniture market trade was approximately US\$149 billion in the world, 4% higher than last year and make a 6% increase

in 2017. The European market share in import and export of global furniture market are respectively 44% and 41%. Based on the CSIL (2019) report, around one million workers are working in European furniture industry directly and indirectly and most of them are skilled workers. According to the report of the CSIL, there was an increasing by 3.2% in 2019 in furniture global market. European furniture industry is facing challenges as follows: Asian countries which are producing furniture like China and Vietnam are in competitive situations with European countries because of the raw material lower prices and low rate of labor costs. Furniture producers are mainly consisting of small and medium scales companies that are managed by their owners and are more flexible than big companies. Updating their management system, required financial support and matching marketing strategies with global market change are another challenge. Logistic and distribution of products is particularly important problem because any inefficiency in the values chain and supply chain can impact the final prices for the customers and accordingly lead to market share portion.

The most effective strategies for the furniture producers in Europe are designing with the innovative manner, concentrate on new market segment with new business models like e-business, using materials which are environmental friendly, new methods and systems in supply chain and lead time reduction are competitive advantages, moreover flexibility is important factor because each customer is unique with special demand, as a result, new customer preferences and life style has been lead to new business models, new furniture design and new ways of production in this regard.

Finally, it has been mentioned that European furniture industry is pioneer in terms of design and environmentally friendly materials in the world, but the industry is facing some major problems and must change tradition business model to new emerging business models and try to generate more added value to the industry.

2.3 Customers behaviors in Furniture Industry

Patryk Zwierzyński (2017) mentioned that there are 2 critical factors to determine the customers behaviors for furniture buying which are indirect and direct. Indirect determinants can be divided into economic, demographic, and direct is being divided to marketing and psychological.

Table 1. Customer behaviors for furniture buying (source: Zwierzyński, 2017)

Indirect determinants		Direct determinants	
economic	demographic	marketing	psychological
<ul style="list-style-type: none"> - supply - incomes - expenses and savings - possibility of taking credit - possessed durable goods resources 	<ul style="list-style-type: none"> - consumer's age - consumer's sex - household size - household location 	<ul style="list-style-type: none"> - product features - product price - kind of product distribution - advertising related to a given product 	<ul style="list-style-type: none"> - needs - viewpoint - motifs - attitudes - preferences - personality - learning - risk related to an acquisition

According to this research, consumers behaviors in terms of buying furniture can be affected by several parameters. Some of these factors are independent and some of them can affect others. While the economic factors are the most key factors to buy furniture by customers, the age of the purchasers also is one of the important aspects to purchase the furniture. Totally, we can conclude that the process of furniture buying is a complicated process and was influenced by mentioned factors and when the customer finalizes her/his decision, it is especially important for the Ekornes to satisfy the customer and make him or her loyal. It means that for making desirable experience for the customer, Ekornes must be flexible and try to adjust its process in terms of purchasing, production as well as logistics to provide high quality services with optimum cost. This goal affects the main KPIs, and we can see later how it is going to impact transportation and specifically trucks capacity utilization rate. In other words, having acceptable service level like on time delivery and logistic cost must be balanced to reach optimum situation of service level and cost.

2.4 Supply Chain Management and Logistics

According to the Council of supply Chain Management definition (CSCMP) and (Mohammad Asif Salam et al,2015) logistics is part of the supply chain process and term of supply chain checks the integration of logistics processes and is defined beyond of logistics. Logistics is a set of functional activities that are being done throughout the process to convert raw materials into finished products and added and make added values for consumers. Based on this research and what the Council of Supply Chain Management (CSCMP) defined, "logistics system includes different parts which are customer service, demand forecasting, distribution communications, inventory control, material handling, order processing, parts and service support, plant and warehouse site selection (location analysis), purchasing,

packaging, return goods handling, salvage and scrap disposal, traffic and transportation and warehousing and storage. Each of component includes Key and Support activities."

2.4.1 Transportation System

Mohammad Asif Salam et al (2015) mentioned that logistics includes all movement in each step to produce products from first point to the last point which is consumption and contains raw materials, supplies, finished goods. If a final product not being ready based on promised time, it leads to major consequences like lost sales or customer dissatisfaction and production problems. Transportation plays a significant role in terms of logistics cost and on time service level. It has been mentioned that the main goals of transportation are satisfying customers as well as minimizing cost. This can be happened through the profit contribution and competitiveness. Better competitiveness depends on progress in transport system and higher profit margin will be met through economy of scale and lower transportation cost. In transportation, the most effective way for cost reduction is using bigger shipments instead of small shipments. In other words, it can be said that consolidation of small shipments to big ones can be led to lower price because in this way, cost per unit of weight will be decreased.

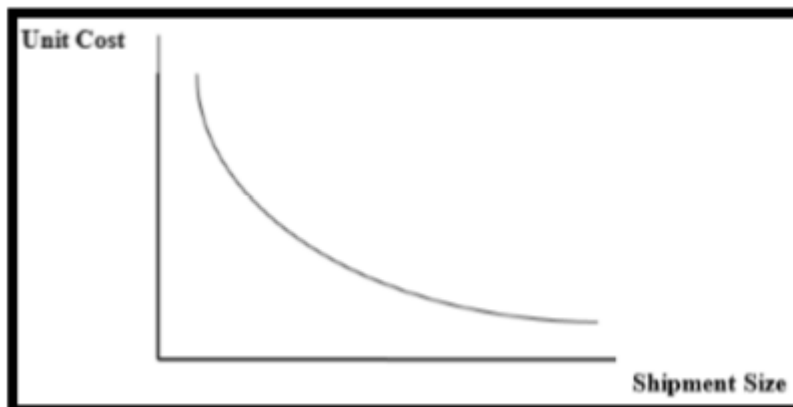


Figure 3 Unit Cost Vs Shipment Size (Source:Asif Salam et al, 2015)

As also has written also mentioned, international transportation companies can use different type of transportation which are water, rail, truck, air, and pipeline. This diversity can help them reduce cost and service time by different modes' compatibilities. Moreover, they can employ labor with lower rates and make sure that they service customers effectively and in a proper way. We can see the Ekornes supply chain situation in Europe in case description part they use water and road transport modes for distribution in Europe. We are going to deep dive on the Europe distribution and focus on the container type of transportation mode.

As (Mohammad Asif Salam et al,2015) conclude Trucks and containers have some advantages rather than other modes of transport. First, it can have lower transport cost, shorter transit time and finally loading time can be less than other types. The primary goal of truck loading is to maximize of space utilization. Normally there should be procedure to load different type of things such as cartons, boxes, parcels, cases into truck.

2.4.2 Order cycle time

Mohammad Asif Salam et al (2015) wrote that order cycle time is the time between customer's order, or the time which service requested and when the order or service received by customer.

2.5 Supply Chain Performance Measurement

The performance measurement is an especially important part of supply chain management and without evaluation process, it is not possible for companies to make sure all processes and activities are being done based on company objectives and targets (Elgazzar, S. et al, 2019). Moreover, supply chain performance management is a complicated process because of the need for clarity in determining which aspects of the supply chain are subject to measurement and evaluation process. (Mishra, D. et al, 2018).

A supply chain management system can be defined as the several indexes which are used to evaluate and control the efficiency and effectiveness of SC processes and relationships and activities also check that if supply chain processes meet the strategic goals of the company or not (Maestrini, V. et al, 2017). According to (Li, L. et al, 2011) data collection for some measurements is easy and tangible such as cost, time, capacity, time productivity and utilization while others effectiveness, reliability, flexibility, and availability can be categorized as the intangible subjects for evaluation.

2.5.1 Supply Chain Performance Measurement Indicators

According to (Baierle LC et al, 2020; Elgazzar et al., 2019) performance indicators are being chosen by managers to help them for correct decision making and help them to check if the processes and activities are being performed align with the company goals and strategies.

According to (Elgazzar et al. 2019), there is not a specific measurement method that can be applied to supply chain performance evaluation. In addition, there must be balance between

financial and non-financial measurement for the supply chain evaluation. Based on (Govindan, K. et al, 2015) more than cost and service level metrics, such other metrics like reverse logistic, green design, green purchasing, carbon management and the meeting of social expectations should be added to the supply chain measurement of the company.

2.6 Measuring Vehicle Utilization

(Enes Horasan,2015) wrote in his research that Performance measurement is defined as the process of checking and examination of the efficiency and effectiveness of an activity. therefore, resource utilization is the usage resources divided by maximum available resources.

(Alan McKinnon, Julia Edwards, 2010) has written that road transport is the most important type of transportation in the most of developed countries. In addition, it has a significant impact on the environment. If the trucks and containers were fully loaded, the damage to the environment could be decreased. According to some statistics, near 25% of trucks in EU run empty (Eurostat, 2007) and trucks with maximum capacity of 44 tonnes carry 29 tonnes maximum, and averagely load 17.6 tonnes. In case of giving permission, run empty rate reduced to 12.7 tonnes (Knight et al, 2008). Increasing load factor is a popular strategy for transportation companies because it can meet both cost reduction goal and make a positive impact on the environment. Companies are willing to find solutions to increasing utilization because of the transport cost and oil price condition. In this situation companies are going to revise the added values which they gain from strategies like just in time and lean production against fuel price. They understand that regarding fuel prices, the importance of high rate of vehicle utilization is more important than previous years. (Gosier et al, 2008)

There are four types of utilization measurement: ton-kilometres, number of pallets, volume-based fill rate, weight-based fill rate.

First, Ton-kilometers: It is calculated through dividing the actual ton-km taken to the maximum available ton-km capacity of a truck according to the (European Environment Agency, 2007). Although, this demonstrates the productivity situation, the utilized capacity of the vehicle is not recognized. So, it can be said that it is not a powerful index (McKinnon, 2007).

The index rate has been decreased from 63 percent in 1990 to 57 percent in 2007. It was due to the trucks weigh changes from 38 to 44 tons in 2001. On the other hand, the average

destiny of material had been shifted from heavier to lighter and the third reason was the increasing amount of packaging. Therefore, the utilization rate decreased. Totally this measure is appropriate for high destiny materials while is not an appropriate indicator for low destiny materials. For Those materials with high destiny which occupy the space more than high destiny materials volumetric measure can represent the realistic rate.

Second, Number of pallets: This measure is calculated via dividing the number of loaded pallets on the truck by the maximum capacity of the truck (McKinnon & Edwards, 2010).

(Enes Horasan,2015) wrote that Ton-kilometers does not represent the occupied capacity in the vehicle. Moreover, it has been mentioned that volume-based capacity calculation is difficult since the transport company is not probably equipped with devices which can assess the occupied space.

Third, Volume-based fill rate: It is the percentage of usage space on the truck. (McKinnon & Edwards, 2010). Three dimensions of the truck's filling area must be calculated, and the occupied space of the cargo must be measured then the usage volumetric space divide on the total space shows the proportion of occupied space. There is no systematic collection of volumetric data for road freight flows, so assessing based on volume utilization is the most difficult method (McKinnon, 2007).

Forth, weight-based fill rate: This measure is equal to the proportion of the actual goods carried to the maximum weight that can be taken on a trip (McKinnon & Edwards, 2010).

Although the evaluation and assessment of truck utilization based on weight is much easier, but it is not a perfect method for low destiny items like wood, plastic, and furniture product. This kind of product are not heavy while occupies the truck space and need to be arranged carefully to not be damaged. So, for this kind of items, the best index could be volumetric utilization capacity measurement. According to what has been written and based on the nature of Ekornes product, for the capacity utilization of containers, we considered volumetric utilization.

2.6.1 Factors Affecting the Utilization of Truck Capacity

McKinnon (2007) has been classified the main 5 categories relevant to the capacity utilization.

1. Market-related constraints: It depends on the pattern of trade and fluctuations on the volume of the cargo.

2. Regulatory constraints: It is about the size and weight of trucks, schedule of deliveries and all aspect of health and safety of vehicle loading/ unloading.
3. Inter-functional constraints: it can be identified by transportation management as well as departments structures, policy, and relationships.
4. Infrastructural constraints: It can be related to the available facilities like transport capacity or warehouse capacity.
5. Equipment-related constraints: It can be like loading/unloading equipment or some other tools and devices.

figure 4 can show the details about all part of above classification.

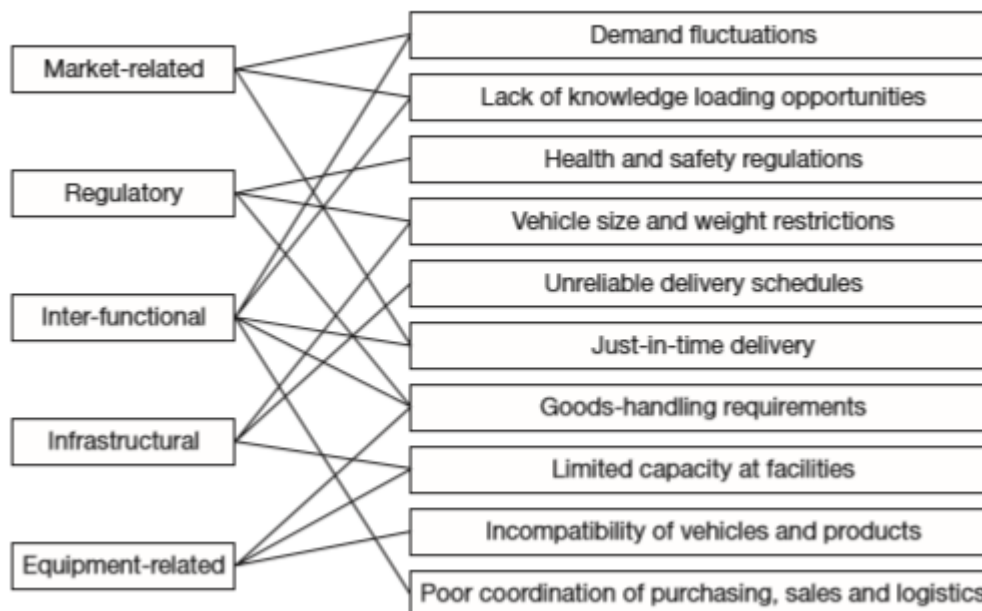


Figure 4: Factors Affecting the Utilization of Truck Capacity (Source: Alan Mckinnon & Julia Edwards,.....)

Among factors which has impact on the capacity utilization, some of them are more important than other factors and can be relevant to the Ekornes business, so we are going to describe these factors. The most critical factor which impact on the capacity utilization is demand fluctuation. Furniture product contrasts with FMCG product that have a fixed consumption and typically customers select furniture product carefully, also as it has been mentioned earlier many factors have impact on the customer's decision to buy furniture. On the other hand, customers satisfaction is one of the most critical factors for companies and since the on-time delivery is one of the key indexes of customer satisfaction, just in time synchronize production and delivery promised date so it can reduce the transportation

capacity utilization, that is why just in time is critical in this area. In addition, loading opportunities lead to lower empty running of transportation vehicles and optimize logistic cost.

2.6.1.1 Demand Fluctuation

The most key factor that effect on the truck's capacity utilization is demand fluctuation. As (Alan McKinnon and Julia Edwards, 2010) mentioned in the predictable customers purchasing situation, it is easier to get required vehicles with an acceptable utilization rate. At peak periods and unpredictable seasonal fluctuations, it is important to have prediction regarding demands to make sure that orders are being fulfilled in a proper way. It means that customers' orders are being transferred on time and the logistic cost are being managed effectively. Forecasting the future sales trend and giving notification to the logistic managers plays a vital role in this regard. In this situation, additional fleets can be employed, and the available capacity of trucks can be utilized properly with respect to all other limitations in terms of sales volume, customer delivery promised date and so on. Some strategies like set promotional activities and different payment types for the customers can positively impact on the utilization rate optimization. (McKinnon, 2004)

For furniture product the process of demand fluctuation prediction is much more difficult rather than food product and grocery because it does not follow the seasonal demand change as it is like food product, Moreover, orders customization is crucial for this type of product. Customization will change the delivery promised date and most of the times, producer company must deliver the orders regardless of supply chain metrics goal which is mostly trying to reduce unit cost.

As we saw earlier, the process of furniture buying is the complicated process from customers point of view and several factors can impact on the customer's decision. On the other hand, since it is expensive product and be used for lengthy period, order customization can be asked by customers. All these reasons and others can push company to meet the customers' needs. Accordingly, delivery time could be affected. In this situation company need to have procedures to make balance between cost and level of service. Although extreme level of service will satisfy customers, logistic cost will increase remarkably.

2.6.1.2 Lack of knowledge of loading opportunities

Although having enough knowledge about loading opportunities in the route can help transportation companies to increase the utilization rate, it is not working for the Ekornes company since the Ekornes products are being carried exclusively from Norway to Germany and they do not have such a policy to combine their product with other products of other companies.

2.6.1.3 Just-in-time (JIT) delivery

The main objective of JIT is to minimize the inventory level with synchronization of production process with transportation. This leads to transport small batches in a limited delivery time. Regarding these circumstances, trucks capacity utilization can be sacrificed for more flexibility in production and zero inventory in warehouse. In order to balance between warehouse inventory and trucks utilization rate, some companies apply some strategies in inbound logistic system to get the components from suppliers based on predefined processes and timelines. (Alan McKinnon and Julia Edwards, 2010)

What has been described about setting some rules at inbound logistics could be an effective strategy but in furniture industry maybe doesn't work properly as it is in other businesses like FMCG or car manufacturing because the customers' orders in this business can be very customized to each other even by changing one level in color of one sofa. As a result, meeting the customer needs and delivering on time can be considered prior to the trucks utilization for the company.

2.6.2 Factors Affecting Costs of Trucks Operation:

(MIRSAD KULOVIC, 2004) identified the factors that effect of trucking cost:

1. Truck size and its utilization.
2. Demand pattern
3. Empty running
4. Freight forwarding availability.
5. Road and traffic conditions.
6. Factor prices (labor, vehicle, spares, and fuel)
7. Management quality

2.6.3 Empty running

Empty running can be defined as the proportion of kilometers which trucks run without any cargo. It is happening as the consequences of freight flows in adverse direction. Within the EU, the empty running is around 27 percent (Eurostat, 2007). It has a direct relationship with trip length and if the trip be longer, probably the empty running level will be more. It is due to that fact with longer journey, finding the backward cargo is more difficult. It has a negative effect on the economic as well as environment.

To reduce empty running of transportation fleets, Ekornes should find the solution to use the container's capacity when transportation fleets delivered the goods to the customer and come back to the source without any cargo.

2.7 Capacity Utilization Improvement with tools

Based on (ACEEE, 2021) there was an estimation in 2020 in USA that showed 20 to 35% of trucks run empty and for those of trucks which are not empty, the average capacity utilization was 57%.

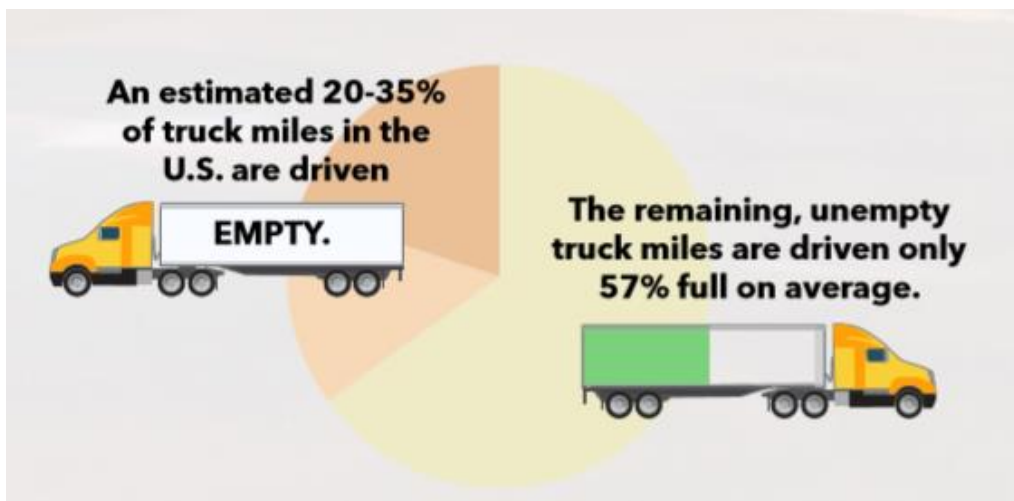


Figure 5 Capacity utilization in USA source (ACEEE2021)

In the era of digitalization and different applications which can transfer data online, there is possibilities to improve the capacity utilization of trucks. During last 10 years ago, new generation of companies and startups made new tools and application to increase load factors which can be shown in the figure 5.

Table 2 Digital Solutions for optimizing Utilization source (ACEEE2021)

Strategy	Description	ICT application	Market	Example
Co-loading	Increasing load factor by sharing truck or rail capacity with other shippers on the same route	Dynamic decision-making to facilitate collaboration	Private and truckload fleets	WeDo
Empty mile reduction	Reducing empty miles by load matching	Real-time load matching	Truckload shippers using digital freight brokerage	Convoy, Uber Freight, Transfix
			Drayage operators	Equill, Dray Alliance
Less-than-truckload to shared truckload	Achieving higher load factor and more direct routing by shifting cargo to point-to-point service	Route optimization algorithms	Less-than-truckload shippers	Flock Freight
Last mile	Increasing load factor by crowdsourcing capacity for urban delivery	Real-time trip assignment via mobile app	Urban delivery	Cargomatic
Cube optimization	Improving trailer packing configuration to increase effective volumetric capacity	Loading software	Private and truckload fleets	The Home Depot ⁶

With help of technology and new applications, several strategies can be used to increase the capacity utilization rate. Co-loading can be applicable for those companies to use trucks and containers on the same route. By this strategy, cost will be reduced, and capacity will be utilized. Empty mile reduction which focuses on the return route. Cube optimization is the strategy that help companies to increase the volumetric capacity with help of software. It is the way to arrange product on the trucks properly to optimize capacity.

3.0 Case Description

3.1 Ekornes Supply Chain Process

According to (Ekornes,2023) the value chain in Ekornes includes five main stages:

1. Supply of Raw materials.

Raw materials for production of furniture includes of wood, leather, fabrics, chemical, plastic, and steel. There are lots of complexity in this area for the furniture producing because many suppliers are responsible to produce and deliver furniture components on time and if there is any late delivery in this stage will affect the next stages in the chain. Since one of the main goals and of the Ekornes is provide the final finished good in the proper way and based on promised delivery time to the customers, any late delivery from components supplier will push the company to complete next stages as soon as possible to compensate lost time. As the result any delay in this stage will affect

the trucks capacity utilization which will be investigated in this research. The complexity of this stage will be more when Ekornes receives the customization request from customer. For example, if the customer requests for one level lighter or darker color of the furniture which is not available, it must be provided by supplier and takes more time so the impact will come to the outbound transportation and trucks capacity utilization accordingly.

2. Production of furniture components. It is consisting of some steps as below:

2.1 Cut and sew of leathers and fabrics.

2.2 Production of molded foam parts and block foam

2.3 Production of wood, steel, and plastic components

2.4 Some finished components sourced from external suppliers.

2.5 Production of solid wood and laminated wood components

There are lots of difficulty and complexity also comes in each of these stages to finished goods be ready based on the plan. In addition to the availability of raw materials which has been mentioned before, the inventory management processes, production planning details, machines situation and several other factors is particularly important to work properly.

3. Production of assembled furniture.

3.1 Assembly and packaging

3.2 Product development

3.3 Testing

3.4 Marketing

4. Distribution and wholesale of assembled furniture to retailers.

There are 19 sales offices which has a close relationship with customers which are in 48 countries.

5. Retail sales of finished goods to end users.

There are more than 4000 sales points around the world.

Figure 6 shows the various stages of Ekornes supply chain.

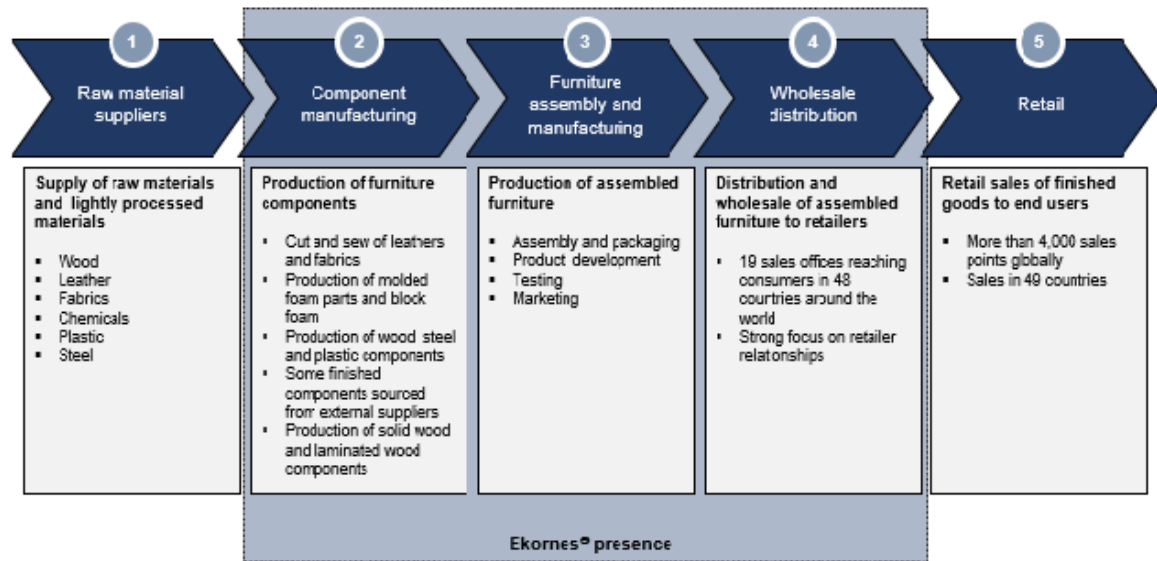


Figure 6: Ekornes Supply Chain Process (Source: Ekornes)

3.2 Ekornes Supply Chain process in Europe

In the Europe, the process of Ekornes supply chain includes supply of raw material, inbound logistics, production, finished goods storage, outbound logistics and finally sales points.

Producing furniture is being done in the Ekornes factory in Sykkylven Norway. The finished goods are being sent to the central hubs in Europe, the Hamburg central hub is the place to receive products which supposed to be sent to the customers in Northern Europe. The main hub in the Europe is Hamburg. furniture from Hamburg is being taken to the 11 countries in Europe as it has been shown in figure 10.

Furniture from Norway to Germany are being sent by containers also by sea transportations. In this thesis, we are going to deep dive in the trucks condition and focus on capacity utilization of trucks and containers.

Ekornes revenue in 1995 was 594.8 million NOK and it has been constantly increasing trend during all the years till 2021 which had the highest level of revenue at 4313Mkr. As it has been explained earlier, because of customers behaviors change during covid, there was a dramatic growth in sales in 2021 and after that in 2022 and 2023, sales are expected to have a decreasing trend. Therefore, in this situation Ekornes start to implement cost reduction strategies to keep the profit margin for stakeholders. Ekornes must find solutions to restructure all operation processes and make sure all of them are working effective and efficient. Ekornes have several hubs in Europe. Furniture are being orders by end customers

who are retailers, then it will be produced in the Ekornes factory in Norway. It will be sent from Norway to the central hubs and distribute to the customers. One of the biggest hubs in Europe located in Hamburg and distribute products to northern Europe countries. Products are being sent by containers to Hamburg. In this situation, we are going to check all outbound shipments from Norway to Germany in 2022 and first analyze the capacity utilization of containers and if there is any improvement area recommend it. (Figure 7)

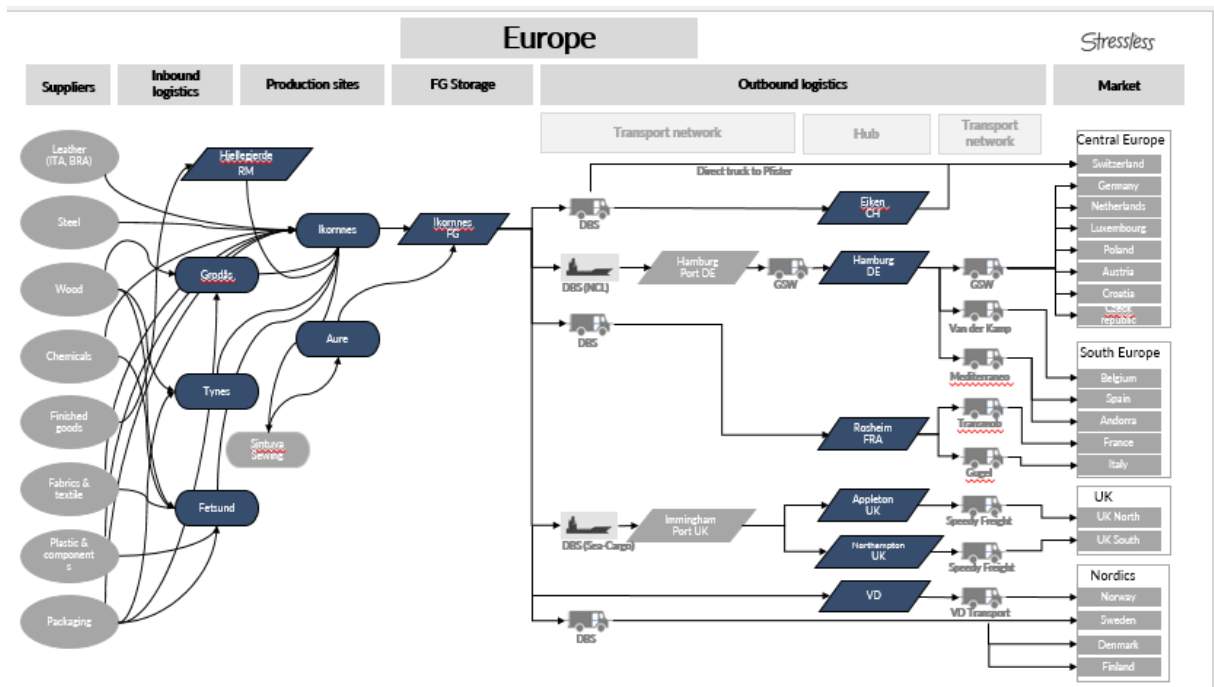


Figure 7: Europe distribution overview (Source: Ekornes)

3.3 Ekornes Value Chain

According to (Bjørn Jæger et al, 2019) the journey of Ekornes from customer point of view starts when he or she is being interested of the furniture and pay for that. The players in the chain of Ekornes are the producers of skin, transporters, producers, shipping companies, logistic service providers, retailers, initial customers, and final customers which has been shown in figure 8. The standard production process is made-to-order with standard delivery which is 72 hours. There is an option for customers to customize their product and have a fast delivery for some smaller product in 72 hours. (Figure 6). It must be added that, end customers of Ekornes are retailers who place orders to Ekornes and receive it from Ekornes.

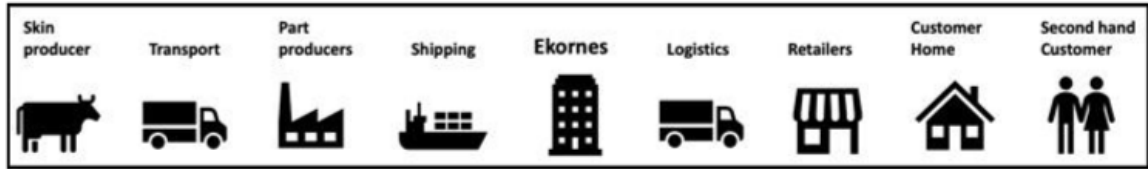


Figure 8: Ekornes Value Chain source (Bjørn Jæger et al, 2019)

3.4 Ekornes Inter Organization

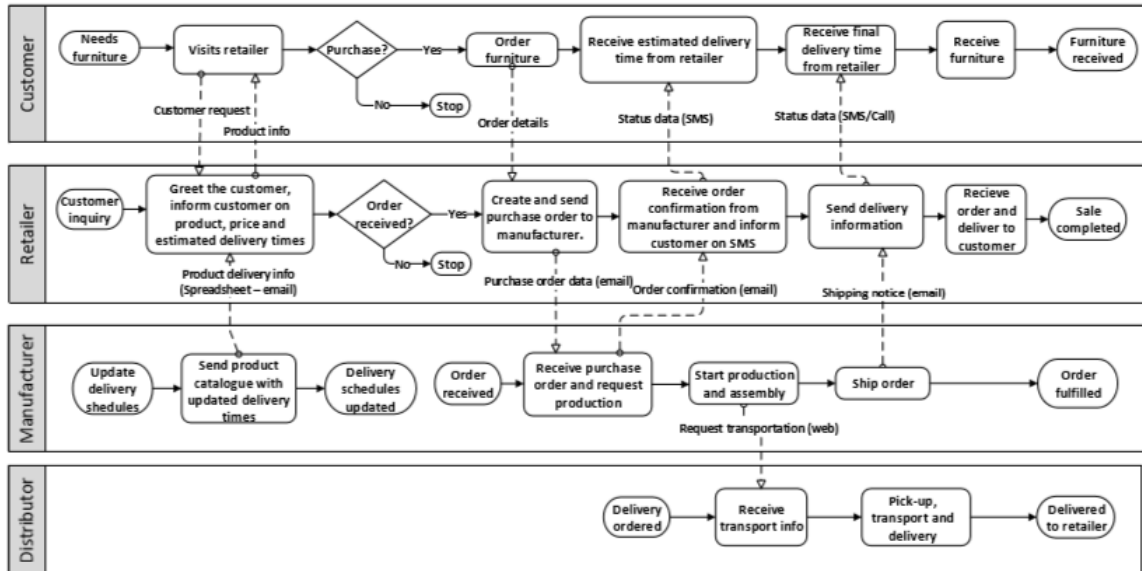


Figure 9: Ekornes ongoing process source (Bjørn Jæger et al, 2019)

As you can see in the figure 9 which describes ongoing process, the information about product availability is being updated weekly basis. After order placement by customer, manufacture will receive and confirm the order order maximum by one day delay. The process of production, assemble and transportation will be started. It is possible that retailer contact customer and agree about the delivery. The customer is connected just to retailer and delivery process takes between 4 to 6 weeks based on the product type and customer location and address.

According to (Bjørn Jæger et al, 2019) the proposed process can be started with have access to devices that can give some information about optional material as well as accurate delivery date exactly when the customer wants to finalize his or her decision. In this method, customer can have additional options with more colours or skin or base. With help of blockchain technology, after completion of product, a request will be sent to the distributor, after receiving, retailer can ship the product to the final customer.

The main difference between existing process and TO-BE process is access of more accurate data for customer in time of shopping, also delivery information will be clear first of the shopping process rather than weekly email update. This change can be useful for Ekornes company to have a better transportation planning which leads to more optimized trucks capacity management and having optimized cost.

4.0 Data and Methodology

4.1 Research Definition

As (Mimansha Patel and Nitin Patel, 2019) have drafted scientific Research can be defined as the systematic research on the specific subject with the relevant information. In addition, it is a method to solve the research problem with applying different steps through systematic approach.

Prabhat Pandey and Meenu Mishra Pandey (2015) have written that Research is a crucial and strong tool in movement toward success. It can be said that without scientific research, many achievements could not happen. Research responsibility is current mistake correction and bring new learning to our knowledge. In addition, research can be considered as the process of scientific analysis which systematic and formal. We can classify different type of research as following:

1. Information basis.
2. Content or subject basis.
3. Approach basis.
4. Method basis.

According to (Mimansha Patel and Nitin Patel, 2019) diverse types of research can be categorized based on 4 different parameters which are goal, settings, ways, and place.

Basic Research that can be describe with formulation of new theory, but it cannot generate solution for the existing problem. It could be helpful and effective for the future problems.

Applied Research which is related to find solution for the existing problem of business or organization. In this research, primary data being collected, analyzed then it will be connected to the hypothesis. Qualitative Research is associated with human behavior, opinion, feeling etc. Quantity research deals with assessment of phenomenon in terms of

quantity. It is related to the subjects like economic statistics etc. Finally, descriptive research which explain what has been happened and what is happening. The most important feature is that researcher does not have any control over the variables.

Mimansha Patel and Nitin Patel (2019) has described that there are two types of research problems. First one is belonging to the nature and second is the relationship between variables.

Based on what have been described above, since this research is being done within furniture producer company with a specific customers and market and considering limitations like production capacity, customers demand, logistics capacity and the most important company strategy and goals, can be put in the descriptive category. On the other hand, since quantitative methods are used in this research, this thesis can be put in this category and finally this thesis can be classified as the applied research, since it is dealing with specific problem of the company and try to give some recommendation for the process improvement.

4.2 Research Methodology

Mimansha Patel and Nitin Patel (2019) wrote that Methodology is the methods that clarify how the research is done scientifically and systematically. It investigates about the methods with consideration of limitations, resources, and consequences. In other words, as authors mentioned research methodology describes how one research can be done in a scientific manner and how one research problem can be solved through specified steps. The main goal of research methods is introducing of analyze methods with consideration of limitation and resources. Various steps can be applied by a researcher to study the research problem. Research must know the research methods as well as research methodology. Researcher not only need to be aware that how to use different techniques like mean or median calculation, but also it is critical to know which methods must be used. Therefore, the most crucial parameter for a researcher is that how he/she can design methodology to solve the problem.

Research method can be quantitative and qualitative or both together. In this research company has been involved in specifying the research problem through diverse ways. This was the qualitative approach, at the same time two data sets has been received and analysed with requirement information of orders and shipments in 2022. These parts are also associated with quantitate research method.

4.3 Research Design

Prabhat Pandey and Meenu Mishra Pandey (2015) mentioned that the goal of research design is to prepare set of related evidence with spending enough time, cost, and effort to achieve research goals. Research design is a plan or guideline for collecting and analysing the data. A good research design increase reliability and decrease bias of the data which is collected. The most effective design prepare opportunity for studying different side of the problem.

This research has been started with an analysis of available data, then based on data availability the research problem identified and relevant theoretical concepts, models have been applied to the existing data. After that, some analysis is being done on the data to provide the better overview of current situation in terms of transportation capacity utilization.

The purpose of this research is to check the situation of current situation of transportation capacity utilization in the outbound shipments of Ekornes company in Europe from Norway factory which is in Sykkylven to main hub which is in Hamburg to see the current result and provide some recommendation for improvement with consideration of any limitation for the company.

4.4 Data Gathering

Mimansha Patel and Nitin Patel (2019) wrote that way of data collection can be defined as the data collection design. We have two types of data collection which is primary data and secondary data. Primary data is the general data that has been collected for the purpose of this research. In this research, we used data history of the company in the format of excel for 2022 from Norway Sykkylven to Germany that was around 57000 transactions and required information about total sales situation, operational process and company challenges has been given through face-to-face meeting, finally required data about trucks capacity and some details and explanation about data sheets has been given to us via emails. Therefore, we used secondary data for this thesis.

4.5 Reliability

Prabhat Pandey and Meenu Mishra Pandey (2015) have written that reliability can be defined as the consistency of the assessment. It means that if someone send the information,

he is responsible to complete the previous data for the second and third time. We can say that if responsible change, the consistency will not be met.

To have consistency of data gathering, some parts of data which was belong to the transportation company data base, have been provided by the Ekornes. In addition, any further explanation and correction was asked from Ekornes. As the result consistency of data gathering and reliability has been met.

4.6 Validity

Any assessment and evaluation are valid if measure what is expected to check as (Prabhat Pandey and Meenu Mishra Pandey, 2015) have described.

Different type of contact and communication has been arranged with the direct person who was responsible in this project to specify the problem. As it has been already discussed, there was lots of limitations in terms of data gathering and submission time of the thesis. Some conceptual frameworks have been applied in this thesis which can be applied on other parts specially on the transportation capacity utilization subjects.

5.0 Findings

5.1 General Findings

In data set that has been received for the whole 2022, there was a total 1470 unique tour numbers which means that 1470 shipments have been sent from Norway to Germany separately.

To have a better understanding, some general information which has been extracted from data set is shown in table 3. Averagely, 37 orders were taken per truck or container with 1967kg weight and 32 cubic meters volume and totally for each shipment 1798 Euro has been paid.

The containers capacity based on Ekornes information is 67cubic meters. They are using standard 40 ft containers which can be seen on iContainers (2023)¹. The average utilization capacity based on cubic meters for all shipments in 2022 is 48%. Due to the shape of the

¹ <https://www.icontainers.com/the-different-types-of-containers/>

packages a full utilization of the containers is unrealistic and in a real situation covering more than 75% of the container's capacity is not possible. Hence, we have assumed a 75% utilization as a full container, which corresponds to 50 cubic meters ($50/67 = 75\%$).

As we discussed earlier in literature review, for products like furniture which occupy the space and have low density capacity should be calculated based on volume. In table 3 we can see that the average weight is less than 2000kg for each container. On the other hand, furniture product is expensive and must be carried with important level of protection with prominent level of quality. It means that it is important to deliver it without any damage, so arrangement of product on the transportation vehicle needs safety procedures.

Based on what has been mentioned and Ekornes people recommendation, full capacity was considered 50 cubic meters for each container and for those containers with more than 75% occupied capacity, it has been assumed that 2 vehicles have been used. Therefore, with new calculation, we reach to 35% actual capacity utilization for containers.

Table 3 Summary of Ekornes dataset

Total count of shipments	Average number of orders per shipment	Average weight per shipment-KG	Average volume per shipment-Cubic Metric	Average Cost per shipment	Avg utilization weight	Primary Utilization Volume before splitting	Final Avg utilization volume
1470	37	1967	32	1798	8%	48%	35%

5.2 Frequency Of Shipments and Capacity Utilization

Now we are going to show the frequency of shipments with consideration of count of orders in each shipment. It demonstrates that 561 shipments have been sent from Norway to the Germany distribution center with maximum 20 orders. It means that proportion of shipments with 1 to 20 orders are 38% of total shipments. It has been shown in the figure 10.

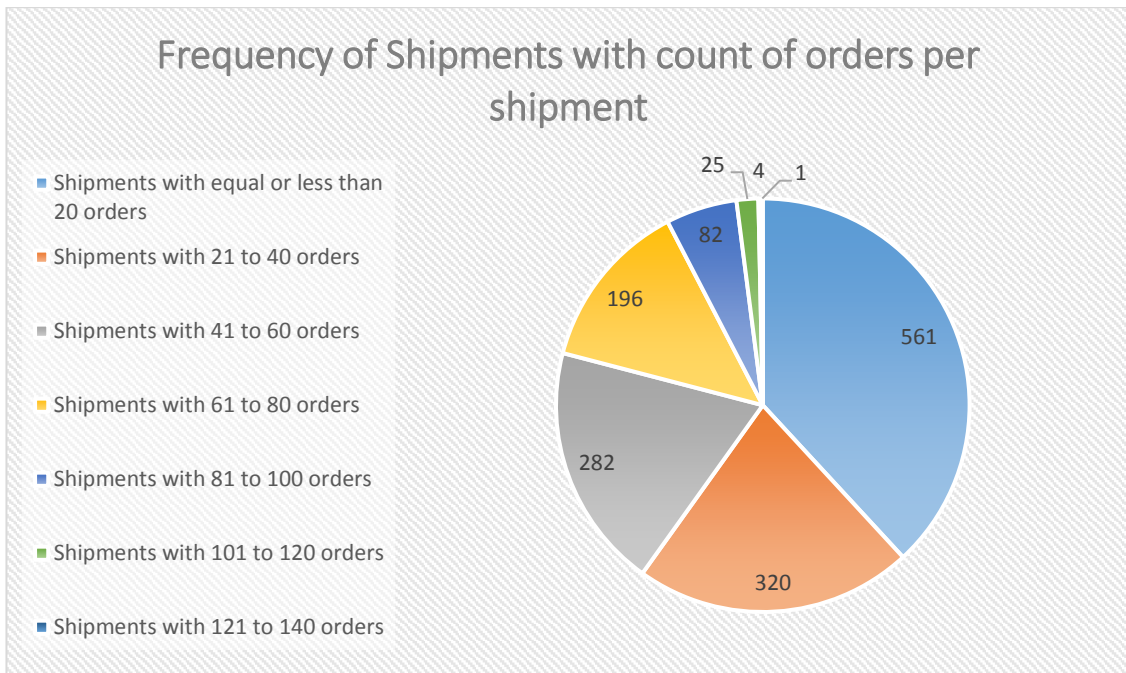


Figure 10: Frequency of shipments with count of orders

As it has been mentioned, furniture product is a low-density product which means that utilization of capacity based on weight is not showing the correct picture of situation of capacity utilization to us.

The capacity of each container is 26000Kg and average weight of each shipment is less than 2000kg. It can be concluded that weight is not a correct measure for capacity utilization. You can see the capacity utilization based on weight in figure 11.

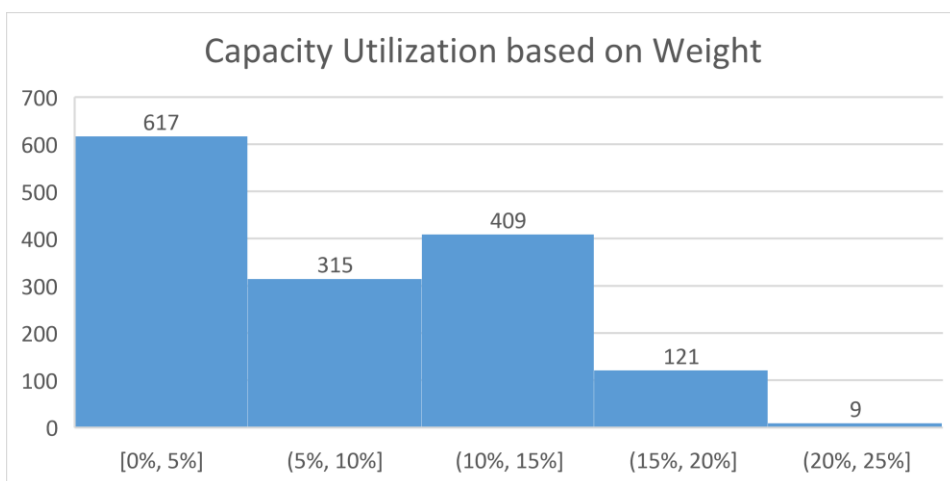


Figure 11: Capacity Utilization based on weight.

The result shows that as it has been discussed in the literature review part, we could not rely on the utilization rate based on weight and the best measure for furniture product is volumetric.

About frequency of shipments based on volume, figure 12 is showing the situation.

Since the capacity of each truck is 67 cubic metrics and what have been checked with Ekornes, for those shipments which have more than 50qubic metric volume we recalculate the capacity. It means 413 shipments actual volume spilt to 2 equal parts, so you see the final chart with consideration of correction. As you can see on the chart 3, 254 shipments were in the area between 26 to 30 cubic meters. On the other hand, 169 shipments have been sent to Germany with least volume which means in the area less than 4 cubic meter.

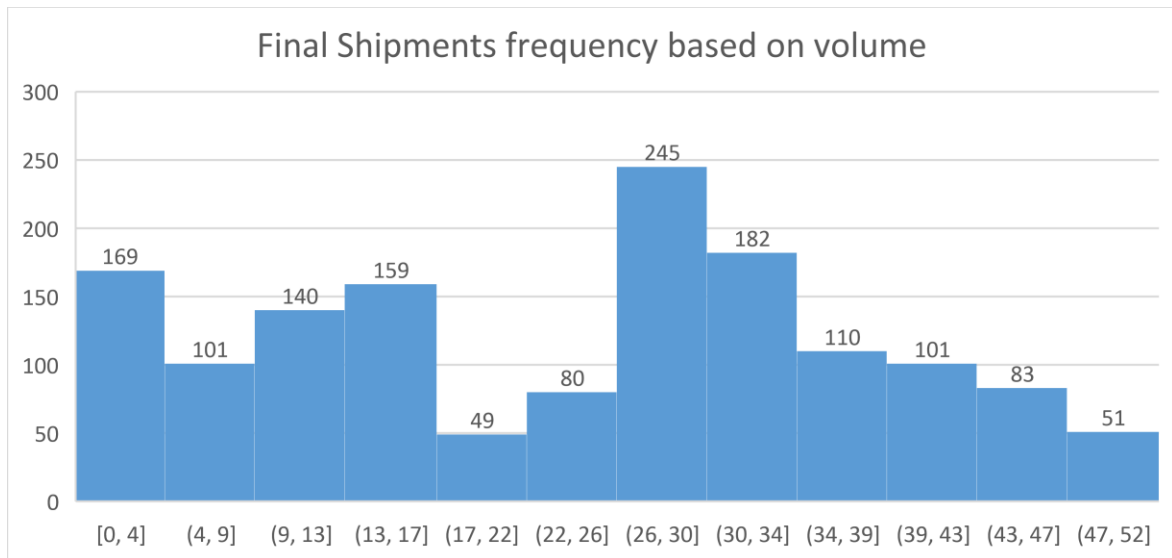


Figure 12: Volumetric shipment capacity Frequency

The final capacity utilization based on volume with correction of volumes above than 50 cubic meters is shown on figure 13. We can see that 170 shipments were sent with minimum transportation available capacity which supposed to be used. It means, cost of transportation is not very well optimized, because the high portion of the shipments are not well optimized regarding capacity. By considering the actual figures, it is necessary for the company to check and revise processes that direct or indirect influence on the transportation cost. Transportation planning, customers order placement, agreement between company and customers about delivery promised date and production planning strategies could be checked and revised. Having lots of shipments with low-capacity optimization is one evidence that company tried to keep customers satisfied with short delivery time. This was an appropriate

strategy when there was an increasing sale therefore, it should be changed and aligned with new company strategies since the situation has been changed.

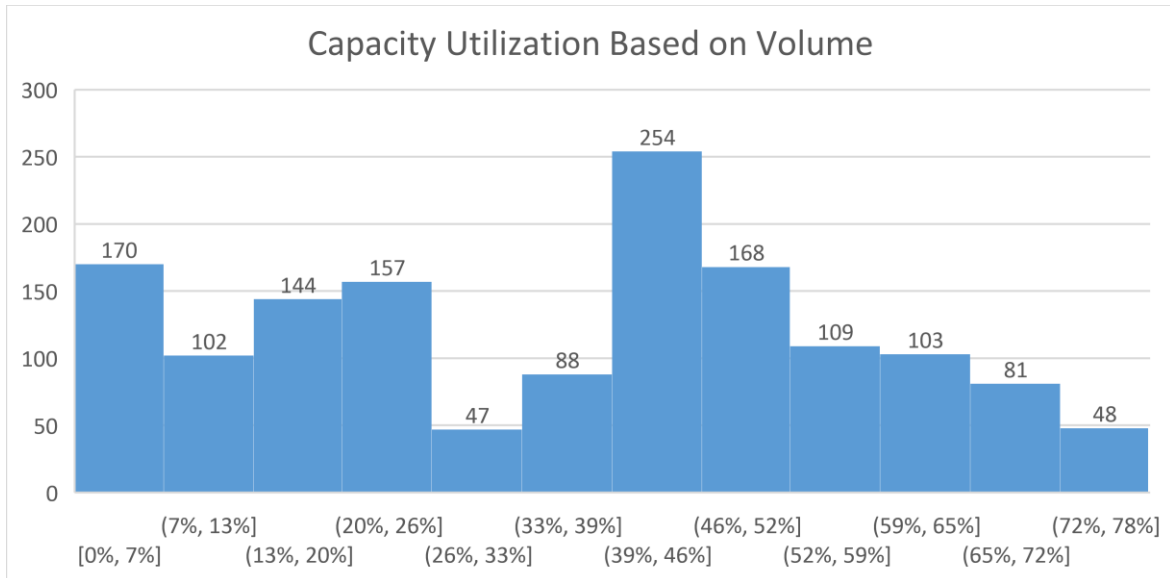


Figure 13: Volumetric Capacity Utilization

5.3 Monthly Analysis

In this section, we check the impacts of seasonality parameters. As we have mentioned earlier, demand fluctuation is one of the factors which affect transportation cost and capacity utilization. As a result, we can check the orders and shipments situation monthly. As it can be checked on the table 4, the orders count is variable in different month. The average volume that had been taken with each shipment is between 26.8 to 36 cubic metrics.

In August, there was a lowest number of orders (1890). In other words, 69 shipments have been sent to Hamburg which means every day just 2.2. while in March 6456 orders has been sent. In February, approximately 6 shipments have been sent to the Hamburg per day.

In terms of the cost per cubic metric volume, it differs between 50 to 62 euros, but the best result can be seen in February with 50.8 euros, in contrast, the worst situation is in Oct with more than 62euro per cubic metric.

Regarding demand fluctuation, having dynamic transportation plan is necessary for the Ekornes to optimize transportation cost. We cannot see the tangible cost difference between March and August as the highest season and lowest season with 6456 and 1890 orders. One of the strategies which could be used is waiting for a certain filling degree of capacity and accordingly, the variable delivery time for customers. Sending fixed number of shipments over the year could increase cost of transportation remarkably.

Table 4: Seasonality Ekornes situation

Months	Shipments	Orders	Volume	Cost	Volume per Shipment	Shipment per day	Days per Month	Cost per cubic mt
Jan	150	5874	4916	252716	32.8	4.8	31	51.4
Feb	166	5856	5047	256289	30.4	5.9	28	50.8
Mar	136	6456	4859	257786	35.7	4.4	31	53.1
Apr	127	5496	4659	251955	36.7	4.2	30	54.1
May	109	4309	3890	214079	35.7	3.5	31	55.0
Jun	145	4059	3977	229307	27.4	4.8	30	57.7
Jul	128	4658	4544	248760	35.5	4.1	31	54.7
Aug	69	1890	1847	103116	26.8	2.2	31	55.8
Sep	116	4471	4015	232118	34.6	3.9	30	57.8
Oct	103	3152	3082	191369	29.9	3.3	31	62.1
Nov	111	3992	3261	199918	29.4	3.7	30	61.3
Dec	110	4078	3518	206119	32.0	3.5	31	58.6

5.4 Improvements Areas

In this section we are going to compare the cost per cubic meter for the shipments, so we need to classify shipments based on volume and compare the total cost between various categories. Therefore, we considered six different segments to see how much each segment has actual cost.

As we can see in the figure 14 the portion of shipments based on volume is shown.

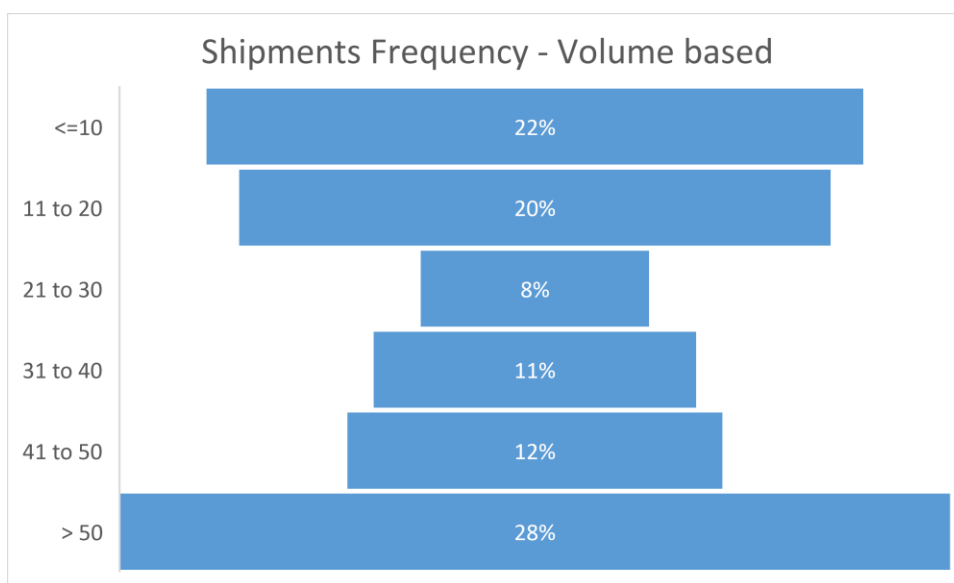


Figure 14: Shipments Frequency volume based.

22% of shipments has been sent with volume ≤ 10 cubic metrics. The cost which has been paid for these shipments is 75.2 euro per cubic metric which means approximately 18 euro above than average. Ekornes should apply strategies to avoid too much low volume shipments to reduce transportation cost.

Table 5: Classification of Orders based on Volume.

Shipments with different volume	Shipments	Orders	Total Cost	Total Volume	Cost per Cubic Metric
≤ 10	322	2108	103564	1378	75.2
11 to 20	290	5164	239878	4193	57.2
21 to 30	112	3256	160284	2913	55.0
31 to 40	158	6442	292050	5641	51.8
41 to 50	184	9685	429726	8408	51.1
> 50	407	27673	1419830	25119	56.5

It is clear low volume shipments are the expensive shipments and if we can find solutions to reduce the number of shipments with low utilization capacity, the shipment cost will be less. In this part, based on actual data, we are going to specify some practical suggestions to improve capacity utilization with considerations of orders shipping date. To clarify the customer's orders situation, we can look on some special shipping data of Ekornes to see what has been happened. Totally there was 745 different destinations who received their orders from Hamburg hub centre. We can see that many small orders with low-rate volume have been dispatched with different shipment numbers in short periodic time.

Table 6: One of Germany's destinations

Country	Destination	Volume	Tour-Date
Germany	FULDABRÜCK	0.96	03.01.2022
Germany	FULDABRÜCK	0.39	07.01.2022
Germany	FULDABRÜCK	2.61	13.01.2022
Germany	FULDABRÜCK	1.20	24.01.2022
Germany	FULDABRÜCK	0.36	26.01.2022
Germany	FULDABRÜCK	10.28	10.02.2022
Germany	FULDABRÜCK	14.90	28.02.2022
Germany	FULDABRÜCK	7.05	07.03.2022

Germany	FULDABRÜCK	5.69	14.03.2022
Germany	FULDABRÜCK	0.79	17.03.2022
Germany	FULDABRÜCK	19.23	04.04.2022
Germany	FULDABRÜCK	1.59	08.04.2022
Germany	FULDABRÜCK	4.50	20.04.2022
Germany	FULDABRÜCK	7.35	02.05.2022
Germany	FULDABRÜCK	8.72	16.05.2022
Germany	FULDABRÜCK	4.33	23.05.2022
Germany	FULDABRÜCK	20.32	20.06.2022
Germany	FULDABRÜCK	3.79	06.07.2022
Germany	FULDABRÜCK	2.77	11.07.2022
Germany	FULDABRÜCK	6.11	22.07.2022
Germany	FULDABRÜCK	9.03	27.07.2022
Germany	FULDABRÜCK	0.40	29.08.2022
Germany	FULDABRÜCK	2.62	05.09.2022
Germany	FULDABRÜCK	4.21	12.09.2022
Germany	FULDABRÜCK	7.69	04.10.2022
Germany	FULDABRÜCK	0.17	07.10.2022
Germany	FULDABRÜCK	3.88	17.10.2022
Germany	FULDABRÜCK	5.87	27.10.2022
Germany	FULDABRÜCK	3.17	07.11.2022
Germany	FULDABRÜCK	5.27	14.11.2022
Germany	FULDABRÜCK	6.60	28.11.2022
Germany	FULDABRÜCK	3.79	05.12.2022
Germany	FULDABRÜCK	1.10	24.10.2022

For the retailer "FULDABRÜCK", several orders have been shipped with low volume and in a brief period. For example, in the period of 2 days, two small orders have been shipped for this customer. Different practical strategies can be applied in these cases. First, there is possibility to set limitation for the minimum capacity of transportation vehicles. Second, could be orders consolidation to not send small orders separately. Third, it is possibility to deal with retailers about delivery promised dates, as we know always there is a trade of between service level and cost that could be balanced to avoid too much cost with maximum service level. Making balance could help to satisfy customers with acceptable rate with optimum cost.

Table 7: One of Netherland's destinations

Country	Destination	Volume	Tour-Date
Netherland	ZUTPHEN	3.58	05/01/2022
Netherland	ZUTPHEN	2.00	14/01/2022
Netherland	ZUTPHEN	1.92	31/01/2022
Netherland	ZUTPHEN	1.34	07/02/2022
Netherland	ZUTPHEN	1.46	17/02/2022
Netherland	ZUTPHEN	4.47	16/02/2022
Netherland	ZUTPHEN	1.61	24/02/2022
Netherland	ZUTPHEN	0.80	03/03/2022
Netherland	ZUTPHEN	1.58	09/03/2022
Netherland	ZUTPHEN	8.08	22/03/2022
Netherland	ZUTPHEN	0.38	01/04/2022
Netherland	ZUTPHEN	6.51	06/04/2022
Netherland	ZUTPHEN	7.22	08/04/2022
Netherland	ZUTPHEN	3.50	25/04/2022
Netherland	ZUTPHEN	9.84	26/04/2022
Netherland	ZUTPHEN	0.10	09/05/2022
Netherland	ZUTPHEN	2.08	11/05/2022
Netherland	ZUTPHEN	0.87	19/05/2022
Netherland	ZUTPHEN	3.06	02/06/2022
Netherland	ZUTPHEN	0.61	09/06/2022
Netherland	ZUTPHEN	10.48	01/07/2022
Netherland	ZUTPHEN	1.34	17/06/2022
Netherland	ZUTPHEN	0.67	21/06/2022
Netherland	ZUTPHEN	9.29	27/06/2022
Netherland	ZUTPHEN	7.16	28/06/2022
Netherland	ZUTPHEN	3.53	04/07/2022
Netherland	ZUTPHEN	4.78	18/07/2022
Netherland	ZUTPHEN	0.11	26/07/2022
Netherland	ZUTPHEN	3.65	28/07/2022
Netherland	ZUTPHEN	0.56	23/08/2022
Netherland	ZUTPHEN	1.29	29/08/2022
Netherland	ZUTPHEN	0.67	31/08/2022
Netherland	ZUTPHEN	3.41	09/09/2022
Netherland	ZUTPHEN	0.67	15/09/2022
Netherland	ZUTPHEN	3.21	22/09/2022
Netherland	ZUTPHEN	0.16	03/10/2022
Netherland	ZUTPHEN	4.39	07/10/2022

Netherland	ZUTPHEN	7.98	11/10/2022
Netherland	ZUTPHEN	5.33	14/10/2022
Netherland	ZUTPHEN	1.12	28/10/2022
Netherland	ZUTPHEN	6.91	04/11/2022
Netherland	ZUTPHEN	12.25	16/11/2022
Netherland	ZUTPHEN	8.95	28/11/2022
Netherland	ZUTPHEN	6.75	02/12/2022
Netherland	ZUTPHEN	1.95	05/12/2022
Netherland	ZUTPHEN	5.38	09/12/2022
Netherland	ZUTPHEN	3.64	15/12/2022
Netherland	ZUTPHEN	3.66	22/12/2022
Netherland	ZUTPHEN	10.47	29/12/2022

Another example is ZUTPHEN which is in Netherland with several small orders which has been distributed in an abbreviated period.

In these cases, company can set strategies to make a balance between cost and service. For example, they can set minimum utilization rate for the trucks and containers to fill at least 50% of the truck capacity or another strategy could be set minimum days to send order for one customer. They can consolidate orders for example every 7 days. For sure, this kind of strategies can have effect on the customer satisfaction since the delivery time will be increased but since company in the middle of cost reduction policies during sales reduction the balance between cost and service level could be revised.

Table 8: One of Belgium's destinations

Country	Destination	Volume	Tour-Date
Belgium	SINT GILLIS WAAS	3.88	06/01/2022
Belgium	SINT GILLIS WAAS	1.20	14/01/2022
Belgium	SINT GILLIS WAAS	3.16	25/01/2022
Belgium	SINT GILLIS WAAS	1.22	02/02/2022
Belgium	SINT GILLIS WAAS	4.13	04/02/2022
Belgium	SINT GILLIS WAAS	3.06	11/02/2022
Belgium	SINT GILLIS WAAS	0.04	17/02/2022
Belgium	SINT GILLIS WAAS	0.86	23/02/2022
Belgium	SINT GILLIS WAAS	1.65	03/03/2022
Belgium	SINT GILLIS WAAS	3.32	11/03/2022
Belgium	SINT GILLIS WAAS	3.54	15/03/2022
Belgium	SINT GILLIS WAAS	4.46	17/03/2022
Belgium	SINT GILLIS WAAS	2.67	23/03/2022
Belgium	SINT GILLIS WAAS	0.72	25/03/2022

Belgium	SINT GILLIS WAAS	1.83	06/04/2022
Belgium	SINT GILLIS WAAS	0.67	12/04/2022
Belgium	SINT GILLIS WAAS	1.89	18/04/2022
Belgium	SINT GILLIS WAAS	2.40	26/04/2022
Belgium	SINT GILLIS WAAS	2.15	29/04/2022
Belgium	SINT GILLIS WAAS	0.97	09/05/2022
Belgium	SINT GILLIS WAAS	2.40	11/05/2022
Belgium	SINT GILLIS WAAS	4.01	19/05/2022
Belgium	SINT GILLIS WAAS	3.35	31/05/2022
Belgium	SINT GILLIS WAAS	7.55	02/06/2022
Belgium	SINT GILLIS WAAS	5.16	14/06/2022
Belgium	SINT GILLIS WAAS	1.32	21/06/2022
Belgium	SINT GILLIS WAAS	1.74	23/06/2022
Belgium	SINT GILLIS WAAS	1.86	04/07/2022
Belgium	SINT GILLIS WAAS	9.65	15/07/2022
Belgium	SINT GILLIS WAAS	0.90	18/07/2022
Belgium	SINT GILLIS WAAS	1.22	23/08/2022
Belgium	SINT GILLIS WAAS	2.86	09/09/2022
Belgium	SINT GILLIS WAAS	2.76	15/09/2022
Belgium	SINT GILLIS WAAS	0.56	03/10/2022
Belgium	SINT GILLIS WAAS	1.52	07/10/2022
Belgium	SINT GILLIS WAAS	1.70	18/10/2022
Belgium	SINT GILLIS WAAS	1.88	11/11/2022
Belgium	SINT GILLIS WAAS	0.71	18/11/2022
Belgium	SINT GILLIS WAAS	0.03	02/12/2022
Belgium	SINT GILLIS WAAS	3.52	15/12/2022
Belgium	SINT GILLIS WAAS	3.80	22/12/2022
Belgium	SINT GILLIS WAAS	1.77	30/12/2022

For the destination "SINT GILLIS WASS" as well can be seen that, there was not any fixed duration between shipments. On the 09.12.2022 small order has been sent to this retailer while 3 days later there was a respectively big order. Consolidation orders and setting minimum capacity limitation could be led to have less transportation trip with more capacity utilization and eventually will lead to decreasing cost.

If we consider minimum days as the limitation for all shipments, we need to consolidate orders and keep more days before dispatch. It can improve transportation capacity utilization with dispatching larger orders rather than small orders. With this changes, number of shipments will be reduced, and capacity will be utilized better, on the other hand it could lead to increasing lead time for customers that could be one of the options for the Ekornes to balance between customer's satisfaction and cost reduction.

In the table 9 we can see what would happen, if 5 to 7 days limitation considered for those destinations in Germany, Belgium, and Netherland.

Table 9: Number of Shipments after Orders Consolidation

Country	Destination	Number of actual Shipments	Number of shipments with 5 to 7 days lag
Germany	FULDABRÜCK	33	25
Belgium	SINT GILLIS WAAS	42	36
Netherland	ZUTPHEN	49	38

In addition to having fixed lag time between shipments, waiting until reaching certain volume for shipments could be another available solution for the company to get saving quickly. In 2022, 444 shipments have been sent with 14 cubic meter volume or less than it. By remove these shipments, cost per reach to 55.5 euro per cubic meter.

6.0 Conclusion

6.1 Conclusion

Ekornes is the biggest producer of furniture in Norway with 3 main category brands and several factories in Norway and out of Norway. It has a big market all over the world. There was a sales growth over the company life cycle but there was a dramatic increasing sales growth during Covid pandemic due to change in customers behaviors, and it led to additional cost for the company. After pandemic and deceasing in sales, it is necessary for Ekornes to set strategies to optimize cost and keep profit margin properly to satisfy stockholders. Now is the time for the Ekornes to check and restructure processes and make sure all of them are effectively managed.

Ekornes value chain is very extensive with different processes. It is from customers who place the orders, suppliers who provide different components of furniture, manufacturing, transportation and ...in this thesis we focused on the transportation and one of the main indexes for transportation which is transportation capacity utilization. Transportation capacity utilization is particularly important since it can have impact on cost optimization and environment.

As we talked, Ekornes has been expanded in lots of countries, but Europe is a critical area for Ekornes because of income portion which can be earned thorough it. Therefore, transportation capacity utilization of containers in Europe with source of Norway and destination of Hamburg in Germany has been analyzed. Ekornes has also other distribution centers in Europe but the most important is Hamburg because it will deliver goods to northern countries.

In this regard the historic excel file for 2022 has been checked and analyzed. It included all containers information which has been shipped from Norway to Germany with required information like shipment numbers and all orders inside it plus volumes, cost and weight and date of shipment.

Actual situation of vehicle utilization calculated for different shipments and frequency of shipments with consideration of volume and other parameters like weight has been considered and finally some improvements strategies has been recommended to Ekornes. Ekornes has several limitations and must consider lots of variables to change operational process. On the other hand, cost and service level are always against each other. Maximum service level for customers lead to too much cost, in contrast, minimum service level led to least cost. In the rapidly changing world and complicated completion between companies, making balance between service level and cost is one of the most important aspect of companies' mission.

In this part, we briefly explain the strategies that can help Ekornes to improve transportation capacity utilization.

1. Orders consolidation

Order consolidation could be effective to reduce shipment numbers and increase utilization. 444 shipments have been dispatched with less than 14 cubic meters volume and 22 % of orders were less than 10 cubic meters volume. It leads to more cost and less utilization. As it is shown for some of customers, small orders are sent to different destination without any lag days. One good applicable strategy could be defining frequency dispatch per week for each destination. 5 to 7 days lag between 2 shipments could lead to a smaller number of shipments with more utilized capacity.

2. Set limitation for the minimum capacity utilization.

Another applicable recommendation could be avoided to send shipments with less than 50% capacity utilization. It could lead to increase lead time of customers but in terms of the cost reduction will be effective.

3. Changing in the process of orders placement with help of blockchain technology.

Customization is an inevitable part of furniture shopping and in time of shopping some of request by customers could not be checked immediately, because the components must be provided by suppliers. As the result, when customer order for customization, it needs to more time to be checked after that production and delivery process will speed up to satisfy customer. Any change in the process of order placement is we discussed in the chapter 3, could lead to customized order sooner. Therefore, other part of the process includes production and delivery can be implemented properly.

4. Using new applications which help Ekornes to optimize capacity utilization. As it has shown in the last part of chapter 2, some application introduced for the shipment optimization. One of that is "WeDo ". it is for Co-Loading and lead to using specific shipment with shared capacity.

6.2 Recommendation

For the further research related to the furniture product, one of the promising ideas could be packing product. Furniture is low density product and since it is expensive must be taken carefully. Arrangement of the product on the shipment is overly critical. How could increase shipment capacity utilization with consideration of safety. More than what is suggested in the conclusion part, packing could be one of the principal factors.

7.0 Reference

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