CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Faculty of Economics and Management

Diploma Thesis Title:

ANALYSIS OF REVERSE LOGISTICS IN A SUSTAINABLE BEER COMPANY. CASE STUDY BUDWEISER BUDVAR 2006-2016, CZECH REPUBLIC

This Diploma Thesis has been written and defended at the **Université Catholique de Lyon** in **France** under the Double Degree Agreement between the Czech University of Life Sciences Prague, and the **Universite Catholique de Lyon**. In accordance with the Double Degree Agreement, this Diploma Thesis is fully recognized as part of the MSc programme study at the Czech University of Life Sciences Prague.

Author: Orbelyants Grygor

Diploma Thesis Supervisor: Ing. Jiří Mach, Ph.D.

ANALYSIS OF REVERSE LOGISTICS IN A SUSTAINABLE BEER COMPANY. CASE STUDY BUDWEISER BUDVAR 2006-2016, CZECH REPUBLIC.

ORBELYANTS GRYGOR

STUDENT NUMBER: 2016 000889

SUBJECT: SOURCING

TUTOR: MR. PATRICK SCHOLLER

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF INTERNATIONAL BUSINESS ADMINISTRATION

SEPTEMBER 2017

UNIVERSITE CATHOLIQUE DE LYON

esdes Lyon

THE BUSINESS SCHOOL OF UCLY

Declaration

I declare that I have worked on my diploma thesis titled " Analysis of Reverse Logistics in a sustainable Beer Company. Case Study Budweiser Budvar 2006-2016, Czech Republic " by myself and I have used only the sources mentioned at the end of the thesis. As the author of the diploma thesis, I declare that the thesis does not break copyrights of any their person.

Prague on 31.10.2017 ____________________________

Grygor Orbelyants

Acknowledgement

Firstly, I would like to thank God for the strength to have gotten to this stage, my family for giving me an opportunity to study abroad and my friends who supported me while writing this work. I am immensely grateful to my supervisor Dr. Patrick Scholler Ph.D. whose support and mentoring was a crucial element of this thesis as well as Ing. Jiři Mach Ph.D. More so, I want to thank all the lecturers I encountered during the period of study for giving me the vital skills and knowledge for my future career.

Analyse de la logistique inversée dans une entreprise de bière durable. Étude de cas Budweiser Budvar 2006-2016, Prague, République Tchèque

Abstrait

L'un des produits les plus importants dont la République tchèque est célèbre est sa bière. Depuis 30 ans, les producteurs de bière ont prospéré et ont étendu leur présence sur les marchés étrangers. Cette industrie contribue non seulement à l'économie, mais aussi à l'environnement, à la société et à la culture à l'intérieur et à l'extérieur de la République tchèque. La durabilité est devenue un objectif souhaité pour tous les acteurs du marché. Budweiser Budvar est l'un des rares producteurs de bière qui n'a pas été privatisé et qu'il est resté dans la propriété publique géré par le gouvernement, mais c'est le plus important parmi eux. Cette société est très préoccupée par son aspect public et accorde une attention exceptionnelle à des problèmes tels que l'utilisation des ressources en eau, la pollution ou l'élimination des déchets. L'une des clés de la durabilité pourrait être l'amélioration des processus de logistique inversée, qui «n'a jamais cessé» tout au long de la longue histoire de la brasserie, mais a prospéré au cours des 2 dernières décennies. "Malgré la petite pause en 2008-2010, c'est un processus constant d'amélioration et d'optimisation des processus", a déclaré Budweiser Budvar en mai 2016.

En recueillant des données statistiques concernant Budweiser Budvar, Carlsberg Group et AB InBev dans la période 2006-2016, cet article examine l'effet de différents facteurs sur l'EBT de Budweiser Budvar. L'objectif principal est de définir quels facteurs affectent réellement l'EBT de Budweiser Budvar et s'il existe une relation entre l'effet d'amélioration RL et EBT. Les données ont été analysées par GRETL 2017b-git, ce qui nous permet d'estimer le modèle économétrique et de définir l'importance des facteurs, ce qui peut influencer EBT et nous aider à mesurer cet effet. Indépendamment du résultat du modèle simple, le modèle simultané a montré que l'effet de la logistique inversée n'est pas significatif pour l'EBT final. Cependant, il a montré une signification de l'effet logistique inverse du niveau de production de Budweiser Budvar. Cela s'explique également par les améliorations technologiques massives et les mises à niveau de l'ensemble du système d'installations menées en même temps et presque sur le même taux, ce qui n'a pas pu affecter EBT en raison des dépenses importantes sur ces investissements.

Keywords: la logistique inverse, le processus de retour, la production de bière, la durabilité, les coûts, le profit, la perte, la rentabilité, le modèle économétrique, le bénéfice avant impôts.

Analysis of Reverse Logistics in a sustainable Beer Company. Case Study Budweiser Budvar 2006-2016, Prague, Czech Republic

Abstract

One of the most significant products Czech Republic is famous for is its beer. For last 30 years, beer producers flourished and extended their presence in foreign markets. This industry is now contributing not only to economy but also to environment, society and culture inside and outside of Czech Republic. Sustainability became a desired goal for every actor in the market. Budweiser Budvar is one of the few beer producers that was not been privatized and has stayed in the public ownership run by government, yet, it is the biggest among them. This company is highly concerned with its public look and pays exceptional attention to such issues as water resources usage, pollution or waste disposal. One of the keys to the sustainability could be Reverse Logistics process improvement, which “never stopped” throughout the long history of the brewery but flourished in last 2 decades. “Despite of the small pause during 2008-2010 it is a constant process of processes improvement and optimization,” said Budweiser Budvar employee in May 2016.

By collecting statistical data regarding Budweiser Budvar, Carlsberg Group and AB InBev performance in the period of 2006-2016, current research examines the effect of different factors on the EBT (see list of abbreviations) of Budweiser Budvar. The main goal is to define which factors actually affect the EBT of Budweiser Budvar and whether there is a relation between RL improvement effect and EBT. The data was analyzed by GRETL 2017b-git, which provides us with opportunity to estimate econometric model and define significance of factors, which can influence EBT as well as help us to measure that effect. Regardless of the result of simple model, the simultaneous model has shown that the effect of Reverse logistics is not significant for the final EBT. However, it has shown significance of Reverse logistics effect of the level of production for Budweiser Budvar. This can be also explained by the massive technological improvements and upgrades of the whole facilities system conducted at the same time and almost on the same rate, which could not affect EBT due to large expenses on such investments.

Keywords: reverse logistics, return process, beer production, sustainability, costs, profit, loss, profitability, econometric model, earnings before tax.

Table of contents

List of pictures

List of tables

List of appendixes

List of abbreviations

RL Reverse Logistics

EBT Earnings Before Tax

CSR Corporate Social Responsibility

SCM Supply Chain Management

CLSC Closed Loop Supply Chain

PRM Product Recovery Management

RLA Reverse Logistics Association

OEM Original Equipment Manufacturers

RFID Radio frequency Identification

CRC Centralized Return Center

EDL Electronic Data Log

ELP End-life-products

USD United States Dollar

CZK Czech Koruna

DDK Danish Krone

G/L General Ledger

WH Warehouse

BB Budejovicky Budvar / Budweiser Budvar

1 Introduction

Advancement in technologies of transport, information and communication instigates dynamism in businesses; the impact can be either in the production or in operational process of a business model. Managing reverse logistics is becoming an important element of supply chain management and, in some cases, a profit generating function (Rogers and Tibben-Lembke, 2017). In 1980s, almost all supply chains were concentrated on logistics optimization of products from raw material to the end customer. This is still a major issue for most of industries. For instance, the automobile industry is busy changing the physical and virtual supply chain to facilitate end-of-life recovery. There is an essential movement for waste management obligation from both private waste management industry and local governments in direction to manufacturers, distributors and finally retailers. To late years, the obligation for manufacturers has been broadened in order to blanket the whole life cycle of particular products. This also incorporates obligation to the products safe transfer and disposal. Likewise, the implementation of ecological legislation gets more stringent as well as an expanding number of customers who are requesting take-back of their old products, companies are starting to concentrate on conceivable distribution channels for the return possibilities of their old products, which can be Reverse logistics. (Ferguson and Browne, 2001) This may be not practically about actors in the chain being constrained to take their products back, yet also to discover value in already utilized products, which can assist in creation of a more sustainable business model. Moreover, rapid development of e-tailers like Amazon and Alibaba can be observed, which put a lot of effort to get as high return rate as possible at no cost to the customer. It is of no surprise that the Reverse Logistics Executive Council has affirmed those US companies that have been losing billions of USD by the reason of being not prepared enough to manage reverse flows (Rogers and Tibben-Lembke, 2017).

With legislative constraints, financial, social and environmental opportunities provided by reverse logistics supply chain actors can not only rely on forward logistics. Budejovicky Budvar is one of the companies that has had introduced reverse logistics concept to their business model more than twenty years ago. Hence for this thesis, the functionality of reverse logistics in terms of operation, the management system utilized by organization during the process of decision making in the model, valuation of reverse logistics for the society, relation between reverse logistics and sustainability will be shown.

2 Objectives and Methodology

2.1 Objectives

The aim of the thesis is a formulation of practical recommendations for improving of the company reverse logistics and methods of its visualization and define what financial and social opportunities can be gained or lost by the company while managing its returns process. Hence, characterizing the current state of reverse logistics process in Budweiser Budvar as well as factors that affect the process. Therein generating these questions:

- What financial, environmental and social opportunities are gained or lost by the company while managing its returns process?
- Does reverse logistics process effect company's performance? How?

At the end of the research, there would be clarity on the impact of following points:

- Waste management, recycling, reuse, reprocessing, and materials recovery design on the example of keg return process. Regressions to determine if these six reverse logistics practices considered as reverse logistics effect contribute to 3 performance implications (Operational, Financial and Environmental (+social)). Probable result: operational and financial gains but no social benefit.
- Highlight trends in reverse logistics practices. Provide evidence on the business value of reverse logistics adoption
- Show reverse logistics as a path to efficiency and/or competitiveness.

This research is based on providing the access the explanation of theoretical ideas and show the process from a different point of view with econometric analysis and visualization effort as a consistent base. It is important to mention that this dissertation take into considerations prior researches on reverse logistics in business, supply chain management, product life cycle and product recovery management.

2.2 Methodology

In the thesis, will be used different research methods with an aim to reach balance between quantitative and qualitative methods. It this thesis mainly secondary data will be used. Other methods are theoretical generalization, deduction and induction, analysis and synthesis, modeling and formalization, logic simulation, benchmarking etc.

One part of this thesis deals with a theoretical overview of the whole process of development and evolution of ideas of reverse logistics.

Another part of the analysis of social impact of reverse logistics will be based on logic simulation inducting a visual interpretation of keg return process. This include collation and interpretation of information; causal and system analysis; comparative and qualitative methods of analysis summarized by SWOT analysis

Except that, mainly secondary data will be used in the research process. Deduction will be used to specify data essential for the research. This will help to synthesize a sufficient data set for creation of an econometric model, which will be analyzed, and results would be interpreted in order to conduct a proper theoretical generalization.

Software used: Microsoft Excel, Gretl.

2.3 Importance of the Study

With the growth of use of reverse logistics by businesses due to legislative, social and financial reasons, it is important to understand how to maximize companies benefit from the utilization of reverse logistics to achieve best financial result, growth in business and reach sustainability. It has been reported that a slight change from standard type bottles in marketing purposes have significantly decreased the number of bottles and kegs that were reutilized. With a successful implementation of strategies from recommendations that would be delivered at the end of the research, an increase in awareness can be expected, which can result reconsideration of current reverse logistics policies by the management of Budweiser Budvar within and outside of Czech Republic.

3 Literature Review

A literature review was done by examining articles, books, research papers that the author of this thesis considered as relevant. All resources mentioned below were published by accredited scholars and researchers. Chosen literature disposes the research topic within the context of the previous academic findings and sets the background for further studies.

3.1 Concepts of the Reverse Logistics and its Dimensions

In this part main concepts and dimensions of Reverse Logistics would be described. As well as terminology and definitions used by various authors in their previous works and researches regarding this topic.

Beckley & Logan (1948), Terry (1967) and Giultinian & Nwokoye (1975) officially focused on returns however without alluding to them as RL flows. Murphy (1986) apparently one of the vital creators of utilizing the fundamental idea and the concept of RL He utilized Reverse Distribution as a comparable term; after him, the twofold phrasing was likewise used by other authors (Pohlen & Farris 1992; Barry, Girard & Perras 1993; Bloemhof-Ruwaard, van Beek, Hordijk & Van Wassenhove 1995; Carter & Ellram 1998; Jayaraman, Patterson & Rolland 2003). Murphy characterized Reverse Distribution (1986: 12) specifically as “the movement of goods from a consumer towards a producer in a channel of distribution”. Consequently, this writer touched upon the backwards direction of flows which he eventually considered as RL flows. The first maker (producer) isn't the actual "producer" in this definition. To the extent, by which distribution channel is concerned, nothing was determined in the definition. Questions could emerge between the two primary potential outcomes to be recognized: the mentioned distribution channel being the already used one (in the forward channel) or an entirely different one. (Fernandez, 2017)

Around the same time at 1995, Thierry, Salomon, Nunnen & Wassenhove instituted the expression "Product Recovery Management" (PRM) to depict “all those activities that encompass the management of all used and discarded products, components, and materials that fall under the responsibility of a manufacturing company. The objective of product recovery management is to recover as much of the economic (and ecological) value as reasonably possible, thereby reducing the ultimate quantities of waste" (Thierry et al. 1995: 114).

There is developing social burden for companies to decrease their rates of utilization of nonrenewable natural resources and in parallel, to likewise decrease the output of post-production and post-consumption waste to landfills, water bodies and air, along these lines damaging the environment common to everyone. To react to the burden, it is important that companies' operations preferably organize regarding the "3R" objectives: Reduce, Reuse and Recycle. In this unique circumstance, the alleged turn "reverse logistics flows" have raised their significance in the research of supply chains. Typical examples are the parts and materials that are gathered after they are consumed or utilized. Rather than being sent to the landfill organizations utilize reverse logistics to transport them back in supply chains to be reused or, recycled and reincorporated as optional secondary component, part or material for new manufacturing. (Corrêa and Xavier, 2013)

What does it mean "REVERSE DIRECTION"?

According to the past section, it is very evident that there was no common opinion in regards to the direction that products take in RL, once they leave the forward supply chain, which may occur at any point/time inside it. It should be mentioned that a few authors (Carter & Ellram 1998; Dowlatshahi 2000; Ritchie et al. 2000; Guide, Jayaraman & Linton 2003) call a flow "reversed" at whatever the direction of stream is inverse to the forward one that was utilized before it. The meaning of this is that the product returns via the same channel, sent by a downstream supply chain contractor/partner. (Fernandez, 2017)

Different researchers, though, conceded the deviation of these returned products towards various channels are subject to being considered as RL too (Thierry et al. 1995; Fleischmann 2000; Reverse Logistics Executive Council). Recycling activities give multiple cases that are inside this second more extensive sense "reversed", given that, from one perspective, recyclers interested in components and materials might be not the same as the first makers (producers) or initial manufacturers about all in secondary or optional recycling. Then again, initial manufacturers may not own the equipment required for recycling and leave it to more specialized companies, which are capable of recycling. (Fernandez, 2017)

Can Reverse Flows be Equivalent to Returns Flows?

RL may allude to reverse flows. These are flows of products, which move entirely in reverse directions through the channel. Nonetheless, another more adequate point of view was found in the literature (Fleischman, Krikke, Dekker & Flapper 2000; Stavros, Costas & Theodore 2003), which alludes to the return management in reverse direction as well as, in forward direction once returned products have been changed (repaired, transformed, remanufactured, etc.) and again return to the markets. Here, in this second sense, all operations where products are included right at the point when they have returned, are likewise considered inside the RL scope. (Fernandez, 2017)

The two points of view concur in considering Reverse Logistics flows as those that are sent in reverse direction along the supply chain (for example, from end consumers to original producers). Yet, there was an undeniable contradiction in regard of acknowledgement as RL activities those, which have been performed to send already transformed returned products to the markets. (Fernandez, 2017)

Could “RECOVERY” and “REVERSE” be False Synonyms?

Additionally intense discussion was caused by the expressions "recovery" and "reverse", which are not exact etymological counterpart terms. As per the word reference in the dictionary, the term recovery takes its roots in the Latin expression "recuperare" which means, "to take". At the same time, the term reverse is the past participle of the Latin expression "reversus" meaning, "to turn back". As the meanings mentioned above have shown, it can be easily concluded that the meaning of the term recovery is obviously more abundant than the one derived from the term reverse. To summarize, it can be admitted by expressing that not all that is "taken" needs to or should be "turn back". (Fernandez, 2017)

Is there any Difference Between RL and Green?

The expanding number of laws being passed especially in the last 15 years concerning environment and ecology has been momentous. Not only the vast number, yet in addition the fact that laws are becoming stricter and demanding, may well have had an impressive impact for the expressions "green logistics" and "RL" being compared and sometimes even equalized. In such circumstances, Handfield and Nichols (1999) underlined the fundamental role that the "green" issues will play in future. Then again, the study completed by Murphy, Poist and Braunschweig (1995) demonstrated how 60% of the interviewed managers viewed ecological issues as critical in their companies' business. These cases helped to show the expanding influence and pressure of green given nowadays. (Fernandez, 2017)

Van Hoek (1999) contributed with his article to evade stirring up green logistics and RL. The expression "green logistics" was instituted to allude to those practices inside the supply chain that target decreasing sources of waste and resources of consumption. They are not obligatory of RL process. For example, dismantling and disassembly are operations firmly identified with RL; it is essential before taking a decision, quite often, what to do thereafter with the product (repair, reuse, remanufacture or recycle it). On the other hand, it will be simply connected to Green Logistics in the plan & design procedure if the dismantling and disassembly operations are profoundly thought for not experiencing ruinous operations, which implied no less than a loss of added value but possibly even materials and components. Moreover, some forward logistics processes first producer to first customer could be "green" too. (Fernandez, 2017)

Recycling

The utilization of the expression "recycling" might be a source of false impressions, as appeared for example, in the paper by Lave and Hendrickson (1994) where the absence of mutual understanding in U.S.A. with regards to choosing what constitutes the alleged Recycling of Municipal Solid Waste (MSW). Likewise, which part of the post-consumption waste ought to be included in it, has been described by that time. (Fernandez, 2017)

The most generally acknowledged meaning is that recycling suggests the fact of recovering materials (Pohlen and Farris II 1992; Guide et al. 2003), which participate in the construction of the recyclable product. Recycling subsequently includes the higher level of dismantling and disassembly of the product. In any case, it is not surprising to run over a more wide and common usage of the term that infers any movement in the reverse process or any reusing opportunity. (Fernandez, 2017)

Recall

Identical situation happened with the term Recall. It is utilized to allude the reverse process of consumer goods, which could possibly harm the customer. Effective recall practice is, in this sense, concentrated on limiting public risk, getting back whatever number defective products as could be expected under the circumstances and limiting expense and inconvenience for the company and the customer. (Smith, Thomas and Quelch 1997; Rogers and Tibben-Lembke 1999; Ritchie et al. 2000; Muffatto and Payaro 2003). In any case, the term could be likewise discovered suggesting a broader point of view (Jayaraman et al. 2003); for this situation, recall a product is equally identical to repossess the product by the producer company. (Fernandez, 2017)

Other Meanings

According to Wikipedia.org, other terms synonymous to Reverse Logistics (RL) are Retrogistics (retro logistics), Aftermarket Logistics or Aftermarket Supply Chain. The return process management of reverse supply chain is likewise a term utilized to define the activity. RL should not to be mistaken for forward logistics or getting the product to the market generally known as the forward supply chain. Sorts of movement normal with reverse logistics includes: repair, restoration, reusing, logistics, warehousing, repair, refurbishment, e-waste, recycling, call center support, reverse fulfillment, field service and numerous others. (Rengel, 2002)

Gailen Vick, President RLA describes it in following way: "In other words, anytime money is taken from a company's Warranty Reserve or Service Logistics budget, that is a Reverse Logistics operation" - (Reverselogisticstrends.com, 2017)

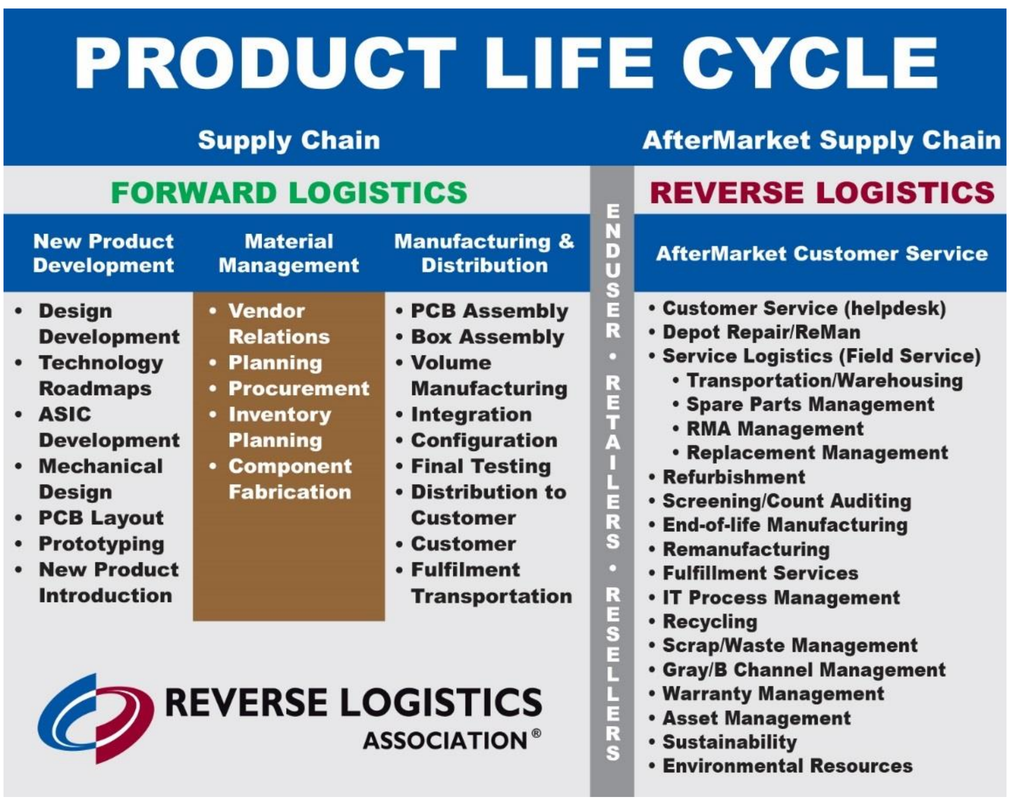
As it can be concluded on all the terminology issues and various interpretations there is no common opinion on what should be included in Reverse Logistics and what should be separated from it. In this dissertation, the most generalized description provided by RLA will be considered as main one.

3.2 Reverse Logistics in Business

Many people are now familiar with various vital parts of Supply Chain Management in regards to new product development, material management, production and distribution. These are yet considered as most basic and fundamental parts of Supply Chain Management process even considering the development of legislative conditions and technological development. This does not imply that these parts are currently useless but rather the scope of companies is now dedicated more for reverse logistics as it used to be.

In the Figure 1 Reverse Logistics Association (RLA) shows their point of view on view on the Product life cycle in the Supply Chain. Though they divide the Supply Chain into two parts: Forward Logistics and Reverse Logistics. One of their points is that these are two different parts of supply chain, while some authors mentioned above state the point that it eventually should become an essential part of one Closed Loop Supply Chain. (Reverselogisticstrends.com, 2017)

Figure 1. Product Life Cycle by Reverse Logistics Association



Source: (Reverselogisticstrends.com, 2017)

Doherty at Foodlogistics.com points out - “A recent study from the Supply Chain Consortium found that companies do not measure their returns process with the same scrutiny they use for the outbound distortion.” (Doherty, 2017)

To catch the advantage from reverse logistics while maintaining a strategic distance from disadvantages of not doing so numerous companies are, if not changing their business models yet, rather at any rate rebuilding their effectively existing Supply Chain as for reverse logistics. There are a few reasons why they are tending to roll out such an improvement:

3.2.1 Cost

As Kosmala mentioned on Quintiq: “Reverse container logistics plans and operates the physical flow of empty beverage containers after consumption to recapture the value of the container (the re-fillable ones distributed to mass-consumption venues where the beverages are resold on tap) … Reverse container logistics requires beverage producers to plan, implement and control an efficient and cost-effective flow of containers from the point of consumption back to the point of origin.” (Kosmala, 2017)

Keg barrels (kegs or KEGs) are the property of the brewer, and they are loaned through the rest of the supply chain on a deposit principle, directly down to the client level. Thusly, beer producers and distributors must likewise oversee noteworthy inventories of barrels to benefit their business customers and institutional clients. In addition, bars and restaurants must keep vast numbers of barrels available to serve it to their customers. In case, those barrels are lost – or progressively stolen – the brewer charges its distributor for the loss, implying that the dollar misfortunes are felt all through the beer production and distribution business' supply chain. As per industry sources, right around 400,000 barrels are "lost" every year in the United States, out of an aggregate barrel number of almost 11 million. This converts into an expected misfortune in abundance of $52 million to the beer industry in the U.S. alone. (Wyld, 2017)

3.2.2 Level Playing Ground

Reverse Logistics is not restricted to just wealthy multinational or large corporations; it is opened for all levels of enterprises hence giving the small and medium enterprise the chance to compete with the top players in business and attracting their share of the targeted sales. Instead of spending additional money on advertising companies may use Reverse Logistics, which can help to create positive image of a company.

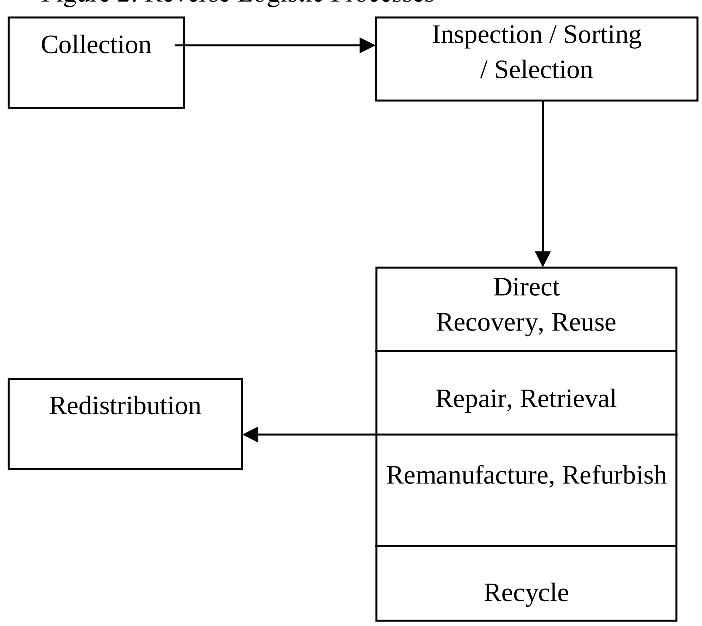
3.2.3 Real-Time Result

The effect of reverse logistics on company's cash flow may be both positive and negative. Moreover, even a slight improve will have the effect very quickly. The goal is to maximise it in the best interest of both company and its customers.

Terreri and foodlogistics.com blog mentions O'Brien's statement, "We have consulted with our clients on packaging changes and different ways to load trailers, and our people conduct root-cause analyses with shippers to identify some of the trends driving damage. But it is not just about damages anymore. We are looking more closely at code date issues, discontinued products, and operational practices at both the shipper and receiver levels to create order exceptions and influence returns policy," says O'Brien. (Terreri, 2017)

Inmar's researches utilize data management systems that give customers centered perceivability. "Clients can view their information online through our Web-based application portal," says Tom Marcellino, executive vice president of business development for Inmar Inc. in Winston-Salem, NC, "Our centralized returns facilities enhance visibility so clients can reduce damaged and unsaleable merchandise." (Terreri, 2017)

Figure 2: Reverse Logistic Processes"



Source: (Reverselogisticstrends.com, 2017)

In Figure 2 is shown the basic overview of reverse logistics processes. Yet it should be acknowledged that this part of supply chain is much more complex.

Vick at RLA repeats a well-known fact that today's food industry works within very low margins. "So, if companies can resurrect even just 1 percent to the bottom line, the CEO would be considered a hero. Unfortunately for some companies, return logistics is not a big enough problem for the CEO because he is worried about saving a nickel on forward logistics simply because, in many cases, reverse logistics does not bubble up. The reason is because CEOs do not have anyone high enough in their management teams who are managing reverse logistics." (Terreri, 2017)

These opinions can prove our statement that Reverse Logistics affect decision making in companies and affect their policies. Additionally, as it was stated before, any decrease or increase in costs would be immediately shown in the financial statements and benefits or losses would be recognized resulting reconsideration of the company's policy.

3.2.4 Generation of Better Return on Investment

Effective reverse logistics process deliver profits for business in terms of revenue generation. Together with a good branding and revenues, there is a higher expectancy of Return on Investment (ROI)

Reverse logistics is gaining interest as a function, says Tom Marcellino, "We are even beginning to see individuals with titles like senior director or vice president of reverse logistics as companies assign resources to this area. They recognize that when you apply discipline, management and resources to an issue as significant as 'unsaleables', the benefits are worth the investment." (Terreri, 2017)

Operations, which differ from traditional supply chains, are included in closed loop supply chains (SLSC) for example, repairing, recycling, remanufacturing, and disposal. Among these options, remanufacturing is the most generally utilized type of manufacturing, harmless to environment.

Remanufacturing is potentially another income-generating alternative through recapturing materials from returned items. Thus, remanufacturing is successfully adapted in numerous businesses, for example, automobile production, aerospace and electronics. For example, Kodak appreciates noteworthy cost benefits of up to $9 million every year from remanufacturing of single-use cameras (Chengalur, 2005). Caterpillar is another case, where two diverse diesel motors with 20,000 item parts are dismantled and reconstruct, from base to top, per eight-hour shifts. With 14 diverse remanufacturing plants, Caterpillar's yearly income comes to $1 billion, with 20% yearly growth (Jayaraman and Luo, 2007).

As it shown at the examples provided Reverse Logistics are not a legislative obligation, which only harms the ROI of the companies obliged to implement and maintain it. Building up a CLSC can bring both profit benefits as well as contribute to the sustainability of the company.

3.2.5 Influences Consumer Decisions

As of late, ecological issues and waste management have progressively turned out to be critical over customer concerns. Per 2012 Commodity Flow Survey, waste and scraps are returned on the amount of $83,153 million worth in the United States (United States Department of Transportaiton). Defective or damaged products, leased product returns, and end-of-life returns commonly stand out to be origin for these waste and scraps (Jayaraman and Luo, 2007; Toffel, 2003). The diminished life cycle of the products increased the quantity of returned products in the most recent decades. Additionally, strict legislation regarding take-backs constrain original equipment manufacturers (OEMs) to gather returned products from customers. Extra gathering and transfer operations of returned products have prompted expanded transportation and transfer costs. Therefore, to take out product returns and extra costs, OEMs plan to transform their traditional supply chains to closed loop supply chains. (Thejournalofbusiness.org, 2016)

Later investigations try to outline the significance remanufactured products perception by the customers. Michaud and Llerena (2011) research willingness to pay (WTP) of a consumer for remanufactured products by utilizing test auctions. They reasoned major part of consumers consider remanufactured products to have a lower quality level than that of new products. In any case, OEMs can turn around this observation by offering quality assurance. Quality and price are considered as key elements to influence influencing customer decision, particularly among environmental conscious customers. (Thejournalofbusiness.org, 2016)

Regardless of the widespread opinion that recycled goods are of lower quality than new ones, a huge positive change in the perception of recycled goods and companies can be observed, which tend to reach CLSC and actively utilizing Reverse Logistics practices. It should also be mentioned as another example Japanese car producers, which tend to collect most of the used cars from the local market and remanufacture components for new ones.

3.2.6 Business Survival and Sustainability

Environmental Stewardship and Sustainability has turned into an issue that is creating considerable consideration around the globe. Mr. Paul Laudicina, Chairman of the

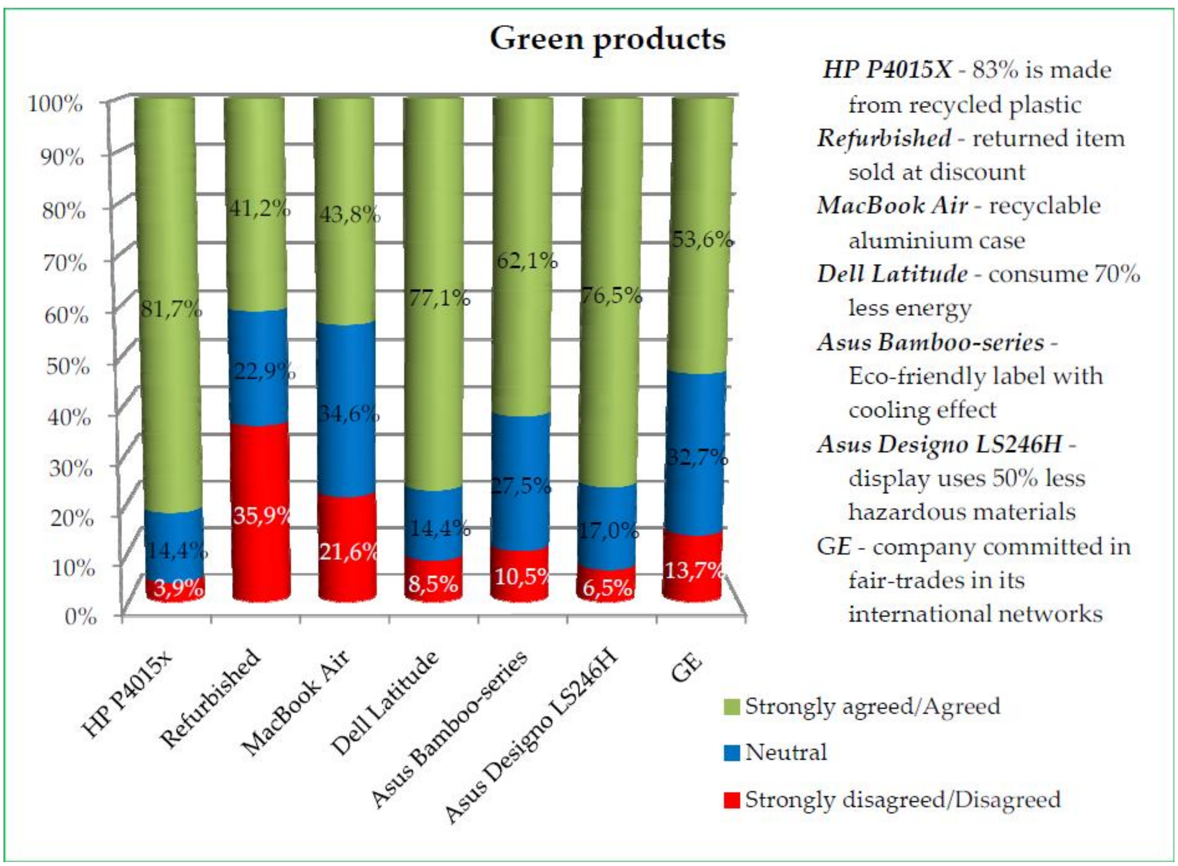
Board of the world-renowned consulting firm A.T. Kearney captured the significance of its impact: "This is an absolute shift in the paradigm for doing business today and in the future. We have not seen a shift in the norms of business as pronounced as this since the dawn of the information age." (Lee, 2017)

The huge impact which CLSC can contribute to the sustainability of every company becomes obvious. The independence from the resource provides and traditional suppliers may help achieve survival for businesses in modern fast changing world within its unstable environment and constant movement.

3.2.7 Brand Reputation

Recovery can also be part of an image build-up operation, which can improve brand reputation. For instance, Canon has linked the copier recycling and cartridge recycling programs to the “kyo-sei” philosophy, in other words - cooperative growth, proclaiming that Canon is for “living and working together for the common good” (www.canon.com).

Figure 3. Green products perception per survey conducted in Netherlands



Source: (Pankaew and Tobé, 2017)

The final consumers may see 'green' in an unexpected way. With regards to the whether to buy or not, it goes above supply chain management. However, it is about a product and consumer behavior regarding it. It included about each stage the product has been and will be. Manget et. al (2009) demonstrated in their report that green purchasing habits shift significantly by product class and category and that green purchasing in food type goods is more typical, and less in green non-food classes (see Figure 3). There emerged the inquiries of whether customers precisely comprehend the definition of 'green' and to which degree a product; in electronics class, specifically, is green to them. (Pankaew and Tobé, 2017)

This helps to define at which areas it is easier to put the accent on the ‘green’ effect of RL and at which areas it has to receive more attention to connect the ‘green’ meaning to RL practices of the company in the customers’ perception of brand and its reputation.

3.3 Why Reverse Logistics are Important

Defining 5 reasons organisations should implement their own Reverse Logistics Strategies:

1. Allows a dealer to get products once more from the customer or send unsold stock back to the producer to be disassembled, sorted, reassembled or recycled; limiting general expenses for the company.
2. Reverse logistics can be beneficial in expanding product lifecycles, supply chain structure complexity, viable practices and customer preferences; which must be enhanced to keep up efficiency and development.
3. Gains can incorporate expanding rate of generation, diminishing costs (transportation, administrative, and aftermarket support, repair and substitution), holding clients by enhancing service objectives and meeting sustainability objectives.
4. More advantage can be gained from utilized/returned products as opposed to overspending workforce, time and expenses of raw materials associated with the original supply chain.
5. Improved consumer loyalty and satisfaction by providing more specific care and dedication to flawed products, and repairs of stock. Reverse logistics can involve

receiving criticism to make enhancements and to develop the comprehension of genuine purposes behind product returns. (Aalhysterforklifts.com.au, 2017)

All these 5 reasons together can prove the importance of the reverse logistics for modern companies. The effect is diverse and versatile. Starting from the facilitation of dealer's selling possibilities for aged products and ending with effect on consumer behavior, enhancing their loyalty and satisfaction.

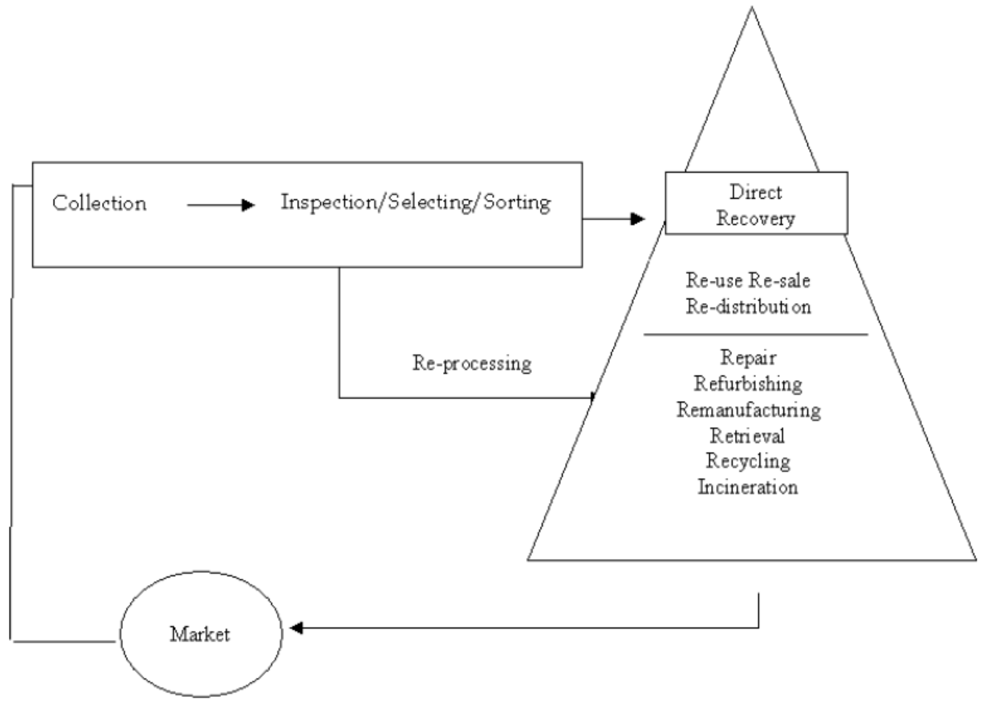
3.4 Supply Chain Models considering Reverse Logistics

The how perspective is intended to explain how Reverse Logistics functions: how is value recovered and advantage regained from products.

Recovery is in fact one of many processes engaged with the entire reverse logistics process. Initially there are collecting activities, next there is the simultaneous assessment / determination / sorting process, thirdly there is recovery (which might be straight-forward or it might include a type of re-processing), lastly there is redistribution. (see Figure 4). Collecting activities alludes to conveying the products from the client to the site of recovery. Here the products are examined, i.e. their quality is inspected and a choice between a sort of recovery is made. Products would then be able to be arranged and directed by the recovery that takes place after. On the off chance that the quality is (near) "as-good-as-new," products can be transferred to the market very quickly through re-utilize, re-distribution and re-sale. If not, another kind of recovery might be included yet now requiring more activity, i.e. a sort of re-processing.

Re-processing can take place at various levels: repair at product level, refurbishing at module level, remanufacturing at components level, specific part level (retrieval), raw material level (recycling), energy level (burning). Alluding to Thierry et al. (1995) for more complete terminology. For different perspectives on recovery and re-processing levels, see Fleischmann et al. (1997), and Goggin & Browne, (2000). The product at module level, e.g. an expansive tangible asset, building or another civil object gets overhauled and generally restored, which can be called refurbishment. If there should arise a component recovery case, products are disassembled and utilized while new parts can be utilized either in the assembling of similar products or of various products, which can be called remanufacturing.

Figure 4: Reverse logistics processes (Thierry et al. 1995)

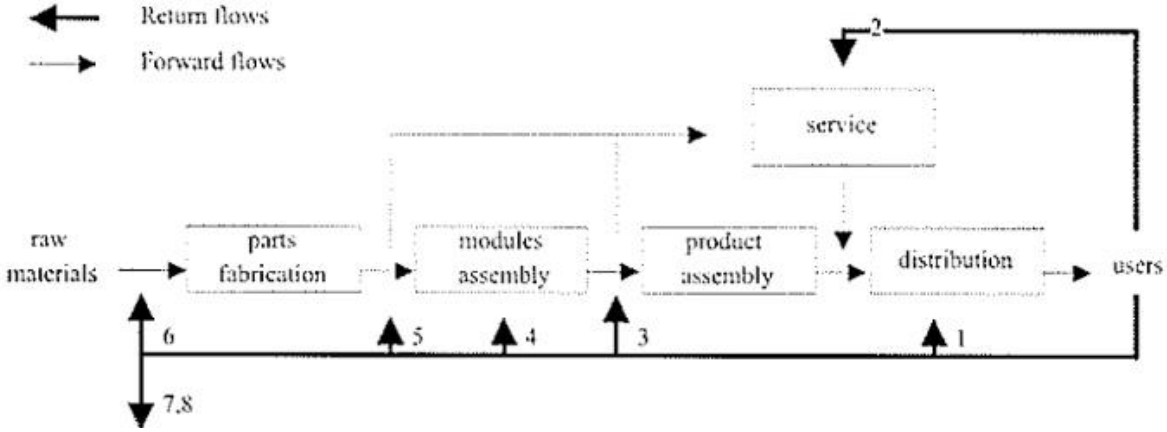


Source: (Thierry et al. 1995)

In raw material recovery, products are crushed and their raw materials are distributed with and organized per quality requirements, so any recycled materials can become input raw material, for example, paper mash and glass. At last, in energy recovery products are incinerated and the discharged energy is gathered. On the off chance that none of these recovery forms happen, products are probably going to be moved to landfill.

The expression "Product Recovery Management" (PRM) was instituted by Thierry, Salomon, Nunnen and Wassenhove to illustrate “all those activities that encompass the management of all used and discarded products, components, and materials that fall under the responsibility of a manufacturing company. The objective of product recovery management is to recover as much of the economic (and ecological) value as reasonably possible, thereby reducing the ultimate quantities of waste” (Thierry et al. 1995: 114).

Figure 5. Integrated supply chain view



Waste Management	Product Recovery Management	Direct Reuse
7. Incineration	5. Cannibalisation	1. Direct reuse/ resale
8. Landfill	6. Recycling	
	2. Repair	
	3. Refurbishing	
	4. Remanufacturing	

Source: (Thierry et al. 1995)

As indicated by authors mentioned above, products and materials could be sent back either to the first producer (subsequently, within supply chain), or to different businesses engaged with different supply chains, gave the action of these businesses comprised of production and manufacturing. They recognized three types of processes: service, waste management processes and product recovery (see Figure 5). Returned components and products could be straightforwardly sold, resold, exchanged, recovered, or discarded (burned or put to landfill). Concentrating just on recovery opportunities, five distinctive further choices could be discovered: repair, remanufacturing, refurbishing, recycling, and cannibalization (see Figure 5).

What are the roles in Reverse Logistics?

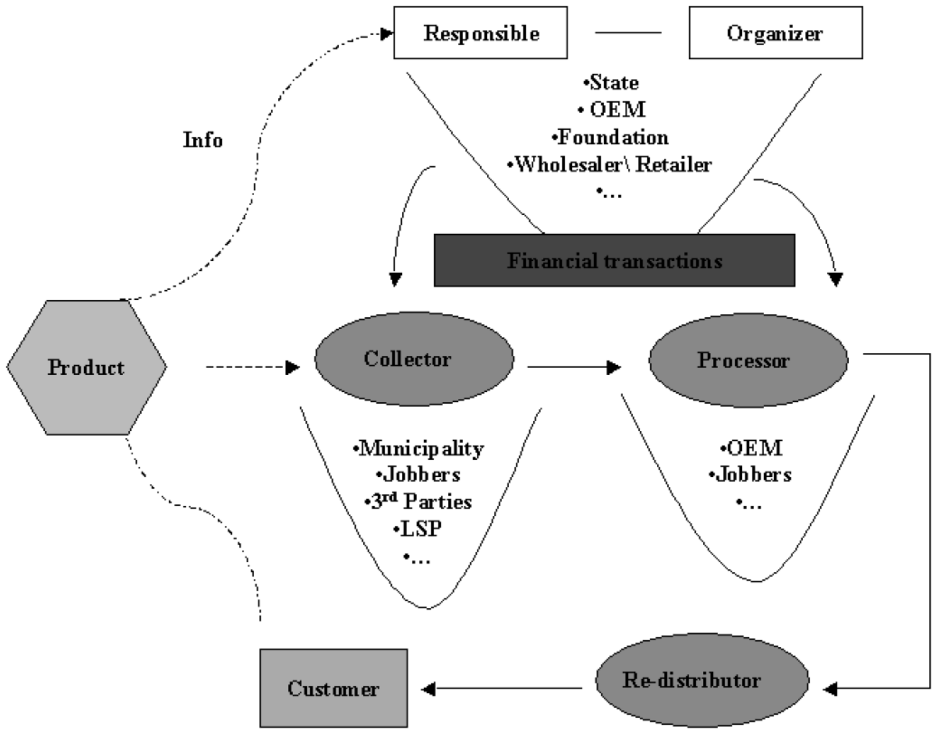
There are a few perspectives on roles distribution in reverse logistics. Following distinction can be made among them (Fuller and Allen, 1996):

• traditional supply chain performers, (from original manufacturer to end customer);
• specific activity performers in reverse chain (recycling specialists);
• temporary players (philanthropists and charity organizations);

One part of the players oversees or arranges the reverse chain while the rest of players directly execute assignments in the chain. The last player role that needs to be added to this is the accommodator, conducted by both the sender/provider and the future customer, without whom recovery would be useless. Any group can be a sender/provider, including clients. The party of performers associated with reverse logistic processes, for example, accumulation and handling, are specific activity performers (recycling specialists), reverse logistic service specialists, municipalities dealing with waste collection, private or public organizations created specifically to deal with recovery. Every party has their own goals, e.g. a producer may conduct recycling keeping in mind the end goal to forestall reselling his products at a different price. The different actors may also compete between each other.

This perspective is clarified in Figure 6. These actors at the top the scheme, are either in charge of or obliged by legislation. They are from the forward chain, just like the OEM. Next, actors conducting the reverse chain are hosted, which can be the same actors, or organizations on the off chance that organizations cooperate or even the state itself. Beneath these actors, two fundamental reverse logistic processes are placed, collecting and processing, which in its turn, may be conducted by various actors.

Figure 6. Roles in Reverse Logistics

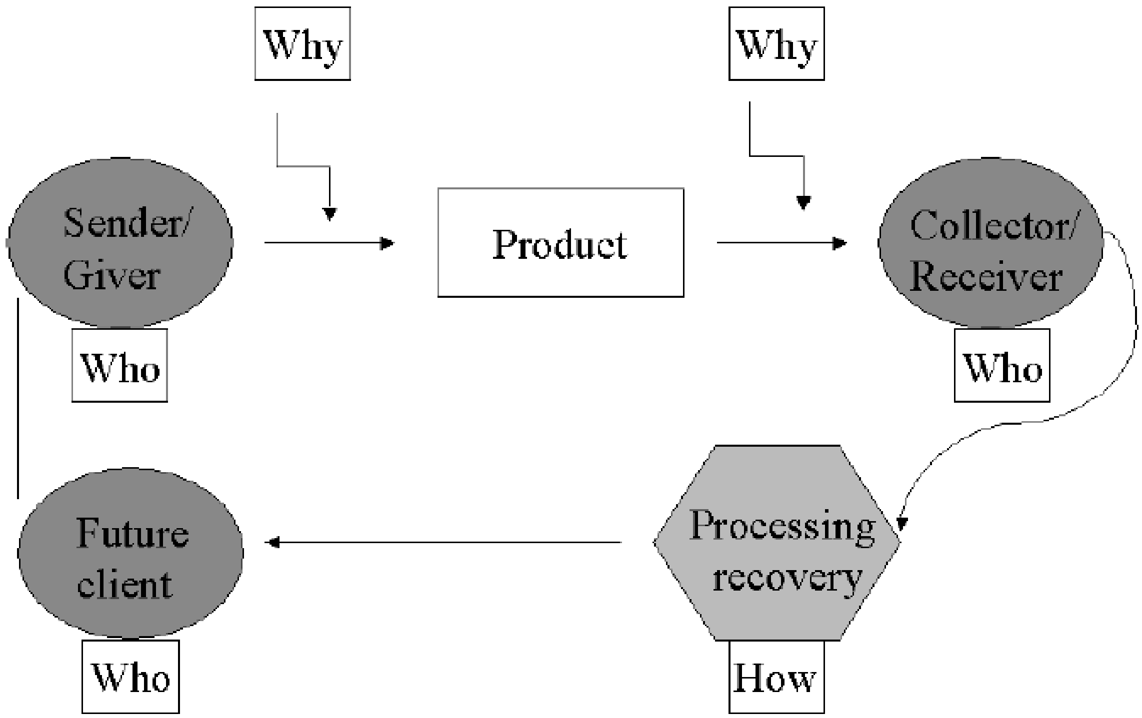


Source: (Fuller and Allen, 1997)

Why, what, who, when, how and reverse logistics issues

On a basic level, each man-made product or framework is returned or disposed at some moment of its life. It is the pattern of product recovery management (PRM) that some sort of recovery and reverse logistics processes ought to have been gotten ready for that point. In numerous manufacturer obligation laws, the first producer is made responsible in this regard. In the past paragraphs, Reverse Logistics was described by showing brief typologies for the return reasons and main forces, for the sort of products, for the recovery activities and for the parties included in the process. These essential qualities are interrelated and their conjunction decides to an expansive degree the sort of issues emerging from the subsequent reverse logistics system (see Figure 7).

Figure 7: Why, what, who, when, how: basic interrelations

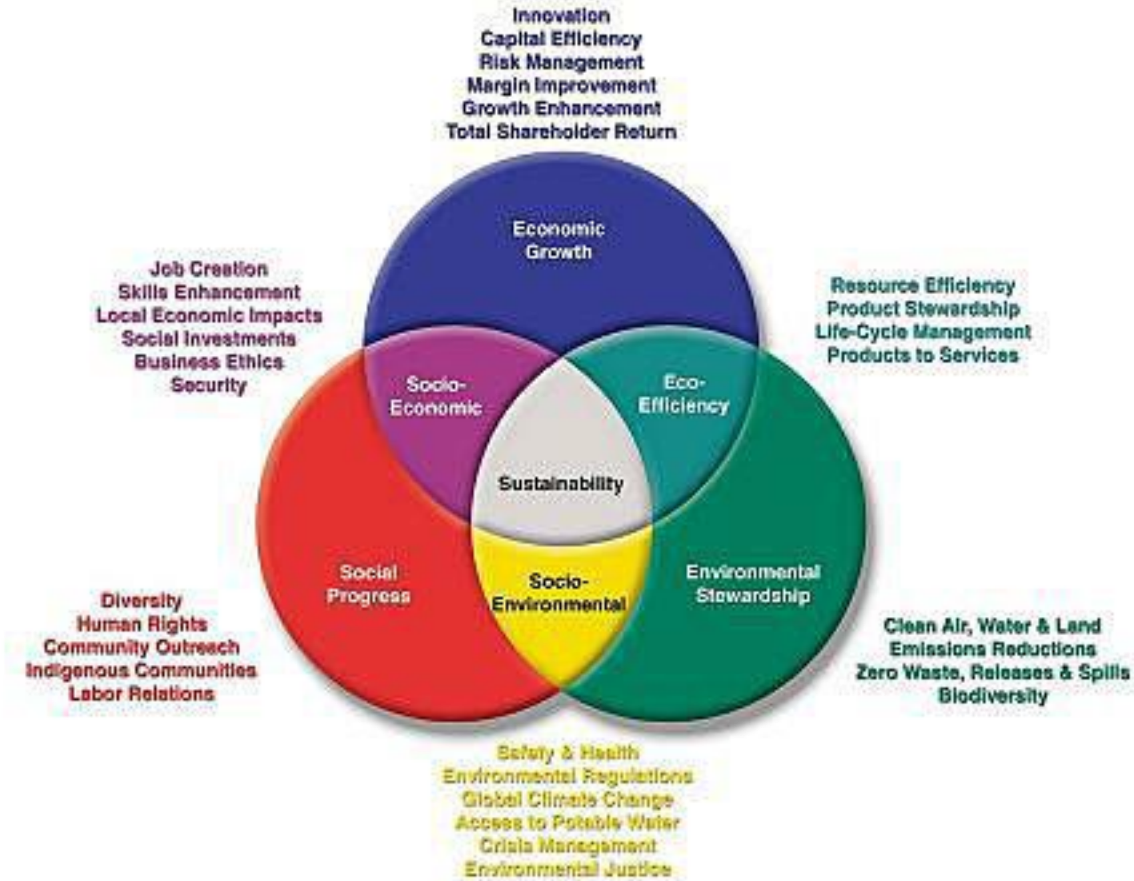


Source: (Thierry et al. 1995)

As it can be concluded from the information provided above, in the RL process there are different actors, who conduct similar and/or different actions and are pursuing their own goals. Some of them are constant actors in this business, others, like charity organizations, are just opportunistic players. Thierry et al. (1995) almost completely answered the question 'how' supply chain model transform, considering reverse logistics, into the closed loop supply chain.

3.5 Triple Bottom Line

Figure 8: Triple-Bottom Line Sustainability Accounting Model (Freer Spreckley, 1981)



Source : (Spreckley, 1981)

Spreckley's Triple Bottom line for the Reverse Logistics

Regarding to the Triple Bottom Line accounting model it can be defined the value of this particular public good (or practice) to the society.

Can **Reverse Logistics** help the **Economic Growth?**

Reverse Logistics is a genuine solution for modern companies that allow them to save money on their supply chain management process.

Capital efficiency can't be evaluated without the certain level of transparency which can be provided by reversed logistics.

Reverse logistics are an essential condition for **risk management** to be able to gain enough information regarding the most amounts of possible risks and evaluate their probability.

At a market with a free flow of information any corporation would less need to spend more money on advertising due to its higher accessibility and lower barriers. Reverse logistics help to create positive image of a company. This can be used instead of spending additional money on advertising.

Total shareholder return would be higher if the reverse logistics process is effective and lessens the expenses (or increases the profit) of a company.

Can **Reverse Logistics** help the **Social Progress?**

Reverse Logistics ensure the re-usage of previously considered as "end-life-products" (ELP) which prevents aggregation of waste. This provides us with opportunity to improve social conditions of living for every person on the planet.

Reverse logistics are now one of the fundamental parts of a Supply Chain that by its existence protect the society against the pollution of the environment.

Higher **community outreach** can be achieved with the help of reverse logistics when all members of the society can gain the access to reused and/or high quality products due to cost reduction and consequently price reductions.

Labor relations are much more sustainable in societies where companies operate with developed reverse logistics. Companies become less attracted by the option of buying cheater materials or products from places where labor is exploited.

Can **Reverse Logistics** help the **Sustainability?**

Reverse logistics can ensure that companies will tend to avoid any abuse of the natural resources of our planet and pollution produced by industries due to its inconvenience. That can help us to sustain **clean air, water and land**.

Reverse logistics can regularly increase the positive effect on the problem of emissions that will eventually lead to stronger **reduce of the emissions**.

Reverse logistics will decrease the probability of any accident and environmental threat created by human activity which can result into a **decrease in waste** and reduce the probability of **releases and spills.**

Biodiversity can be preserved with the help of reverse logistics. As mentioned before: decreasing in waste and pollution can help society to keep biodiversity protected.

Can **reverse logistics** help the **Environmental Stewardship?**

Reverse logistics can help to maintain **security** of the society. Society will become less dependent on natural resources and raw materials which would be simply reused and remanufactured thanks to reversed logistics. Scarcity of natural resources would be of lower threat than it is now.

Business ethics are also supported by the reversed logistics because an effective, environmentally friendly and sustainable supply chain is needed to bring the most appropriate approaches in dealing with future challenges of multicultural environments in our big yet tiny world.

3.6 Summary of Literature Review

In this chapter, Reverse Logistics concepts and dimensions were described. Terminology and definitions used by various authors in their previous works and researches regarding RL were often different and didn't have a common view.

Then it has been shown that RL can affect costs, provide higher efficiency, immediate result and more opportunities for the businesses which put more emphasis on it. More specifically, Reverse Logistics is often missed with just a harmful legislative obligation, which makes the business more complicated and costly. Several authors have shown that in the race for sustainability it is essential to put all possible effort in the development of supply chain to reach as close as possible the desired Closed Loop Supply Chain (CLSC). Not only costs and profits will be positively affected by this practice but also it will make a positive change in customers' perception of the brand of a company which sells recycled goods. Another positive for sustainability point is the independence from raw material providers obtained thanks to CLSC.

Regardless of all the advantages provided by RL there are still lots of companies which try to evade legislative obligation and public pressure in implementation of RL on their business models. Five reasons for such companies to change their mind were outlined. These reasons are purely economic and vary from facilitation of dealer's selling process for ELP to improving consumer's loyalty and satisfaction.

Supply chain models can be changed regarding RL without much complexity. Typical players were described, which pursue their own goals and conduct actions per their current role in the chain. This has also shown that companies don't have to concentrate exclusively on themselves while organizing CLSC and can freely include external players into the process.

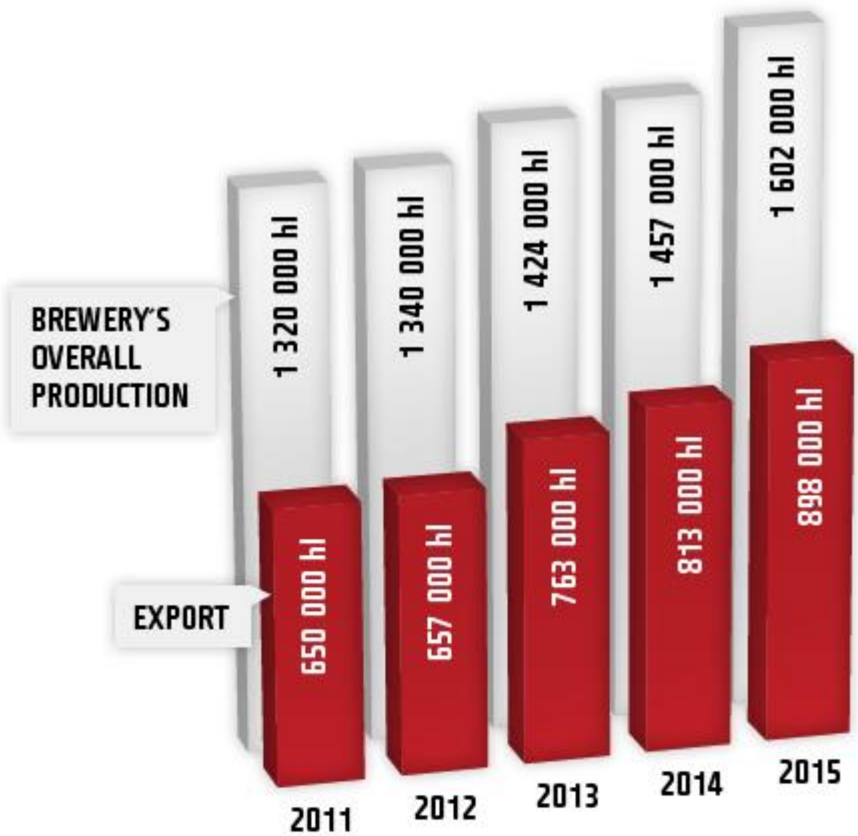
Additionally, regarding the Triple Bottom Line, a close look has been taken on the Reverse Logistics and opportunities which they provide to social growth, environmental stewardship and economic growth. Firstly, economic growth can be supported by better risk management and capital efficiency. Secondly, social growth can be influenced by higher community outreach and better labour relations. Thirdly, environmental stewardship can be also positively affected by decrease of waste and reduce in emissions. Finally, all these aspects would help all stakeholders to improve their sustainability potential by maintaining biodiversity, promoting business ethics, improving public health and enhancing public security.

4 Practical Part

4.1 Reverse Logistics in Budweiser Budvar

Budweiser Budvar is exposed to harsh business competition in more than 60 countries. That is why it is continuously modernizing its production capacities. Investments primarily focus on manufacturing technology, logistics, trade and marketing. Between 1991 and 2013 Budweiser Budvar increased the volume of beer produced almost three times. It significantly strengthened both sales in the Czech Republic and abroad. Just as another example of the success of Budweiser Budvar, it should be mentioned that every year since 2012 Budweiser Budvar are beating the records of their maximum production levels. For instance, in 2015 it produced more than 1 602 000 hectoliters of beer (see Figure 6), 56% of which was exported to other countries. (Budejovickybudvar.cz, 2017)

Figure 9: Share of export in Budweiser Budvar's sales



Source: Budejovickybudvar.cz (2017)

With the arrival of different types of packaging, problems have come. The big problem of reverse logistics is not waste but the collection of packaging materials. The problem mainly concerns the foreign market. The first difficulty lies in the fact that beer is sold in cartons that are not returnable and the bottles in them are, therefore, a special transport must be sent to the crates and the bottles to be loaded. In Austria and Germany, the brewery has a contractual partner who arranges bottling and subsequent removal to breweries. In the summer, they are not sorted out, so part of it is returned to the brewery unassigned. In the brewery, the 0.5 liter bottles are sorted by machine and 0.33 l by hand.

Previously, bottles were unified, eliminating the problem of reverse logistics. At the time of marketing change and innovation, each brewery comes with a different kind of packaging because it wants to vary and attract the attention of the consumer.

The brewery wants to address this issue in the future, but it does not yet know how. One of the ideas is to return to a unified bottle with other breweries.

4.1.1 Reverse Logistics Overview

The materials that the plant takes as returns and after that recycle may be: bottle glass, aluminum cans, plastic bottles of beer and various bundling materials. Company's environmental policy forced this business to take certain actions. The manufacturing plant has applied recycle practices for different materials that are utilized as a part of their office work and manufacturing. This includes: paper, packaging materials, plastic barrels and metal kegs, batteries, inks and a various steel scrap.

Budweiser Budvar has begun recycling in 90's and today recycles nearly every component or material that can benefit the business. The recycled materials are returned to the plant either within reverse logistics process or they are gathered in the area around the plant, workplaces, warehouses and distribution center and then sent for recycling.

Another essential element for the effective application of reverse logistics process and recycling is the area, where the manufacturing plant is located, which is Ceske Budejovice – the political and commercial capital of South Bohemian region. The clear majority of its suppliers are located in the same area and subsequently the backwards flow of both components and materials that are about to be recycled is more affordable.

Budweiser Budvar is continuously investing on machinery, technology, R&D and has invested on the landscape development of the region around its facilities. Not that long after the start of recyclyng activities, the top management of Budweise Budvar has decided to make a brand image more contemporary, so that customers will associate Budvar with environmentally friendly and recycable products Top managers likewise demostrated dedication for the reverse logistics process and attempted to incorporate all actors from its Supply chain to this practice.

Moreover, it invested a lot on training programs for its staff, with a specific end goal to make everybody comprehend the need for reusing and the additional procedures that entered in the generation, circulation and quality control. The two parts of the employees learning and training are of developing enthusiasm for improving and succeeding in application of reverse logistics. Budweiser Buvar early understood that recycling can offer huge competitive advantage, as well as social and environmental benefits.

4.1.2 Reverse Logistics processes

In this part the reverse logistics processes of the company are described. The backwards stream of the materials that the manufacturing plant takes returns from the clients to the grocery stores, retail chains that offer beverages, restaurants, bars and bars back to the manufacturing plant. The returned products are gathered to the warehouse of the manufacturing plant. After the return of the materials to the warehouse they are examined and separated and each takes after its own specific recycle root.

Glass - Bottles

Empty glass bottles are delivered to the manufacturing plant with the same trucks that they ship orders to the clients. At the point when an order is sent to a client, it is defined whether this truck will take empty bottles and the discount that will be given to the client for the return of the empty bottles. Following the return of empty bottles at the manufacturing plant, they are examined and separated to those that can be reused and those that will be sent back to the glass supplier for recycle.

The bottles, that can be reused, get in the bottle laundry to be washed. Their labels are removed and clean bottles are sent for bottling to the appropriate manufacturing line. The redistribution of bottles is done through existing forward logistics chains. It’s important to mention all the process portrayed above is automatic and the laundry is an augmentation at the beginning of an existing manufacturing line. Each bottle, per the condition that is constantly returned, can be reused on average 30 to 60 times.

The bottles that can't be reused are crushed into pieces and the glass is sent back to the provider of glass bottles. Along with these amounts of returned glasses, amounts of glass from bottles that were damaged while bottling and were taken out the manufacturing line are forwarded back to the provider.

Budweiser Budvar has both brown and green glass bottles. Therefore, they are distinguished in accordance to their color and forwarded to the provider separately, which helps to produce new glass bottles with less cost. With these selection and recycling processes the organization has decreased the cost of glass by more than a half.

Paper – Labels

Paper labels are separated from the bottle at the point when bottles get into the laundry to get washed and they end in a specific place of the laundry. After they are dried, they are gathered in plastic containers outside the manufacturing zone and once every month they are sent to the provider for recycling. Budweiser Budvar had chosen to utilize costlier however more water-soluble glue to enhance the separating process of the labels.

All the various paper that is collected in special containers around the plant including paper labels is sold to the label provider or other paper recycling companies.

These containers that are utilized for the gathering of the utilized labels are utilized multiple times too and when they are unusable anymore they are likewise sold to the provider for recycling.

Aluminum - Cans

Regarding the fact that aluminum is a standout amongst the most recyclable materials, Budweiser Budvar doesn't reclaim aluminum cans from its clients. The clear majority of them have an agreement with a recycling company for selling the utilized aluminum cans or collecting them to the special containers for aluminum that are all around city. Those cans that the company can recycle are those that are gathered in the special containers that are situated around the manufacturing plant and those that didn’t pass quality control during manufacturing and packaging

Packaging materials

Budweiser Budvar uses 2 types of packaging materials in their RL process. First one is for packaging bottles and cans that are about to be stored or sent to the customer. Second one is for those in which raw materials were packed in.

The primary type is the packaging materials that are sent back, as returns from its clients and they include plastic boxes and all types of pallets. These packaging materials are returned to the manufacturing plant together with the empty bottles. The process is the same as with glass and the gathering of packaging materials is done to the warehouse of the manufacturing plant.

The pallets that are gathered to the warehouse are distinguished to: those which can be recycled, those that should be settled and those that are crushed and will go for recycling. The plastic boxes are distinguished to: to those that can be reused in case of cleaning and to those that will be recycled. At the same time, plastic boxes, that will be reused, get in another specific laundry that is also placed at the start of the manufacturing line and after they are cleaned they are prepared to be utilized as new ones and pack the bottles. All the mentioned packaging materials that will be reused and recycled are redistributed through the current supply chain.

In the second type, there are materials, for example, barrels (kegs), nylon (recoil thwart), plastic containers and material of crushed plastic crates (boxes in some cases). There are exceptional zones in the warehouse for gathering these materials and when there is sufficient amount, a recycling company that has an arrangement with Budweiser Budvar, goes to the manufacturing plant and takes the recyclable materials. The benefit for the beer company is obtained from selling these recyclable materials.

4.1.3 Other recycling activities

As one of the most important objective targets of the company around Europe is the environmental awareness, Ceske Budejovice’s factory managers try to follow environmental management with all possible recyclable materials.

Apart from the materials that are described in paragraph 4.1.2, the factory expands its recycling activities and therefore its reverse logistic processes. It recycles steel barrels, used cables, steel waste that comes from old machines, pipes and generally steel materials from the production area that can no longer used and batteries. Waste lubricants, from the machines, is another material the company doesn’t landfill due to environmental considerations and sell them to a company that after several processes they turn them to other kind of useful oils.

Over the last five years as there is an increase for recycling of electronic equipment and companies provide such equipment offer discounts to their customers that send back inks, end of life printers and copiers. Therefore, the company made special cans for consumable materials of laser printing and copying machines, inks etc. and likewise collect for recycling all electronic equipment that can no longer used. The profit for the company comes from selling these recyclable materials. For these materials, the reverse flow is from the factory to the supplier.

On the other hand, some of its employees are yet not 100% sure about the benefits of reverse logistics and its contribution to the total revenue. One of the argument mentioned by them was that in 2012 Budweiser Budvar has significantly increased beer exports in irreversible barrels (kegs of the KeyKeg system). It has exported 4700 hectoliters of light and dark lager in this type of packaging to 14 countries, up 127% year-on-year. KeyKeg has thus become one of the factors that helped to achieve the highest export in the history of the brewery in 2012. (parlamentnilisty.cz, 2017)

4.1.4 How can RFID help Reverse Logistics?

The primary issue in RL is vulnerabilities in market trend, cycle time, quantity, variety and quality. The reason of these vulnerabilities is the lack of a proper planning that has made it hard to institutionalize activities inside the RL (Fleischmann& Bloemhof-Ruwaard, 1997).

Precise and accurate data is fundamental for conducting schedule and control activities. For instance, in Master Production Scheduling (MPS); lead time (cycle time), expected volume (market trends), the available returns, quantity and variety, inside the RLSC are the data expected to finish the MPS table. The more accurate data can be discovered the better control over the RLSC can be obtained. This data can be gathered by actualizing RFID in the RLSC. For example, in Master Production Scheduling (MPS); lead time (cycle time), forecasting volume (market trends), demand and available to promise (the available returns, quantity and variety, within the RLSC) are the information needed to complete the MPS table. The more precise information can be found the better control over the RLSC can be gained. This information can be collected by implementing RFID in the RLSC.

After their literature review Sarac, Nabil and Dauzère-Péres (2010) have discovered that the principle areas that RFID can manage are stock laxity (inaccuracy), the bullwhip effect and replenishment strategies. By utilizing RFID, stock laxity and replenishment strategies can be advanced, which is extremely productive in decreasing RLSC vulnerabilities, particularly in quality, quantity and variety. How RFID can gather required data and the reasons why data is essential are clarified below.

Market Trend

Certain data from clients can be gathered through various means, for example, utilizing active RFID labels or EDL which can spare some data amid the use time frame. Additionally, if the passive labels are utilized, some data can be spared in the core server when the client records that data via internet (Jayaraman, Ross, and Agarwal, 2008). Other options of gathering customer trends data through introduction of RFID technology also exist.

One of the vulnerabilities is called Market Trend uncertainties. They differ dramatically from other vulnerabilities. For sure, the market trend data can be utilized to decrease all other vulnerabilities. The clarification is that by understanding the market behavior, a higher quality forecast can be made regarding quality, quantity and variety and cycle time of returns. This forecast can be enhanced by time through measuring and contrasting most recent or even real-time data and the expected values. For instance, by knowing the past returns records for a particular item it is conceivable to have a decent forecast on profits for a newly introduced item of a similar type. For specific items, one of the worries of producers is to discover ways which motivate clients to return the items. Along these lines, by knowing the clients patterns they can discover answers on how to raise returns from costumers.

Cycle Time

Cycle time is also an important vulnerability that needs to be described. It is essential from the point that it allows to forecast the number of returns and some stock management choices by knowing the normal cycle times and their variations. Two types of cycle time are most often distinguished: returns lead time and product usage time.

Returns lead time in RLSC is the measure of time returns spent inside the RLSC. By utilizing RFID, it is also conceivable to define and decrease the cycle time. In view of various quality levels, they should be handled in a different way, which brings to different cycle time. As it was mentioned before by utilizing RFID time required for conducting these procedures including distribution and transportation can be decreased. So clearly processes could be done faster.

Product usage time is the time spent from the minute the client gets the item till the minute he returns it to the gathering point. By utilizing advanced RFID technology, process durations and cycle time in general are effortlessly identified. Accordingly, it is conceivable to identify the normal cycle time and its variation of returns for every item type. This data helps to get a better estimated forecast and thus have a more exact stock and production planning.

Knowledge about the cycle time and its variation could be utilized for further production planning. Moreover, when the motivation behind return by client is repair customer service center can guarantee a more exact conveyance date, by knowing the lead time.

Inventory control and planning

Advanced RFID technology can enhance the stock control of returned items and enables the planner to upgrade the inventory planning, especially if the business utilizes Material Requirements Planning (MRP).

The final goal of SCM in RL is to monitor shipments and receipts that stream into the various facilities and to know exactly the substance of each case (Jayaraman, Ross, & Agarwal, 2008). This control can be made exclusively utilizing RFID labels while it isn't conceivable with Bar Codes. Without a doubt, the data provided to the remote users grant real-time data regarding the amount of each package giving accurate and exceptional declaration and position of every item. The supply chain managers can follow the items and respond rapidly if any issue appears. Because of advanced RFID technology, the stock control is more steadily bounded to “more standardized and efficient sorting processes” (Jayaraman, Ross, & Agarwal, 2008) what's more, the reuse rate rise fundamentally with more precise real-time data (Trappey, Trappey,& Wu, 2010).

As clarified beforehand, the primary distinguishing feature between RFID and other similar technologies is that RFID gives real-time data, which might seem not valuable for MRP at first look. In any case, if one goes further in the research, he/she finds out that the planning is more accurate if the data is updated right along. At that point the more accurate to the suppliers can be predicted faster as clarified by Kumar, Dieveney and Dieveney (2009), in their research of RL inside the pharmaceutical business supply chain. They clarified the way that RFID with its ongoing data flow lessens the time utilized by the producers in predicted the size of the order. This IT innovation gives the producers and every actor in the supply chain a chance to get to the real-time data regarding the quantity, time, and place (what, when and where) of a particular item, which is required at the moment. Advanced RFID can enhance package size, safety factor and, for the most part, decreases uncertainties regarding the quantities in the inventory planning process.

Variety

One of the most important features of returns is the variety of low quantities (Lee & Chan, 2008). Consequently, variety can be considered as one of the vulnerabilities in RL. Without utilizing advanced RFID technology, recognizing the returns model is troublesome. Without advanced RFID, the recognition process needs to be done by humans which is slower and occasionally even not possible at all, since for certain products the components may be different that makes it difficult to identify without dismantling. So, for this situation the advanced RFID has more convenience over bar codes because, by utilizing advanced RFID label, automated scanner and machines the distribution of the returned items can be processed entirely without manual work, which will spare large amount of cost and time.

Presently, if the sorting and distributions is processed manually it is mostly done at Centralized Return Center (CRC) and not in Collection Points (Lee& Chan, 2008) considering the issues with recognition. In the wake of sorting distinctive models, they are mainly sent to their Original Equipment Manufacturer (OEM). This implies no less than two transportations, one from Collection Points to CRC and afterward from CRC to OEM. Though, if the advanced RFID technology is utilized, the sorting and distribution process can be performed in the initial step at Collection Points faster and after that they can be transported straight to OEM. Thereby, both cash and time can be saved on transportation.

Quality

The Quality of returned items can turn into a critical factor in RL when the motivations behind the return are remanufacturing, repair or cannibalization. Since the better is the quality of the return, the more cash OEM can make. Therewith, the less the parts must be changed, the less cash must be paid for the new parts or dismantling.

Except financial concerns, vulnerability in quality of the profits makes it extremely hard to plan a cannibalization, repair or remanufacturing process since diverse returns have different quality levels and therefore each single returned item requires a particular dismantling activity. The person who oversees dismantling must check the quality of every part, component or unfinished product. It should be considered that ordinary RFID labels can't record any data about the quality of returns. The only option to have an approximate forecast on the nature of a return, while utilizing ordinary RFID labels, is when clients record their purchases through web, in this way remanufacturers could have an approximate forecast on the quality levels of returns. In any case, it is important to point out that this strategy is appropriate where the quality of the returns is customer dependent.

Active or semi active RFID labels can be utilized to spare data while utilizing a connected device. This data can be utilized throughout dismantling process. For instance, Bosch Group is utilizing Electronic Data Log (EDL) in some of their products with electronic engines. Utilizing EDL gave Bosch Group the option to know how long the device has worked and they additionally know the longevity of life for every part of the device. So, by being aware of these they can have a decent forecast on the parts that should be changed (Visich, Li,& Khumawala, 2007). To facilitate dismantling process a graphical guide (or map) of every item and dismantling procedure can be saved on the label itself so that, while dismantling procedures take place, it can be displayed on a screen. Those parts that ought to be changed are highlighted, and after that the specialist can proceed with the repair, remanufacturing or cannibalization process with less mistakes and higher speed.

Quantity

As it was indicated Jayaraman, Ross and Agarwal (2008), the vulnerabilities in RLSC originate from the absence of data in the remanufacturing procedure. Some data is absent in the planning and the quantity of return, in the dismantling procedure and in the material recovery.

Advanced RFID technology gives the option to define the quantity of items in each package. As it was indicated by Lee and Chan (2008), by defining the quantity, the productivity could be enhanced in three fundamental areas: to start with, the cost of transportation could be lessened by distinguishing the available stock of each unique actor in the RLSC. At that point, the more exact manufacturing plan should be possible by knowing the available returns for each kind of items (e.g. the quantity of items for cannibalization is known). Lastly, best placements can be selected for collection centers.

4.1.5 Business cases of reverse logistics implementation

Reverse logistics normally represent 3 to 4 % of a business's total logistics costs. Businesses can spare 10 % from their yearly logistics expenses by efficiently managing reverse logistics process. 20% of this sum is spared in labor costs and the rest 80 percent is spared in lessened freight costs and decreased pipeline inventory (Minahan, 2017).

As per Rogers and Tibben-Lembke, the Automotive Parts Rebuilders Association (APRA) gauges that worldwide in the car business alone, 155,000 railroad cars could be filled every year by the raw materials spared at production. The car business remanufactured vehicle parts share was calculated to be more than $36 billion in 1999. This is a case of the capability of using reverse logistics to spare cash and to improve environmental sustainability. (Rogers and Tibben-Lembke, 2017)

Bosch is known as automotive and modern innovation-driving organization, which is focused on industrial technology. Recently, this company incorporated sensors with its power instruments that show if the engine in worth reconditioning. The sensors lessen examination and disposition costs, enabling the organization to acknowledge benefits on the remanufactured power instruments. (Guide Jr., Daniel and Wassenhove, 2002)

General Motors (GM), USA car manufacturer improved its procedure for returning car parts by enabling parts to be returned to a one specific facility utilizing GM's pre-printed delivering labels. This less expensive process improved GM's associations with its clients and store network accomplices. (Stock, James. Speh, Thomas. and Shear, Herbert, 2002)

Volvo expected the Swedish government passing a law considering auto producers responsible for return process and disposal of vehicles. Volvo introduced a reverse logistics procedure of rescuing and disassembling vehicles. The organization gained revenues by offering the utilized metal, plastics and auto parts. (Stock, James. Speh, Thomas. and Shear, Herbert, 2002)

4.2 KEG Return process visualization

4.2.1 Interview

Today, together with advancement of Radio Frequency Identification (RFID) technology it becomes more and more popular to improve the accountability of their barrels. Budweiser Budvar, unfortunately, uses older generation of RFID on their kegs, which limits their possibilities in tracking of kegs. It is still passive type of RFID which requires actions to me taken by men to identify each keg.

Today with such an innovation integrated into accounting system of a brewery it can improve the whole inventory management by automatization of incoming and outgoing processing. The point which should be highlighted is not more sufficient reports but enhanced asset visibility and business process in general. This integration of technology will allow all involved actors to access the system with real-time graphic location. Accounting and budgeting team will provide sales team with inventory planning and modelling for kegs.

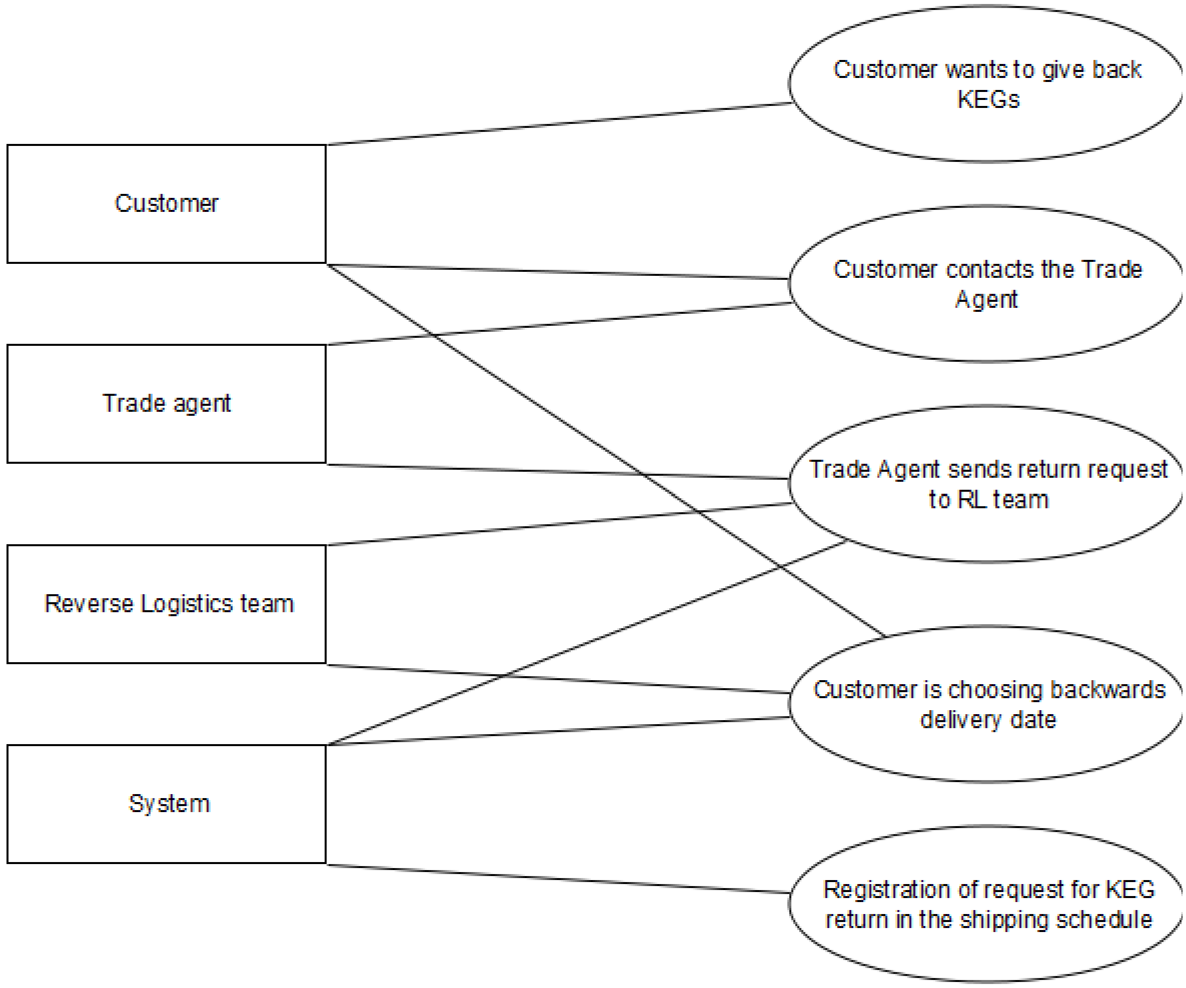
In this chapter, vision of the keg return process vision will be introduced. From the external point of view this process might look fully automated, yet many parts of it require constant involvement of men to proceed successfully to next stage and keep the cycle flowing. The goal of this chapter is to show how the basic return process can be organized, so that any even the smallest company can implement it in their business model. The process will be divided into smaller processes (stages) and describe every stage in detail.

4.2.2 Sketches

On following figures, basic view on the process will be shown before the detailed description was provided and general ideas on every stage of the process. Final processes might differ from sketches due to more complexity and deeper insight of every stage.

1) Intent of Return. Booking

Figure 10: 1. Intent of Return. Booking

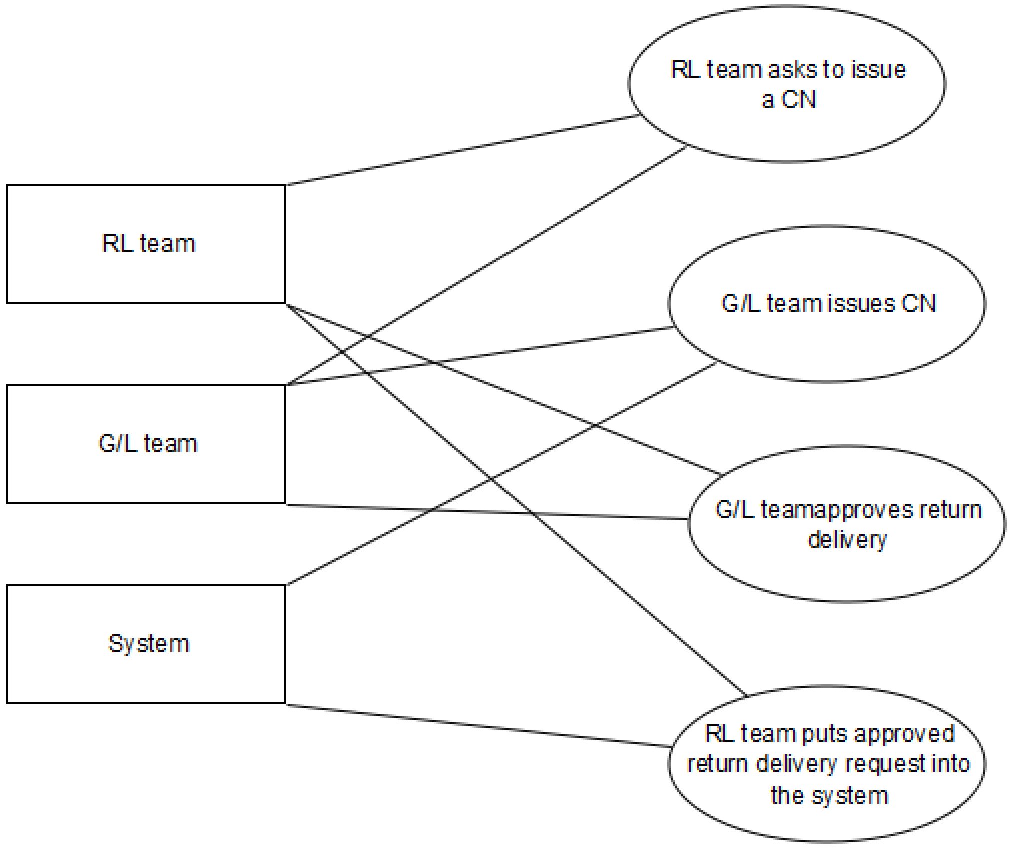


Source: own figure

On the Figure 10 is shown the initial vision of the first stage of Return of kegs process – the intent of return and the booking itself. It shows the relationship between actions taken and actors conducting actions. These include Customer, Trade agent, Reverse Logistics (RL) team and the System.

2) G/L process

Figure 11: 2. G/L process

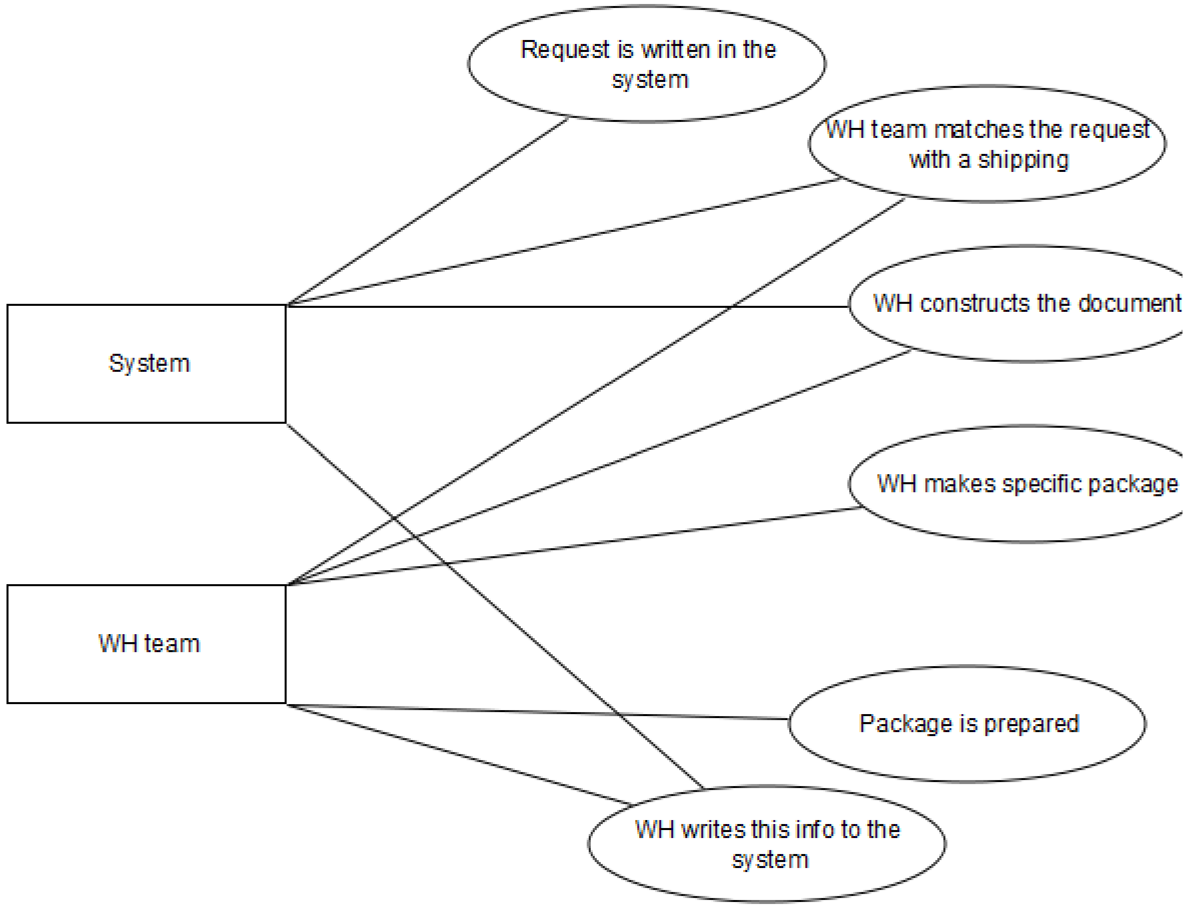


Source: own figure

On the Figure 11 is shown the initial vision of the second stage of Return of kegs process – the General Ledger (G/L) process. It shows the relationship between actions taken and actors conducting actions. These include G/L team, RL team and the system.

3) Warehouse packaging

Figure 12: 3. Warehouse packaging



Source: own figure

On the Figure 12 is shown the initial vision of the third stage of Return of kegs process – the warehouse (WH) packaging. It shows the relationship between actions taken and actors conducting actions. These include only WH team and the system.

4) Delivery to customer

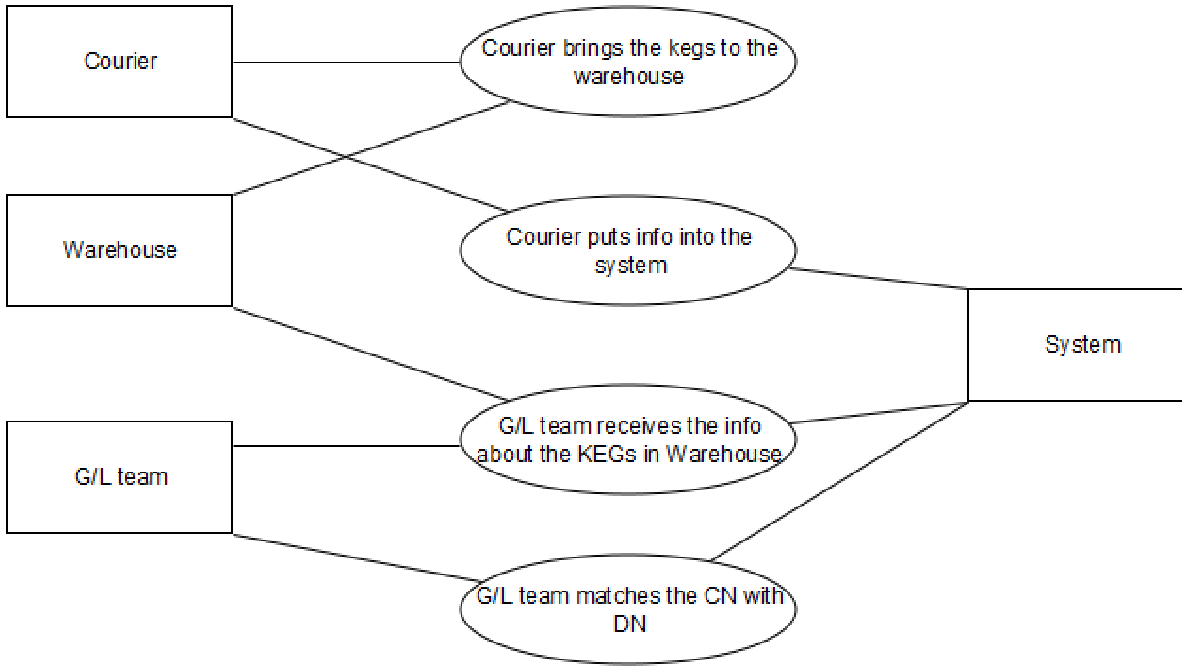
Figure 13: 4. Delivery to customer

Source: own figure

On the Figure 13 is shown the initial vision of the fourth stage of Return of kegs process – the delivery to customer. It shows the relationship between actions taken and actors conducting actions. These include Delivery team, WH team, Customer, Courier and the system.

5) Courier brings KEGs

Figure 14: 5. Courier brings KEGs

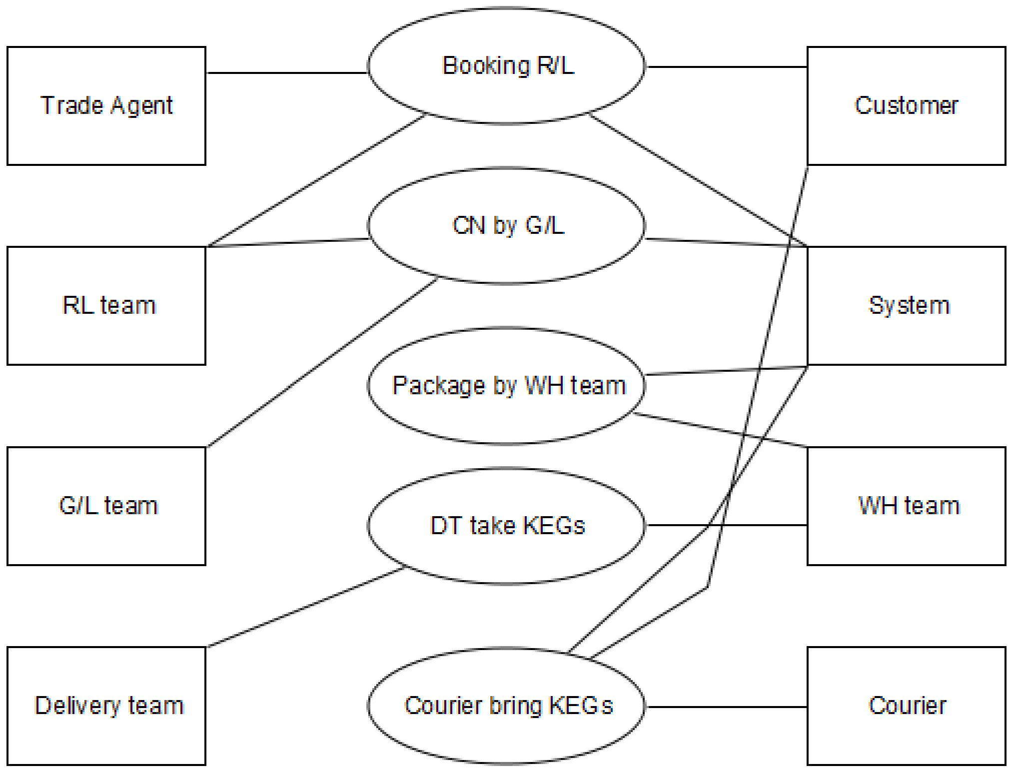


Source: own figure

On the Figure 14 is shown the initial vision of the last stage of Return of kegs process – the courier brings kegs. It shows the relationship between actions taken and actors conducting actions. These include WH team, G/L team, Courier and the system.

6) Process and Objects

Figure 15: 6. Process and Objects



Source: own figure

On the Figure 15 is shown the initial vision of the summary of Return of kegs process. It shows the all the stages regarding which actors are involved in which stages. Here we suspected that system might not stand as action taker in one of the stages, yet in the process of modelling we discovered that it can't be ignored.

7) General information

This project is dedicated to the demonstration of process of booking paying and performing the Beer Company Reverse Logistics process for KEGs in all stages from the beginning to the delivery of empty KEGs back to the Beer Company. There are 5 main Sketches in the project, 6 participants, 2 functions: external and internal, 5 scenarios, 1 general business architecture diagram, 5 main business diagrams that also include data flows, and 6 classes. In this project, will be given a description for functions, scenarios, participants, basic modelling cards, detail modelling cards, data flows, business architectures and business diagrams.

4.2.3. Functions

In this model, there are 2 types of functions: External and Internal. External concerns processes mainly conducted outside of the company, while internal functions concerns processes mainly conducted inside the company.

External Function

External function is mainly related to Customer involvement. This function includes the booking of return process and delivery to the customer.

Internal Function

Internal function is related to inner process with no and almost no external actors' involvement. This function includes the G/L process, warehouse packaging and retrieval of kegs from the customer.

4.2.4. Scenarios

1. Booking of return

Booking of return can be identified as the initial stage of the whole process and it starts from the very intent of the customer to give back the empty kegs to the brewery. Customer will contact the brewery via trade agent as the major actor in the interaction with customers. Trade agent will fill in the request form and contact reverse logistics team to get the green light for adding empty kegs into the list scheduled in next shipping. Every step will be shown in the derived diagram for booking of return. This scenario is followed by G/L process scenario.

2. G/L process

This stage can be considered as fully internal and integrated into the internal function. G/L process starts at the very moment of the request for return being put into the system. It takes place at the same time and should be conducted as quickly as possible. The beginning of this stage can be marked as the point when RL team accepted the request. Request yet needs to be approved by the G/L team. RL teams contacts G/L team asking for an approval. G/L team, on their side, considers the request and checks the credit balance and inventory balance of this customer. When all the requirements are met G/L team approves the request and issues a credit note, which will be shown in the system right away. Every step will be shown in the derived diagram for G/L process. This scenario is followed by warehouse packaging scenario.

3. Warehouse packaging

Just as the previous stage, this one can also be considered as fully internal and integrated into the internal function. Only 2 actors are involved in this process, which are system and warehouse team. The warehouse team will receive the request for keg return already inside the draft invoice. In straight accordance to the invoice, warehouse team will construct a package considering the availability and due dates of every specific product type. In the end of this stage warehouse team will have a constructed package, per which they will adjust the final invoice and write it into the system. Every step will be shown in the derived diagram for warehouse packaging. This scenario is followed by delivery to customer.

4. Delivery to customer

Unlike the previous stage, this one should be considered as more external than internal and integrated into the external function. Five actors are involved in this process, which are courier, customer, delivery team, system and warehouse team. This stage starts with delivery team getting information regarding the return delivery. Then delivery team transfers information to a specific courier (including invoice/bill). Courier on its side takes the package from the warehouse to the customer. There he leaves the products and takes empty kegs money (can be transferred in various ways) from the customer. As the result of this stage empty kegs should be taken from the customer and the bill should be paid. Every step will be shown in the derived diagram for delivery to customer. This scenario is followed by courier brings kegs.

5. Courier bring KEGs

This stage cab be considered as mostly internal and integrated into the external function as it starts at the moment when courier already has empty kegs and money. Four actors are involved in this process, which are courier, G/L team, system and warehouse team. This stage starts with courier bringing kegs to the warehouse then courier brings money to the accounts receivable department of G/L team (in case of cash). Warehouse send confirmation to the G/L team. G/L team's part is, firstly, to confirm the return of kegs and receiving money. Secondly, to match credit note, debit note and the payment. Thirdly, write and mark everything in the system. Every step will be shown in the derived diagram for delivery to customer.

4.2.5. Participants

In the return process, 8 participants are defined. Every participant is playing a certain role in the process. In general, roles of the participants as well as the set of the participants can be changed according to specifications of every particular business model. Some participants may be replaced by external actors, which are more specified in certain activities. Jobbers and charity organizations may help to substitute or supplement some roles in the process. For example, wholesalers may concentrate empty kegs for the brewery. At the same time charity organizations, may help in facilitation of the process as well as providing more advanced reusable barrels.

Courier

Courier may seem as just a technical executor of shipping and return activity. However, on its shoulders lies the responsibility for checking whether kegs belong to the correct beer company. More advanced RFID technology may turn this process in a matter of seconds for each keg as it would be scanned by the courier at the moment of putting kegs to the truck. Yet, it is also possible to install an automated system of active RFID, which will automatically identify and write in the system the information about kegs, loaded into the truck.

Customer

Customer's role should not be undervalued. Very often, especially in last 3 decades, it was mainly a matter of customer consciousness for kegs to be returned. Today, with the development of legislation and technology as well as increase in keg's price, a sufficient increase in the rate of returned kegs is shown. Customers also are highly interested in returning all the empty kegs as they can evade paying for barrels by just returning them.

Delivery team

Delivery team is responsible for almost all physical distribution processes. Their role is to maintain all the deliveries and make sure that they are in time. Delivery team is constantly tracking all the deliveries on their way to the customers and back. Advanced RFID technology might help them to keep track on every keg which is outside of their warehouse, which can help to analyze and improve the distribution model to make it faster, cheaper and more efficient.

General Ledger accounting team

General Ledger accounting team is responsible for all accounting processes regarding the keg return process. This includes billing, issuing credit and debit notes, final invoices and allocation of cash. Additionally, G/L team controls the credit balances of the customers and takes part in the budgeting process which may also include the inventory planning and modeling for kegs.

Reverse Logistics team

Reverse Logistics team is responsible for organization of all reverse flows that includes return, recycle and retrieval. In case of keg return process they are helping to fill up the trucks on their way back to the brewery, so that reverse flows are integrated into one supply chain. In case if there is no such opportunity, their responsibility will be to find the most efficient way to bring the product back to the brewery.

System

System in this case is not substituting people but enhancing them by providing more relevant data, options and opportunities. Regarding modern RFID technologies, such system can provide company with real-time geographic location of the entire inventory. Main function of the system is providing all the actors with most updated information regarding every step in the process. Speed and quality of accounting process is likewise improved due to better information flows inside the company.

Trade Agent

Trade agent is interacting the most with the customer. This role provides constant information flow between the customer and the company. Trade agent is responsible to collect orders and return requests from the customer. Some companies outsource this role to distributors but the set of functions stays the same. Information for sales planning is also often collected by the trade agent.

Warehouse team

Warehouse team is also very important in the return process. Warehouse team is constructing packages for delivery team according to orders provided by trade agents. Advanced RFID technology with and active RFID system with network connection in the warehouse may provide real-time status information for the company considering all the kegs which come into, come out of the warehouse and currently present at the warehouse.

4.2.6. Basic modelling cards

Modelling cards will show us the collaboration between actors on every stage of keg return process. Direct or indirect collaboration is conducted by every actor on every stage of the process.

Courier

As it was described in sketches and scenarios, courier is involved in 2 stages of the return process: “delivery to customer” and “courier brings kegs”. In both stages courier plays the central role and directly collaborates with every other actor.

Customer

Customer is likewise involved in 2 stages of the return process: “booking of return” and “delivery to customer”. In the first case customer interacts only with trade agent, while in the other one customer interacts only with the courier.

Delivery team

Delivery team, unlike precious actors, is involved only in 1 stage of the return process: “delivery to customer”. Here delivery team interacts with system and courier.

General Ledger accounting team

General Ledger accounting team is also involved in 2 stages of the return process: “G/L process” and “courier bring kegs”. In the first case G/L team interacts only with RL team, while in the other one G/L team interacts with system and courier.

Reverse Logistics team

Reverse Logistics team is involved in 2 stages of the return process as well: “booking of return” and “G/L process”. In the first case customer interacts with system and trade agent, while in the other one RL team interacts every other actor in that stage.

System

System is involved in every stages of the return process. In the first stage system interacts only with RL team. In the second stage system likewise interacts only with the RL team. In the third stage system interacts with the only other actor which is warehouse team. In the fourth stage system directly collaborates with delivery team. In the last stage system interacts with G/L team and courier.

Trade Agent

Trade agent is involved only in 1 stage of the return process: “booking of return”. In this stage customer interacts with customer and RL team.

Warehouse team

Warehouse team is involved in 3 stages of the return process: “warehouse packaging”, “delivery to customer” and “courier brings kegs”. In the first case warehouse team interacts only with system. In “delivery to customer” warehouse team interacts only with courier. In “courier brings kegs” warehouse team likewise interacts only with courier.

4.2.7. Detail modelling cards

Detail modeling cards will show us the collaboration between actors and direction of decision making from initiator to decider. Only direct collaboration, which is conducted by every actor on every stage of the process, will be shown here.

Courier

Collaboration in the stage “delivery to customer” starts with incoming invoice from delivery team following transferring invoice to the warehouse team. In return courier gets final invoice and package. Next, courier brings invoice and package to the customer and received empty kegs and money from the customer.

Collaboration on the next stage "courier brings kegs" is less complicated and consists of less data flows. Courier brings kegs to the warehouse and gets confirmation in return. The same confirmation is then transferred to the system, while money is brought directly to the G/L team.

It is important to mention that in both stages courier plays the central role and directly collaborates with every other actor.

Customer

Though customer is also involved in 2 stages of the return process, customer usually interacts with only 1 other actor.

Collaboration at "booking of return" starts with request from the customer to the trade agent. After some time customer gets in return a response regarding available dates for backwards delivery. After taking the decision regarding the preferred date, customer sends one more request to the trade agent informing him/her about the decision taken.

At the stage "delivery to customer" collaboration starts with receiving invoice and package from the courier and ends with giving in return empty kegs and money. As it was mentioned before, in the first case customer interacts only with trade agent, while in the other one customer interacts only with the courier.

Delivery team

Delivery team is involved only in 1 stage of the return process: "delivery to customer". Delivery team awaits and receives the invoice from the system. After short processing, delivery team transfers it to specific courier. As it was mentioned before, in this stage of keg return process delivery team interacts with system and courier.

General Ledger accounting team

General Ledger accounting team in the stage "G/L process" receives the request from the RL team, after which G/L team checks credit balance of the client and decides whether to approve or not the return delivery. In case if G/L team approves the delivery, then it issues a credit note and gives the approval for the RL team.

In the stage “courier brings kegs” G/L team receives confirmation from the system regarding the presence of empty kegs on the warehouse. Additionally, G/L team receives money from the courier and matches the payment with credit and debit notes.

Reverse Logistics team

Reverse Logistics team in the stage “booking of return” receives return request from the trade agent and checks the system for available dates. Having this information available RL team asks trade agent to choose a date of delivery. In the end RL team receives required information and confirms registration of the request for keg return in the shipping schedule.

In the stage “G/L process” RL team asks G/L team to issue a credit note and approve the return delivery request. After the return delivery is approved, RL team writes the approved return delivery request into the system.

System

System is not an independent actor and does not initiate any stage if it’s not a transfer from a previous stage. Yet, it is vital part of every stage.

System in the first stage system interacts only with RL team. Firstly, it receives a request from RL team and checks for the available dates. Then, in return, it provides requested information to the RL team. At the end of this stage system registers the request for keg return in the shipping schedule according to RL team request.

In the second stage system also directly collaborates only with the RL team and approved return delivery in written into the system by the RL team.

In the third stage system receives request from warehouse team and provides it with new order in form of a bill. In the end of this stage, warehouse team writes information regarding formed and prepared package into the system.

In the fourth stage delivery team gets the information about return delivery from the system in form on an invoice. Surprisingly, nothing is additionally written in the system.

In the last stage courier registers confirmation of returned kegs on the warehouse (can be conducted by WH team too) and then system provides (passively or by notification) confirmation for the G/L team.

Trade Agent

Trade agent in the stage “booking of return” receives the return request from the customer and forwards it to the RL team. Then, trade agent receives request to choose the delivery date from RL team and transfers it to the customer. After getting the chosen date from the customer, trade agent provides preferred delivery date to RL team and asks to register the request of keg return in the shipping schedule

Warehouse team

Warehouse team in the stage “warehouse packaging” appears as the main actor. Initially, warehouse team checks the system for new orders. After receiving an order in for of a bill (or initial invoice), warehouse team constructs a package and final invoice. At the end of this stage warehouse team writes to the system information regarding prepared package and invoice.

In the stage “delivery to customer” warehouse team receives invoice from the courier and matches it with the package. In return warehouse team provides courier with package and gives him back the invoice.

In the last stage “courier brings kegs” warehouse team receives the empty kegs from the courier. After that warehouse team confirms receiving empty kegs and provides this confirmation to the courier.

4.2.8. Data Flows

In this paragraph will be distinguished main data flows, their directions and transformations.

Bill

The order, placed in the system, is transformed into the form of initial invoice or bill and then system provides warehouse team with this bill. Warehouse team constructs final document (invoice) based in this bill.

Confirmation

Confirmation of empty kegs placed in the system is initially provided by warehouse team to the courier. Courier, on its side, registers confirmation in the system. Lastly, the G/L team receives this confirmation about kegs in warehouse from the system.

Empty KEGs

Customer provides courier with empty kegs. Courier, after receiving empty kegs, brings them to the warehouse. In the end, warehouse team receives the empty kegs and waits for further commands in refilling process.

Invoice

Warehouse team provides final invoice after package is prepared. The information regarding formed invoice and prepared package is written into the system.

At the stage “delivery to customer” delivery team receives invoice from the system. Delivery team then gives invoice to specific courier, which brings it to the warehouse. Warehouse team matches the invoice with the package and gives it back to the courier. Then again courier brings the invoice to the customer.

Money

Customer gives courier money for the invoice and package. Courier, after receiving money, brings it the G/L team. In the end, G/L team matches the payment with debit and credit notes.

Package

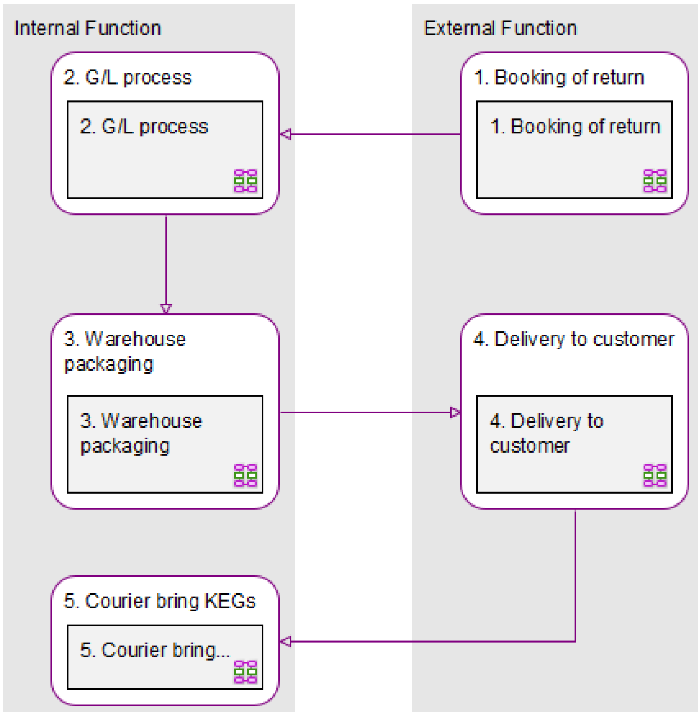
Package starts its flow from the warehouse, where warehouse team has prepared it and gives it to courier. Courier takes it from the warehouse and comes to the customer with the package. In the end, customer receives package from the courier and in return provides him/her with money and empty kegs.

4.2.9. Business architectures

Reverse Logistics

Finally, it is possible to build up business architectures demonstrating flow and stages of the reverse logistics.

Figure 16: 7. Reverse Logistics



Source: own figure

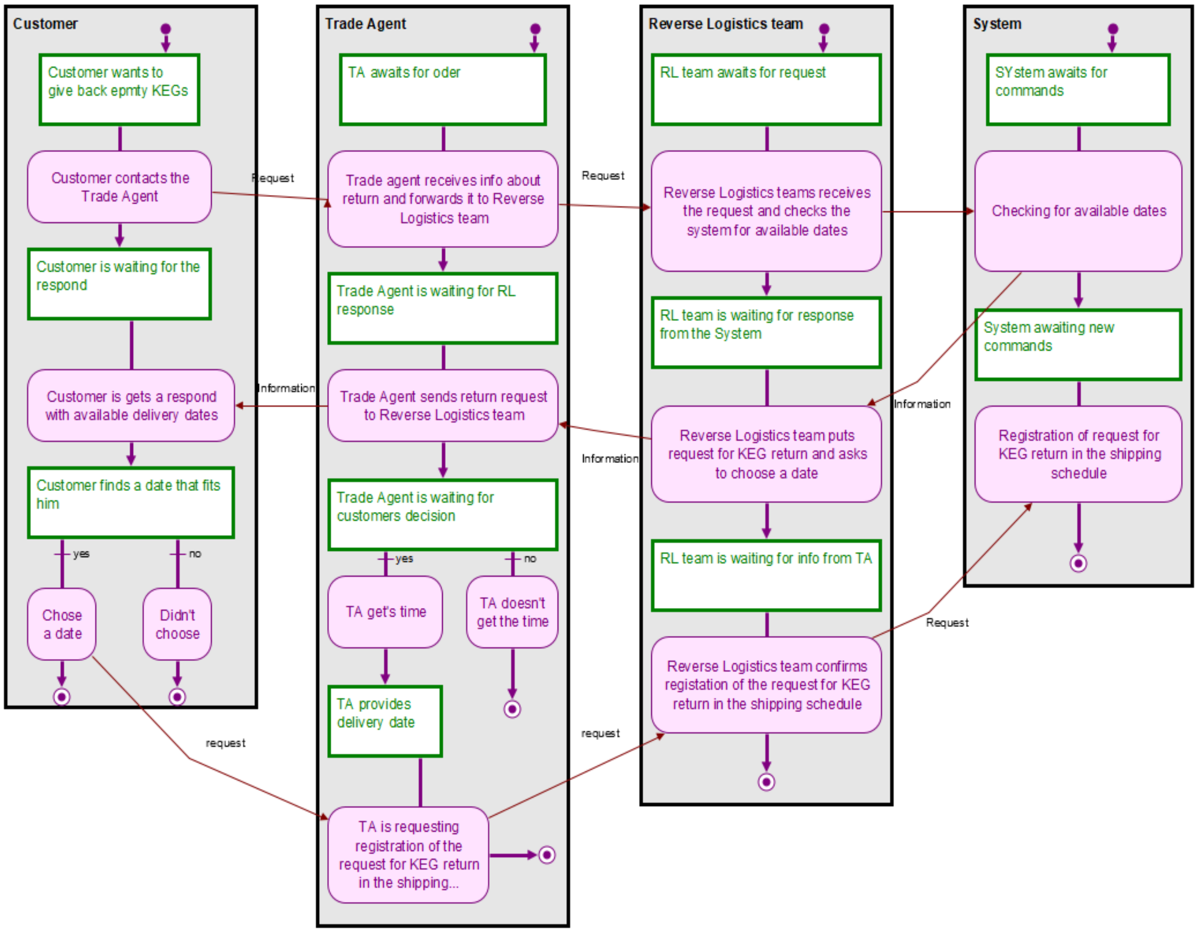
Business architecture in regarding relation of stages to external or internal function is presented in the Figure 16. As it can be seen, stages 1 and 4 are considered as integrated into external function, while stages 2, 3 and 5 into internal function.

4.2.10. Business diagrams

1. Booking of return

Booking of return - this scenario comes first in this project.

Figure 17: 1. Booking of return



Source: own figure

Customer

At Figure 17 customer comes out as the initiator in this stage and process in general. This stage starts with the customer's intent to give back empty kegs.

Reverse Logistics team

Reverse logistics team, as one responsible for managing reverse flows, plays vital role in organization and execution of return process.

System

System provides other actors with vital information regarding the shipping schedule and contemporary information transfers between other actors.

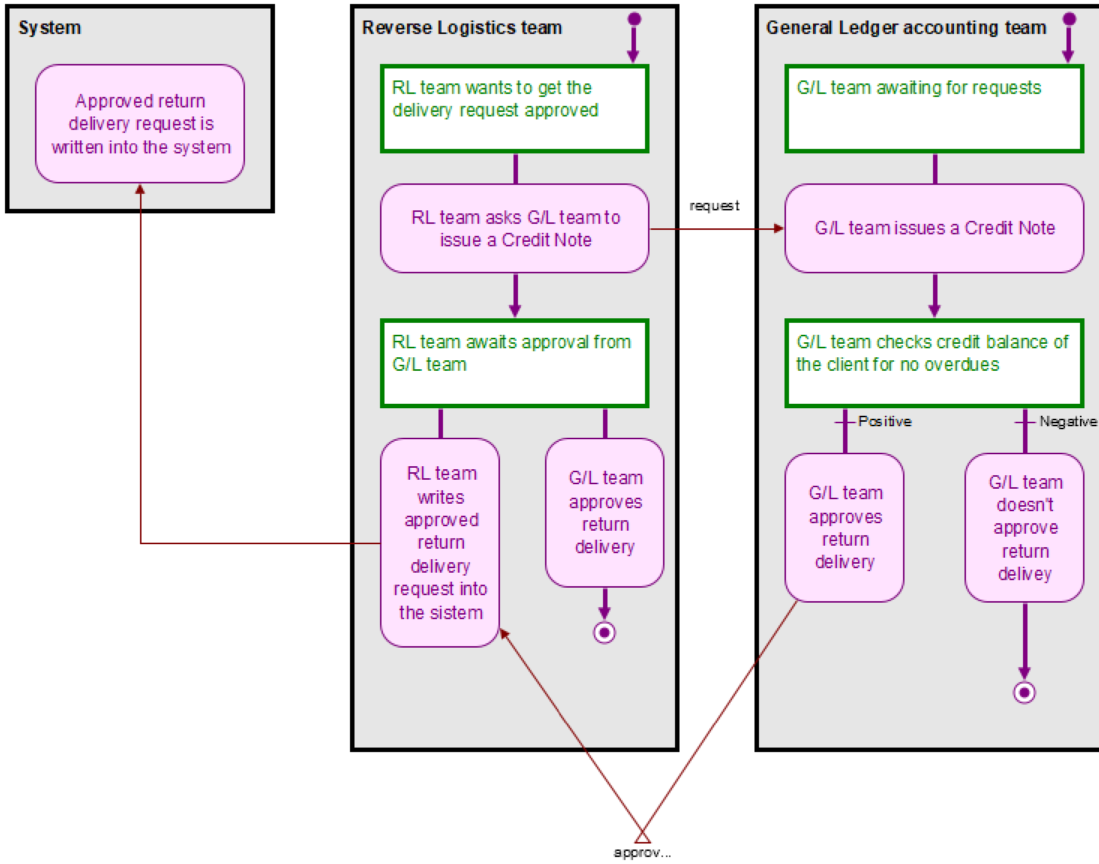
Trade Agent

Trade agent, as the main interconnector between customer and the rest of actors collects information from the customer as well as provides customer with updated information.

2. G/L process

G/L process - this scenario comes second in this project

Figure 18: 2. G/L process



Source: own figure

General Ledger accounting team

General Ledger accounting team is responsible for issuing credit note and checking customer's credit balance after receiving return request from RL team. In case if the balance is positive, G/L team approves return delivery and sends this approval to RL team.

Reverse Logistics team

At Figure 18 Reverse Logistics team is responsible for requesting the approval for return delivery from G/L team. In case if G/L team approves return delivery, RL team writes approves return delivery request into the system.

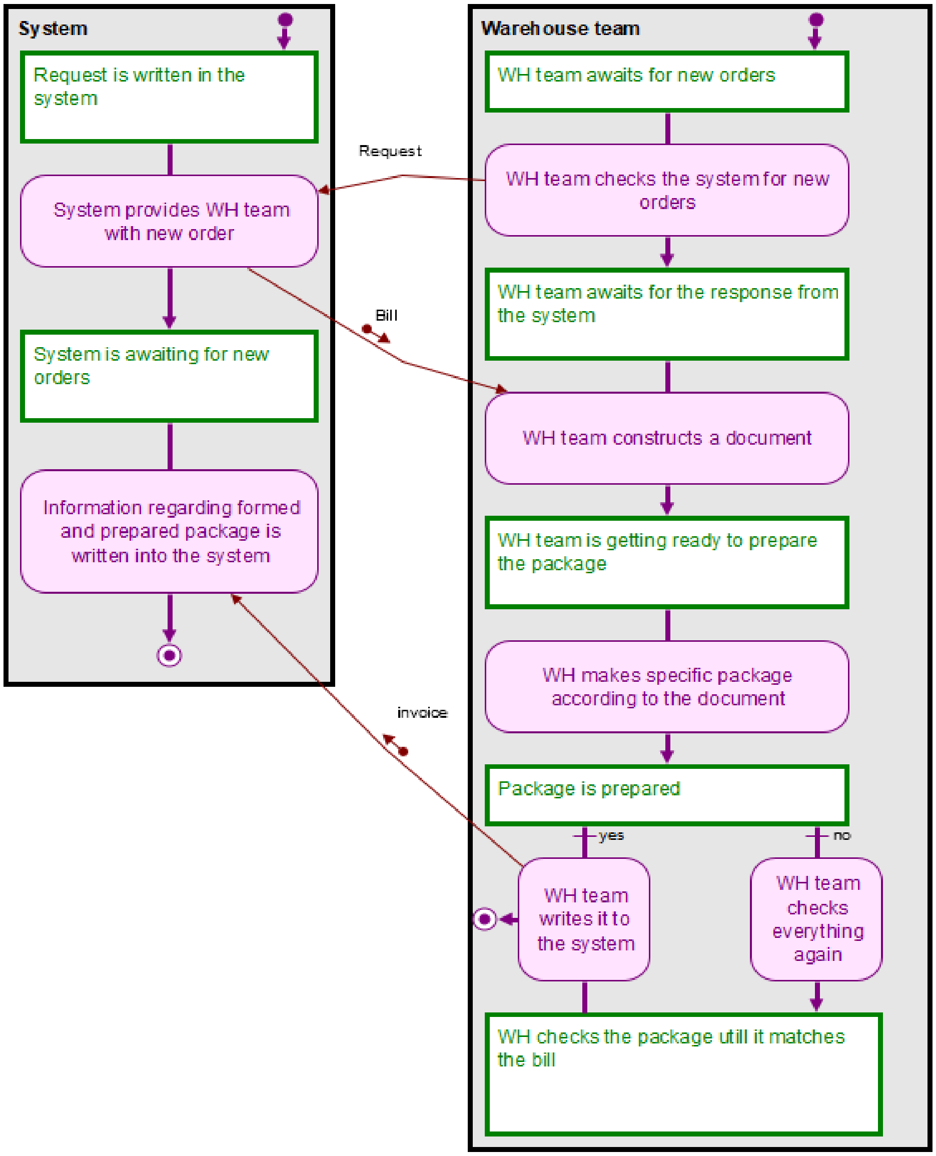
System

System plays the role of information storage for other actors in this stage.

3. Warehouse packaging

Warehouse packaging - this scenario comes third in this project

Figure 19: 3. Warehouse packaging



Source: own figure

<u>System</u>

At this stage system, in response to the request of the warehouse team, provides them with essential information regarding new order in form of bill (initial invoice). At the end of this stage final invoice is written by warehouse team into the system.

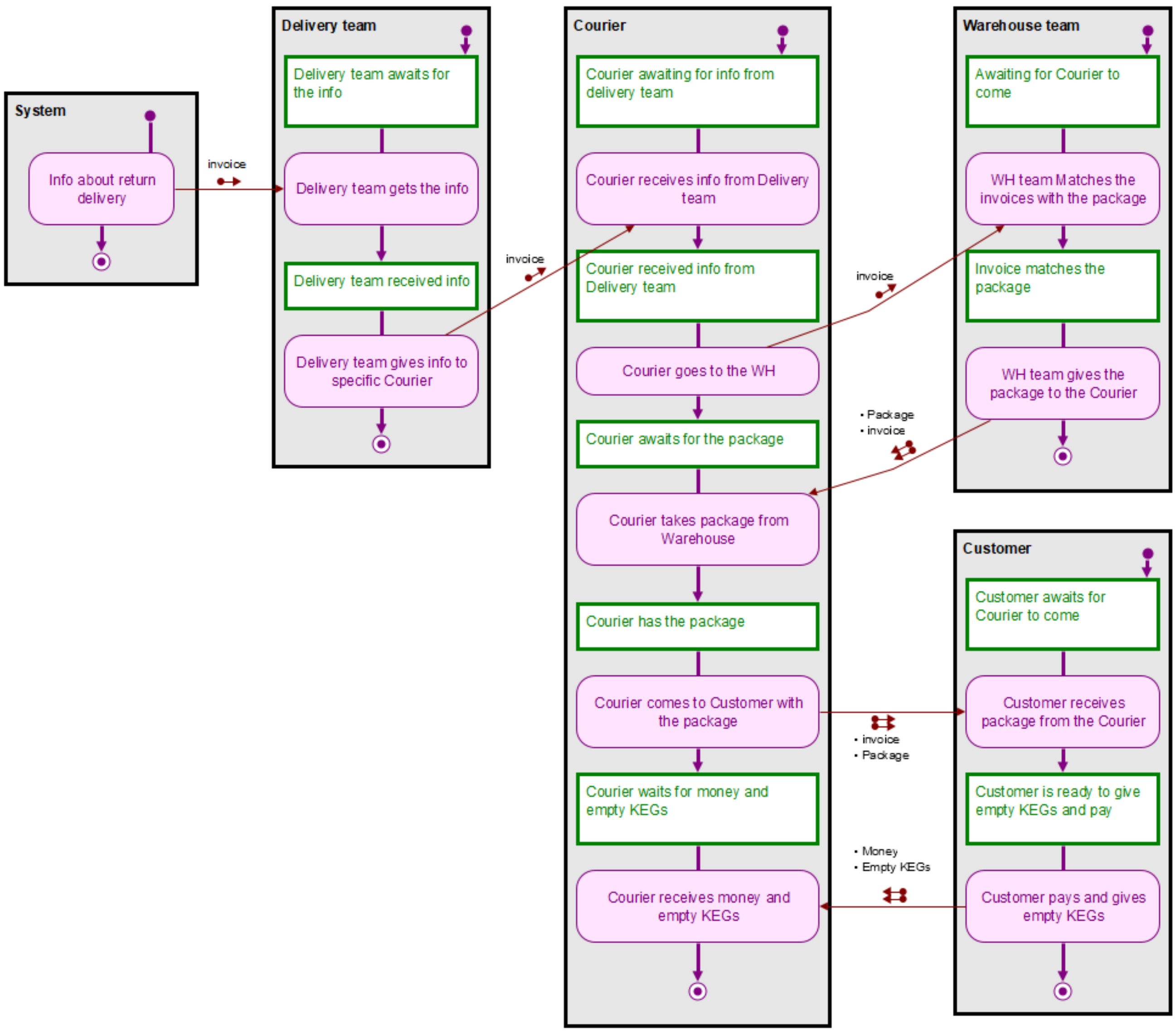
<u>Warehouse team</u>

At Figure 19 warehouse team in accordance to the initial invoice received constructs the package. Taking into consideration all available products requested in invoice, their due dates, weight and size warehouse team prepares package and the final invoice

4. Delivery to customer

Delivery to customer - this scenario comes fourth in this project

Figure 20: 4. Delivery to customer



<u>Courier</u>

Looking at Figure 20, it can be seen that at this stage courier plays the central role in the process. Initially, courier receives the information from the delivery team together with invoice. With this invoice courier goes to the warehouse. There courier receives package according to invoice provided. When courier has the package, he/she goes to customer to give the invoice and package. In return, courier receiver from the customer money and empty kegs

Customer

This is the exact point where the main interaction outside of the company takes place. Right at this moment customer gives back empty kegs, which would start their long road for being refilled, brought to the market and reused. Customer also pays money for the package provided according to the information provided in the invoice.

Delivery team

The role of delivery team here is to get the info regarding the delivery and define a specific courier, which is going to execute the delivery itself and to provide him/her with all required information and documentation.

System

System here plays the role of transferring information from previous stages. As storage of information, system notifies delivery team about invoice and package, which are ready and waiting for delivery.

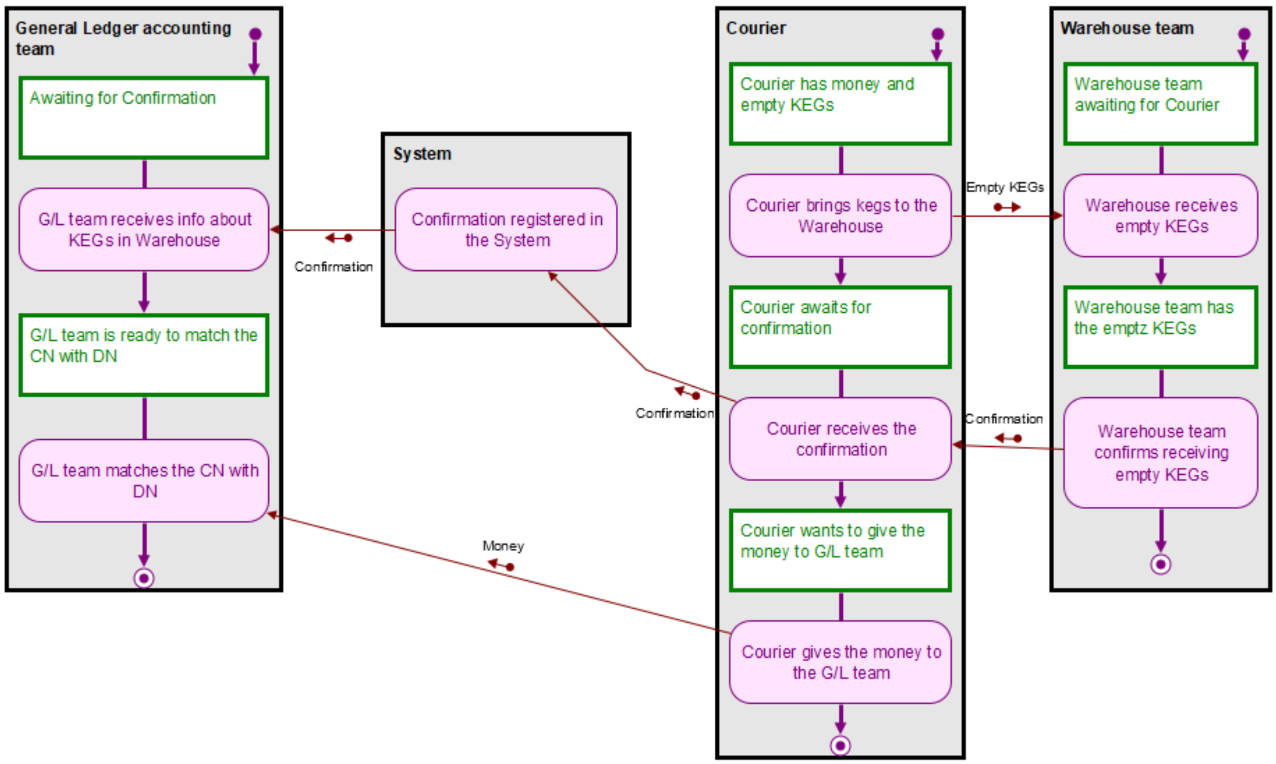
Warehouse team

Warehouse team waits for the courier and according to the provided invoice gives courier the package. Also, invoice is being matched with the package.

5. Courier bring KEGs

Courier bring KEGs - this scenario comes fifth in this project.

Figure 21: 5. Courier bring KEGs



Source: own figure

Courier

Once again, at Figure 21 it is shown can see that at this stage courier plays the central role in the process. Initially, courier, who holds money and empty kegs, brings them to the warehouse. There courier receives the confirmation of receiving empty kegs and registers it in the system. Finally, courier brings money to the G/L team

General Ledger accounting team

General Ledger accounting team, in its turn, receives confirmation of empty kegs being in warehouse through the system. When G/L team becomes ready to match credit note and debit note, they receive the payment and match it with credit and debit notes updating credit balance of the customer.

System

System at this stage provides every actor with most recent information updates being written by other actors. It transfers confirmation of receiving empty kegs by warehouse team from courier to G/L team.

Warehouse team

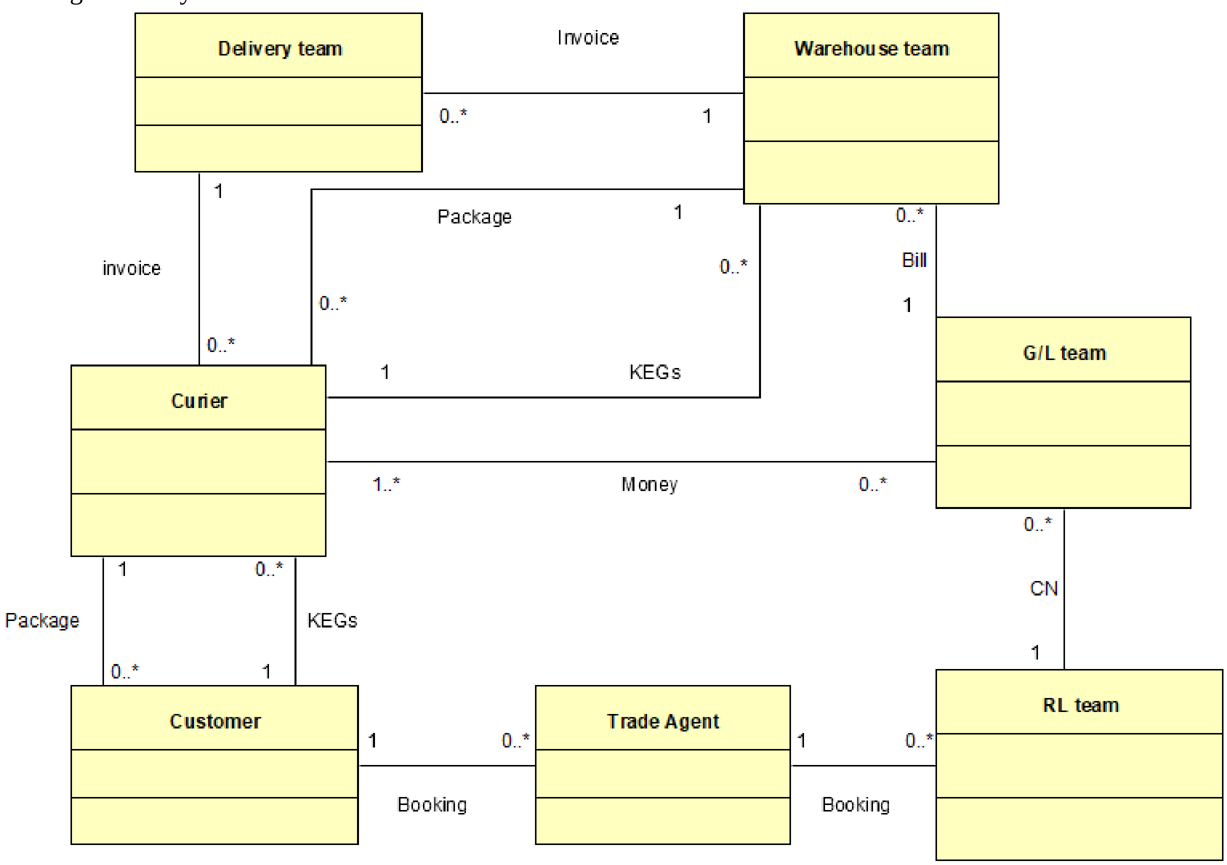
Warehouse team starts this stage waiting for the courier to bring empty kegs to the warehouse. After receiving empty kegs and checking their RFID, warehouse team confirms receiving empty kegs by providing confirmation to the courier.

4.2.11. Conceptual

System

At the Figure 22 is shown the total overlook the whole process. Collaborations and data flows are marked with lines. "1" at the beginning of the line means that there is one actor chosen amongst a huge variety of possible actors. "0..*" at the end of the line means than this one actor can receive similar requests or data flows from many other actors.

Figure 22: System



Source: own figure

As a conclusion to this visualization it should be admitted once again that this is only one of possible structures for the keg return process. This process may include different internal and external actors conducting similar roles or substituting each other.

RFID can possibly drastically change and reintroduce the management of retail returns. Today, with item identification based on bar code, both producers and retailers have little data on what exactly is being returned. When RFID labeling of individual products winds up, this will give an opportunity for all actors in the returns management process to have far more inventory visibility and create value from the process.

By sharing data about: product line, manufacturer, store, dates of sale and consumer to producers of goods, both sides will have the capacity to better maintain returns procedures and gain understanding of patterns that may transform through inventory planning and modelling for different products in different markets. Yet, some retailers may be concerned about privacy. A few big American retailers have just gathered and follow up on arrangements of clients on supposed "don't return" lists, which forbid customers who routinely make inadequate quantities of returns from bringing products back for credit. Such lists incorporate people who may have bought products through fraud or shoplifting and after that later tried to return the products for money or credit.

4.2.11. SWOT Analysis

SWOT analysis focuses on the internal strengths and weakness as well as the external opportunities and threats. This analysis enables the organisation to achieve its objectives with the attributes in existence as well as identify what can cause harm to the organisation. For this research, the SWOT analysis is as follows:

Figure 23 SWOT of RFID in RLSC

	STRENGTHS	**WEAKNESSES**
OPPORTUNITIES	- No need for direct contact with the label; - Read several labels simultaneously; - The accuracy of reading the mark is not affected by weather conditions; - Placing a tag inside an object allows you to exclude any physical impact on it; - Identification of objects can be carried out even if they are at large distances from the reader; - Some types of tags provide active interaction with any information systems.	- Screening of labels with goods containing large metal elements → Plastic and carbon barrels may solve the problem. - Relatively high cost of RFID tags → Price is constantly decreasing - The complexity initial installation of RFID tags → Can be solved by installation of RFID tags by initial manufacturers
THREATS	- High energy consumption makes it energy dependent. - Technology is almost useless without contemporary software → Software dependent	- Placing of tag/label inside the project might be harmful - Electro-magnetic emissions - Tags/labels can be remotely read and/or hacked threatening privacy

Strengths

- Basic RFID already implemented in the brewery itself;
- Simple search for a given product or group of goods;
- Identification of objects can be carried out even if they are at large distances from the reader (up to 100 m), and also move at a speed of up to 100 km / h;
- Some types of tags provide active interaction with any information systems, allowing not only to read information, but also to record it;
- Read several labels simultaneously (there are devices capable of registering up to 200 objects per second);
- Placing a tag/label inside an object allows you to exclude any physical impact on it, providing virtually endless service life;

Weaknesses

- Screening of labels with goods containing large metal elements (including foil or metal sputtering) or liquids;
- Relatively high cost of RFID tags (for simple labels-stickers as for 2014 it was minimal about $ 0.15 in large volumes);
- The complexity initial installation of RFID tags. it would be significantly better, if the products will already come from the manufacturer with labels, but while the manufacturers are ready for this a little;

Opportunities

- Inventory check (inventarization) of a given group or zones of goods in a warehouse;
- Goods shipment clearance;
- Acquisition and verification of the order collection process regarding nomenclature and quantity;
- Receipt of goods that came to the warehouse, without the necessary access to each unit of goods;

Threats

- Bad SCM can affect the image of the company;
- Software dependent;
- Energy dependent (active RFID systems);
- Placing of tag/label inside the project might be harmful;
- electro-magnetic emissions can harm people or create interference;
- tags/labels can be remotely read and/or hacked threatening privacy;
- Negative feedback or ignorance from other members of SC;
- New technological trends that may make RFID obsolete.

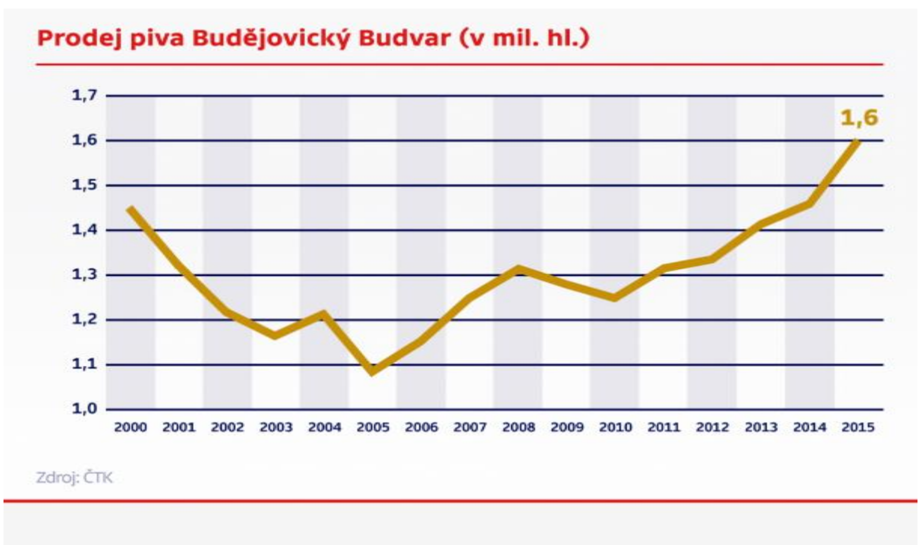
Obviously, the technology of radio-frequency identification is only at the beginning of its development path, but, judging by the successes achieved, it has good potential. There are a number of logistics processes in which there are no alternatives to this technology, for example: ongoing control of personnel, fleet management or tracking of cargo transportation. At first glance, a reliable and inexpensive bar coding system combining the price / quality parameters looks more attractive, but it is not able to offer an optimal solution to these problems. Complex control over all logistics operations using RFID with a large initial investment will subsequently achieve significantly greater strategic advantages.

Even if we consider the advantages obtained only at the level of one enterprise, their list will inspire any head of the logistics department: reducing manual labor, reducing the number of errors (all types), reducing the paperwork, increasing the level of control of all processes, improving the accounting system, However, the modern economy is increasingly seeking to globalization and integration. Thus, for the successful operation of the enterprise, the most important is the effective information interaction with partners in the supply chain. And at this level, the possibilities of radio-frequency identification are fully revealed. The use of unified standards for the formation of information arrays allows us to build a harmonious system of mutually beneficial data exchange and successfully integrate into the business community on a par with the largest transnational corporations.

4.3 Econometric analysis

This project is about Earnings Before Tax, Budvar price per litre, the production by Budvar, Carlsberg price per litre, InBev price per litre, Reverse Logistics effect (factor) and about certain dependency which is clearly should exist between these chosen variables. The reason why this work is trying to emphasize exactly on Earnings Before Tax and its most important connections, is the state of modern world`s economy. There is surely nothing new in fact, that today`s companies are very strong influenced by EBT data. About some companies, it even could be said, that they are still working only because of good EBT numbers. And EBT is one of the greatest way of defining company’s efficiency – that`s why this project is concentrated on EBT. Research will try to show the impact, which production, competitors prices and reverse logistics effect have on earnings before taxes by Budweiser Budvar, which is the one of the biggest beer company in CR.

Figure 24 Annual sales of beer by Budweiser Budvar 2000-2015



Source: Česká Televize (2017)

As it can be seen at Figure 23, Budweiser Budvar was suffering a decline in sales in the period 2000-2005. This is the reason, why research period starting from year 2006 has been chosen.

Aims

An attempt to determine the factors, affecting the earnings before tax by the Budweiser Budvar in CR. In the research the will be an attempt to determine the significance of the influence of Budvarprices, Calrsberg prices, InBev prices, production at Budweiser Budvar and Reverse Logistics factor. These factors have comprised the aim of the research, which is achieved in the work by addressing the following goals:

a) describing the behavior of EBT of Budweiser Budvar;

b) finding the significant factors that affect the EBT;

c) explaining and predicting the future of the Budweiser's EBT;

It is believed by the author that the future of Budweiser's EBT strongly depends on developments in production and reverse logistics, as well as being significantly impacted by the visible drop in the Budweiser's prices that has a potential to negatively influence Budweiser's EBT trends.

Assumptions

There are several assumptions which this research will try to prove by making analysis of data: Earnings Before Tax depends on Budvar price per litre, the production by Budvar, Carlsberg price per litre, InBev price per litre, Reverse Logistics effect. More specifically:

- Increase of Budvar price per litre causes increase in Earnings Before Tax
- Increase of Carlsberg price per litre causes increase in Earnings Before Tax
- Increase of InBev price per litre causes increase in Earnings Before Tax
- Increase of Reverse Logistics effect causes increase in Earnings Before Tax
- Increase of production level by Budvar causes increase in Earnings Before Tax

4.3.1 One equation model

This one-equation model is focused on the Earnings Before Tax (EBT) at Budejovicky Budvar during the years 2006 to 2016. Beside the EBT as the explained variable, four explanatory variables were chosen – Budvar price per litre, the production by Budvar, Carlsberg price per litre, InBev price per litre, Reverse Logistics effect.

1.1.1. Economic model $y_{1t} = f\,(x_{1t} + x_{2t} + x_{3t} + x_{4t} + x_{5t} + u_{1t})$

1.1.2. Econometric model (β_{11}) $y_{1t} = \gamma_{11}x_{1t} + \gamma_{12}x_{2t} + \gamma_{13}x_{3t} + \gamma_{14}x_{4t} + \gamma_{15}x_{5t} + \; + u_{1t}$

y_{1t} – Earnings Before Tax (thousand CZK)

x_{1t} – Interceptor

x_{2t} – Budvar price (USD per Ltr)

x_{3t} – Carlsberg price (USD per Ltr)

x_{4t} – InBev price (USD per Ltr)

x_{5t} – Reverse Logistics factor (rate of usage)

u_{1t} – random error

1.2 Data base

Prices were calculated as averages per every year for each beer company. Statistical methods were used to collect and analyze the date from open sources. Calculation data is available at Appenix 2. The data was combined into an excel table.

Table 1. Data for calculation of the first model

Year	EBT	B Price	C Price	In Price	R.L. factor	B Production
2006	267 200	0,268	15,052	18,525	0,200	1 152 000
2007	302 000	0,290	14,726	19,795	0,300	1 253 048
2008	213 000	0,357	10,607	17,682	0,400	1 312 580
2009	298 600	0,287	13,456	10,774	0,400	1 275 271
2010	219 970	0,338	12,205	10,990	0,400	1 250 096
2011	239 682	0,368	12,071	10,228	0,500	1 318 709
2012	222 642	0,329	11,861	10,127	0,600	1 337 923
2013	325 836	0,342	11,902	9,801	0,700	1 422 728
2014	307 399	0,305	12,333	9,749	0,800	1 457 782
2015	349 831	0,264	14,287	10,660	0,900	1 601 938
2016	367 300	0,261	15,269	11,034	1,000	1 663 000

Source: Budejovickybudvar.cz, AB InBev, Carlsberg group and own calculations (2017)

Budweiser Budvar employee in May 2016 mentioned: “Despite of the small pause during 2008-2010 it is a constant process of processes improvement and optimization.” According to this statement a pause in RL supply chain development at Budweiser Budvar can be assumedat the period of 2008-2010 (see Table 1). The highest impact is considered the last available period with most recent data of 2016 (see Figure 23). In earlier periods investments on RL supply chain were less significant.

Figure 25 Global Beer War. AB InBev against Budweiser Budvar at 2010

Source: (Hospodarske noviny, 2017)

AB InBev was chosen as one of the main influencing variables to analyze due to a huge global beer war (see Figure 24) taking place at global beer market. Recently Budweiser Budvar started to win several courts at European countries to forbid AB InBev to sell their beer under Budweiser trademark. Regardless of low competition in Czech Republic, this is a major issue on many markets all around the globe.

Correlation matrix

Pearson Correlation – These numbers measure the strength and direction of the linear relationship between the two variables. The correlation coefficient can range from -1 to +1, with -1 indicating a perfect negative correlation, +1 indicating a perfect positive correlation, and 0 indicating no correlation at all. A variable correlated with itself will always have a correlation coefficient of 1. 5% critical value (two tailed) - this is the p-value associated with the correlation. (IDRE Stats, 2017)

Using given data, it is possible to calculate a correlation matrix for dependent and independent variables. The results of calculating Pearson correlation coefficients is given in the Table 2. As per Pearson Correlation, Correlation Coefficients were calculated, using the observations 2006 – 2016. 5% critical value (two-tailed) is equal to 0.6021 for 11 observations.

Table 2. Correlation matrix for one equation linear regression model

	EBT	BPrice	CPrice	InPrice	RLfaktor
EBT	1.0000	-0.7809	0.6720	-0.2384	0.7256
BPrice	-0.7809	1.0000	-0.7741	-0.0537	-0.2564
CPrice	0.6720	-0.7741	1.0000	0.3565	0.0193
InPrice	0.2384	-0.0537	0.3565	1.0000	-0.6808
RLfaktor	0.7256	-0.2564	0.0193	-0.6808	1.0000

Source: own computation

Multicollinearity test

Multicollinearity refers to a situation where a number of independent variables in a multiple regression model are closely correlated to one another. Multicollinearity can lead to skewed or misleading results when a researcher or analyst is attempting to determine how well each one of a number of individual independent variables can most effectively be utilized to predict or understand the dependent variable in a statistical model. In general, multicollinearity can lead to wider confidence intervals and less reliable probability values (P values) for the independent variables. (Investopedia, 2017)

Variance Inflation Factors

Minimum possible value = 1.0

Values > 10.0 may indicate a collinearity problem

Table 3. Multicollinearity test results for one equation linear regression model

BPrice	2.989
CPrice	3.358
InPrice	2.560
RLfaktor	2.247

Source: own computation

As per Gretl`s correlation matrix, there is no multicollinearity in the model. However, there is a strong negative relation between Carlsberg price and Budvar price, which is reasonable and fits the main economic principles.

1.3 Estimation of parameters in SW Gretl

Using software package Gretl the parameters for one-equation we estimated. For the calculation was used Ordinary Least Squares method, using observations 2006-2016. Number of observation periods is 11. Earning before tax was chosen as the dependent variable.

Table 4. Parameters for one equation linear regression model

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	133.049	61.3985	2.167	0.0734	*
BPrice	−303.028	99.1280	−3.057	0.0223	**
CPrice	12.0991	2.65906	4.550	0.0039	***
RLfactor	130.494	14.3609	9.087	9.97e-05	***
InPrice	0.840545	1.00024	0.8403	0.4329	

Source: own computation

Table 5. Coefficients summary for one equation linear regression model

Mean dependent var	282.0715		S.D. dependent var	47.92146
Sum squared resid	358.6664		S.E. of regression	7.731607
R-squared	0.984382		Adjusted R-squared	0.973970
F(3, 45)	94.54188		P-value(F)	0.000015
Log-likelihood	−34.77306		Akaike criterion	79.54612
Schwarz criterion	81.53560		Hannan-Quinn	78.29203
rho	−0.291539		Durbin-Watson	2.495612

Source: own computation

The model shows accordingly high level of determination coefficient, $R^2 = 0{,}984$. It can serve as a proof that estimated model is significant, once it describes almost 98% of all market valuation dynamics for the given dataset.

Excluding the constant, p-value was highest for variable 5 (InPrice)

LM test for autocorrelation up to order 1 -

Null hypothesis: no autocorrelation

Test statistic: LMF = 0.667559

with p-value = P(F(1, 5) > 0.667559) = 0.451064

1.4 Economic verification

$$y_{1t} = \gamma_{11}x_{1t} + \gamma_{12}x_{2t} + \gamma_{13}x_{3t} + \gamma_{14}x_{4t} + \gamma_{15}x_{5t} + u_{1t}$$

$$y_{1t}=133.049 - 303.028^* x_{2t} + 12.0991^* x_{3t} + 0.840545^* x_{4t} + 130.494^* x_{5t} + u_t$$

Calculated absolute elasticities for regression variables are shown in the Table 6

Table 6. Absolute elasticities of independent variables to dependent variable

Variable name	Change of independent variable	Change of dependent variable
γ_{11} – constant	All other variables = 0	133.049 mln CZK
γ_{12} - Budvar price	+ 1 USD	– 303.028 mln CZK
γ_{13} – Carlsberg price	+ 1 USD	+ 12.0991 mln CZK

γ_{14} – InBev price	+ 1 USD	+ 0.840545 mln CZK
γ_{15} – RL factor	+ 1 unit (100%)	+ 130.494 mln CZK

Source: own computation

At the beginning, four assumptions were stated:

- Increase of Budvar price per litre causes increase in Earnings Before Tax
- Increase of Carlsberg price per litre causes increase in Earnings Before Tax
- Increase of InBev price per litre causes increase in Earnings Before Tax
- Increase of Reverse Logistics effect causes increase in Earnings Before Tax

As it can be concluded from the data provided by Table 6, The model has proven <u>three assumptions out of four</u> made at the beginning of the paragraph 4.3.1.

1.5 Statistical verification (Statistical significance of parameters R2)

Statistical verification of the equation:

Goodness of fit = R^2 = coefficient of determination = 0.984382 i.e. 98.4 per cent of variability of EBT was estimated by this model. Variation of EBT at Budweiser Budvar was described from 98.4% which is very good.

Durbin-Watson value 2.4956: Dl is 0,4441 and Dh is 2,2833, the value is not in the interval <0,441; 2,2833>) signifies that it is significantly possible to decide whether there is autocorrelation among residuals. **Breusch-Godfrey** test for first-order autocorrelation has shown no significant autocorrelation problem.

As per these results, it is possible to say that for the period of 2006 - 2016 EBT of Budweiser Budvar was under significant influence of Budvar price, Carlsberg price and RL factor. At the same time, Constant and InBev price proved to be insignificant for EBT of Budweiser Budvar.

The most influencing factor is Budvar price. This factor has the highest elasticity, the highest regression coefficient and the highest correlation with market value. The dependence is negative, thus increase of Budvar should decrease EBT of Budweiser Budvar.

1.6. Econometric verification

Autocorrelation

Breusch-Godfrey test for first-order autocorrelation

OLS, using observations 2006-2016 (T = 11)

Dependent variable: uhat

Table 7. Breusch-Godfrey test for one equation linear regression model

	Coefficient	*Std. Error*	*t-ratio*	*p-value*
const	20.0154	67.7571	0.2954	0.7796
BPrice	−37.0512	111.621	−0.3319	0.7534
CPrice	−1.23567	3.12612	−0.3953	0.7089
RLfactor	4.78562	15.8946	0.3011	0.7755
InPrice	0.417227	1.14888	0.3632	0.7313
Uhat_1	−0.426568	0.522088	−0.8170	0.4511

Source: own computation

Breusch-Godfrey test didn’t show any autocorrelation in the model.

Unadjusted R-squared is equal to 0.117786, which means that this test describes only 11.8% of the whole model

According to the Gretl`s output, there is the result for Durbin-Watson statistic, which is 2.4656. This value indicates there is no autocorrelation, existing in this model.

Heteroscedasticity

White's test for heteroskedasticity

OLS, using observations 2006-2016 (T = 11)

Dependent variable: uhat^2

Table 8. White‘s test for one equation linear regression model

	Coefficient	*Std. Error*	*t-ratio*	*p-value*
const	877.161	7197.82	0.1219	0.9141
BPrice	13746.1	20895.1	0.6579	0.5782
CPrice	−404.273	872.912	−0.4631	0.6888

RLfactor	73.0114	1567.99	0.04656	0.9671
InPrice	−41.5297	241.486	−0.1720	0.8793
sq_BPrice	−21721.2	33611.2	−0.6462	0.5844
sq_CPrice	15.4564	32.8690	0.4702	0.6845
sq_RLfactor	−113.803	1181.27	−0.09634	0.9320
sq_InPrice	−0.426568	8.11273	0.1057	0.9255

Source: own computation

Unadjusted R-squared = 0.565338, which means that this test describes only 56.5% of the whole model. Yet, it describes more than half of it.

Table 9. Calculated values for White's test for one equation linear regression model

Calculated variables	TR2	Chi-square (8)	p-value
values	6.218719	> 6.218719	0.622747

Source: own computation

According to the results of White test, there is the p value of 0.622747. Then, p value is compared with alpha level of 0.01. Therefore, 0.622747 > 0.01, so null hypothesis is accepted, which means that there is no heteroskedasticity in the model.

Normallity

Statistic test for normality show whether the distribution of values is symmetric or asymmetric. The values were divided into 5 bins (intervals). Mean value is -3.87569e^{-014}, while sd is 7.73161

Frequency distribution for uhat4, obs 1-11

Table 10. Calculated intervals for normality test for one equation linear regression model

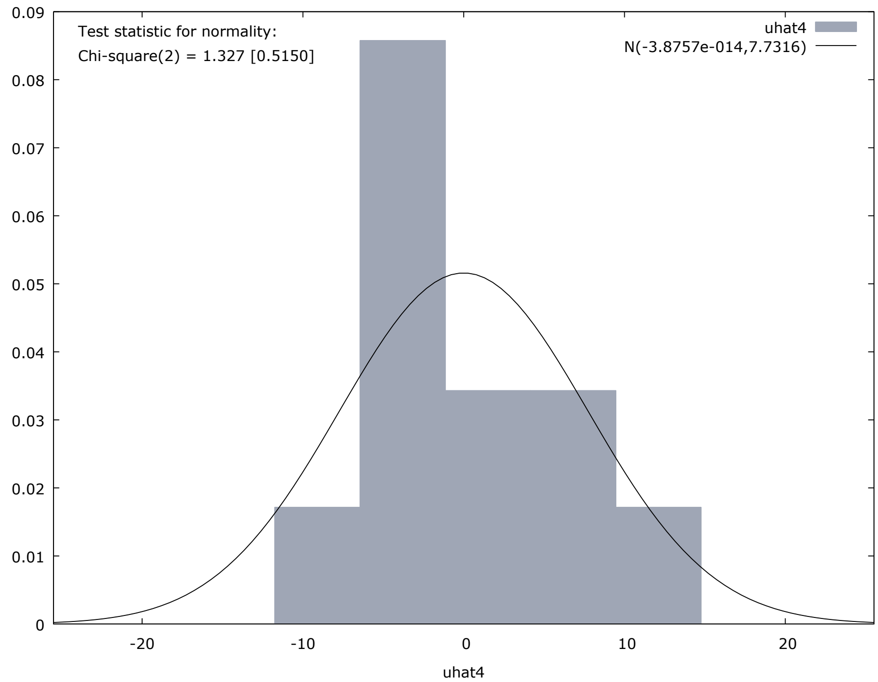
Interval	*Midpt*	*Frequency*	*Relative*	*Cumulated*	
< -6.4449	-9.0955	1	9.09%	9.09%	***
-6.4449 - -1.1439	-3.7944	5	45.45%	54.55%	****************
-1.1439 - 4.1572	1.5066	2	18.18%	72.73%	******
4.1572 - 9.4582	6.8077	2	18.18%	90.91%	******

>= 9.4582	12.109	1	9.09%	100.00%	***

Source: own computation

Test for null hypothesis of normal distribution: Chi-square(2) = 1.327 with p-value 0.51500

Figure 26 First equation normality test



Source: own calculation

To conduct normality test we will consider 2 hypotheses: H_0: the distribution is normal; H_a: the distribution is not normal. According to the results of the normality test given in Table 10, p=0.51500, which means the model’s distribution is asymmetric (see Figure 25).

1.7. Model application (coefficients of elasticity; scenarios' simulation)

Elasticity coefficients

For 95% confidence intervals, t(6, 0.025) = 2.447

Table 11. Calculated values for prognosis for one equation linear regression model

	EBT	prediction	std. error	95% interval
2016	373.984087	378.338801	9.620267	354.798855 - 401.878747

Table 12. Relative elasticities of independent variables to dependent variable based on 2016

Variable name	Change of independent variable	Change of dependent variable
Budvar price	+ 1%	– 0,209046%
Carlsberg price	+ 1%	+ 0,4883%
InBev price	+ 1%	+ 0,02451%
RL factor	+ 1%	+ 0,34491%

Source: own computation

Direct price elasticity *-303,028*(0,261/378,3388)= - 0,209046*, that means when Budvar prices increase by 1% EBT decreases by 0,209046%

Cross price elasticity *12,0991*(15,269/378,3388)=0,4883,* that means when Carlsberg prices increase by 1% EBT increases by 0,4883%

Cross price elasticity *0,840545*(11,034/378,3388)=0,02451*, that means when InBev prices increases by 1% EBT increases by 0,02451%

RL factor Elasticity *130.494*(1/378,3388)=0,34491*, that means when RL factor increase by 1% EBT increases by 0,34491%

Scenario Simulation

Table 13. Estimated scenario simulation for one equation linear regression model

Input used	Change of independent variable	Change, %	Simulated result, mln CZK	Change, %
Data for 2016	No change	0.0	378.468	0.0
Budvar price	+ 0.15	57.47	333.014	- 13.649
Carlsberg price	- 0.25	16.37	375.443	- 0.8
InBev price	+ 1.5	13.59	379.699	0.32
RL factor	+ 0.5	50.00	443.685	14.7

Source: own computation

EBT value prognosis according to estimated model would be following:

$y_{1t} = x_{1t} + x_{2t} + x_{3t} + x_{4t}$ = 133,049 – 303,028*0,261 + 12,0991*15,269 + 0,840545*11,034 + 130,494*1 = 378,4684234

<u>Scenarios</u> described in table 12:

1) What could have happened in 2016 to Budweiser Budvar's EBT, if Budvar price had increased by another 0**,15** USD? Real EBT was **373,98**.

Yt=133,049 – 303,028*0,411 + 12,0991*15,269 + 0,840545*11,034 + 130,494*1 = 333,0142234

EBT could have decreased to 333,0142 million CZK in that case.

2) What could have happened in 2016 to Budweiser Budvar's EBT, if Carlsberg price had decreased by another 0**,25** USD? Real EBT was **373,98**.

Yt=133,049 – 303,028*0,261 + 12,0991*15,019 + 0,840545*11,034 + 130,494*1 = 375,4436449

EBT could have increased to 375,4436 million CZK or by 0.806% in that case.

3) What could have happened in 2016 to Budweiser Budvar's EBT, if InBev price had increased by another 1**,50** USD? Real EBT was **373,98**.

Yt=133,049 – 303,028*0,261 + 12,0991*15,269 + 0,840545*12,534 + 130,494*1 = 379,699082

EBT could have increased to 379,699 million CZK or by 0.324% in that case.

4) What could have happened in 2016 to Budweiser Budvar's EBT, if RL price had increased by another **0,5**? Real EBT was **373,98**.

Yt=133,049 – 303,028*0,261 + 12,0991*15,269 + 0,840545*11,034 + 130,494*1.5 = 443,685262

EBT could have increased to 443,685 million CZK or by 33.233% in that case.

One-equation model conclusion

As it can be concluded from the tests and calculations above, there is reverse relation between Earnings Before Tax and Budvar prices, but there is direct relation between Budvar prices, Carlsberg prices, InBev prices and Reverse Logistics factor. This does not align with our assumptions at the beginning of the modeling. Budvar prices were expected to have direct (forward) relation with EBT.

Yet, it should be admitted that values of statistical verification are good. In this model, there is quite high R squared and 3 of 4 significant variables. InBev prices may have become insignificant because of it’s the less representation on the main market of Budvar in Czech Republic. In other words, people don’t buy InBev as a substitute for Budvar.

Considering the elasticity coefficients, it is shown that the elasticity of the model is low. Yet, regarding the data collected and shown in data tables, it is shown that for Budejovicky Budvar price, InBev and Carlsberg prices have very stable values and didn’t changed much since year 2006. Nonetheless, the level of production increased much more as well as EBT, which will be shown in the simultaneous model.

4.3.1 Simultaneous model

2.1.1 Assumption

Previous is was assumed that Earnings Before Taxes depending on Budvar price per litre, the production by Budvar, Carlsberg price per litre, InBev price per litre, Reverse Logistics effect. To make simultaneous model the level of production as a dependent variable is included because level of production depends on Budvar price, competitor prices and RL effect.

- Increase of Budvar price per litre causes increase in Earnings Before Tax
- Increase of InBev price per litre causes increase in Earnings Before Tax
- Increase of Reverse Logistics effect causes increase in Earnings Before Tax
- Increase of production level by Budvar causes increase in Earnings Before Tax
- Increase of Budvar price per litre causes increase in production level by Budvar
- Increase of Carlsberg price per litre causes increase in production level by Budvar
- Increase of Reverse Logistics effect causes increase in production level by Budvar
- Increase of Earnings Before Tax causes increase in production level by Budvar

2.1.1. Economic model

$$y_{1t} = f\,(y_{2t} + x_{1t} + x_{2t} + x_{3t} + x_{4t} + u_{1t})$$

$$y_{2t} = f\,(y_{1t} + x_{1t} + x_{2t} + x_{3t} + x_{4t} + u_{1t})$$

2.1.2. Econometric model

$$(\beta_{11})y_{1t} = \beta_{12}y_{2t} + \gamma_{11}x_{1t} + \gamma_{12}x_{2t} + \gamma_{15}x_{5t} + u_{1t}$$

$$(\beta_{21})y_{2t} = \beta_{22}y_{1t} + \gamma_{21}x_{1t} + \gamma_{23}x_{3t} + \gamma_{24}x_{5t} + u_{2t}$$

2.1.3 Declaration of variables (+ units):

y_{1t} – Earnings Before Tax (thousand CZK)

y_{2t} – production by Budvar (thousands of hectoliters)

x_{1t} – Intercept term – unit vector

x_{2t} – Budvar price (USD per Ltr)

x_{3t} – Carlsberg price (USD per Ltr)

x_{4t} – Reverse Logistics factor (rate of usage)

x_{5t} – InBev price (USD per Ltr)

u_t – random error

2.2. Data set (data table + source; correlation matrix + multicollinearity elimination)

2.2.1 Data table

Prices were calculated as averages per every year for each beer company. Statistical methods were used to collect and analyze the date from open sources. Calculation data is available at Appenix 2. The data was combined into an excel table

Table 14. Data for calculation of the simultaneous model

YEAR	EBT	B Price	B Production	C Price	R.L. factor	In Price
2006	268	0,288	1 152	15,012	0,20	18,725
2007	293	0,300	1 253	15,726	0,30	19,795
2008	218	0,357	1 313	10,607	0,40	17,682
2009	280	0,257	1 275	13,456	0,40	10,774
2010	237	0,348	1 250	12,205	0,45	10,990
2011	244	0,368	1 319	12,071	0,50	10,228

2012	246	0,359	1 338	11,861	0,60	10,527
2013	285	0,342	1 423	11,902	0,70	9,801
2014	308	0,305	1 458	12,333	0,80	9,749
2015	350	0,264	1 602	14,287	0,90	10,660
2016	374	0,261	1 663	15,269	1,00	11,034

Source: Budejovickybudvar.cz, AB InBev, Carlsberg group and own calculations (2017)

In the simultaneous model, it will be assumed that there could be a significant mutual relationship between Budweiser Budvar level of production and EBT.

2.2.2. Correlation matrix:

Using given data, it is possible to calculate a correlation matrix for dependent and independent variables. The results of calculating Pearson correlation coefficients is given in the Table 2. As per Pearson Correlation, Correlation Coefficients were calculated, using the observations 2006 – 2016. 5% critical value (two-tailed) is equal to 0.6021 for 11 observations.

Table 15. Correlation matrix for simultaneous linear regression model

	EBT	BPrice	BProduction	CPrice	RLfactor
EBT	1.0000	-0.7809	0.7958	0.6720	0.7256
BPrice	-0.7809	1.0000	-0.3647	-0.7741	-0.2564
BProduction	0.7958	-0.3647	1.0000	0.1403	0.9697
CPrice	0.6720	-0.7741	0.1403	1.0000	0.0193
RLfaktor	0.7256	-0.2564	0.9697	0.0193	1.0000

Source: own computation

As per results of correlation matrix, it can be concluded that multicollinearity was found in RL factor and Budvar production in simultaneous model.

2.3. Model identification

$$y_{1t} = \beta_{11} y_{2t} + \gamma_{12} x_{2t} + \gamma_{14} x_{4t} + \gamma_{15} x_{5t} + u_{1t}$$

$$y_{2t} = \beta_{21} y_{1t} + \gamma_{22} x_{2t} + \gamma_{24} x_{4t} + \gamma_{23} x_{3t} + u_{2t}$$

k Number of predetermined variables in the Model,

k_* Number of predetermined variables in equation,

k_{**} Number of predetermined variables, which are not in equation

g Number of endogenous variables in the Model

g_Δ Number of endogenous variables in particular equation

Criterion formula of identification: **$k^{**} \geq g\Delta - 1$**

Model identification:

1st equation:

$k = 4$; $k_* = 3$; $k_{**} = 1$; $g = 2$; $g_\Delta = 2$; $g_\Delta - 1 = 1$=>

$k_{**} = g_\Delta - 1$ => this means that 1st equation is **exactly identified**

2nd equation:

$k = 4$; $k_* = 3$; $k_{**} = 1$; $g = 2$; $g_\Delta = 2$; $g_\Delta - 1 = 1$=>

$k_{**} = g_\Delta - 1$ => this means that 2nd equation is **exactly identified**

2.4. Parameters' estimation using TSLSM in SW Gretl

In the context of whole model, for the 1st equation (with dependent variable "EBT") we obtained following parameters:

1-st equation parameters estimation in Gretl:

Using software package Gretl the parameters for simultaneous model were estimated. For the calculation was used Two-Staged Least Squares method, using observations 2006-2016. Number of observation periods is 11. Earning before tax was chosen as the dependent variable. Budweiser

Budvar production was chosen as instrumented variable. Instruments were: Budvar price, InBev price, Carlsberg price and RL factor.

Table 16. Parameters for 1st equation of simultaneous linear regression model

	Coefficient	*Std. Error*	*z*	*p-value*	
BProduction	0.0905529	0.115885	0.7814	0.4602	
BPrice	−210.154	155.372	−1.353	0.2182	**
CPrice	13.8964	5.19686	2.674	0.0318	***
RLfactor	72.5371	76.5224	0.9479	0.3747	

Source: own computation

Table 17. Coefficients summary for 1st equation of simultaneous linear regression model

Mean dependent var	282.0715		S.D. dependent var	47.92146
Sum squared resid	425.8251		S.E. of regression	7.799497
R-squared	0.981508		Adjusted R-squared	0.972159
F(2, 46)	3688.562		P-value(F)	1.04e-11
Log-likelihood	−98.56633		Akaike criterion	205.1327
Schwarz criterion	206.7242		Hannan-Quinn	204.1294
rho	0.074304		Durbin-Watson	1.766578

Source: own computation

The model shows accordingly high level of determination coefficient, $R^2 = 0,981$. It can serve as a proof that estimated model is significant, once it describes almost 98% of all market valuation dynamics for the given dataset.

Hausman test -

Null hypothesis: OLS estimates are consistent

Asymptotic test statistic: Chi-square (1) = 0.00424905 with p-value = 0.948027

Weak instrument test -

First-stage F-statistic (1, 7) = 1.39482

Critical values for desired TSLS maximal size, when running tests at a nominal 5% significance level:

Table 18. Weak instrument test for 1st equation of simultaneous linear regression model

size	10%	15%	20%	25%
value	16.38	8.96	6.66	5.53

Source: own computation

As it can be concluded from table 16, maximal size may exceed 25%

Table 19. Estimated parameters of the 1st equation:

0.0905529	$\beta 12$
−210.154	$\gamma 12$
13.8964	$\gamma 13$
72.5371	$\gamma 14$

Source: own computation

Final form of the 1st equation:

$y_{1t} = 0.0905529 y_{2t} - 210.154 x_{2t} + 13.8964 x_{3t} + 72.5371 x_{4t} + u_{1t}$

2nd equation parameters estimation in Gretl:

Using software package Gretl the parameters for simultaneous model were estimated. For the calculation was used Two-Staged Least Squares method, using observations 2006-2016. Number of observation periods is 11. Budweiser Budvar production was chosen as the dependent variable. Earning before tax was chosen as instrumented variable. Instruments were: Budvar price, InBev price, Carlsberg price and RL factor

Table 20. Parameters for 2nd equation of simultaneous linear regression model

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
BPrice	1407.38	211.570	6.652	0.0003	***
RLfactor	457.831	145.750	3.141	0.0164	**
InPrice	7.09797	6.57913	1.079	0.3164	
EBT	2.03822	0.501887	4.061	0.0048	***

Source: own computation

Table 21. Coefficients summary for 2nd equation of simultaneous linear regression model

Mean dependent var	1367.734	S.D. dependent var	155.4293
Sum squared resid	16386.74	S.E. of regression	48.38350
R-squared	0.935802	Adjusted R-squared	0.905900
F(4, 7)	2220.936	P-value(F)	6.16e-11
Log-likelihood	−98.56633	Akaike criterion	205.1327
Schwarz criterion	206.7242	Hannan-Quinn	204.1294
rho	0.195989	Durbin-Watson	1.571701

The model shows accordingly high level of determination coefficient, R^2 = 0,935. It can serve as a proof that estimated model is significant, once it describes almost 94% of all market valuation dynamics for the given dataset.

Hausman test -

Null hypothesis: OLS estimates are consistent

Asymptotic test statistic: Chi-square (1) = 0.873184with p-value = 0.350075

Weak instrument test -

First-stage F-statistic (1, 7) = 101.749

Table 22. Weak instrument test for 2nd equation of simultaneous linear regression model

size	10%	15%	20%	25%
value	16.38	8.96	6.66	5.53

Source: own computation

As it can be concluded from table 20, maximal size is probably less than 10%

Table 23. Estimated parameters of the 2nd equation:

2.03822	β12
1407.38	γ22
457.831	γ24
7.09797	γ25

Source: own computation

Final form of the 2nd equation:

$y_{2t} = 2.03822y_{1t} + 1407.38x_{2t} + 457.831x_{4t} + 7.09797x_{5t} + u_{2t}$

2.5. Economic verification

1st equation:

$y_{1t} = 0.0905529y_{2t} - 210.154x_{2t} + 13.8964x_{3t} + 72.5371x_{4t} + u_{1t}$

Interpretation:

Calculated absolute elasticities for 1st equation regression variables are shown in the Table 22

Table 24. Absolute elasticities for 1st equation of independent variables to dependent variable

Variable name	Change of independent variable	Change of dependent variable
Budvar production	+ 1 000 hl	0.0905529 mln CZK
Budvar price	+ 1 USD	– 210.154 mln CZK
RL factor	+ 1 unit (100%)	+ 72.5371 mln CZK
Carlsberg price	+ 1 USD	+ 13.8964 mln CZK

Source: own computation

As it can be concluded from the data provided by Table 22, The model has proven three assumptions out of four related to this equation made at the beginning of the paragraph 4.3.2.

2nd equation:

$y_{2t} = 2.03822y_{1t} + 1407.38x_{2t} + 457.831x_{4t} + 7.09797x_{5t} + u_{2t}$

Interpretation:

Calculated absolute elasticities for 2nd equation regression variables are shown in the Table 23

Table 25. Absolute elasticities for 2nd equation of independent variables to dependent variable

Variable name	Change of independent variable	Change of dependent variable
EBT	+ 1 mln CZK	– 2.03822 ths hl
Budvar price	+ 1 USD	+ 1407.38 ths hl
RL factor	+ 1 unit (100%)	+ 457.831 ths hl
Carlsberg price	+ 1 USD	+ 7.09797 ths hl

Source: own computation

As it can be concluded from the data provided by Table 23, The model has proven three assumptions out of four related to this equation made at the beginning of the paragraph 4.3.2.

2.6. Statistical verification

Statistical verification of the 1st equation:

Goodness of fit = R^2 = coefficient of determination = 0.9815 i.e. 98.2 per cent of variability of EBT was estimated by this model. Variation of EBT at Budweiser Budvar was described from 98.2% which is very good.

Durbin-Watson value 1.7665: Dl is 0,81396 and Dh is 1,75014, the value is not in the interval <0,81396; 1,75014>) signifies that it is significantly possible to decide whether there is autocorrelation among residuals. **Breusch-Godfrey** test for first-order autocorrelation has shown no significant autocorrelation problem.

As per these results, it is possible to say that for the period of 2006 - 2016 EBT of Budweiser Budvar was under significant influence of Carlsberg price. At the same time, Budweiser Budvar's production, Budvar price and RL factor proved to be insignificant for EBT of Budweiser Budvar.

The most influencing factor is Budvar price. This factor has the highest elasticity, the highest regression coefficient and the highest correlation with market value. The dependence is negative, thus increase of Budvar should decrease EBT of Budweiser Budvar.

Statistical verification of the 2nd equation:

Interpretation:

Goodness of fit = R^2 = coefficient of determination = 0.9358 i.e. 93.6 per cent of variability of EBT was estimated by this model. Variation of EBT at Budweiser Budvar was described from 93.6% which is very good.

Durbin-Watson value 1.5717: D_l is 0,81396 and D_h is 1,75014, the value is not in the interval <0,81396; 1,75014>) signifies that it is not significantly possible to decide whether there is autocorrelation among residuals. **Breusch-Godfrey** test for first-order autocorrelation has shown no significant autocorrelation problem.

As per these results, it is possible to say that for the period of 2006 - 2016 Production of Budvar was under significant influence of Budvar price, RL factor and EBT. At the same time, InBev price proved to be insignificant for production of Budvar.

The most influencing factor is Budvar price. This factor has the highest elasticity, the highest regression coefficient and the highest correlation with market value. The dependence is positive, thus increase of Budvar should increase production of Budvar.

2.7. Econometric verification

2.7.1 Autocorrelation test

1st equation autocorrelation test:

Breusch-Godfrey test for first-order autocorrelation

TSLS, using observations 2006-2016 (T = 11)

Dependent variable: EBT

Instruments: BPrice InPrice CPrice RLfaktor uhat_1

Table 26. Breusch-Godfrey test for 1st equation of simultaneous linear regression model

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
BProduction	0.0817783	0.138453	0.5907	0.5763	
BPrice	−197.009	188.743	−1.044	0.3368	

CPrice	14.2632	6.14659	2.321	0.0594	*
RLfaktor	77.7909	90.2030	0.8624	0.4216	
uhat_1	0.0961571	0.503005	0.1912	0.8547	

Source: own computation

Breusch-Godfrey test didn't show any autocorrelation in the model.

Unadjusted R-squared is equal to 0.981448, which means that this test describes almost 98.1% of the whole model.

According to the Gretl`s output, there is the result for Durbin-Watson statistic, which is 1.7665. Also there is the result for Pseudo-LMF = 0.036544, with p-value = P(F(1,7) > 0.0365442) = 0.855.Considering α = 0.05, it becomes obvious that p – value > α. This value indicates there is no autocorrelation, existing in this model.

2nd equation autocorrelation test :

Breusch-Godfrey test for first-order autocorrelation

TSLS, using observations 2006-2016 (T = 11)

Dependent variable: Budvar Production

Instruments: BPrice RLfaktor InPrice CPrice uhat_1

Table 27. Breusch-Godfrey test for 2nd equation of simultaneous linear regression model

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
BPrice	1349.00	241.508	5.586	0.0014	***
RLfaktor	541.463	193.035	2.805	0.0310	**
InPrice	11.0046	8.86930	1.241	0.2610	
EBT	1.75673	0.656714	2.675	0.0368	**
uhat_1	0.340795	0.515585	0.6610	0.5332	

Source: own computation

Breusch-Godfrey test didn't show any autocorrelation in the model.

Unadjusted R-squared is equal to 0.937451, which means that this test describes almost 93.7% of the whole model.

According to the Gretl`s output, there is the result for Durbin-Watson statistic, which is 1.5717. Also there is the result for Pseudo-LMF = 0.436903, with p-value = P(F(1,7) > 0.436903) = 0.533.Considering α = 0.05, it becomes obvious that p – value > α. This value indicates there is no autocorrelation, existing in this model.

2.7.2 Normality test

1st equation normality test:

Statistic test for normality show whether the distribution of values is symmetric or asymmetric. The values were divided into 5 bins (intervals). Mean value is 0.0558927, while sd is 7.79918.

Frequency distribution for uhat1, obs 1-11

Table 28. Calculated intervals for normality test for for 1st equation of simultaneous linear regression model

Interval	*Midpt*	*Frequency*	*Relative*	*Cumulated*	
< -5.6873	-8.2060	2	18.18%	18.18%	******
-5.6873 - -0.64995	-3.1686	4	36.36%	54.55%	*************
-0.64995 - 4.3874	1.8687	3	27.27%	81.82%	*********
4.3874 - 9.4248	6.9061	0	0.00%	81.82%	**
>= 9.4248	11.943	2	18.18%	100.00%	******

Source: own computation

Test for null hypothesis of normal distribution: Chi-square(2) = 1.880 with p-value 0.39065

Interpretation:

According to the Gretl`s output, there is the p-value = 0.39065. Considering α = 0.05, it becomes obvious that p – value > α. This value indicates that homoscedasticity is confirmed.

2^{nd} equation normality test:

Statistic test for normality show whether the distribution of values is symmetric or asymmetric. The values were divided into 5 bins (intervals). Mean value is 1.1099, while sd is 48.3635.

Frequency distribution for uhat2, obs 1-11

Table 29. Calculated intervals for normality test for for 2^{ns} equation of simultaneous linear regression model

Interval	*Midpt*	*Frequency*	*Relative*	*Cumulated*	
< -28.083	-44.191	3	27.27%	27.27%	*********
-28.083 - 4.1338	-11.975	5	45.45%	72.73%	****************
4.1338 - 36.350	20.242	1	9.09%	81.82%	***
36.350 - 68.567	52.459	1	9.09%	90.91%	***
>= 68.567	84.676	1	9.09%	100.00%	***

Source: own computation

Test for null hypothesis of normal distribution: Chi-square(2) = 3.368 with p-value 0.18565

Interpretation:

According to the Gretl`s output, there is the p-value = 0.18565. Considering $\alpha = 0.05$, it becomes obvious that $p - value > \alpha$. This value indicates that homoscedasticity is confirmed.

In both 1^{st} and 2^{nd} equations is normal distribution of residuals.

2.8. **Matrix B, Γ and matrix M**; reduced form of the model + interpretation; explanation of differences between structural and reduced form

2.8.1 Matrix B and Matrix Γ

Matrix B

$$\begin{vmatrix} 1 & -\beta 12 \\ -\beta 21 & 1 \end{vmatrix}$$

Matrix Γ

$$\begin{vmatrix} -\gamma_{12} & \gamma_{13} & 0 & \gamma_{14} \\ -\gamma_{22} & 0 & .-\gamma_{24} & -\gamma_{25} \end{vmatrix}$$

Structural form of the model:

1) $y_{1t} = 0.0905529y_{2t} - 210.154x_{2t} + 13.8964x_{3t} + 72.5371x_{4t} + u_{1t}$
2) $y_{2t} = 2.03822y_{1t} + 1407.38x_{2t} + 457.831x_{4t} + 7.09797x_{5t} + u_{2t}$

Interpretation:

Structural form of the model explains the dependence of endogenous variables on predeterminant and other explanatory variables.

2.8.2 Matrix M, reduced form of the model

Matrix M= -B-1 * Γ:

$$\begin{vmatrix} 284{,}995629 & -11{,}731209 & -26{,}236745 & 0{,}542597 \\ -826{,}496210 & -23{,}910785 & -511{,}307258 & -5{,}992039 \end{vmatrix}$$

Reduced form of the model:

1) $y_{1t} = 284{,}995629y_{2t} - 11{,}731209x_{2t} - 26{,}236745x_{3t} + 0{,}542597x_{4t} + u_{1t}$
2) $y_{2t} = -826{,}496210y_{1t} - 23{,}910785x_{2t} - 511{,}307258x_{4t} - 5{,}992039x_{5t} + u_{2t}$

Interpretation:

Unlike in structural form, in reduced form endogenous variables are explained only by predetermined variables. Parameters of the reduced form represent both direct and indirect effects of predetermined variables on an endogenous.

2.9. Model application (coefficients of elasticity; scenarios' simulation)

2.9 Coefficients of elasticity

1st equation elasticity:

$y_{1t} = 0.0905529y_{2t} - 210.154x_{2t} + 13.8964x_{3t} + 72.5371x_{4t} + u_{1t}$

Table 30. Relative elasticities of independent variables to dependent variable 1st equation based on 2016

Variable name	Change of independent variable	Change of dependent variable
Budvar production	+ 1%	+ 0,398028%
Budvar price	+ 1%	– 0,144976%
Carlsberg price	+ 1%	+ 0,560831%
RL factor	+ 1%	+ 0,191725%

Source: own computation

Production elasticity *0.0905529*(1663/378,3388) = 0,398028*, that means when production by Budvar prices increase by 1% EBT increases by 0,398028%

Direct price elasticity *-210.154*(0,261/378,3388) = - 0,144976*, that means when Budvar prices increase by 1% EBT decreases by 0,144976%

Cross price elasticity *13.8964*(15,269/378,3388) = 0,560831*, that means when Carlsberg prices increase by 1% EBT increases by 0,560831%

RL factor Elasticity *72.5371*(1/378,3388) = 0,191725*, that means when RL factor increase by 1% Consumption increases by 0,191725%

2nd equation elasticity:

$y_{2t} = 2.03822y_{1t} + 1407.38x_{2t} + 457.831x_{4t} + 7.09797x_{5t} + u_{2t}$

Table 31. Relative elasticities of independent variables to dependent variable 2nd equation based on 2016

Variable name	Change of independent variable	Change of dependent variable
EBT	+ 1%	+ 0,457457%
Budvar price	+ 1%	+ 0,220435%
RL factor	+ 1%	+ 1,2101%
InBev price	+ 1%	+ 0,469997%

Source: own computation

EBT elasticity *2.03822*(374/1666,372) = 0,457457*, that means when EBT increase by 1% production by Budvar increases by 0,457457%

Direct price elasticity *1407.38*(0,261/1666,372) = 0,220435*, that means when Budvar price increase by 1% production by Budvar increases by 0,220435%

RL factor elasticity *457.831*(1/378,3388) = 1,2101*, that means when RL factor increase by 1% production by Budvar increases by 1,2101%

Cross price Elasticity *7.09797*(11,034/1666,372) = 0,469997*, that means when InBev price increase by 1% production by Budvar increases by 0,469997%

3. Conclusion

In one equation model, there is reverse relation between Earnings Before Tax and Budvar prices, but there is direct relation between Budvar prices, Carlsberg prices, InBev prices and Reverse Logistics factor. Values of statistical verification are good. In one equation model, there is quite high R squared and 3 of 4 significant variables, insignificance of InBev become because it’s the less representation of main market of Budvar in Czech Republic, so people don’t perceive InBev as a substitute for Budvar or Carslberg. So, it can be concluded that thus elasticity of the model is low, because if you look at the data table, you will see that for Budejovicky Budvar, Budvar price, Inbev and Carlsberg prices have very stable values, so it hasn't changed much since year 2006. Yet, the level of production increased much more as well as EBT, which will be shown in the simultaneous model

In simultaneous two-equation model, there was 1 of 4 significant variable in the first equation and 3 of 4 significant variables in the second equation. In the first equation, elasticity is quite low again, but in the second model, there is very high RL factor. Values of statistical verification are good. Also in our simultaneous model, there is quite high R square and as a result of test, there is homoscedasticity, normal distribution of residuals, and there is no autocorrelation.

Yet, regarding the simultaneous model, it can be concluded that RL factor is not significant for the EBT of the Budejovicky Budvar. However, it affects the production efficiency but it can be also explained by simple technological progress and upgrade of the facilities.

This dissertation might be valuable for other people, because beer market is very specific and it has just been proven by analysis.

5 Results and Discussion

5.1 Findings

Regardless of the 3 models created to analyze the impact of RL on the performance of a beer company, it can be concluded that the impact is yet too small and can't be distinguished from simply technological enhancements due to lack of information gathered of this particular company. Yet the proposed keg return visualization show the common way of the reverse logistics process for the beer company.

More specifically: only 6 hypothesizes out of 9 assumed were proven by the econometric analysis. At the same time, only 4 of them were not denied by other models and can be considered as significant enough to examine their impact on the dependent variables. InBev price proved to be insignificant factor for both EBT and level of production of Budweiser Budvar in both models and all 3 equations. This may be also caused by the fact that InBev is weakly present in the Budvar's main market – Czech Republic. On the other hand, Carlsberg price proved it's significance on both models and 2 equations. This is very interesting finding due to the fact of close partnership between the two beer companies.

5.2 Recommendations

To gather recommendations, the following questions should be answered:

- How to harvest economic opportunities?
- How to maximize economical + ecological + social impact?
- How to measure economical + ecological + social impact?
- How can legislation best contribute?
- How to design and manage Closed Loop Supply Chains?
- What services can be linked to Closed Loop Supply Chains?
- What markets are available for those services?

- How to harvest economic opportunities?

Reverse Logistics is far from being just a case of "Green" practice. It is vital part of any modern Supply Chain Management model. The most significant reason is cost reduction which Reverse Logistics can provide to almost any company. By various examples from KEGs to glass bottles is has been shown that the Reverse Logistics process can help companies to decrease losses connected to inventory management.

- How to maximize economical + ecological + social impact?

As discussed in the paragraph 3.5 it has been shown that Reverse logistics affects society, economics and ecology. To maximize the impact, companies should introduce the most contemporary solutions in materials used in production, returns process organizations using electronic systems adding more efficient inventory management solutions and promote such practices both in the whole industry and beyond it. These three directions should improve not only the perception of the practice but the actual economical + ecological + social impact.

- How to measure economical + ecological + social impact?

Impact of reverse logistics can be noticed right away. The first thing every company notices is the reduction in costs that it obtains thanks to an improve in Supply Chain Management. Social effect can be measured by defining public opinion regarding this practices and perception of brands and companies that are effective in their Reverse Logistics Process.

- How can legislation best contribute?

The main goal of legislation is not forcing companies to spend more. In opposite, the main goal is to improve the business models of companies in a way that more sustainability in a long run can be reached and all three spheres of interests are included and satisfied.

- How to design and manage Closed Loop Supply Chains?

Closed loop supply chain might be managed using any existing design in the industry adapted to specific business. Yet, experience is often considered to be not transferable, which means that business will be obliged to develop its own supply chain with its own specifics and features. Consequently, by learning from others business will invent a closed loop supply chain of its own scheme.

- What services can be linked to Closed Loop Supply Chains?

Closed loop supply chain for a beer company should include processes of collecting, sorting, distribution and remanufacturing of components and materials. This means that every step of its supply chain will represent both forward and backwards flows, for instance, every forward delivery of kegs is, at the same time backward collection of empty kegs.

- What markets are available for those services?

Literally any Producing market can be suitable for Closed Loop Supply Chains. However, every industry has it’s features and/or limitations and the type of products and materials used and their ability to be recovered in any way.

6 Conclusion

By collecting statistical data regarding Budweiser Budvar, Carlsberg Group and AB InBev performance in the period of 2006-2016, current research examines the effect of different factors on the EBT of Budweiser Budvar. The main goal is to define which factors affect the EBT of Budweiser Budvar and whether there is a relation between RL improvement effect and EBT. The data was analyzed by GRETL 2017b-git, which provides us with opportunity to estimate econometric model and define significance of factors, which can influence EBT as well as help us to measure that effect. Regardless of the result of simple model, the simultaneous model has shown that the effect of Reverse logistics is not significant for the final EBT. However, it has shown significance of Reverse logistics effect of the level of production for Budweiser Budvar. This can be also explained by the massive technological improvements and upgrades of the whole facilities system conducted at the same time and almost on the same rate, which could not affect EBT due to large expenses on such investments.

To make RL more efficient from the profit-making perspective, the precise planning and control are fundamental. Without exceptionally precise data, planning and controlling can't be as efficient as in forward logistics. Utilizing advanced RFID technology, producers can acquire some helpful data that is very important for institutionalizing and planning closed loop supply chain. The gathered data helps the reverse logistics supply chain to decrease the vulnerabilities (uncertainties). Once these vulnerabilities decreased, a more precise production, inventory and distribution planning occur which empowers producers to institutionalize their activities and optimize them.

7 References

- Aalhysterforklifts.com.au. (2017). *Advantages of Reverse logistics: 5 Reasons it should be Implemented - Part 3 - Logistics & Materials Handling Blog | Adaptalift Hyster*. [online] Available at: http://www.aalhysterforklifts.com.au/index.php/about/blog-post/advantages_of_reverse_logistics_5_reasons_it_should_be_implemented [Accessed 28 Aug. 2017].

- Ab-inbev.com. (2017). *How we manage sustainability | AB InBev*. [online] Available at: http://www.ab-inbev.com/better-world/how-we-manage-sustainability.html [Accessed 1 Oct. 2017].

- Ab-inbev.com. (2017). *A cleaner world | AB InBev*. [online] Available at: http://www.ab-inbev.com/better-world/ a-cleaner-world.html [Accessed 1 Oct. 2017].

- Ab-inbev.com. (2017). *Manja Pamodzi*. [online] Available at: http://www.ab-inbev.com/news/our-stories/better-world/manja-pamodzi.html [Accessed 1 Oct. 2017].

- Barry, J.; Girard, G. & Perras, C. (1993). Logistics planning shifts into reverse. Journal of European Business, Vol. 5, No 1, pp. 34–38. [Accessed 28 Aug. 2017].

- Beckley, D. and Logan, W. (1948). *The retail salesperson at work*. New York: McGraw-Hill, 1948. [Accessed 1 Oct. 2017].

- Bloemhof-Ruwaard, Jacqueline, van Beek, Paul, Hordijk, Leen and Van Wassenhove, Luk N., (1995), *Interactions between operational research and environmental management*, European Journal of Operational Research, 85, issue 2, p. 229-243. [Accessed 28 Aug. 2017].

- Budejovickybudvar.cz. (2017). *Business achievements - Budějovický Budvar, n.p.*. [online] Available at: http://www.budejovickybudvar.cz/en/o-spolecnosti/obchodni-uspechy.html [Accessed 2 Oct. 2017].

- Carter, C.R, Ellram, L.M. Reverse Logistics: a review of literature and framework for future investigation. Journal of Business Logistics, Vol. 19, No. 1, 1998. [Accessed 2 Oct. 2017].

- Česká Televize. "Budvar Prodal Rekordní Množství Piva, Víc Rostl Vývoz." ČT24. N.p., 2017. [online] Available at: http://www.ceskatelevize.cz/ct24/ekonomika/1651303-budvar-prodal-rekordni-mnozstvi-piva-vic-rostl-vyvoz [Accessed 2 Oct. 2017].

- Chengalur, S. (2005) United States Environmental Protection. [online] Available at: http://www.epa.gov/climateleadership/documents/events/may2005/chengalur0505.pdf. [Accessed 2 Oct. 2017].

- Prediction of Consumer Behavior Regarding Purchasing Remanufactured Products: A Logistics Regression Model (PDF Download Available). Available from: https://www.researchgate.net/publication/301888344_Prediction_of_Consumer_Behavior_Regarding_Purchasing_Remanufactured_Products_A_Logistics_Regression_Model [accessed Nov 14 2017].

- Corrêa, H. and Xavier, L. (2013). Concepts, design and implementation of Reverse Logistics Systems for Sustainable Supply Chains in Brazil. *Journal of Operations and Supply Chain Management*, 6(1). [Accessed 28 Aug. 2017].

- Chengalur, S. (2005). Retrieved 09 24, 2013, from United States Environmental Protection Agency. [online] Available at: http://www.epa.gov/climateleadership/documents/events/may2005/chengalur0505.pdf. [Accessed 28 Aug. 2017].

- Doherty, K. (2017). *Sustainability: Reverse Logistics | Food Logistics*. [online] Food Logistics. Available at: http://www.foodlogistics.com/article/10255802/sustainability-reverse-logistics [Accessed 28 Aug. 2017].

- Dowlatshahi, S. (2000), Developing a Theory of Reverse Logistics. Interfaces 2000; Vol.30, No.3, pp. 143-155. [Accessed 28 Aug. 2017].

- Dyckhoff, H., Lackes, R. and Reese, J. (2004). *Supply Chain Management and Reverse Logistics*. Berlin, Heidelberg: Springer Berlin Heidelberg, pp.3-8.

- En.wikipedia.org. (2017). *Reverse logistics*. [online] Available at: http://en.wikipedia.org/wiki/Reverse_logistics [Accessed 25 Aug. 2017].

- Ferguson, N. and Browne, J. (2001). Issues in end-of-life product recovery and reverse logistics. Production Planning & Control, 12(5), pp.534-547. [Accessed 28 Aug. 2017].

- Fleischmann, M. (2000). Quantitative models for Reverse Logistics. Springer-Verlag. [Accessed 28 Aug. 2017].

- Fleischmann, M, Bloemhof-Ruwaard, J.Dekker, R., Vander Laan, E.,van Nuen J.A.E.E, van Wassenhove, L.N. (1997). *Quantitative models for reverse logistics: A review*. European journal of Operation Research, Vol. 103, No. 1, 1997. [Accessed 1 Oct. 2017].

- Fleischmann, M., Krikke, H.R., Dekker, R., & Flapper, S.D.P. (2000), “A characterization of logistics networks for product recovery”, The International Journal of Management Science, Omega 28, pp.653-666. [Accessed 1 Oct. 2017].

- Fuller, Donlad. A., Allen, Jeff. & Glaser Mark (1996). Materials recycling and reverse channel networks: The public policy challenge. Journal of Macromarketing, Vol.16, No.2, p.52-72. [Accessed 1 Oct. 2017].

- Goggin, Kate & Browne, Jim. (2000). The resource recovery level decision for end-of-life products. Production Planning and Control. 11. 10.1080/095372800432098. [Accessed 1 Oct. 2017].
- Govindan, K., Soleimani, H. and Kannan, D. (2017). *Reverse logistics and closed-loop supply chain: A comprehensive review to explore the future*. [online] www.sciencedirect.com. Available at: http://www.sciencedirect.com/science/article/pii/S0377221714005633 [Accessed 1 Oct. 2017].
- Guide Jr., Daniel and Wassenhove, Luk. (2002) *The Reverse Supply Chain*. *Harvard Business Review*. [Accessed 1 Oct. 2017].
- Guide, D.J.; Jayaraman, V. & Linton, J.D. (2003). *Building contingency planning for closed-loop supply chains with product recovery*. Journal of Operations Management. Article in Press. [Accessed 25 Aug. 2017].
- Giultinian, J.P. & Nwokoye, N.G. (1975). Developing distribution channels and systems in the emerging recycling industries. International Journal of Physical Distribution, Vol.6, No. 1, pp. 28-38. [Accessed 25 Aug. 2017].
- Handfield, R.B. & Nichols, Jr., E.L. (1999). Introduction to supply chain Management. Prentice-Hall, Englewood Cliffs, NJ. [Accessed 25 Aug. 2017].
- Hospodarske noviny. (2017). *Budejovicky Budvar uz nebude v USA zastupovat Anheuser-Busch. Neplnil plan*. [online] Available at: http://byznys.ihned.cz/c1-56400650-budejovicky-budvar-uz-nebude-v-usa-zastupovat-anheuser-busch-neplnil-plan [Accessed 3 Oct. 2017].
- IDRE Stats. (2017). *Correlation | SPSS Annotated Output - IDRE Stats*. [online] Available at: https://stats.idre.ucla.edu/spss/output/correlation/ [Accessed 3 Oct. 2017].
- Inboundlogistics.com. (2017). *Green Reverse Logistics Brings Many Happy Returns - Inbound Logistics*. [online] Available at: http://www.inboundlogistics.com/cms/article/green-reverse-logistics-brings-many-happy-returns/ [Accessed 1 Oct. 2017].
- Investopedia (2017). *Multicollinearity*. [online] Investopedia. Available at: https://www.investopedia.com/terms/m/multicollinearity.asp#ixzz4yKszdyRO [Accessed 3 Oct. 2017].
- Jayaraman, V., & Luo, Y. (2007). Creating competitive advantages through new value creation: a reverse logistics perspective.*The Academy of Management Perspectives*, 21(2), 56-73. [Accessed 28 Aug. 2017].

- Jayaraman, V., Patterson, R. and Rolland, E. (2003). The design of reverse distribution networks: Models and solution procedures. *European Journal of Operational Research*, 150(1), pp.128-149. [Accessed 2 Oct. 2017].

- Jayaraman, V., Ross, A. D.,& Agarwal, A. (2008). Role of information technology and collaboration in reverse logistics supply chains. International Journal of Logistics: Research and Applications, 11(6), 409–425. [Accessed 2 Oct. 2017].

- Kosmala, K. (2017). *The positive side of beverage reverse logistics in Asia*. [online] Quintiq.com. Available at: http://www.quintiq.com/blog/positive-side-beverage-reverse-logistics-in-asia/ [Accessed 25 Aug. 2017].

- Kumar, S., Dieveney, E., & Dieveney, A. (2009). Reverse logistics process control measures for the pharmaceutical industry supply chain. International Journal of Productivity and Performance Management, 58(2), 188-204. [online] Available at: http://www.emeraldinsight.com/doi/abs/10.1108/17410400910928761 [Accessed 2 Oct. 2017].

- Lave, L. B., Hendrickson, C. T., and McMichael, F. C. (1994). ‘‘Recycling decisions and green design.’’ Envir. Sci. and Technol., 28(1), 18A–24A. [Accessed 2 Oct. 2017].

- Lee, C. K. M., & Chan, T. M. (2008). Development of RFID-based Reverse Logistic System. Expert Systems with Applications, 36(5), 9299-9307. [online] Available at: http://www.sciencedirect.com/science/article/pii/S0957417408008774?via%3Dihub [Accessed 2 Oct. 2017].

- Lee, J. (2017). *Reverse Logistics Magazine - Reverse Logistics Association Sustainability and Environmental Management Committee | RL Magazine | Reverse Logistics Association*. [online] Reverselogisticstrends.com. Available at: http://www.reverselogisticstrends.com/rlmagazine/edition14p32.php [Accessed 28 Aug. 2017].

- Manget, J., Münnich, F. & Roche, C. (2009) Capturing the Green Advantage for Consumer Companies. *BCG Report.* [online] Available at: http://www.bcg.com/documents/file15407.pdf [Accessed 28 Aug. 2017].

- Meijer H. W. (1998) *Green logistics*. In A.R. Van Goor, S. D. P. Flapper, and C. Clement, editors, Handboek of Reverse Logistics. Kluwer B. V., Deventer, The Netherlands, 1998. (in “Dutch”). [Accessed 28 Aug. 2017].

- Michaud, C., & Llerena, D. (2011). Green consumer behaviour: an experimental analysis of willingness to pay for remanufactured products. *Business Strategy and the Environment*, 20(6), 408-420. [Accessed 28 Aug. 2017].

- Minahan, T. (2017). *Manufacturers take aim at end of the supply chain.*. [online] Highbeam.com. Available at: https://www.highbeam.com/doc/1G1-20555224.html [Accessed 3 Oct. 2017].
- Murphy, P.R, (1986) A preliminary study of transportation and warehousing aspects of reverse distribution. Transportation Journal, Vol. 35, No. 4, summer, 1986. [Accessed 3 Oct. 2017].
- 23.Murphy, P.R.; Poist, R.F. & Braunschweig, C.D. (1995). Role and relevance of logistics to corporate environmentalism. International Journal of Physical Distribution & Logistics Management, Vol. 25, No. 2, pp. 5-19. [Accessed 3 Oct. 2017].
- Pankaew, P. and Tobé, M. (2017). *Consumer Buying Behavior in a Green Supply Chain Management Context – A Study in the Dutch Electronics Industry*. JÖNKÖPING INTERNATIONAL BUSINESS SCHOOL (JÖNKÖPING UNIVERSITY), Glasgow.
- Panousopoulou, P., Manthou, V., & Vlachopoulou, M. (2006). Reverse Logistics through Recycling: A Case Study from the Brewery Sector. *Management and Development of Mountainous and Island Areas*, [online] Available at: http://utopia.duth.gr/~apapage/Lab/conferences/naxos_vol2.pdf#page=13 [Accessed 1 Oct. 2017].
- parlamentnilisty.cz. (2017). *Budějovický Budvar loni výrazně zvýšil export piva v nevratných sudech*. [online] Available at: http://www.parlamentnilisty.cz/zpravy/tiskovezpravy/Budejovicky-Budvar-loni-vyrazne-zvysil-export-piva-v-nevratnych-sudech-261841 [Accessed 1 Oct. 2017].
- Piyachat, B. (2017). The relationships among resources' commitment reverse logistics innovation reverse logistics performance and reverse logistics cost savings: Manufacturing vs service industry. *Journal of Administrative and Business Studies*, [online] 3(3), pp.1630-1639. Available at: https://www.medwelljournals.com/abstract/?doi=sscience.2017.1630.1639 [Accessed 28 Aug. 2017].
- Pohlen,T.L., Farris, M.T. Reverse Logistics in plastics recycling. International journal of logistics and Management, Vol. 22, No. 7, pp. 5-47, 1992 [Accessed 1 Oct. 2017].
- Reverselogisticstrends.com. (2017). *What is Reverse Logistics? | Reverse Logistics Association*. [online] Available at: http://www.reverselogisticstrends.com/reverse-logistics.php [Accessed 25 Aug. 2017].
- Rengel, P. & Seydl, C. (May 2002). Completing the Supply Chain Model [online] Available at: seydl.edu. [Accessed 25 Aug. 2017].

- Ritchie, L.; Burnes, B.; Whittle, P. & Hey, R. (2000). The benefits of Reverse Logistics: the case of Manchester Royal Infirmary Pharmacy. Supply Chain Management: an international Journal, Vol. 5, No. 5, pp. 226-233. [Accessed 25 Aug. 2017].
- Rogers, Dale & Melamed, Benjamin & Lembke, Ronald. (2012). Modeling and Analysis of Reverse Logistics. Journal of Business Logistics. 33. 10.1111/j.0000-0000.2012.01043.x.
- Rogers, D. and Tibben-Lembke, R. (2017). *AN EXAMINATION OF REVERSE LOGISTICS PRACTICES*. [online] Available at: http://onlinelibrary.wiley.com/doi/10.1002/j.2158-1592.2001.tb00007.x/full [Accessed 25 Aug. 2017].
- Rogers, D.S. & Tibben-Lembke, R.S. (1999). Going backwards: Reverse Logistics trends and practices. Reverse Logistics Executive Council, Pittsburgh, P.A. [Accessed 25 Aug. 2017].
- Sarac, Aysegul & Absi, Nabil & Dauzère-Pérès, Stéphane, 2010. *A literature review on the impact of RFID technologies on supply chain management*, International Journal of Production Economics, Elsevier, vol. 128(1), pages 77-95, November. [online] Available at https://ideas.repec.org/a/eee/proeco/v128y2010i1p77-95.html [Accessed 03 Oct. 2017].
- Smith, N.C.; Thomas, R.J. & Quelch, J.A. (1997). A Strategic Approach to Managing Product Recalls. Journal of Product Innovation Management, Vol. 14, No. 3, pp. 228-229. [Accessed 03 Oct. 2017].
- Spreckley, Freer (1981). *Social Audit: A Management Tool for Co-operative Working. Beechwood College*. [Accessed 03 Oct. 2017].
- Stavros, Daniel & Costas, Pappis & G Voutsinas, Theodore. (2003). Applying life cycle inventory to reverse supply chains: A case study of lead recovery from batteries. Resources, Conservation and Recycling. 37. 251-281. 10.1016/S0921-3449(02)00070-8. [Accessed 25 Aug. 2017].
- Stock, James. Speh, Thomas. and Shear, Herbert. (2002) *May Happy (Product) Returns. Harvard Business Review*. Vol. 80. Issue 7. [Accessed 03 Oct. 2017].
- Terry, S.H. (1869). The retailer’s manual. Jennings Brothers, Newark, reprinted by B. Earl Puckett Fund for Retail Education, Guinn, New York, NY (1967). [Accessed 25 Aug. 2017].
- Terreri, A. (2017). *Reverse Logistics Moves Forward | Food Logistics*. [online] Food Logistics. Available at: http://www.foodlogistics.com/article/10255988/reverse-logistics-moves-forward [Accessed 28 Aug. 2017].

- Thejournalofbusiness.org. (2016). *International Journal of Business and Social Research*. [online] Available at: http://www.thejournalofbusiness.org/index.php/site [Accessed 28 Aug. 2017].

- Thierry, M., Salomon, M., Van Nunen, J. and Van Wassenhove, L. (1995). Strategic Issues in Product Recovery Management. *California Management Review*, 37(2), pp.114-136. [Accessed 28 Aug. 2017].

- Toffel, M. W. (2003). The growing strategic importance of end-of-life product management. *California Management Review*, 45(3), 102-129. [Accessed 28 Aug. 2017].

- Trappey, A. J. C., Trappey, C. V., & Wu, C-R. (2010). Genetic algorithm dynamic performance evaluation for RFID reverse logistic management. Expert Systems with Applications, 37(8), 7329–7335. [online] Available at: http://www.sciencedirect.com/science/article/pii/S0957417410002976?via%3Dihub [Accessed 03 Oct. 2017].

- Visich, J. K., Li, S., & Khumawala, B. M. (2007). Enhancing Product Recovery Value in Closed-loop Supply Chains with RFID. Journal of Managerial Issues, 19(3), 436-452. [Accessed 03 Oct. 2017].

- Wyld, D. (2017). *The Reverse Logistics of Beer: Combating Keg Theft by Better Managing the "Float" in the Very Unique Supply Chain for Draft Beer | Edition 17 | RL Magazine | Reverse Logistics Association*. [online] Reverselogisticstrends.com. Available at: http://www.reverselogisticstrends.com/rlmagazine/edition17p16.php [Accessed 25 Aug. 2017].

8 Appendix

Appendix 1. Dissertation research and submission formalities

1. The Applicant

Registration No:

Name: Grygor Orbelyants

Addresses:

Home address: Pankevicha, 78, 88000, Uzhorod, Ukraine

Term time address (if different): 1283 Kamycka, 16500 Praha 6 – Suchdol, Czech Republic

2 The Program of Research.

Proposed title:

Summary of proposal

3. Supervisory Teacher *Patrick Scholler*

Planned frequency of contacts between student and supervisor.
One session per month plus, e mail and telephone contact with supervisor

4 Statement by the Applicant.

I wish to apply for registration on the basis of the proposals given in this application.

I confirm that the particulars given in the above sections are correct.

I understand that, except with the specific permission of ESDES School of Management I may not, during the period of my registration, be a candidate for an award of another university.

I understand that, except with the specific permission of ESDES School of Management, I must prepare and defend my thesis in English.

Signed: *Date: 04.10.2017*
Obrelyants Grygor

Appendix 2. Pre-calculated data

Data calculations

Year	EBT	B Price	B Production	C Price	In Price	R.L. faktor
2006	268,07	0.268	1,152,000	15.052	18.525	0.200
2007	293,26	0.300	1,253,048	15.726	19.795	0.300
2008	217,89	0.357	1,312,580	10.607	17.682	0.400
2009	279,54	0.257	1,275,271	13.456	10.774	0.400
2010	237,35	0.348	1,250,096	12.205	10.990	0.450
2011	243,77	0.368	1,318,709	12.071	10.228	0.500
2012	245,92	0.359	1,337,923	11.861	10.527	0.600
2013	285,05	0.342	1,422,728	11.902	9.801	0.700
2014	308,09	0.305	1,457,782	12.333	9.749	0.800
2015	350,01	0.264	1,601,938	14.287	10.660	0.900
2016	373,98	0.261	1,663,000	15.269	11.034	1.000

InBev price calculations

Year	Revenue	Production	price $/liter
2000	5,657	76,000	13.43468269
2001	7,303	97,000	13.28221279
2002	6,992	102,000	14.58810069
2003	7,044	120,000	17.03577513
2004	8,568	210,310	24.54598506
2005	11,656	223,504	19.17501716
2006	13,308	246,529	18.52487226
2007	14,430	285,644	19.795149
2008	16,102	284,719	17.68221339
2009	36,297	391,070	10.77416866
2010	36,297	398,918	10.99038488
2011	39,046	399,365	10.22806433
2012	39,758	402,631	10.52704361
2013	45,483	445,786	9.801156476
2014	47,063	458,801	9.748656057
2015	46,928	500,242	10.65977668
2016	45,517	502,246	11.03425094

Carlsberg price calculations

Year	Revenue	Production	price DKK/liter	price $/liter
2000	25,650	39,800	1.5517	11.8530
2001	34,419	67,000	1.9466	15.5514
2002	35,544	78,600	2.2113	19.1056
2003	34,626	81,400	2.3508	16.2262
2004	36,284	92,000	2.5356	15.1507
2005	38,047	101,600	2.6704	15.2481
2006	41,083	100,700	2.4511	15.0519
2007	44,750	115,200	2.5743	15.7260
2008	59,944	126,800	2.1153	10.6066
2009	59,382	137,000	2.3071	13.4557
2010	60,054	136,500	2.2730	12.2051
2011	63,561	140,900	2.2168	12.0707
2012	66,468	138,700	2.0867	11.8613
2013	64,350	139,400	2.1663	11.9024
2014	64,506	143,800	2.2292	12.3327
2015	65,354	141,800	2.1697	14.2874
2016	62,614	138,800	2.2168	15.2695

Budvar price calculations

Year	Revenue	Production	price CZK/liter	price $/liter	EBT
2006	1843600	1152000	6.249	0.268	268,07
2007	2005400	1253048	6.248	0.300	293,26
2008	2100700	1312580	6.248	0.357	217,89
2009	2041000	1275271	6.248	0.257	279,54
2010	1958479	1250096	6.383	0.348	237,35
2011	2027950	1318709	6.503	0.368	243,77
2012	2102490	1337923	6.364	0.359	245,92
2013	2198516	1422728	6.471	0.342	285,05
2014	2339224	1457782	6.232	0.305	308,09
2015	2469862	1601938	6.486	0.264	350,01
2016	2550000	1663000	6.522	0.261	373,98