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Optimization of Material Costs in Škoda Auto a.s.

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Abstract

The profit maximization is the most crucial task these times. This thesis deals with the saving processes in one of the biggest and most successful company in the Czech Republic - Škoda Auto a.s. - and departments that enter into such processes. The most common way to increase the profits is to lower the costs. We will investigate how are general microeconomics rules related to the real business environment in this company. We will analyze theory of the firm and structure of the costs to propose a theoretical background to the problem of costs optimization. We would like to describe the processes in Škoda Auto a.s. in a wider context in order to understand how enormous and complicated the structure of the company is. Škoda Auto a.s. uses modern company management instruments to manage its cash flow and profit in order to succeed in today's extremely competitive market conditions. We will talk about the most important units in the whole process of optimization and we will also describe some particular steps which lead to cost savings.

JEL classification: D21, D24, M21, M31

Key words: production, optimization, costs, profit, price, potential, business

Abstrakt

Maximalizace zisku je v současné době nejdůležitější úkol každé společnosti. Tato práce popisuje proces optimalizace nákladů v největším průmyslovém podniku v České republice - ve Škodě Auto a.s. - a oddělení, které vstupují do tohoto procesu. Nejběžnější způsob, jak zvýšit zisk, je snižování nákladů. Abychom mohli celý problém kvalifikovaně posuzovat, položíme nejprve teoretické základy. Popíšeme teorii firmy a strukturu nákladů, abychom teoreticky nastínili pozadí problému obtimalizace nákladů. Ukážeme procesy ve Škodě Auto a.s. v širších souvislostech, aby měl čtenář představu, jak je organizace společnosti rozsáhlá a komplikovaná. Škoda Auto a.s. používá moderní nástroje k řízení finančních toků a zisku, aby byla na dnešním trhu konkurenceschopná a dosahovala co nejlepších výsledků. Budeme analyzovat činnost nejdůležitějších oddělení a popíšeme konkrétní kroky, které vedou k úsporám.

Klasifikace JEL: D21, D24, M21, M31

Klíčová slova: výroba, optimalizace, náklady, zisk, cena, potenciál, byznys

Declaration

I hereby declare that I compiled this thesis independently, using only the listed resources and literature.

I declare that this thesis was not used to acquire degree from any other institution.

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Prague, May 17, 2012

Signature

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I would like to thank to my supervisor PhDr.Mgr. Jana Chvalkovská for valuable suggestions and support. I am also grateful to Ing. Jaroslav Drahota from the Škoda Auto a.s. for provision of the required company's internal data.

Responsibility for any remaining errors lies with the author alone.

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TEZE BAKALÁŘSKÉ PRÁCE

Student:	Ondřej Sezemský
Obor:	Ekonomie
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Garant studijního programu Vám dle zákona č. 111/1998 Sb. o vysokých školách a Studijního a zkušebního řádu UK v Praze určuje následující bakalářskou práci

Předpokládaný název bakalářské práce:

Optimization of Material Costs in Škoda Auto a.s.

Charakteristika tématu, současný stav poznání, případné zvláštní metody zpracování tématu:

The main aim of this thesis is to map, analyze and evaluate cost saving processes in Škoda Auto a.s. company's manufacturing during one business year. The company's objective is to realize large profits, therefore precisely organize manufacturing, searching for money saving potentials and cooperating with reliable external partners are essential and necessary fundamentals. In order to achieve optimal outcomes, many tools can be exploited, especially the optimization workshops or change management targeted at unification of components, saving of material, suppliers changes and funding for realization of these measures.

In my thesis I will focus on descriptions of these processes, efficiency of optimizing workshops, recovery factor of particular measures and return on resources spent. I will define particular potentials, track the progress of their implementation as well as real application in practice. I will also compare the results with similar potentials from last years. In the conclusion I will discuss the application of introduced optimization methods in company's overall Business plan. Furthermore, I will summarize the most important theoretical phenomenons and compare them to the practical processes.
My thesis will be consulted with external consultant Ing. Jaroslav Drahota who is coordinator of Management of production changes and Business Plan. Further, I will exploit professional Škoda Auto a.s. software including available internal data.

Struktura BP:

1) Metodika a průběh procesu optimalizace
2) Popis zdrojů pro vyhledávání úsporných potenciálů
3) Očekávaný přínos, návratnost prostředků
4) Již zrealizované procesy, ukázky z minulosti
5) Zpracování business plánu pro společnost Škoda Auto a.s.
6) Závěrečné hodnocení procesu optimalizace

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V Praze dne

Ondřej Sezemský Jana Chvalkovská

Contents

1 Introduction

I wrote my bachelor thesis "Optimization of material costs in Škoda Auto a.s." while being in this very company on trainee position in Technical Changes Department (within Production Area). This thesis presents a complex material whose crucial Chapter 4 widely describes the operations in Škoda Auto a.s. related to the optimization of material costs as well as the functions of individual departments entering into the optimizing process (with focus on the Production Area).

The thesis is divided into two main parts - theoretical and practical. Because of this structure, the thesis is unique in the way that it combines the necessary theoretical background as well as the case study of one of the biggest companies in the Czech Republic. Few academic studies like this have been elaborated so far because the most of the companies deal with these topics internally and their focus on the theory is very limited. Furthermore, the thesis is suggesting several recommendations for improvements and further research.

In the first Chapter, Škoda Auto a.s. company will be introduced; I will outline brief overview of from its long history, provide general data about the company as well as the main principles of its corporate philosophy. I will also describe the organization of Škoda Auto a.s. for better understanding of the company's functioning.

The second Chapter summarizes the most important theoretical phenomenons which appear in production and costing areas of an automotive company. These phenomenons are based on exact mathematical definitions and illustrated by appropriate graphs. In my opinion, theory is underestimated these times but knowledge of all important terms and ability to apply them in practice is very important. In general, theoretically educated manager could better estimate the impact of his decisions.

The management of the companies passed through great development in last decades. Customer is in the center of interest of producers, companies have more optimized structures and employ more educated and motivated people to reach higher production and better quality of products. The third Chapter deals with - in order to achieve better understanding - internal and external problems that the company must handle. Controlling monitors internal processes from the economical point of view, collects

data and suggests solutions to divergence from the company's plans. On the other hand, Marketing focuses on customer, collects data from the market and suggests sales strategy. Chapter Three describes the theoretical approach to these areas as well as their concrete particular activities and functions in Škoda Auto a.s.

The crucial chapter of the thesis is Chapter Four. Using the available internal materials of Škoda Auto a.s., I created well arranged structure describing optimization of material costs in the company. Sometimes, suitable diagrams are used, for better imagination of the processes, which are fully in accordance with the corporate identity of Škoda Auto a.s. My analysis could also serve as an introduction to the mutual relationships among departments, i.e. as a description of the "communication net" in Škoda Auto a.s. In the end of this Chapter, I suggest changes in one of the processes. This Chapter could be also used as educational material for managers and employees of Škoda Auto a.s.

1.1 History

Car production has long tradition in the Czech Republic. In 1905, first vehicle was constructed in Mladá Boleslav by Mr. Klement and Mr. Laurin and this act was the origin of the biggest manufacture on the Czech territory. [14] Two years later, the company had already 600 employees and the product supply was increased. After a great fire in one of production halls, Mr. Klement and Mr. Laurin decided to merge their firm with the concern Škoda in Pilsen with validity from 1th January 1925. After the Second World War, during which the car production in Škoda factories was replaced by war material production, Škoda concern was nationalized and divided into two smaller companies, one based in Pilsen and the second one being based in Mladá Boleslav. At the same time the industrial factories in Vrchlabí and Kvasiny were incorporated into Mladá Boleslav-based Škoda company. During the years 1960 – 1970 new plants had been launched; this expansion can be considered as the beginning of the mass car production with 120,000 cars a year. In 1989, Škoda, at this time relatively small company, was looking for the strategic partner in order to succeed in the European competition. After several negotiations with world leading car companies, on 28th March 1991, the contract was signed with German concern Volkswagen with the objective being Škoda's production of 400,000 cars a year by the end of the century. In 1991, Škoda also celebrated 5 millionth produced vehicle. The merger opened access to Volkswagen's know-how. The cooperation in both Škoda's and Volkswagen's units significantly accelerated and improved technical development as well as management approaches. The biggest impact was on the Quality and Technical Development departments. During past 20 years, Škoda Auto a.s. has

been constantly proving its exceptional position within the Volkswagen concern and its potential and ideas which are continuously offered to its customers.

1.2 General Data

Škoda Auto a.s. is developing, manufacturing and selling high-quality and environmentally friendly automobiles, genuine parts and accessories. Today, Škoda Auto a.s. is joint-stock company with the contributed capital of CZK 16,708,850,000; the only shareholder is Volkswagen international Finance N.V. The main statutory organ is seven-memebered Board of Management composed from the chiefs of single Areas. The Chairman of the Board is Prof.Dr.h.c. Winfried Vahland.

On 12th October 2011, Škoda Auto a.s. has produced its 10 millionth vehicle in the factory in Mladá Boleslav, and on 30th January 2012, Škoda Auto a.s. has produced its overall 14 millionth vehicle since 1905. Fourteen-millionth car was Škoda Superb of the Laurin&Klement special edition rolled-off the assembly line at the factory at Kvasiny. With a total production of 879,200 vehicles in 2011, the company sold more automobiles than ever in its 117-year history. Until the 2018, annual Škoda Auto a.s. sales are planned to increase to at least 1.5 million units. In order to accomplish this goal, Škoda Auto a.s. has begun the largest model offensive of its history. The company has increased its model series from 1 to 7 since 1991. At the moment, Fabia, Octavia, Roomster, Superb and Yeti models are being produced. With the small car Citigo produced in Slovakia and the compact sedan Rapid produced and sold only in India, the sixth and seventh model series celebrated their sales premieres at the end of 2011. In the coming years, Škoda Auto a.s. wants to introduce one new model in the market every six months on average. Further, Škoda Auto a.s. continues the consistent internationalization of the brand, particularly focusing on strong growth in the emerging markets of China, Russia and India. Company operates on more than 100 markets worldwide.

The headquarters and the biggest factory of Škoda Auto a.s. is in Mladá Boleslav; the factory includes assembly lines of models Fabia and Octavia, 3 stamping factories, 4 weld assemblies and 2 painting facilities, 2 steel mills, producing of gearboxes and motors, potting shed and so on. For better imagination please see Appendix, where the map of the plant in Mladá Boleslav is depicted. Subsidiaries are located in Kvasiny (the assembly line for Superb and Yeti, 1 stamping factory, 1 weld assembly) and Vrchlabí (the assembly line of Roomster and Octavia). Furthermore, there are additional assembly lines in India, Russia, China, Slovak Republic, Ukraine and Kazakhstan. [13] Into these states are often exported only dismantled cars which are

subsequently assembled in the particular assembly line[1].

1.3 Organization of Škoda Auto a.s.

Škoda Auto a.s. is divided into 7 Areas and circa 60 Organizational Units. Furthermore, each Organizational Unit is divided into Specialized Departments[2] and each Specialized Department is divided into Centers. The Organizational Units and Specialized Departments are headed by managers, the each Centers are headed by coordinators. Areas and most important Units are supplemented by personnel statistics. Škoda has 26,480 employees[3] including loaned personnel. [17]

1. Area "G", Board Chairman (1,106 employees), includes some very important Organizational Units like Quality (812 employees), Product Management or Audit.

2. Area "E", Commercial Affairs (810 employees), is responsible for a wide range of activities in the company. It provides effective financial management in the company in order to ensure long-term economic stability of Škoda Auto a.s. Main Units are Controlling (222 employees), Accounting or Legal Affairs.

3. Area "P", Sales and Marketing (1,137 employees), is responsible for the sales of both new and used cars, accessories and post-sales services. Among the aims of this Area belong the improvement of the image of the company's brands on the present markets as well as introducing the company's brands to the new markets. Škoda Auto a.s. is well known for its "Human Touch" philosophy thanks to this Area. Main Units are Sales Management and Marketing (153 employees).

4. In area "V", Production and Logistics (20,693 employees), vehicles and components production and brand logistics are the most crucial tasks. I was a trainee in Specialized Department of Technical Changes in Area "V".

5. Area "T", Technical Development (1,714 employees), is responsible for coordinating the developments of designs, vehicles, interiors and electronic systems.

[1] The reason behind this procedure are high tariffs on import of finished product in these countries; therefore, Škoda Auto a.s. usually concludes an agreement with particular state that it will invest money in the country and create new working opportunities. In exchange for that, Škoda Auto a.s. receives lower tariffs on imported parts. There are three stages of dismantlement: SKD – Semi knocked down, MKD – Medium knocked down and CKD – Completely knocked down.

[2] There are circa 150 Specialized Departments.

[3] Report on the state of personnel, intern material of Human Resources Planning ("ZP Unit"), situation at 30.4.2012.

One part of Area "T" is the Specialized Department of Cost Optimization, which leads the optimization processes in the whole company. It manages the projects and sets deadlines and financial targets.

6. Area "Z", Human Resources Management (709 employees), follows the motto: "Recruit, Develop and Retain Motivated Employees". It plans Human Resources, selects and trains employees, supports innovations and improvement proposals.

7. Area "N", Purchasing (194 employees), is responsible for purchasing production and operating materials. Its main objective is to reduce costs of material and determining and optimizing the supplier structure.

1.4 Policy of Škoda Auto a.s.

Škoda Auto guarantees following principles which are the implementation of its growth strategy:

- To guarantee the top quality of products as the customers expect.
- To fulfill all requirements which arise from laws, regulation and ethical principles.
- To measure and evaluate process performances and, if needed, determine measures to continually improve the companys' products, processes and services.
- To improve environmental credibility by continually reducing pollution, use natural resources and energy in a responsible manner, apply environmentally friendly technologies and use as many re-usable materials as possible. We also motivate our contractual partners to do the same.
- To control and protect our data, assets and information.
- To construct balanced and fair relationships with our contractual partners and the public.

These principles are also fulfilled in its saving processes.

2 Theory of the Firm

Firstly we have to precisely formulate microeconomics relations in order to study the processes in Škoda Auto a.s. I will define the terms which are - in my opinion - the most important in decisions of the managers in real business. Theory is the basis of every field of human's interest. Of course, the practical processes could be often very different from theoretical background but knowledge of theoretical terms provides better comprehension and opens new perspectives. The same is valid for Škoda Auto a.s. and that is why this Chapter is so important to study.

Automotive industry is an example of oligopoly[1] with differentiated product. It is very difficult to enter the automotive market because of huge initial costs. Therefore there are only several firms in the market. Oligopoly with differentiated product is a situation in which companies produce goods which are considered different by consumers. Besides product quality, marketing and image of the brand (see Section 3.2) play decisive roles in the eyes of customers. It is very difficult to succeed in such a competitive environment, so managers' decisions, often based on microeconomics rules, are extremely important for economic health of a particular company.

Any economic decision is a balancing act between costs and revenues (benefits). If an appropriate decision is going to be made, we must have the right costs calculated. We will start with production theory and then we will move to structure of the costs and cost curves.

2.1 Production

The way people get income is through producing goods that other people want to buy and selling those goods with a profit. Production includes production of goods, selling of goods and financial services. Without production we would have had pure exchange economy where market players own some bundles of goods in the beginning and they exchange their goods in order to gain higher utility. However this theory

[1] An oligopoly is a market form in which a market or industry is dominated by a small number of sellers (oligopolists).

doesn't explain how from certain goods and services (inputs), other goods and services (outputs) can be created. A firm is limited by customers, competitors and nature in the beginning of production process. We will focus on constraints caused by nature. There is always maximal amount of output which can be produced from particular inputs.

Objective of this Section is to understand position of production theory in microeconomics theories and its simplifications, to understand technological constraints of the producer in terms of microeconomics, to understand relations between scale of production and output, between production in long term and short-term period and relations between output and particular input (especially relations of marginal and average product).

2.1.1 Mathematical Definitions

Microeconomics theory of the firm is based on exact mathematics rules. In this Subsection we will present all required definitions for our purposes. I quote them from [7].

Definition 1 (Mapping) *Let A and B be nonempty sets. A mapping of the set A to the set B is an assignment, which assigns to each $x \in A$ exactly one element of y from B. This element y we usually denote $f(x)$. The symbol $f : A \to B$ stands for a mapping f from A to B.*

Definition 2 (A function of one variable) A *function of one real variable (a* function *for short) is mapping $f : A \to B$ where $\mathbb{R}$ is set of Real Numbers and M is a subset of $\mathbb{R}$.*

Definition 3 (Increasing function) *A function $f : M \to \mathbb{R}$* is *increasing on an interval J, if for each pair x_1 and $x_2 \in J$, $x_1 < x_2$, we have the inequality $f(x_1) < f(x_2)$. The notion of decreasing, non-decreasing and non-increasing are defined in an analogical way.*

Definition 4 (Monotony) *By a monotone (strictly monotone respectively) function an the interval J we mean a function, which is non-decreasing or non-increasing (increasing or decreasing respectively) on J.*

Definition 5 (Limit of a function) *We say that $A \in \mathbb{R}^*$is a limit* of *a function f at the point $c \in \mathbb{R}^*$, if*

$$\forall \varepsilon \in \mathbb{R}, \varepsilon > 0 \exists \delta > 0 \forall x \in P(c, \delta) : f(x) \in B(A, \varepsilon),$$

where $P(c, \delta)$ is punctured neighborhood of c and *$B(A, \varepsilon)$ is neighborhood of A.*

Definition 6 (Continuity) *We say that function f is continuous* at *$c \in \mathbb{R}^*$*, if *$lim_{x \to c} f(x) = f(c)$.*

Definition 7 (Derivation) *Let f be a real function and $a \in \mathbb{R}$. Then derivation of f at the point a is defined by*

$$f^{'}(a) = lim_{h \to 0} \frac{f(a+h) - f(a)}{h}.$$

Definition 8 (Convexity) *We say that $f : I \to \mathbb{R}$ is convex on interval I, if*

$$\forall x_1, x_2 \in I \forall \lambda \in \langle 0, 1 \rangle : f(\lambda x_1 + (1-\lambda) x_2) \leq \lambda f(x_1) + (1-\lambda) f(x_2).$$

The notion of concave, strictly convex and and strictly concave are defined in an analogical way.

Definition 9 (Partial derivatives) *Let f be a function of n variables, $j \in \{1, ..., n\}, a \in \mathbb{R}^n$. Then number*

$$\frac{\partial f}{\partial x_j}(\mathbf{a}) = lim_{t \to 0} \frac{f(\mathbf{a} + t\mathbf{e}^j) - f(\mathbf{a})}{t} =$$

$$= lim_{t \to 0} \frac{f(a_1, ..., a_{j-1}, a_j + t, a_{j+1}, ..., a_n) - f(a_1, ..., a_n)}{t}$$

is called *partial derivatives (of first order) of function f according to j-th variable at the point* $\mathbf{a}$ *(if it exists).*

2.1.2 Discovering Production

We defined main mathematics terms in previous Subsection 2.1.1, which we will use in building of this theory, so we can start with simplifying assumptions.

Assumptions for Production

1. Producer *maximizes* its profit (regardless of his personality or organization of the firm).
2. Possibility not to use all sources without additional costs.
3. Perfect divisibility of inputs and outputs (mostly unrealistic).
4. Perfect foreknowledge (mostly unrealistic).
5. Absence of externalities - It is not possible to consider the external economies of scale (orchardist x beekeeper).

6. Homogeneity of inputs and outputs - Every unit of of work (land, capital, ...) is the same quality as every other unit.

Firm transforms goods with the use of *technology* which is the set of constraints defining how one can combine or convert inputs into outputs. We won't analyze technology itself in this theory, we are only interested in inputs to this process and its outputs and their amounts. [3] Hence, the right way to view a technology is as a constraint on the process of production. Now it is time to describe technical constraints which nature determines to the firm. Only some combinations of inputs represent acceptable way to produce particular amount of output and firm has to restrict itself to technologically available production plans.

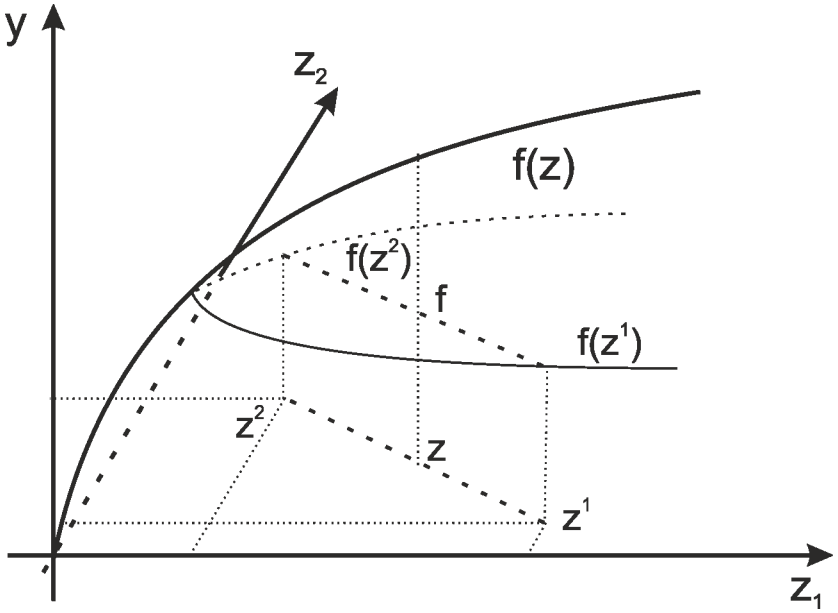
Definition 1.1 (Production function) *Production function f assigns to each set of inputs $(z_1, ..., z_n)$ maximal possible output which can be produced from this set of inputs: $y \leq f(z_1, ..., z_n)$.*

Definition 1.2 (Production set) *Production set Y is space defined by production function f and required non-negativity of inputs $(z_i \geq 0)$ and output $(y \geq 0)$. Thus it represents all acceptable combinations of inputs and output or technologically available plans of the firm $(y, z_1, ..., z_n)$: $Y = \{(y, z_1, ..., z_n) \mid 0 \leq y \leq f(z_1, ..., z_n); z_i \geq 0 \forall i\}$.*

Definition 1.3 (Set of required inputs) *Set of required inputs $V(y^0)$is set of all available set of inputs$\{(z_1, ..., z_n), where\, z_i \geq 0\}$, from which is possible to produce required output $y^0 \geq 0$:*
$V(y^0) = \left\{(z_1, ..., z_n) \in \mathbb{R}^n_{0+} \mid f(z_1, ..., z_n) \geq y^0\right\}$.

Definition 1.4 (Isoquant of production) *Isoquant of production $Q(y^0)$ is set of all available sets of inputs from $V(y^0)$, for which the maximal produced amount of output $(y^0 \geq 0)$ will be maximal possible: $Q(y^0) = \left\{(z_1, ..., z_n) \in \mathbb{R}^n_{0+} \mid f(z_1, ..., z_n) = y^0\right\}$. In other words, it is set of bundles given by production function which produce the same output most efficiently. They never cross each other.*

Figure 2.1.1: Example of Production Function with Two Inputs



Source: [3]

Assumptions for Production Function, Production Set and Isoquants

1. Non-reversibility - This assumption states that you cannot run a production process in reverse (you can't dismantle output to original inputs). There could be "strong non-reversibility" thus one or more inputs are so essential that nothing can be produced without them (for example work).

2. No Free Lunch - The assumption that you can't get any output from a production process without inputs. Production Function passes through the origin: $f(0, ..., 0) = 0$.

3. Free Disposability - If we can produce a certain output from a given combination of inputs, then with those inputs we can always produce strictly less: $(\forall z_1, ..., z_n : 0 \leq y \leq y_{max} = f(z_1, ..., z_n))$.

4. Perfect divisibility - If we can produce an output level of y using inputs z_2 and z_2, then we could produce, for example, $\frac{1}{2}y$ using *some* combination of inputs z_2 and z_2.

5. Continuity of Production Function

6. Smoothness of Production Function - Production function has continuous partial derivations of first and second order.

7. Local Monotonicity of Production Function - Production function is always increasing at least in one input.

8. Strictly Convexity of the Set of Required Inputs - Curvature of isoquants of production is toward the beginning.

Following two definitions describes what happens if we change the level of a particular input.

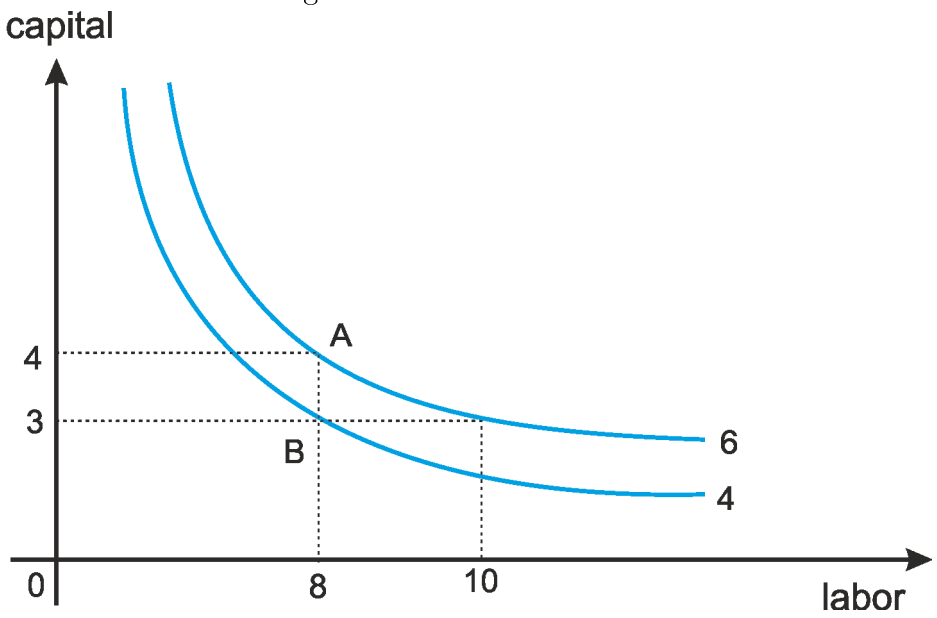
Definition 1.5 (Marginal product of i-th input) *Marginal product of i-th input* $MP_i = \frac{\partial f(z)}{\partial z_i} = \frac{\Delta y}{\Delta x_i}$ *is the amount by which output would increase if we added one more unit of i-th input to production, holding all other inputs fixed.*

Definition 1.6 (Marginal rate of technical substitution) *Marginal rate of technical substitution of input 2 for input 1* $MRTS_{21}$*is the rate at which one input can be substituted for another while keeping the output produced constant.* $MRTS_{21}$ *is the* -1 *times slope of the isoquants.*

$$MRTS_{21} = \frac{\frac{\partial f(z)}{\partial z_1}}{\frac{\partial f(z)}{\partial z_2}} = \frac{\frac{\Delta y}{\Delta z_1}}{\frac{\Delta y}{\Delta z_2}} = \frac{MP_1}{MP_2}$$

Isoquants indicate real level of output. Let us start with example in Figure 1.1.2. Assume that producer is at point A, let $z_1 = 8$ be labor and $z_2 = 4$ capital (inputs to production which are also produced goods - machines, buildings, computer technology) and he produce output $y = 6$. If we subtract one unit of capital, our producer moves from point A to B and the output would then fall about three units. We say that $MP_2 = \frac{\Delta y}{\Delta z_2} = 2$. If we want to stay on the same isoquant, we have to add two units of labor $MP_1 = \frac{\Delta y}{\Delta z_1} = \frac{2}{2} = 1$, thus $MRTS_{21} = \frac{1}{2}$ at point A and the slope of the isoquant at point A is $-\frac{1}{2}$.

Figure 2.1.2: MP and MRTS



Source: [2]

What will happen when we are constantly adding one input and hold other inputs fixed? Imagine following simplified situation. Workers are inputs, they manufacture cars in one assembly line and we are changing their amount. Cars are output and other inputs are fixed. Let one worker manufactures the car in one day, two workers manufacture two cars a day, four workers manufacture 3 cars a day, eight workers manufacture 4 cars a day and so on. When we will add workers, the amount of cars produced will rise but marginal product on one worker will decrease. If we employ hundreds of workers, the assembly line would be overcrowded and it could cause even decrease in the final product. This phenomenon is called *Law of diminishing marginal product*. [1, p. 316]

2.1.3 Describing Technologies

Production function determines the efficient output-input combination. Producer has many possible output levels and various combinations of inputs to achieve them. However we need to define concept which would tell us, which combination of inputs is the best for an entrepreneur to maximize his profits. Technologies are characterized by two following attributes:

Elasticity of Substitution

Definition 1.7 (Elasticity of substitution) *Elasticity of substitution σ is a measure of how easy it is to substitute one input for another in producing a given level of output. For example if a 1% change in the ratio of input prices leads to a 1% change in the ratio in which these inputs are used, we would say that $\sigma = 1$.*

$$\sigma = \frac{\Delta \frac{z_j}{z_i}}{\frac{z_j}{z_i}} / \frac{\Delta MRTS_{ji}}{MRTS_{ji}} = \frac{1}{\frac{\partial MRTS_{ji}(z)}{\Delta\left(\frac{z_j}{z_i}\right)}} . \frac{MRTS_{ji}(z)}{\frac{z_j}{z_i}}$$

Returns to Scale

Definition 1.8 (Returns to scale) *Returns to scale measures the ratio between the resulting change in the output level and the proportionate change in the levels of all the inputs.*

When we are talking about returns to scale of a technology, we are actually asking what will happen to our output if we multiply all inputs by the same parameter. Let $s \geq 0$ be the parameter of returns to scale. If $s < 1$, then scale of production is decreasing and if $s > 1$, scale of production is increasing. [3] We have three possible situations:

1. Constant returns to scale - A feature of technology that is such that when all inputs are increased by fixed multiple $s \geq 0$, output increases by *the same* multiple: $y = f(sz) = f(s, z) = sf(z)$.

2. Increasing returns to scale - A feature of technology that is such that when all inputs are increased by fixed multiple $s \geq 0$, output increases by *more* than that multiple: $y = f(sz) = f(s, z) > sf(z)$.

3. Decreasing returns to scale - A feature of technology that is such that when all inputs are increased by fixed multiple $s \geq 0$, output increases by *less* than that multiple: $y = f(sz) = f(s, z) < sf(z)$.

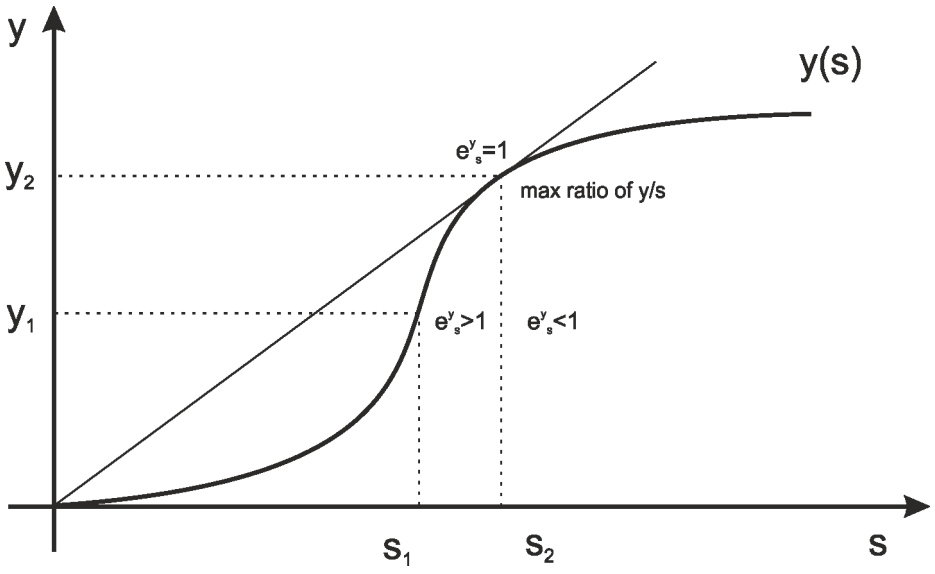
Thus, if we use 2 units of z_1, 3 units of z_2, output $y = 6$ and $s = 2$, if we got after multiplying of inputs output $y = 14$, we talk about increasing returns to scale. Increasing returns to scale can arise from many reasons. For example we don't always double all inputs when the output is doubled (for example we don't need two times more managers). Next reason are synergistic effects when more inputs better "cooperate" among themselves. Another reason is that some types of machinery are very efficient when used to produce large quantities, but they are costly when production

is limited to small quantities. Reasons for decreasing returns to scale could be for example different productivity of one type of input (different diligence of workers). Scale of production, where increasing returns to scale change into decreasing returns to scale, is called *minimal effective scale of production.* [3]

Returns to scale could be measured by *elasticity of returns to scale:*

$$e_s^y = \frac{\partial f(sz)}{\partial s} \cdot \frac{s}{f(sz)}$$

Figure 2.1.3: Fluctuation in Returns to Scale



Source: [3]

2.1.4 Time Constraints

Producer's next objective is to adjust his output to the market demand and price. Output is flow variable thus it has to have its time dimension. Information that someone has produced 10 million vehicles is useless if we don't know in what time horizon. Producer must determine optimal combination of inputs to gain optimal output. To find most appropriate level of input and output we must know how much time it will take to a producer to adjust inputs to the optimal level. We have two types of inputs; *fixed factors of production* which cannot be adjusted in given period of time (e.g. capital) and *variable factors of production* (e.g. labor) which can be adjusted. [2, p. 175] We distinguish two main periods of time:

1. Short run - The time period during which at least one factor of production is fixed (size of assembly line, number of robots, number of offices). Special case of short run is immediate run, which is a period of time so short that producers are unable to change any of their inputs to meet changes in demand or other changes, so all inputs are fixed.

2. Long run - The period of time long enough to change all factors of production, so all inputs are variable.

The concept of time constraints has dramatic effect on producer's decision. Until now we have been discussing concept of *long run production function* which allows the producer to change the levels of all inputs in an effort to produce given quantity. However, *short run production function* allows producer to change the levels of some but not all inputs. We will now look at the concept of short run production function in more detail.

Definition 1.9 (Average product) *Average product* $AP_i(z) = \frac{f(z)}{z_i}$ *is the ratio between output and amount of i-th input.*

Again, we have three possible situations similarly as in long-term production function: [4]

1. Constant returns to factor - Increasing ratio $\frac{f(z)}{z_i}$ with z_i, $MP_i = AP_i$.

2. Increasing returns to factor - Invariable ratio $\frac{f(z)}{z_i}$ with z_i, $MP_i > AP_i$.

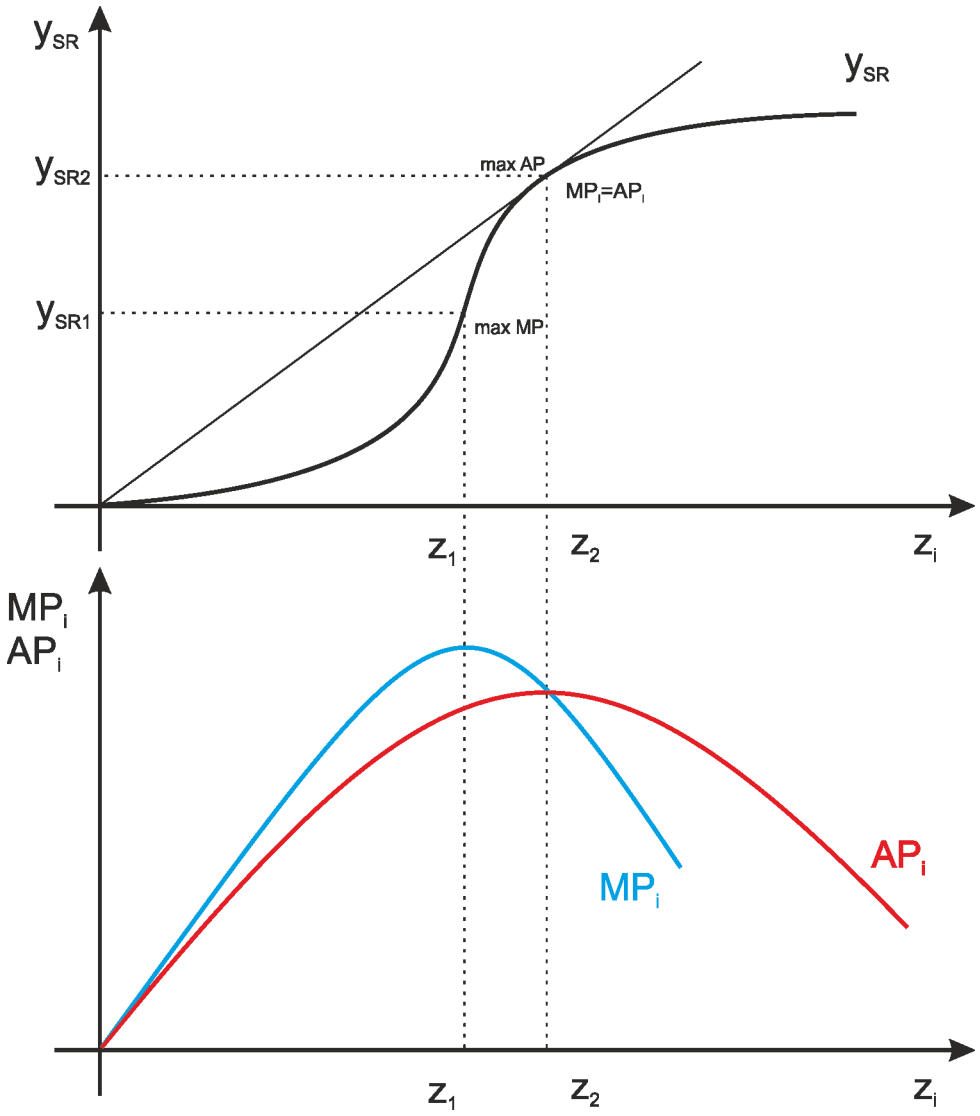
3. Decreasing returns to factor - Decreasing ratio $\frac{f(z)}{z_i}$ with z_i, $MP_i < AP_i$.

Amount of input z_i, for which increasing returns to factor change into decreasing returns to factor, is called *minimal effective use of factor*. [4]

Returns to factor could be measured by *elasticity of returns to factor:*

$$e^y_{z_i} = \frac{\partial f(z_i)}{\partial z_i} . \frac{z_i}{f(z_i)} = \frac{MP_i}{AP_i}$$

Figure 2.1.4: Changes in Returns to Factor



Source: [4]

2.1.5 Maximization of the Profit

Profit $\prod$ is the difference between revenues and expenditures. [5] If company produces outputs $y_1, ..., y_m$ and consumes inputs $z_1, ..., z_n$, prices of outputs are $p_1, ..., p_m$ and prices of inputs are $w_1, ..., w_n$, we have:

$\prod = \sum_{i=1}^{m} p_i y_i - \sum_{i=1}^{n} w_i z_i$. We can simplify this equation for one output: $\prod = p.y - \sum_{i=1}^{n} w_i z_i$. If the company is *technically effective*[2] and amount of output could

[2]Production is technically effective if given output couldn't be produced with smaller amount of at least one input while maximally same amount of other inputs is preserved.

not be produced with less amount of inputs then following equation holds: $y = f(z) \Rightarrow \prod = p.f(z) - \sum_{i=1}^{n} w_i z_i$. If we want to maximize profit, we have two conditions:

1. We have to find an extreme of the equation: $\frac{\partial \prod}{\partial z_i} = p.\frac{\partial f(z)}{\partial z_i} - w_i = 0 \Rightarrow p.MP_i = w_i$.

2. Function has to be strictly concave in particular point (we have to find *maximum*): $\frac{\partial^2 \prod}{(\partial z_i)^2} = p.\frac{\partial^2 f(z)}{(\partial z_i)^2} < 0$.

2.2 Costs

Having studied technology in proceeding section, now we can describe firm's cost function. In this Section we exploit theory of production developed in Section 2.1 to derive various types of cost functions. All decisions of a firm have to consider costs of the output and revenues that will result when output is sold. We will look for the cheapest or the most efficient way to produce any given output. We will define two types of *cost function*; one for long run and one for short run.

2.2.1 Minimization of Costs in Long Run Period

In long run period we are able to change all inputs. The length of long-term period depends on fixed factors. If we consider wages as a fixed factor, then in the long-term period there will be time to change them.

The isoquants of production are constraints on production and give us an infinite number of input combination to get particular output. However, producer want to choose only the least-cost combination of inputs to produce required output. In following text we will describe how to find this set of inputs.

We can write costs as: $C = \sum_{i=1}^{n} w_i z_i$. We are looking for minimum of $\sum_{i=1}^{n} w_i z_i$ by choosing of set of inputs $(z_1, ..., z_n)$ satisfying these conditions:

1. $f(z_1, ..., z_n) \geq y^0$

2. $z_i \geq 0,\ i = 1, ..., n$

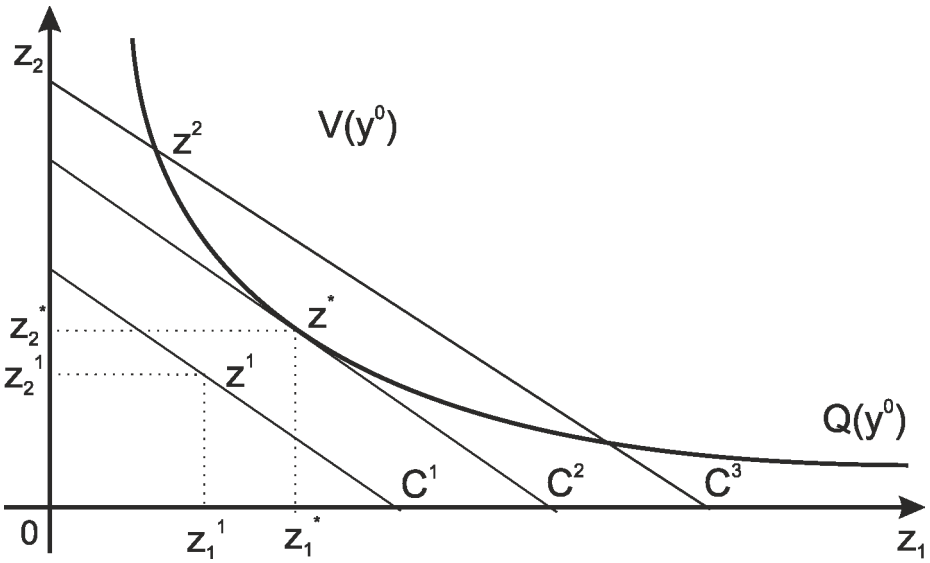
Definition 2.1 (Optimal combination of inputs) *Optimal combination of inputs is the mixture of inputs that produces a particular level of output at the lowest cost.*

Definition 2.2 (Conditional demands) *Conditional demands z_1^* for inputs are amounts of input which minimize costs on output y and prices of inputs w: $z_i^* = z_i(w_1, ..., w_n, y) = z(w, y)$.*

Definition 2.3 (Isocost curves) *Isocost curves C^j are curves in which all combinations of inputs on the curve are equally expensive.*

If input prices are fixed, such isocost curve is a fixed line. All possible combinations of two inputs we can write as $C = w_1 z_1 + w_2 z_2$ which we can rewrite as $z_2 = \frac{C}{w_2} - \frac{w_1}{w_2} z_1$. Therefore isocost curve is a line with the slope $-\frac{w_1}{w_2}$ and intersection point with vertical axis is $\frac{C}{w_2}$. [2; p. 341] We can formulate process of minimization of costs as the finding of a point on isoquant corresponding to the lowest isocost curve (see point z^* on Figure 1.2.1).

Figure 2.2.1: Isocosts and Isoquants



Source: [6]

Minimization of Costs Assumptions for 2 Inputs

1. $MRTS_{21} = \frac{MP_1(z^*)}{MP_2(z^*)} = \frac{w_1}{w_2}$
2. $f(z^*) = y^0 \Leftrightarrow z^* \in Q(y^0)$

Minimization of Costs for i Inputs

For minimization of costs for more than 2 inputs Lagrange method could be used. [6]

$$L = \sum_{i=1}^{n} w_i z_i + \lambda \left(y - f\left(z_1, ..., z_n \right) \right)$$

1. $\frac{\partial L}{\partial z_i} = w_i - \lambda^* . \frac{\partial f(z^*)}{\partial z_i} = w_i - \lambda MP_i\left(z^*\right) = 0 \qquad i = 1, ..., n$
2. $\frac{\partial L}{\partial \lambda} = y - f\left(z_1, ..., z_n\right) = 0$. For two different inputs:

$$\frac{\partial L}{\partial z_i} = 0,\ \frac{\partial L}{\partial z_j} = 0 \Rightarrow \lambda^* . MP_i\left(z^*\right) = w_i,\ \lambda^* MP_j\left(z^*\right) = w_j$$

$$\frac{MP_i\left(z^*\right)}{MP_j\left(z^*\right)} = \frac{w_i}{w_j}$$

We can see that for $n = 2$ we have the same results as for minimization of costs for two inputs. We are often confronted with a situation, where the amount of some input is equal zero. Then we talk about *corner solution*.

Production is *economically effective* when costs are minimized. [6]

> **Definition 2.4 (Marginal costs)** *Marginal costs MC are the ratio at which minimized costs on particular output y increase with change of this output.*
>
> **Definition 2.5 (Cost function)** *Cost function $C\left(w, y\right)$ is the function which demonstrates relationship between cost and quantity; it tells us how much it will cost to produce any given quantity of a product.*

Cost function assigns the smallest value of total costs to the given output y and input prices w: $C = \sum_{i=1}^{n} w_i z_i^* = C = \sum_{i=1}^{n} w_i z_i\left(w_1, ..., w_2, y\right) = C\left(w, y\right)$. Assumptions of cost function:

1. Increasing in output y and non-decreasing in prices w
2. Proportional change in all prices w causes change of value of Cost function in the same proportion[3]: $C\left(kw, y\right) = kC\left(w, y\right) \forall k > 0$
3. Continuous in prices w and output y
4. Concave in prices

[3] We say mathematically that Cost function is linearly homogeneous

5. Shephard's lemma: Conditional demand z_i^* for i-th input equals the ratio in which minimized costs are changing with small change of price of i-th input: $\frac{\partial C(w,y)}{\partial w_i} = z_i^*(w,y)$. Shepard's lemma is an useful tool how to estimate changes in costs with small changes in price of some input. If price of i-th input increase by Δw_i then approximate increase in costs will be $\Delta w_i z_i$[4].

Long Run Cost Curves:

Definition 2.6 (Total cost curve of long run period) *Total cost curve of long run period LTC* depicts minimized costs of long run period $C(w,y)$ as a function of output y and assumes particular and constant vector of prices w.

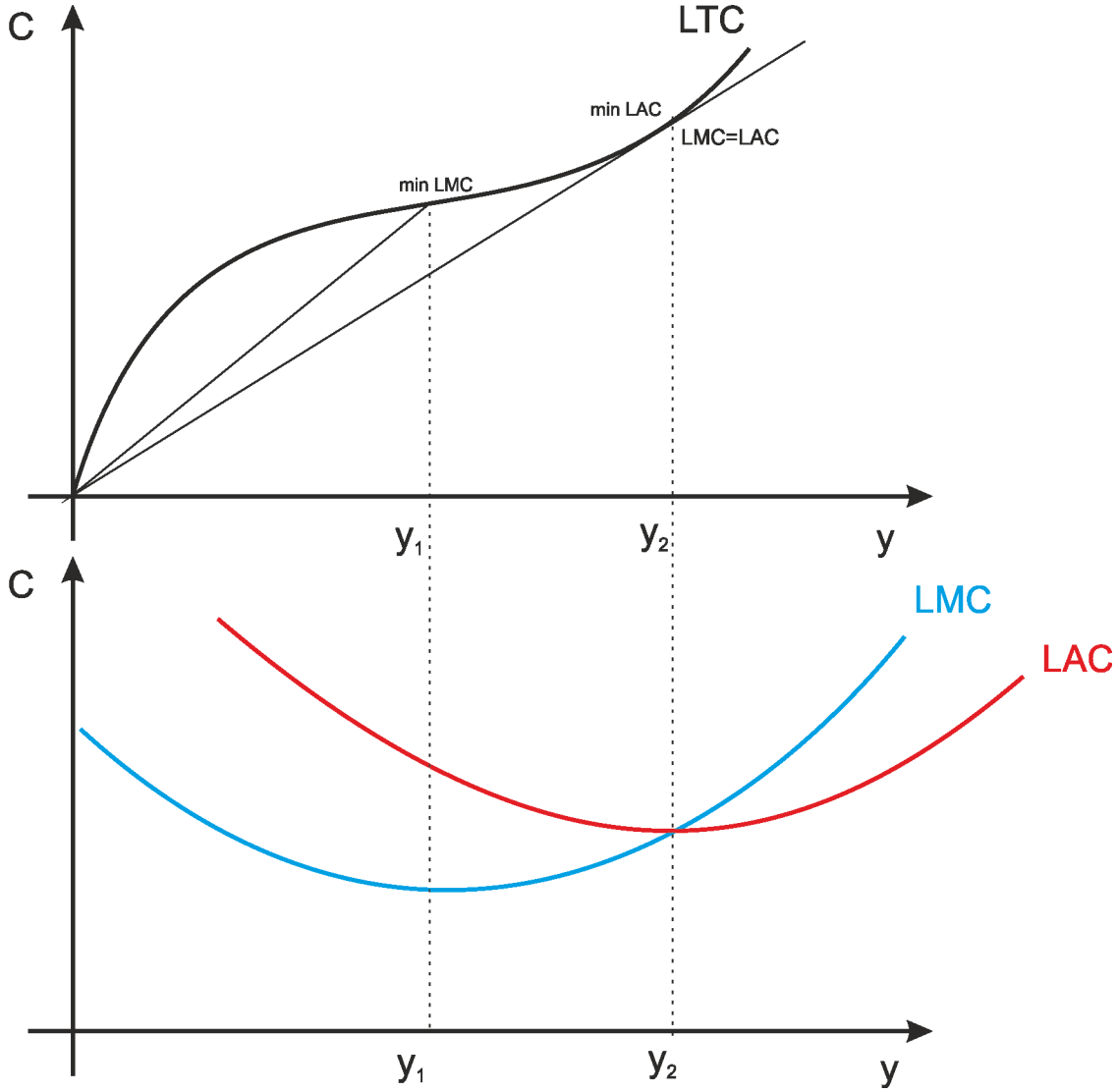
When we substitute conditional demands to this function, we get minimized total costs as function prices of inputs and required output.

Definition 2.7 (Average costs of long run period) *Average costs of long run period LAC are ratio of LTC and particular output y:* $LAC(y) = \frac{LTC(y)}{y^0}$.

Definition 2.8 (Marginal costs of long run period) *Marginal costs of Long run period LMC are ratio at which LTC changes with change of y:* $LMC(y) = \frac{\partial LTC(y)}{\partial y} = \frac{\partial C(w^0,y)}{\partial y}$.

[4]For example if the company has 1,000 employees and salaries would rise about CZK 2 then estimated increase in costs would be CZK 2,000.

Figure 2.2.2: Total Cost Curve of Long Run Period



Source: [6]

LMC curve determines change in costs for particular change in output: $LMC\,(y) = \frac{\triangle LTC(y)}{\triangle y}$. If we have *decreasing* average costs, we have to add marginal unit whose value is *lower* than average value of this output. This implies that if we have *decreasing* LAC, LMC have to be lower than LAC. Thus LMC passes through minimum of LAC.

Definition 2.9 (Economies of scale) *Economies of Scale is situation when average costs decrease with increasing output.*

There are specific relations between economies of scale and returns on scale:

1. Economies of scale (increasing returns on scale → economies of scale).

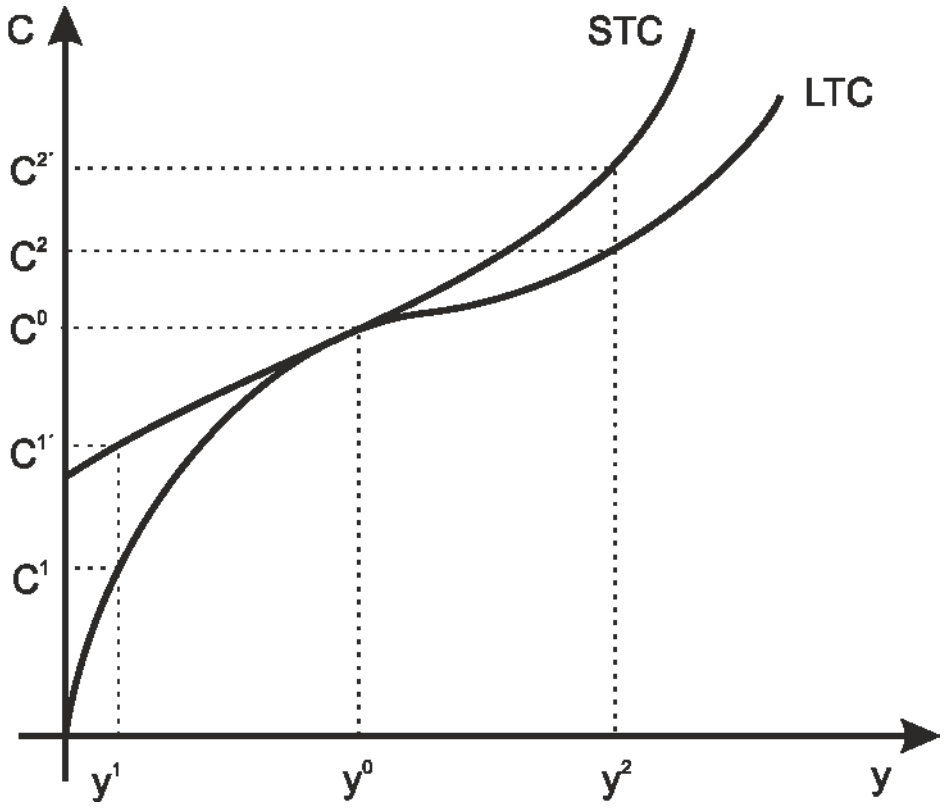
2. *Negative* economies of scale is situation when average costs increase with increasing output (decreasing returns on scale → negative economies of scale).

3. *Zero* economies of scale is situation when average costs are constant (constant returns on scale → zero economies of scale)

2.2.2 Minimization of Costs in Short Run Period

With the short run cost function we will minimize costs to produce desired quantity of output given that we cannot change at least one input. Thus producer doesn't have the flexibility to combine inputs in an optimal way as he would in long run. Short run costs are always higher or equal than long run costs.

Figure 2.2.3: Total Cost Curves of Short Run Period and of Long Run Period



Source: [6]

In such a case, the producer finds the optimal input combination by using the smallest amounts of the variable inputs.

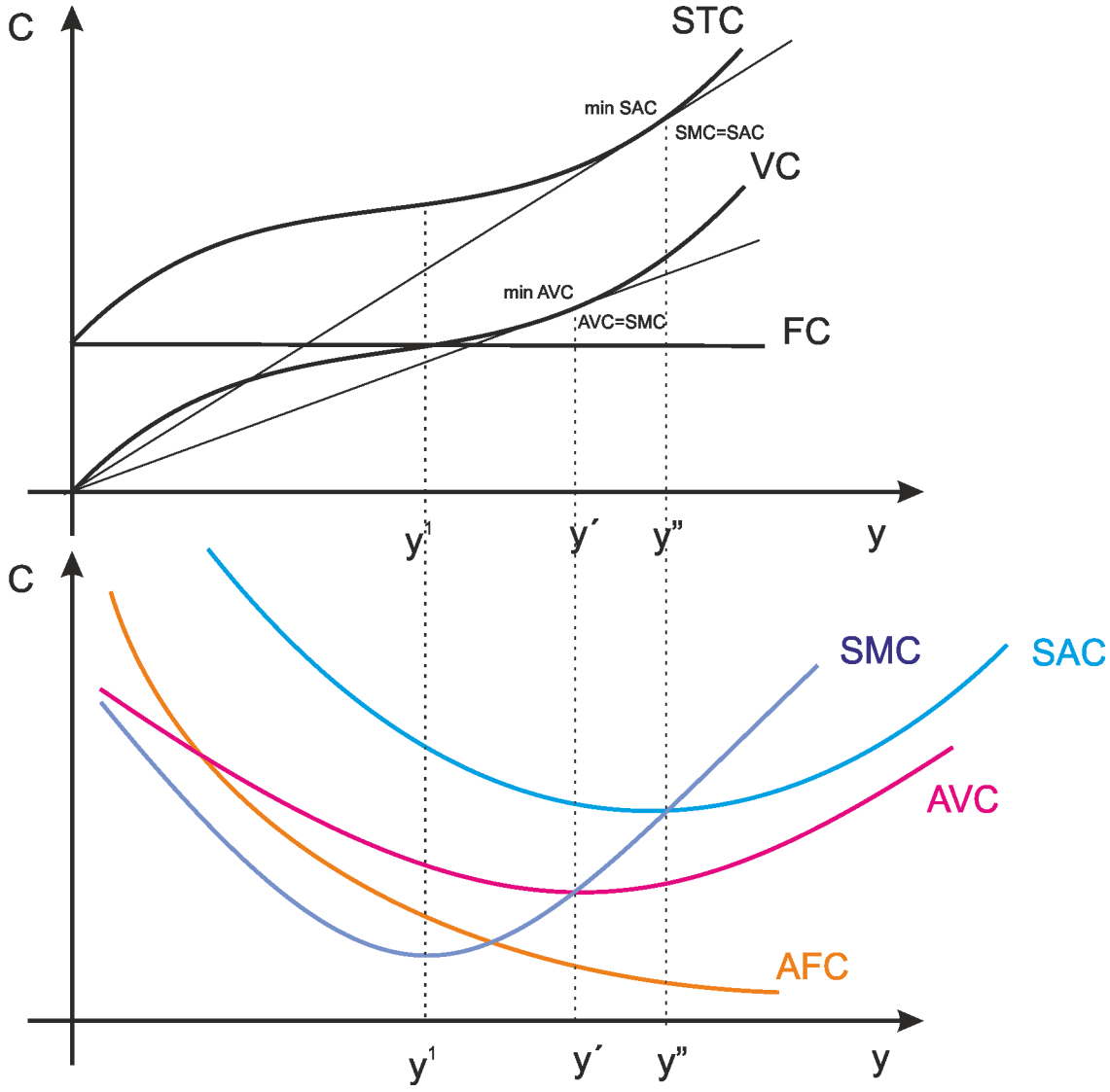
Short Run Cost Curves:

Definition 2.10 (Fixed costs) *Fixed costs FC are the costs of fixed factor of production; the costs that do not change with the level of output.*

Definition 2.11 (Variable costs) *Variable costs VC are the costs of the variable factors of production; the costs that change with the level of output.*

Definition 2.12 (Total cost curve of short run period) *Total cost curve of short run period STC depicts minimized costs of short run period $C(w, y)$ as function of output y and assumes particular and constant vector of prices w and particular and constant amount of fixed inputs: $STC = FC + VC = w_2\bar{z}_2 + w_1 z_1$.*

Figure 2.2.4: Total Cost Curve of Short Run Period



Source: [6]

Definition 2.13 (Average costs of short run period) *Average costs of short run period SAC are ratio of STC and particular output y: $SAC(y) = \frac{STC(y)}{y}$.*

Definition 2.14 (Marginal costs of short run period) *Marginal costs of short run period SMC are ratio at which STC changes with change of y: $SMC(y^0) = \frac{\partial STC(y)}{\partial y}$.*

Definition 2.15 (Average variable costs of short run period) *Average variable costs of short run period AVC are ratio of variable costs of short run period and particular output y: $AVC(y) = \frac{VC(y)}{y} = \frac{w_1 z_1}{y}$.*

Definition 2.16 (Average fixed costs of short run period) *Average fixed costs of short run period AFC are ratio of fixed costs of short run period and particular output y: $AFC(y) = \frac{FC(y)}{y} = \frac{w_2 \bar{z}_2}{y}$.*

Generally, average costs determine costs on one unit of production. We showed in Figure 1.2.4 how does these functions look graphically. The simplest is function AFC. If $y = 0$, $AFC = \infty$ and if output is increasing, $AFC \to 0$. Now consider function AVC. We will start with $y = 1$. Then AVC will be equal to VC required for production of one unit of production: $AVC(y) = w_1 z_1$. If we increase level of output, we can organize production more effectively, so AVC could decrease. But AVC will finally increase because, from a particular moment, fixed factors of production generate restrictions. As an example we will assume that fixed factors will be the payment on the loan on assembly line. If we reach capacity of this line, AVC will rapidly increase. SAC curve is the sum of these two curves, so it has "U" shape.

SMC curve determines change in costs for particular change in output: $SMC(y) = \frac{\triangle STC(y)}{\triangle y}$. If we have *decreasing* average costs, we have to add marginal unit whose value is *lower* than average value of this output. This implies that if we have *decreasing* SAC, SMC has to be lower than SAC. Similarly, if we have *increasing* SAC, SMC has to be *higher* than SAC. We can use analogical arguments in case of AVC.

In the beginning, average cost curve will be decreasing because of decreasing average fixed cost curve, but from a particular moment, it will rise because of increasing average variable costs. Marginal costs and average variable costs are identical for the first unit of production. SMC curve passes through minimum of SAC and AVC curves.

2.2.3 Transaction Costs

This thesis is aimed at the optimization of material costs. However sometimes there is a situation that even if optimization process generates savings, overall profit of

the firm is lower. This could be because of *the transaction costs*. As every company focuses mainly on optimization of costs in manufacturing on the other hand the transaction costs might be neglected. Transaction costs are the part of *the institutional economics* but are closely related to the microeconomics. The definition is following: *"Transaction costs are the costs of operation of economic system,"* [8] or *"Transaction costs are costs incurred in making an economic exchange."* They are analogous to "frictions".

Microeconomics understands frictions as a market failure or as a consequence of monopolistic practices. Institutional economics tries to explain the frictions via transaction costs. This analysis of costs is more micro-analytical and is more aware of its behavioral assumptions. We distinguish *ex-ante* (e.g. negotiation of agreement) and ex-post (e.g. lawsuit) transaction costs. [8; p. 32]

Transaction costs are everywhere, they differ only by their size. Zero transaction costs are only a limit state. Efforts to minimizing the transaction costs inside company lead to a search for optimal organization of the company.

2.2.4 Conclusion

In this Chapter we discussed only theoretical terms which are, in my opinion, the most important to be aware of in Škoda Auto a.s. They are based on exact mathematical formulas and the consistent structure of the Chapter should ensure good comprehension. We defined some simplifying assumptions for our needs but the core of the problem is generally valid in every automotive company. If the managers are not sufficiently educated in the theoretical functioning of the company, their decisions could negatively influence profit and costs.

In the next Chapter we will analyze instruments of the company to manage profit and costs. They have impact on the company's cost curves and if they perform well, they could positively influence financial results.

3 New Approach to the Management of the Company

In this Chapter I will describe theoretical and practical approach to two very important company functions - Controlling and Marketing. Two Organizational Units represent Controlling and Marketing in Škoda Auto a.s. (see Organization of Škoda Auto a.s. in Appendix). We will talk about these Units in Chapter 4 so it is important to have an idea about them.

3.1 Controlling

Controlling, in the sense of *management method,* has origin in the first half of the 20th century. It plays an important role in financial management of the company and determining the right strategy to reach the future prosperity. Managerial functions of Controlling are planning, organizing, staffing and directing. Controlling is still changing and adapting to the new market conditions and requirements of the management. The pragmatic approach to the management of the company shifted the function of Controlling more into *management philosophy.* [9; p. 28.]

3.1.1 Theoretical Concept of Controlling

Henri Fayol formulated one of the first definitions of Controlling in the beginning of the 20th century:

> *"Control of an undertaking consists of seeing that everything is being carried out in accordance with the plan which has been adopted, the orders which have been given, and the principles which have been laid down. Its object is to point out mistakes in order that they may be rectified and prevented from recurring."*

Importance of Controlling increased in 80th and 90th the last century as a reaction on increasing requirements on more effective management of firms. At this time Controlling is considered primarily as information tool of the management. Responsibility of controller was to prepare foundations for support of the management - reporting. Such reporting documents were mostly related to accounting information and were intended for top management. Disadvantage of this information was that they focused only on past operations and they had only control function, thus served as an analysis of differences compared to the plans or budgets. Controller was assistant of particular manager on subordinate position and he was responsible for obtaining exact information. This model had its negative features: it was not suitable to create barriers between work with information and decision-making power and responsibility and it was insufficient to establish managerial decisions only on past value information. Therefore the role of Controlling was extended also on the future direction of the company.

The main tasks of current Controlling are standards setting, measuring actual performance and taking corrective actions. Its role moves from internal analysis of past and present to planning for the future. Following diagram depicts relation between manager and controller:

Figure 3.1.1: Manager vs. Controller

Source: [16]

Manager plans and decides. He actively takes action to reach better economic results. Controller gets information, processes information, analyzes information and suggests solution to management. He manages the planning process and focuses on overall performance of the firm. Among most important activities of controller belong adjustment of information (25%), the care of the system (15%), internal consultancy (ideally 55%) and inserting data to the system (5%).

Utilization of controllers' activities: [16]

1) Shaping the environment for managers:

- reduce of complexity - clear structure of system of calculations, focus on key indicators, transparency of internal processes
- analysis of the development - identifying trends in development, influence of the season, analysis of demand
- support of reaction - planning of measures on the basis of collected information

2) Creation of the content with managers:

- creation of variants of the solutions
- distribution of targets
- fulfillment of the targets

We have two types of Controlling:

Operational Controlling

Operational controlling helps to the company to prepare for the future and within one-year horizon manage corrective measures if the company diverges from the outlined objectives. It is short-term process and has only financial orientation. Operational controlling focuses on realization of opportunities. Operational controlling provides management tools, for example creates well-arranged economic complexity of the company, provides information to possible corrective measures or ensures that balance between revenues, costs, profit and financial stability was reached on the basis of strategic security of the future. [10; p. 17] Basic motto of Operational controlling is: "Do the things right."

Strategic Controlling

Strategic controlling focuses on future. Its objective is to take actions which will prevent financial troubles in the future. It means that we analyze future risks before they occur. It is long-term process and has financial and non-financial orientation. Strategic controlling focuses on creating of opportunities. Among main tools of Strategic controlling belongs SWOT analysis (see Subsection 3.2.1), risk analysis, strategic potential analysis, strategic balance, strategic planning and others. Basic motto of strategic controlling is: "Do the right things."

Operational and Strategic controlling are connected. Separation of these two processes is not possible in practice because we need information from both areas for every controlling activity; also, they both generate impulses for corrective actions.

3.1.2 Concept of Controlling in Škoda Auto a.s.

As outlined in Subsection 3.1.1, Controlling has its tasks and a set of tools to fulfill these tasks. It is one of the most important Units in Škoda Auto a.s. The management of the company needs to be well informed about complicated internal and external environment in time. Controlling serves also as a data bank and a filter of the information, suggests solutions, creates scenarios of future impacts of various solutions and adapts to the changing environment (market segmentation, globalization, innovations, knowledge management). Controlling is *the navigator to the target* and ensures the fulfillment of the targets. [16]

The main task of Controlling in Škoda Auto a.s. is to draw up Budget of Škoda Auto a.s. (more in Section 4.3). Moreover it monitors all economically relevant strategic, product and project intentions in order to reduce uncertainty. [17] EC Unit closely cooperates with Accounting Unit and attends main Gremiums related to the management of the company. It is instrument of management for financial management of the company.

Development of Controlling in Škoda Auto a.s.

1. Controller as "registrator" - Registrator aims on accounting and he only informs management. He aims on past on control of the data. He has passive role and he only attend meetings.

2. Controller as "navigator" - Navigator defines targets and monitors their fulfillment. He actively interprets deviations and indicates corrective measures. He aims on present and has coordinating function.

3. Controller as "inovator" - Inovator focus on the future and action. He shows and promotes solutions to problems and is constructive opponent. He creates systems to recognize risk in time.

Controlling and its Philosophy of Planning

The customer is most important in planning of capacity, prices, investments, personnel and markets in which the company wants to enter. Targets are approved

by Board of Management and they generally binding. The company has long-term and medium-term plans, Budget on one year and view on following months (more in Chapter 4). Controlling has the task of collecting information about past development, comparing past development to the plan, analyzing of deviations and suggesting of corrective measures. Controlling regularly informs management of the company about sales, inventories, economic results, profit, balance and about *early warnings*.

3.1.3 Structure of Controlling in Škoda Auto a.s.

Controlling ("EC Unit") is part of Commercial Affairs Area. Description of activities is in Subsection 3.1.2.

1. Controlling of Development and Product ("ECT Department") - This Department is responsible for financial management of new product's origin in order to reach the future targets and financial prosperity.

2. Controlling of Purchasing and Material Costs ("ECN Department") - ECN Department ensures drawing up of Budget of material costs, technical changes and Product costs optimization measures (see Section 4.4). They set standard prices and monitor development and possible deviations of prices.

3. Controlling of Result and Financial Planning ("ECF Department") - ECF Department draws up short-term and medium-term plans, as report of gains and losses, balance or cash-flow, to achieve financial plans of the company. They compare reality to the targets, suggest measures to remove deviations and draw up alternative scenarios of future development.

4. Controlling of Central Administration, Investments and Costs ("ECC Department") - Main tasks of this important Department are planning of product and non-product investments, planning, monitoring and management of personnel and operating costs or evaluation of Make or Buy decisions[1].

5. Controlling of Production Costs and Stock ("ECZ Department") - ECZ Department manages accounting evidence of inventories according to its type (production and operating material, spare parts, incomplete production, completed vehicles or SKD).

6. Controlling of Holdings and Sales ("ECP Department") - This Department manages sales process, with aim on prices, capacity and costs, foreign projects and financially values new products.

[1] The Make or Buy decision is the act of making a strategic choice between producing an item internally (in-house) or buying it externally (from an outside supplier).

7. Controlling of Production and Logistics ("ECV Department") - Tasks of this Department are planning, monitoring and analysis of financial management in Production and Logistics Area.

3.2 Marketing

Marketing is defined by the American Marketing Association[2] as: *"The activity, set of institutions, and processes for creating, communicating, delivering, and exchanging offerings that have value for customers, clients, partners, and society at large."* Marketing is modern business philosophy where customer, his needs, wishes and expectations, are at the center of interest. Assumptions for application of marketing is the market economy and that supply must exceed demand because of competition (problem is to sell, NOT to produce).

3.2.1 Theoretical Concept of Marketing

Marketing has three degrees. First degree is *marketing philosophy* which cares about customer and employees on all levels should be familiar with it. Second is *marketing management* (management, decision making) and employees on all management levels should be familiar with it as well. The last degree is marketing and *marketing techniques* as market research, advertising, public relations or sponsoring.

Characteristics of Marketing

1. Relationship to the customer - There is a feedback between the customer and the company. Marketing research of the market plays an important role in this relationship.

2. View of the profit - The company realizes the its profit through the customer. It has to satisfy the customer in return (e.g. customer gets something for free).

3. Relationship to the surrounding - Company communicates with its surroundings. In case of a negative situation it has to convince the customers to return at costs.

[2]The American Marketing Association is a professional association for marketers. As of 2008 it had approximately 40,000 members. There are 76 professional chapters and 250 collegiate chapters across the United States.

4. View of the competition - Competition is understood as a driving power of the company's future development.

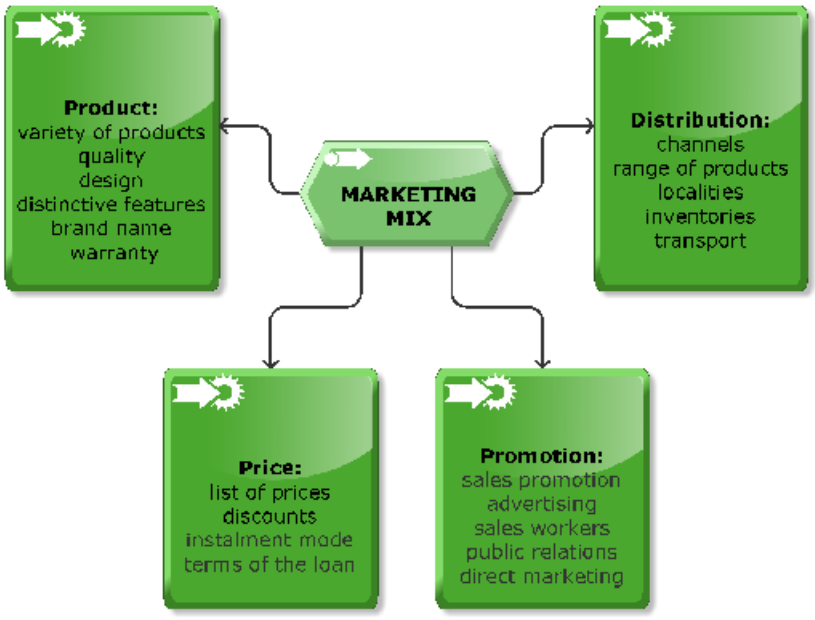
5. Typology of the management style - There are three types of management styles: *autocratic* (unpromising from long run), *democratic* (subordinates participate on the management of the company) and *liberal* (manager delegate part of his competences on subordinates).

6. Dealers - Dealers are important employees from view of marketing. They are in touch with the market, they are familiar with it and they bring information about market to the firm.

The Marketing Mix

Marketing task is to draw up some marketing programs to create, communicate and provide value to the customers. A marketing program consists of many decisions which values strengthening marketing activities to use. One of the traditional descriptions of marketing activities is *marketing mix*. *"Marketing mix is set of marketing instruments which companies use to reach their marketing targets."* These instruments are divided into four groups - *"4P"*: product, price, place and promotion. [11; p. 57]

Figure 3.2.1: Marketing Mix



Source: [11; p. 57]

According to Robert Lauterborn, "4P" corresponds to *"4C"*: product x *customer solution*, price x *customer cost*, place x *convenience* and promotion x *communication*. If companies fulfill customers' needs from financial view, immediately and with effective promotion, they gain an enormous advantage ahead of the competition.

1. Product - "Core" of the product defines its basic functional characteristics (purpose) and "extension effects" make the product unique. We have three groups of effects: effects which widen utility properties of the product (e.g. quality, longer warranty), effects which create conditions for different use of the product (e.g. brand, design or fashion) and effects which are connected to the sales services (e.g. method of payment, transport into the house).

2. Price - We have two main kinds of prices: *price based on supply* and *price based on demand.* Price based on supply contains *cost-oriented price* (core of this price is costing - most common) and *required price* (company determines profit and from it the price is derived). Price based on demand contains *price on the basis of perceived value* (on the basis of market research), *price based on competitors' prices* (average price from prices of competitors) and *psychological price* (e.g. CZK 99).

3. Promotion - Examples of promotion are advertising, direct marketing (e.g. direct mail, teleshopping, telemarketing or direct sale), sales promotion (e.g. tastings, gifts or vouchers), public relations or sponsorship.

4. Place - Place means location of the product on the market, since it has left the warehouse till it gets to the customer.

SWOT Analysis

SWOT analysis is overall analysis of the *strong* and *weak* sides of the company and its *opportunities* and *threats*. [11; p. 90]

1. Analysis of external environment (finding opportunities and recognizing threats) - Company must monitor key forces of *macro environment* (e.g. demographic, natural, technological or political) and *micro environment* (e.g. customers, competitors, suppliers, distributors or dealers) which have the power to influence its profit.

2. Analysis of internal environment (strengths and weaknesses) - Every firm has to evaluate its strong and weak sides. For example, problem could be when employees don't work as team.

Example of SWOT analysis in Škoda Auto a.s.: S - tradition, number of customers, quality; W - long waiting time for a new vehicle; O - expand domestic production of components; T - competition, economic recession.

3.2.2 Structure of Marketing in Škoda Auto a.s.

Marketing ("PM Unit") is part of Sales and Marketing Area. Marketing represents market and customer in the company. It has responsibility for short-term, middle-term and long-term heading of strategic marketing on national and international level. [17] Marketing develops appropriate marketing mix for every model classes of Škoda Auto a.s. They strive to locate companies' vehicles on the market with the utilization of strong features of Škoda Auto a.s.

1. International Sales Strategy ("PMN Department") - Main task of this Department is the creation of high quality sales processes for long-term strengthening of company's position in competitive environment. Customer is always in center of interest of PMN Department.

2. Marketing Communication ("PMK Department") - This Department is responsible for creation and realization of communication strategy. Target is to spread knowledge about brand among customers and support sales of products.

3. Product Marketing ("PMV Department") - They manage process of origin of the product from marketing view and cares about it throughout the life cycle. Main tasks are analysis of the market, analysis of the competition, price strategy or product strategy.

4. International Marketing ("PMI Department") - PMI Department is responsible for Customer relationship management activities, checking of marketing expenses on international markets and for optimization of information flows between importers and Škoda Auto a.s. They ensure consistency in communication between company and all markets, in which Škoda Auto a.s. is present.

3.2.3 Target Costing

Target Costing is a method in which the target costs of the product are derived from future (expected) market prices. The official definition is: *"Target Costing is a cost management tool for reducing the overall cost of a product over its entire life-cycle with the help of production, engineering, research and design."* [12]

PMV Department deals with Target Costing in Škoda Auto a.s. They don't ask the question: "What will the product cost?" but "What *can* the product cost?" [15] Target Costing ensures feedback on customer and on overall targets of the company from early phase of the development of the product. Disadvantages are that it is complicated to determine market value of the product and detailed cost targets. It has to be determined on the basis of experience and intuition. Target Costing has to be the method of change of thinking in all companies' departments ("Customer drives all what we do."). Five principles of Target Costing are:

1. Costs on future products are determined from expected revenues predicted by market

2. Target costs arise from subtracting of planned the profit from the net earnings taking into account risk premium

3. Total costs of the product are assigned to the components proportionally to the customer values

4. Costs divide into components forms target instructions for Specialized Departments in Technical Development, Production, Purchasing and Sales Areas

5. Analysis of departures of target and actual costs using benchmarking optimizing potential at the component level is identified

Target Costing influences costs in the whole production cycle with aim on early stages of the product, where is the best possibility to influence the costs. Target Costing is based on market-oriented cost information and takes into account the full cost of the product.

4 Optimization in Škoda Auto a.s.

4.1 Platform Uniformity

As was mentioned in the history overview in Chapter 1, Škoda Auto a.s. belongs to the Volkswagen concern. Platform components are common for all Volkswagen car factories (for example chassis of Fabia model is the same as for Polo model etc.). The idea of the platform strategy is main key in the optimization of the costs. Whole concern benefits by huge savings because of this uniformity; moreover better quality is reached. Group-wide optimization processes have been important because they have generated several percents savings. Group-wide workshops focused on finding the potentials from development phases to serial production are regularly held. They are imputed and monitored in a common database which provides very effective co-operation tool between the Production and the Technical Development Areas. This database has been a crucial point in monitoring of saving potentials as all information (including design drawings, comments of departments or photo documentation) are together in one, generally accessible place. More about information systems in Subsection 4.4.2.

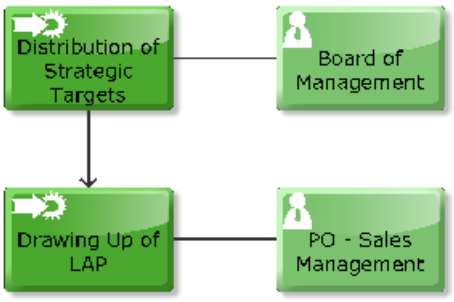
4.2 Planning Round

Planning Round ("PR") is a basic financial planning tool which, among others, includes all expected revenues and costs. [18] Planning Round is prepared for five year horizon and it is updated every year. It includes prime costs (material, salaries, energy etc.), operating costs, start-up costs, investments, Business plans and others.

4.2.1 Setting of Strategic Targets

First of all, there is a Kick Off, where general conditions and economic indicators are discussed and agreed by the concern's Board of Management. Next objective is to specify strategic targets by Škoda's Board of Management.

Figure 4.2.1: Distribution of Strategic Targets



Author based on Škoda Auto a.s. data.

4.2.2 Long-term Sales Plan

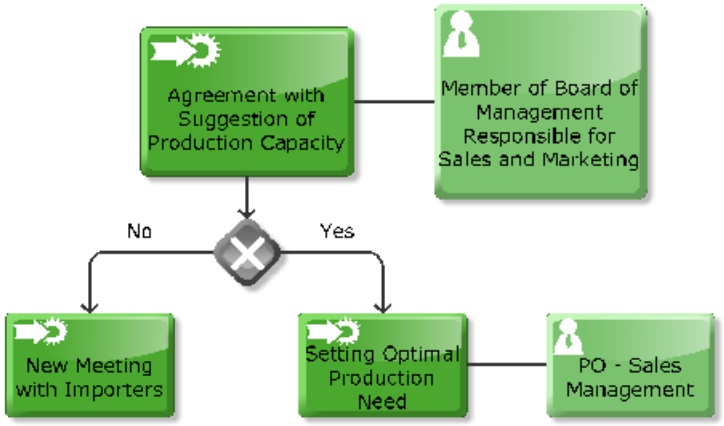
Long-term Sales Plan ("LAP") is planned 10 years ahead and it is based on analysis of trends for Central, East and West Europe, North, Central and South America and Asia. [19] There are several premises for LAP which are set every April.

- Cycle Plan[1] of the product (responsibility of Product Management - "GM Unit")
- Price position on the market and price index of the competition
- Price strategy
- Prognosis of the overall market
- Targets for the share of Škoda Auto a.s. vehicles on the market
- Investment trends and financial results (responsibility of Controlling - "EC Unit")

After setting premises and target values, Controlling, Sales, Marketing and importers discuss about the prices, overall market conditions and market shares. On the basis of importers' sales plans, total production need is planned. It is compared with production capacity of Škoda Auto a.s. and Sales Management Unit ("PO Unit") presents this plan to the member of Board of Management responsible for Sales and Marketing.

[1] It is strictly secreted long-term production plan which realizes plan on model classes, engines and other accessories 10 years ahead.

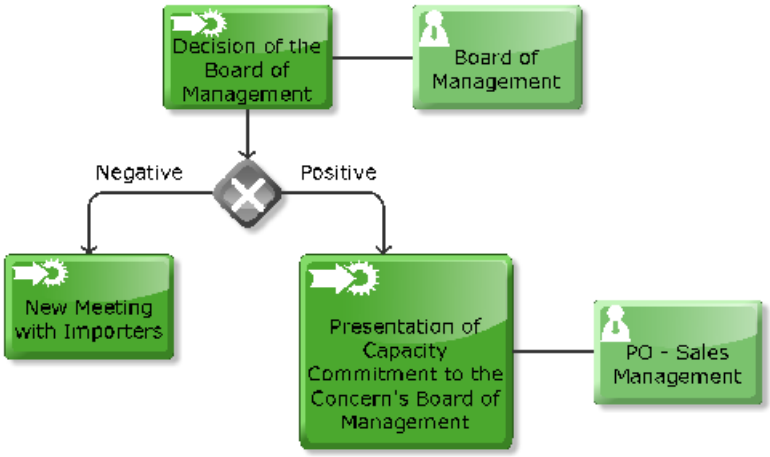
Figure 4.2.2: Agreement with Suggestion of Production Capacity



Author based on Škoda Auto a.s. data.

Sales Management proceeds this suggestion and optimal need for production to other Units (EC, VP, VL, Nx, PD, PS and PM - see Organization of Škoda Auto a.s. in Appendix) for inspection of capacity and financial evaluation. Subsequently, Sales Management carries out presentation for Board of Management for authorization.

Figure 4.2.3: Decision of the Board of Management



Author based on Škoda Auto a.s. data.

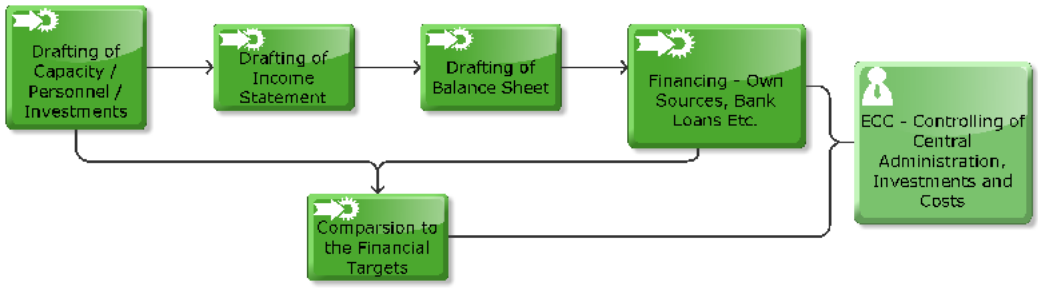
The whole process ends in September. After approval, Sales Management can concentrate on short-term sales planning. First two years of short-term planning are always covered in LAP. First year of short-term planning is the main ground for Budget (see Section 4.3). LAP includes these information:

- Overall market
- Market share
- Deliveries to the customers
- Condition of old orders
- New orders
- Inventory
- Net production needs

This is the ground for the Production Plan of the Vehicles, which is updated by PO Unit every month on PPA Commission's sessions[2]. PPA Commission discuss (on the monthly basis) sales, inventories, order status, new products, control Production Plan of the Vehicles, capacity changes, personal changes, economic evaluation of monthly programs and others.

4.2.3 Next Steps in Setting PR

Figure 4.2.4: Next Steps in Setting PR



Author based on Škoda Auto a.s. data.

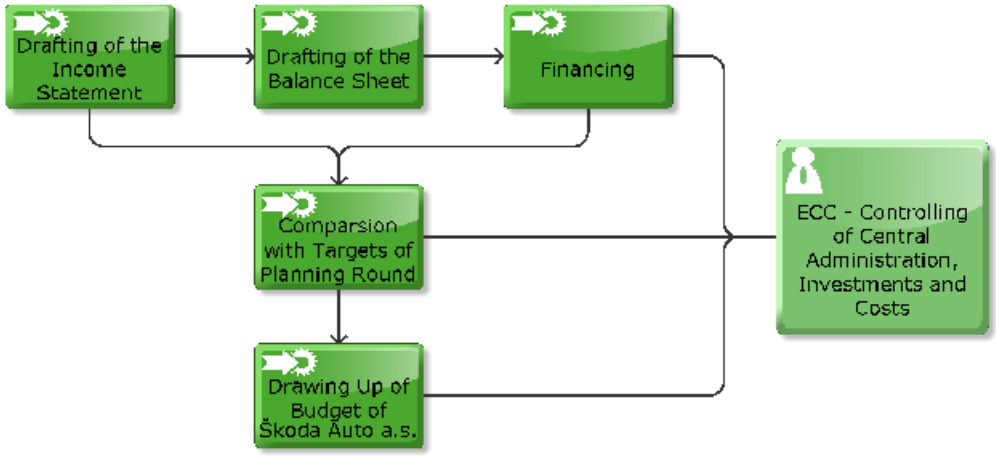
Among financial targets belong return on capital, profit, cash flow and liquidity. Now, Controlling of Central Administration, Investments and Costs Department ("ECC Department") can finally arrange general Planning Round and subsidiaries arrange their own Planning Rounds. Planning Round is electronically approved by particular unit and Board of Management. Finally, the concern's Board of Management approves updated Planning Round. The whole process is continuously monitored and operated by Škoda's Board of Management.

[2]PPA Commission is composed of the representatives of Production, Quality, Sales and Marketing, Controlling, Human Resources Management, Product Management and Purchasing.

4.3 Budget

Once the 5-year Planning Round is approved, financial needs can be planned. Subsequently, Budget (for one year) is established; it is structured in months. [20] First of all, Sales Management updates its needs on manufacturing according to the new Planning Round. This material is advanced to the ECC which continues with following:

Figure 4.3.1: Drawing up of Budget



Author based on Škoda Auto a.s. data.

Process shown on the diagram above is regularly evaluated and monitored. Based on the Budget of Škoda Auto a.s., budgets of subsidiary companies are prepared. The whole process is continuously monitored and operated by Škoda's Board of Management.

Furthermore, in statement called "Vorschau" is compiled prediction on financial needs on the remaining months of the year and this prediction is updated every month. The importance consists in specification of Budget on the basis of reality and approaching to the plan.

4.4 Product Costs Optimization

Product costs optimization (denoted by the abbreviation "PKO" from the German expression "Produktkostenoptimierung") means the optimization of material costs of

product and process in the Volkswagen concern. The goal of the PKO is to offer same or higher quality, technical functionality and customer value throughout the whole concern. It is a tool to reach more effective production and better financial results. All changes which may affect the customers can be realized only with approval of Marketing ("PM Unit"), Quality ("GQ Unit") and Technical Development ("Tx Unit").

4.4.1 Management of Optimization of Material Costs Unit

There are three Areas dealing with PKO: Purchasing, Technical Development and Production. Moreover, Area "T" has PKO targets on platform components. Each Area has its own department dealing with material costs, finding PKO potentials, managing Business plans for individual Areas and monitoring internal data related to the economic conditions. These departments are embraced by the Management of Optimization of Material Costs Unit ("TO Unit") and is monitoring their activity and results. It has 16 employees and its structure is in Appendix. The aim of the TO Unit is to improve the annual financial results of Škoda Auto a.s. in terms of material costs[3] and control the financial health of the company. The targets for each model class are set; they are implemented by particular measures. This will be analyzed in more detail in Section 4.7. TO Unit collects data and provides various services to other departments. Synergies between them are based on mutual communication, technical know-how, effectiveness and efficiency. Cooperation in PKO through TO Unit is important for saving potential's detection. TO Unit activities comprise:

- searching for PKO potentials
- inspection of realization possibilities
- implementation of discovered potentials
- preparation and presentation of "TOP points" on FMK[4]
- coordination of fulfillment of PKO targets within Production and Technical Development (equipment, electricity, aggregate, chassis, coachwork)
- coordination of optimization workshops with suppliers
- moderation of workshops, processing of materials from workshops

[3] There are another departments whose objectives are to optimize effectiveness of work, operating costs, costs on logistics and energies etc. But this would be beyond the scope of this thesis.

[4] Forum Material Costs is a commission composed of Board of Management, Technical Development, Production, Controlling, Quality, Sales and Marketing representatives. FMK meetings are held once per month.

TO Unit distributes targets only among Technical Development, Production and Platform. Purchasing Area distributes its internal targets by itself and then only advances complete plan to TO Unit (more in Subsection 4.7.3).

4.4.2 Information Systems

Various information systems are used in Škoda Auto a.s. The departments dealing with PKO use especially following:

1. AVON - AVON (Antragsvervolgungonline) is the central system for all concern brands. AVON is focusing on all technical changes (more about technical changes in Section 4.6) from their origin to implementation. There are all comments of various Specialized Departments, contacts, the monitoring of the processes or costs. It also contains all information regarding particular technical changes.

2. ZMĚNY - The system for monitoring and evaluation of the technical changes in Škoda Auto a.s. is called ZMĚNY. It includes the overview of investments in particular technical changes. This system is managed by Technical Changes Department ("VSA Department").

3. STEREO - The system for evidence and management of production processes' deadlines.

4. SAP - SAP is a central system taking care of inventories monitoring, operating costs, logistics, use of investments or for personal and wage costs. It is the support for administration and contains huge amount of various information. It is divided into several subsystems: material and personal management, costs, investment and financial accounting and others.

5. ELINA - ELINA is an electronic system for inserting and evaluating applications for approval of investments (Proposal to allow the investment - "BWA", more in Subsection 4.5.1).

6. EBP - EBP is an electronic system for inserting and evaluating applications for various orders. SAP, ELINA and EBP databases are interconnected.

7. PKO data bank - This is Volkswagen central data bank which is used to keep records of all saving potentials ever discovered (including the rejected ones). It contains detailed description of each idea and comments of Specialized Departments.

8. KVS - KVS is a system for administration of construction data. It contains all concern information about construction and allows users to find designs and drawings of the vehicles.

9. Piece List - In this system we can find by number all components, from which the final product is made.

4.4.3 PKO Process

All optimization processes are discussed with Specialized Departments, which provide financial calculations including possible investments, constructions, quality verdicts, technological and logistical support, production and marketing preparations etc. The PKO processes should be transparent and standardized for the whole company, synergies between model classes should be exploited as well. Operations necessary for effective and continuous PKO management are following:

- standardized structure of PKO processes
- approved targets for every department
- clear description of individual work
- delegation of responsibilities on individuals in Specialized Departments
- early evaluation of risk
- diligent documentation of the whole process including all decisions of individual persons, technical information
- transfer of saving potentials' evaluation to other departments

The PKO process is consisting of three stages:

Origin of PKO Ideas

PKO potentials come from specialists' suggestions and ideas. Furthermore, there are systematic tools enabling easier creation of PKO ideas:

1. Internal technical workshops - They are focused on one particular part of the vehicle and they are comparing it with parts from other model classes or with parts from competitive cars. Representatives of Purchasing, Quality, Marketing, Production and Technical Development participate on these meetings and together they are trying to find new ideas related to a particular topic. It may help to create greater synergies between model classes.

2. Visit in a manufacture part of the company - Several times a year, specialists from optimization departments are sent to the assembly lines and/or welding assemblies in order to analyze individual parts together with supervisors and workers. The output of these sessions is setting of the potentials, which have to be discussed with relevant employees of Technical Development. Potentials could be for example the usage of cheaper materials, changes in the surface treatment, changes in technical solutions, reduction of the amount of materials etc.

3. Dismantled car room - This workplace is situated in Technical Development's place in Česana Mladá Boleslav and is determined for a complex analysis of Škoda Auto a.s. competitors' vehicles. Dismantled cars, their parts and constructional solutions are situated here, being compared with Škoda Auto a.s. own vehicles. Dismantled car room is a source for the particular information about technical solutions, used materials and assembly methods. It allows detailed presentations showing the analysis of individual cars and it includes economic analysis of the individual parts. Of course, this is relatively expensive and time consuming process.

4. Program Z.E.B.R.A. - This is an internal electronic system which motivates employees of Škoda Auto a.s. through money remuneration to participate in the PKO process. Proposals are added to the system through personal computers or terminals located at the assembly lines and they are subsequently evaluated. Program Z.E.B.R.A. is not only for the PKO processes; it serves for improvement of working conditions, protection of health, energy savings and environmental protection as well.

5. International auto shows - On these shows, car manufacturing news as well as complex product programs of competitors are presented. In case of doubt, employees of optimization departments can ask experts of a given brand.

6. Improvement proposals from Volkswagen concern - Savings can be generated without participation of Škoda Auto a.s. employees because of the platform uniformity. If any PKO measure is approved on a platform component, it is automatically changed also in Škoda Auto a.s.

Analysis of PKO Ideas

All improvement proposals are recorded in the PKO data bank, where a numerical mark is assigned, under which the proposal is registered. The aim is to have

- maximal savings

- minimal costs
- quick realization

Firstly, current status of the process under review has to be checked. If there is possibility of costs saving, the analysis continue with indication of the time needed for the realization, potential for savings, relevance to customers and how many per cent of vehicles would be affected. Based on these data, possible savings are estimated. The aim is to find a potential with an economic return up to one year and with savings higher than € 0.01 per vehicle (if implemented). These criteria are preliminary and if they are not met, it's not worthy in continuing with further analysis of the potential. If the preliminary results are satisfactory, cooperation with other (internal or external) Specialized Departments can be established in order to obtain their comments. Overview of analysis:

- analysis of project documentation
- component analysis according to the Piece List including finding component numbers
- identifying vehicles involved in this particular potential
- opinion of individual Specialized Departments
- calculation of current costs and of after-optimization costs
- calculation of internal and external costs on development, operating costs and technology

On the basis of these information, the examination of the feasibility of the potential implementation follows. It has to be consulted with engineers in production which are responsible for tests and trials. The idea is then introduced on FMK.

Realization of the PKO Ideas

If the potential is accepted, process of implementation follows. It is a responsibility of Logistics of the Company Unit. VSA Department monitors if the deadlines in the process are met. When PKO potential is implemented, Controlling of Purchasing and Material Costs Department ("ECN Department") confirms that intended savings have been realized.

4.5 Investments in Škoda Auto a.s.

Investment is expenditure of financial resources to reach future profit in particular time period. Thus company spends its present financial resources in favor of future revenues. Every investment influences future and efficiency of the firm. Investments in Škoda Auto a.s. are expenses on expansion of company's property, which are related to particular investment plan of the company. We have two main types of investments in Škoda Auto a.s.: [21]

1. Product - As the name suggests, product investments are related directly to car production.

2. Non-product - Investments which are not directly related to car production but are essential for ensuring of the production (for example technical development, infrastructure, human resources management, IT systems or environmental protection).

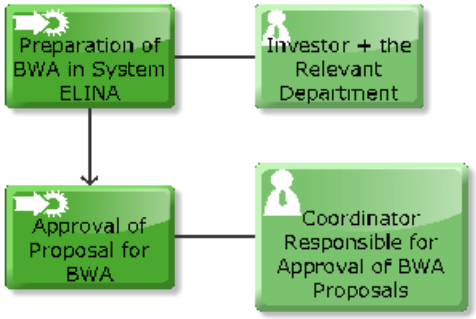
Before realization of every investment are evaluated all possibilities how, how much and into what to invest. For the most interesting projects are prepared studies which contains rationalization of project, risk assessment and timetable for realization. The investment targets are for example expansion of production capacity, improvement final product's quality, investments to new products or changes in the organization in Area "V". The investments are planned in accordance with the Planning Round at the end of every year.

4.5.1 Investment Approval Process

Every department prepares its own proposals for required BWAs in ELINA System in the end of the year. Assumption for drawing up of proposal for BWA is approved plan of the investments divided into particular M-Projects[5]. When proposal for BWA is drawn up, it is necessary to state number of M-Project related to particular proposal for BWA. More proposals for BWA could be drawn up on one M-Project. On behalf of Area "V", the proposals for BWAs are prepared by VSA/3 Center in cooperation with relevant department. VSA/3 Center is also the supervisor responsible for internal product investments ("Investor"); Ing. Jaroslav Drahota is the coordinator responsible for approval of proposal for BWAs.

[5]M-Project is basic element for investment planning because approved financial resources are divided according to it. They serve for identification of resources for their drawing. The list of all M-Projects makes up the investment plan. ECC Department administers M-Projects in system SAP.

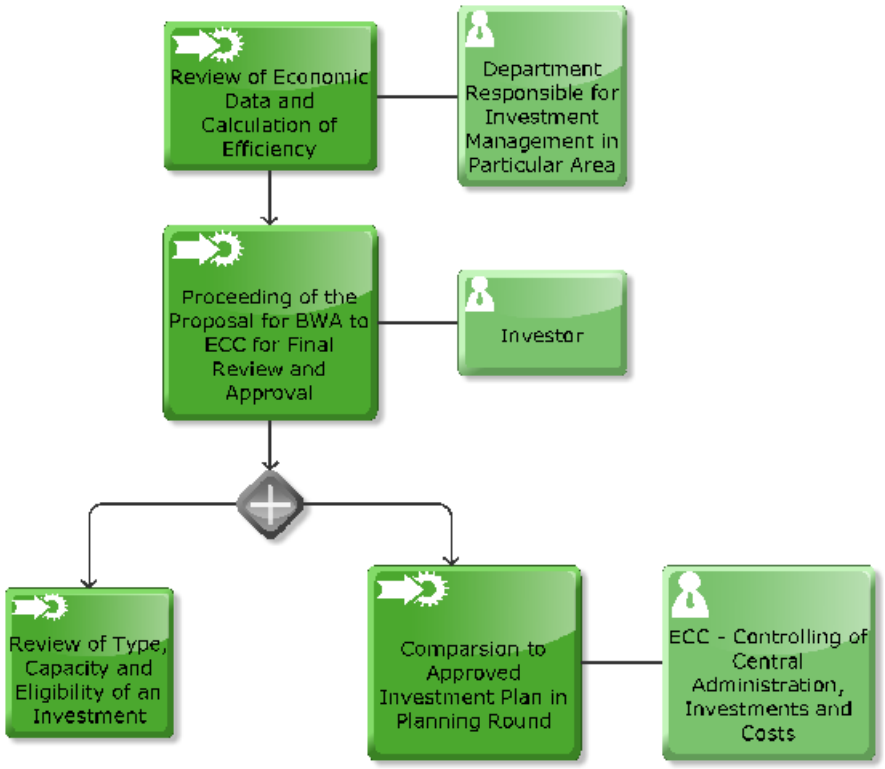
Figure 4.5.1: Preparation of Proposal for BWA



Author based on Škoda Auto a.s. data.

Once a proposal for BWA is prepared, it has to be checked. The coordinator proceeds proposals for review to the department responsible for managing of the investments in particular Area - in case of Area "V", it is Managing of Investments Department ("VPS Department").

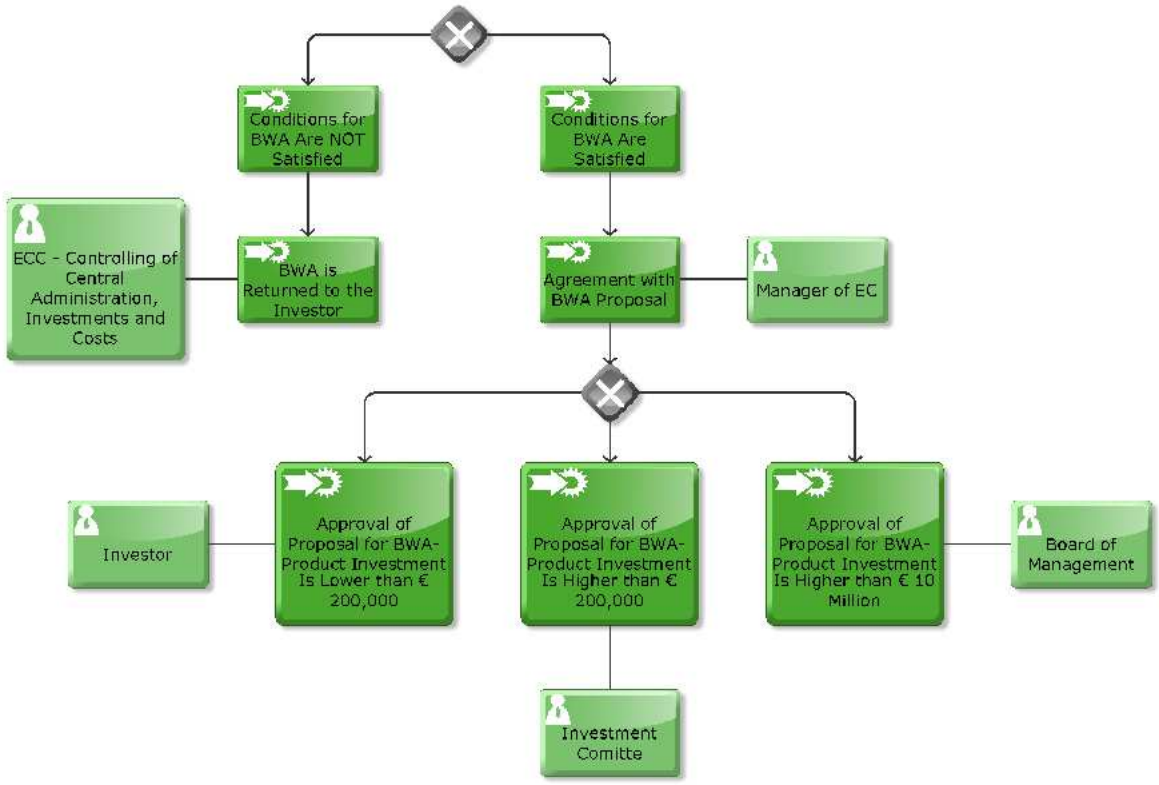
Figure 4.5.2: Review of Proposal for BWA



Author based on Škoda Auto a.s. data.

Once a proposal for BWA is checked by Controlling, the Investment Approval Process moves to its final stage. There are some limits and differences in approval process for each of the investment types. If the non-product investment is higher than € 100,000 or the product investment is higher than € 200,000, it must be approved by the Investment Committee of Škoda Auto a.s. If the non-product investment is higher than € 5 million or the product investment is higher than € 10 million, it must be approved by Board of Management.

Figure 4.5.3: Approval of Proposal for BWA

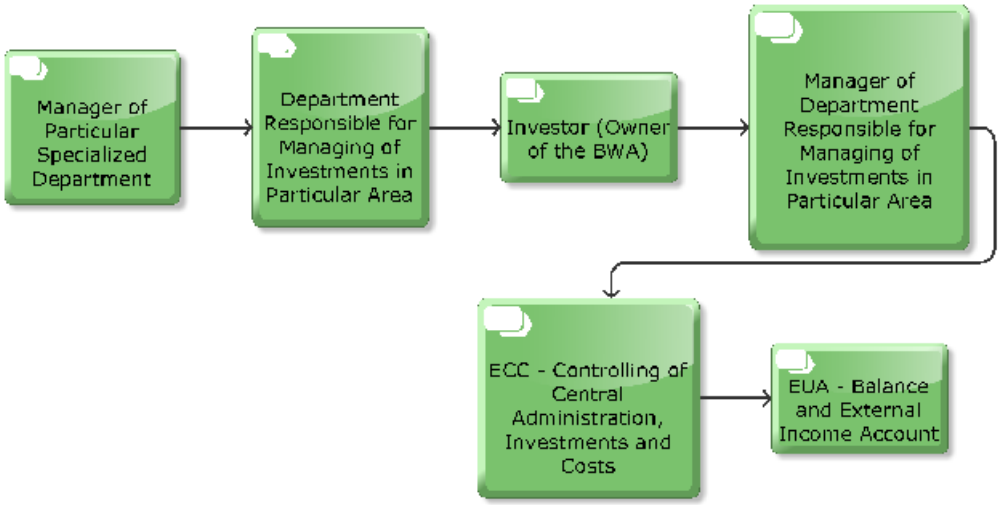


Author based on Škoda Auto a.s. data.

4.5.2 Process of Realization of the Investment

When a proposal for BWA is approved, it is necessary to order the resources required in the proposal. Either Investor or applicant prepares Proposal to Order ("ON") in the EBP and ELINA Systems ; in the latter system the approval tree is available:

Figure 4.5.4: Approval Tree for ON



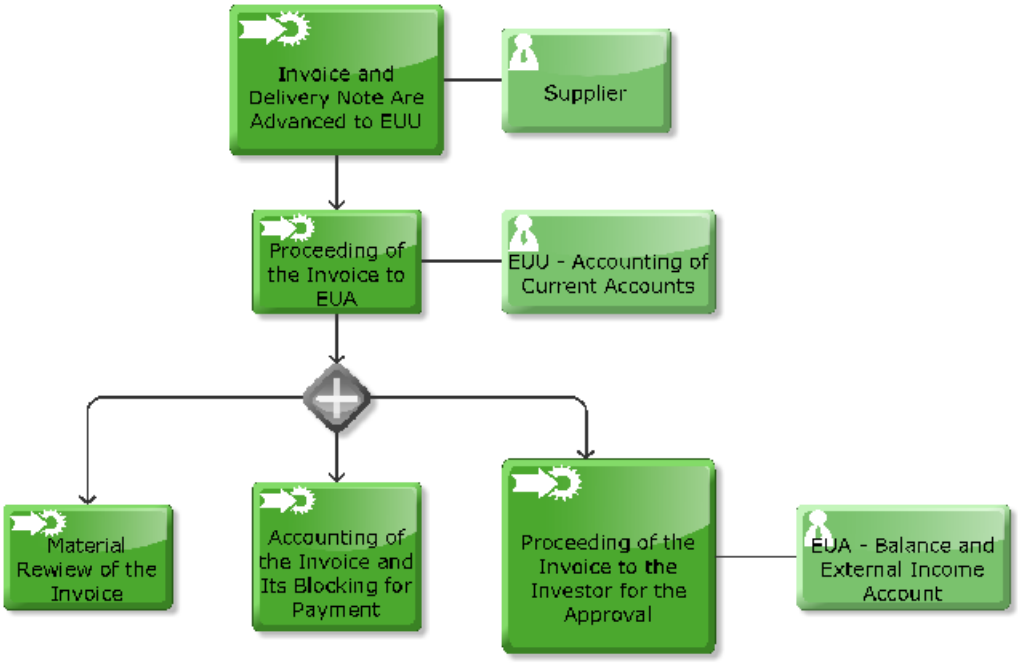
Author based on Škoda Auto a.s. data.

To summarize, relevant departments in Production Area are:

- Responsible for managing of investments in particular Area - VPS Department
- Investor for internal product investment in material costs - VSA Department

Now the ON is in Balance and External Income Account Department ("EUA Department"). In addition to the approval of the ON, EUA Department opens an account for the respective ON and it proceeds it to the Purchasing. From now on, ON is listed as a Requirement to Order ("PoBJ") in the SAP System. Subsequently, corresponding department from Area "N" ("Nx Unit") gives the purchase order and PoBJ gets assigned its number. A supplier performs work and issue an invoice and a delivery note. He advances them both to the Accounting of Current Accounts Department ("EUU Department") which is responsible for communication with external parties.

Figure 4.5.5: Investment in Accounting Unit



Author based on Škoda Auto a.s. data.

EUU Department puts the invoice in the SAP System. Then all handover processes are carried out electronically through the SAP System. Either investor or applicant checks material correctness and returns the invoice to the EUA. EUA Department unblocks the invoice and gives an order for payment. Thereby the work on the investment are finished and the processes of activation[6] and monitoring of investments follows.

4.6 Technical Changes

Technical changes ("TeZ") involves changes in material costs, investments (internal, external), operating costs (internal, external) and development costs. [22] Such changes could increase or save costs (PKO measures, more in Section 4.4) per one vehicle. Generally, it is desirable to save costs; however changes related to quality, design or safety of passengers can increase the price (for example changes in material, unification of parts or increase in quantity of material). There are three types of technical changes:

[6] The day of activation of investments is day, from which particular investment is used. Depreciation of the investment begins with its activation.

1. Pre-series - They are carried out during the first three months after Start of Production ("SOP") (so-called pre-production stage).

2. Series - They are carried out after the first three months after Start of Production ("SOP") (so-called serial production stage).

3. Program Point of Model Care - changes having an impact on the customers. Program Point of Model Care is consisting of several technical changes which are realized before customer relevant date [7].

Table 4.1: Financing of TeZ and Responsibilities of Individual Departments

Type of Costs		**Management of Budget**	
		Pre-series	*Series*
Material Costs		ECT	VSA
Investments	Internal (for area V)	VPx	VSA
	External (for area N)	NP	NP
Operating Costs	Internal (for area V)	VPx, VLx	VSA
	External (for area N)	GMx	NP
Development Costs		TR	TR

Author based on Škoda Auto a.s. data.

Abbreviations of Units and Departments:

- NP - Project Management Purchasing
- TR - Project Technical Management
- ECT - Controlling of Development and Product
- VP - Brand Planning
- VL - Brand Logistics
- GM - Product Management

4.6.1 Department of Technical Changes

As was mentioned in Introduction, I wrote my thesis in the VSA Department which carries out only *serial* technical changes. Now I will focus on activities of individual Centers. Structure of the VSA Department is in the Appendix.

- Center VSA/1 - This Center is responsible for collecting comments from other Specialized Departments to a certain *hat*[8] serial technical change or a Program Point of Model Care and communicates them to the systems AVON and ZMĚNY and to other world regions.

[7] 22th or 45th calendar week.
[8] Changes of Škoda Autos' a.s. parts.

- Center VSA/2 - This Center is responsible for collecting comments from other Specialized Departments to a certain *platform* serial technical change or a Program Point of Model Care and communicates them to the systems AVON and ZMĚNY and to other world regions.

- Center VSA/3 - This is a very unique Center. It is the closest partner of TO Unit in the whole company. Its responsibility is to find PKO potentials, management of Business plan of Production Area and management of Budget of internal investments, material costs and operating costs. Thus VSA/3 Center is the owner of BWA on internal product investments. More in the Subsection 4.7.1.

4.6.2 Change Management of Serial Technical Changes

In this Subsection I will describe the approval process of technical changes and the role of the VSA Department in this process in more detail. There are various phases of "life" of technical change and each of them has its own status. Statuses are numerical codes expressing the state of TeZ in the AVON System. List of the most important statuses is in the Appendix. There are some teams with different competencies entering the approval process:

- E-Team - Team responsible for technical assessment of TeZ. There are mainly constructors from Area "T" thus representatives of TK, TM, TP and TZ (see Organization of Škoda Auto a.s. in Appendix). Furthermore there are representatives of VSA, TO and ECT. Output of E-Team is numbered TeZ which is input into system AVON along with the documentation.

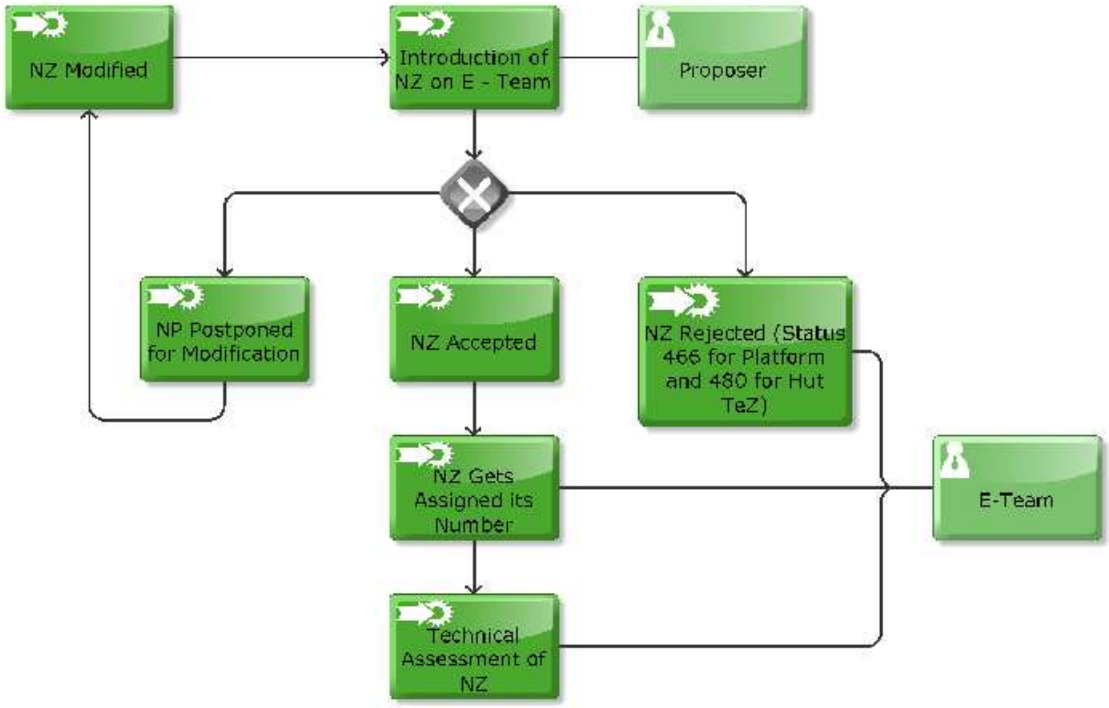
- P-Team - Team responsible for evaluation of TeZ and the decision about its realization. There are mainly technologists from Area "V" thus representatives of VL, VA, VF, VS and VP. Furthermore there are representatives of VSA, TO, GQ, EC and Area "P" and "N" (see Organization of Škoda Auto a.s. in Appendix). Output of P-Team is approved TeZ which is ready for realization.

- R-Team - Team for implementation of TeZ. There are representatives of Logistics of the Company Unit and Vehicle Production Unit who care about SOP determination and in-time realization of TeZ.

In the beginning the proposer must determine the type of TeZ and input TeZ in the AVON System (status 030). TeZ is immediately assigned its date number and become a Proposal of Change ("NZ"). The approval in respective Specialized Department and preliminary comment from Area "T" follows. The proposer then introduces TeZ to

the E-Team (status 080) and in the case of approval of NZ, NZ is assigned a number according to its type.

Figure 4.6.1: NZ in E-Team

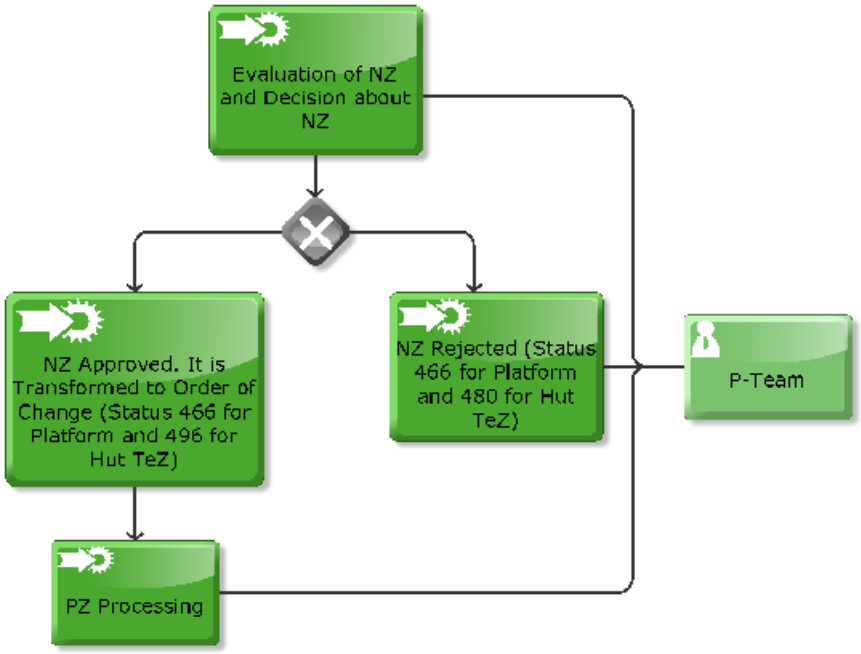


Author based on Škoda Auto a.s. data.

Technical assessment, in cooperation with Technical Development Departments (status 240), relates to the technical realization, state of tests and estimated direct and development costs. Subsequently the representatives from Area "T" and GM Unit decide about the release of NZ for evaluation to the P-Team (status 280 in positive case). While being evaluated by P-Team, NZ is assigned status 400 and such information is passed to the employees of VSA/1 Center or VSA/2 Center. In this moment the role of VSA is starting, by collecting the comments from their contact persons to the respective TeZ.

The evaluation of NZ includes detailed assessment and comments of technologists from Area "V" regarding the feasibility, costs, investments, inventories, timing and other factors.

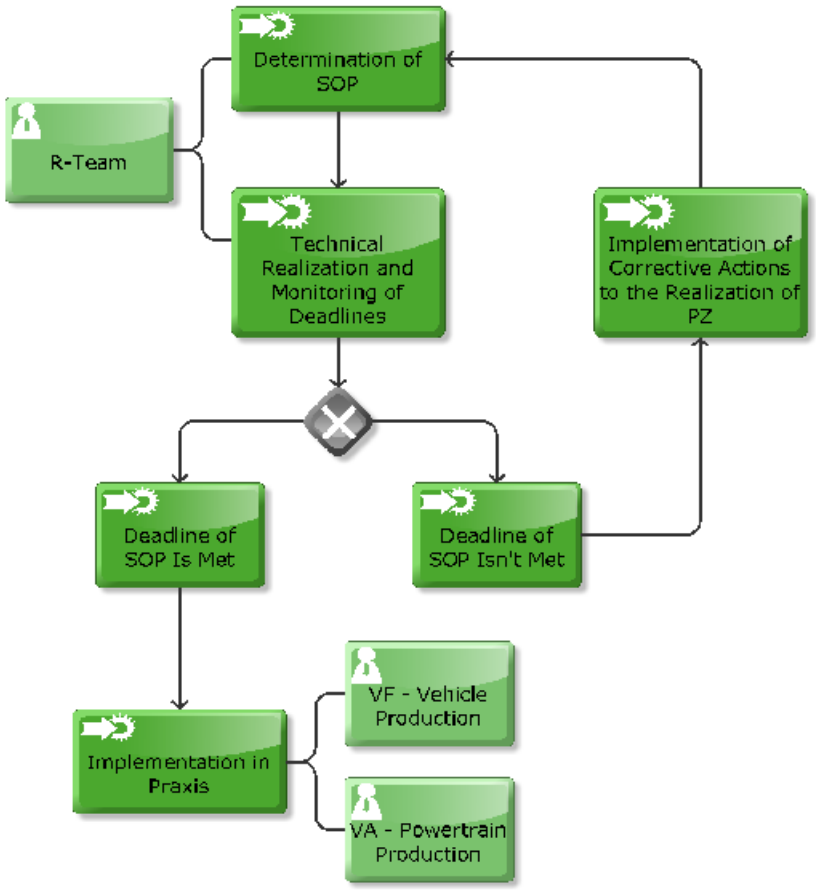
Figure 4.6.2: NZ in P-Team



Author based on Škoda Auto a.s. data.

Decision about Order to Change ("PZ") is monitored in AVON System with appropriate status including protocols from meetings of P-Team. Approved PZ is implemented into the information ZMĚNY and AVON Systems. Now R-Team determines SOP in AVON, ZMĚNY and STEREO Systems. Technical Development receives PZ in order to create corresponding technical documentation (status 700). After input of required data into the information systems, GM Unit concludes the process in AVON with status 800.

Figure 4.6.3: Realization of PZ



Author based on Škoda Auto a.s. data.

Realization of TeZ is monitored in STEREO and ZMĚNY Systems.

4.6.3 Deviation Control

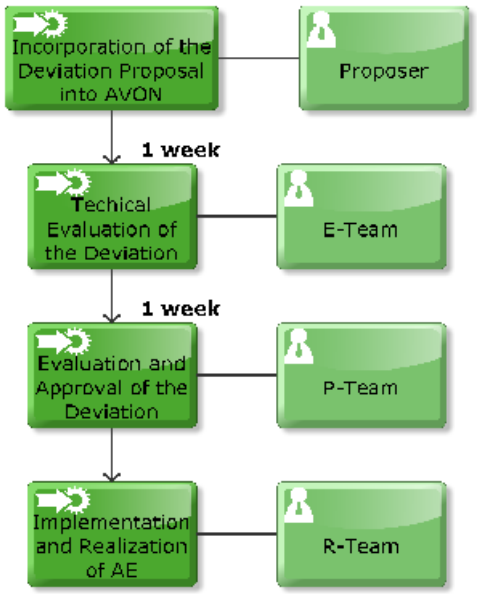
Deviation is temporary technical change which is valid for a certain period of time or for a particular number of products and it is used when product is temporary deviated from technical documentation (drawings, technical Piece Lists an others). [23] The process of approval of a deviation is called Authorization of Deviation (”AE”) and is used particularly for:

- solving of temporary problem (for example temporary different labeling of the same components)
- alternative solution before the problem is solved by correct TeZ

- temporary assembly of deviated components (for example usage of a component from a previous car model) because of insufficient supply
- Consumption of excess material (inventories etc.)

Deviated components have to be recorded in a Piece List but not in drawings. Suggested measure can't require any investment costs. Following diagram depicts approval process for AE.

Figure 4.6.4: Deviation Control



Author based on Škoda Auto a.s. data.

4.7 Business Plan

Business plan ("BP") is a collection of measures which have saving effects on final product and serve for fulfillment of Planning Round's targets and improvement of economic results. It is a modern form of managerial control of the company but it isn't strategy itself, it is just an impulse for the company to achieve given strategy. In other words, it is a mean which provides economical growth and prosperity for the company. Basic assumptions for successful fulfillment of Business plan are clear strategy for achieving of given targets, support from management of the company, regular evaluation, *clear distribution of responsibility* among employees and teams consisting

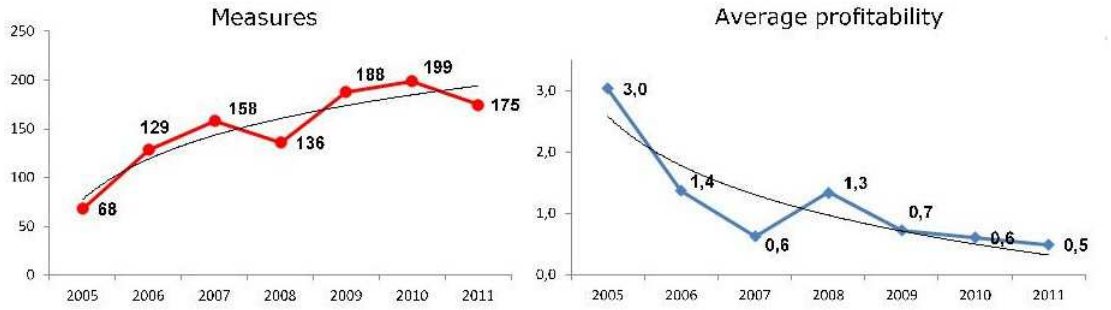
from experienced and motivated employees. Problems can arise from insufficient communication among Specialized Departments or limited possibilities when obtaining documents and comments.

Every technical change, which maintains same or higher customer value and leads to savings, belongs to Business plan. Fulfillment of Business plan is monitored separately for every model class in €/vehicle. All values express defined or achieved goals on "average vehicle" of all vehicles manufactured in given model class in particular year. If for example a measure for 1 €/vehicle can be used only for 20% vehicles, savings are not 1 €/vehicle but only € 0,2 on one car.

In general, it is valid that number of measures increases and a "profitability" of one measure is diminishing (viz. Figure 4.7.1). This trend can be explained by simple consideration. When optimization processes were established in Škoda Auto a.s., a lot of optimization potentials were available. Over time, lot of the measures are already implemented to manufacturing from the beginning. Employees of present-day's departments must analyze whole car in more detail to fulfill PKO targets, so more potentials for less money originate.

Figure 4.7.1: Profitability of PKO Measures in Škoda Auto a.s.

Year	Measures	Savings mil./CZK	Average Profitability mil./CZK
2005	68	206,3	3,033
2006	129	176,8	1,370
2007	158	98,3	0,622
2008	136	182,8	1,344
2009	188	134,8	0,717
2010	199	119,5	0,601
2011	175	85,75	0,49

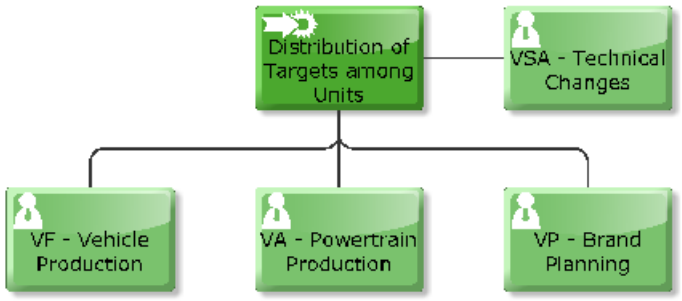


Author based on Škoda Auto a.s. data.

4.7.1 Business Plan in Production

As I mentioned in Subsection 4.6.1, VSA Department, particularly VSA/3 Center, deals with BP PKO in Production Area. In 4th quarter of the year, TO Unit proposes targets on model classes for Area "V". VSA/3 Center evaluates them and together with TO Unit they approve numbers acceptable for both sides. VSA Department then distributes internal targets among Vehicle Production ("VF Unit"), Power-train Production ("VA Unit") and Brand Planning ("VP Unit") on the basis of already defined measures, fulfillment targets in last years and potentials.

Figure 4.7.2: Distribution of PKO Targets among Units in Area "V"



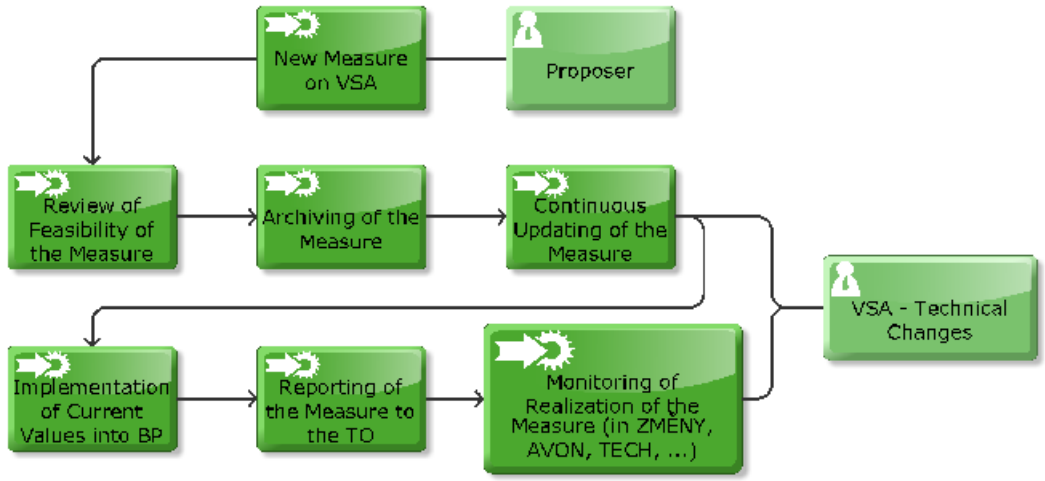
Author based on Škoda Auto a.s. data.

VSA Department informs Units about targets, approves planned values with managers of particular Unit and implements approved values into Business plan of Area "V". VSA Department implements actual list of defined measures into Business plan, presents them to every Unit and approaches them with the request for defining new measures to fulfill their internal targets.

New measure is recorded on the Check-List [9] and is advanced on VSA Department. Activities of VSA Department are described in following diagram.

[9] Form for submitting or recording of the potential.

Figure 4.7.3: Activities of VSA



Author based on Škoda Auto a.s. data.

Measures are discussed on particular meetings according to their importance.

- Meetings of Business plan of Production - These meetings are every two weeks and consist from representatives of TO, VSA, VF, VA and VP. They discuss smaller saving measures with impact to material, dates of their realization, reasons for the delay, problems in various departments (logistics) and so on.
- FMK - Customer relevant changes with higher investments and greater impact in relation to the vehicle. FMK structure was described in Subsection 4.4.1 in more detail. TO Unit presents these measures also on behalf of the Production.

ECN Department confirms savings once a month and VSA Department informs VF Unit, VA Unit and VP Unit about subsequently. VSA Department prepares monthly report about fulfillment BP in Area "V".

Figure 4.7.4: BP PKO of Area "V" in the End of the Year 2011 in €/Vehicle

Fabia 8,0

Department	Target	Reality	Potential	Δ
VF	2,64	3,12	3,12	0,48
VA	2,48	0,10	0,10	-2,38
VP	2,88	1,71	1,71	-1,17
Σ	**8,00**	**4,93**	**4,93**	**-3,07**

Roomster 5,0

Department	Target	Reality	Potential	Δ
VF	1,65	3,04	3,04	1,39
VA	1,55	0,15	0,15	-1,40
VP	1,80	15,52	15,52	13,72
Σ	**5,00**	**18,71**	**18,71**	**13,71**

Octavia 10,0

Department	Target	Reality	Potential	Δ
VF	2,80	3,30	3,30	0,50
VA	3,20	0,36	0,36	-2,84
VP	4,00	3,75	3,75	-0,25
Σ	**10,00**	**7,40**	**7,40**	**-2,60**

Superb 10,0

Department	Target	Reality	Potential	Δ
VF	3,25	6,85	6,85	3,60
VA	2,25	0,04	0,04	-2,21
VP	4,50	10,72	10,72	6,22
Σ	**10,00**	**17,60**	**17,60**	**7,60**

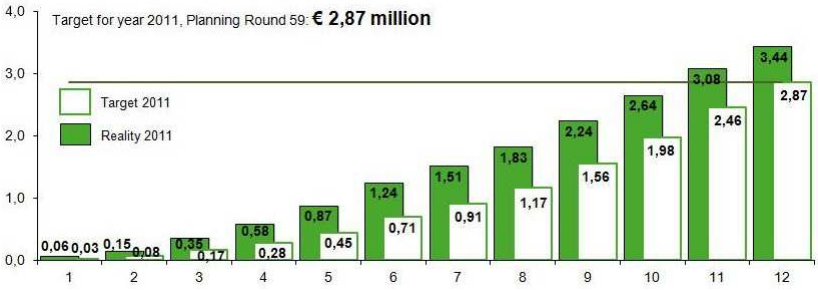
Yeti 10,0

Department	Target	Reality	Potential	Δ
VF	3,25	3,41	3,41	0,16
VA	2,25	0,39	0,39	-1,86
VP	4,50	1,17	1,17	-3,33
Σ	**10,00**	**4,96**	**4,96**	**-5,04**

Author based on Škoda Auto a.s. data.

Figure 4.7.5: Fulfillment of BP of Area "V" in the End of the Year 2011 in Million €

Model Class	Target	Reality	Potential	Δ
Fabia	0,84	0,55	0,55	-0,29
Roomster	0,08	0,50	0,50	0,41
Octavia	1,26	1,23	1,23	-0,03
Superb	0,34	0,97	0,97	0,63
Yeti	0,34	0,19	0,19	-0,15
Σ	**2,87**	**3,44**	**3,44**	**0,57**



Author based on Škoda Auto a.s. data.

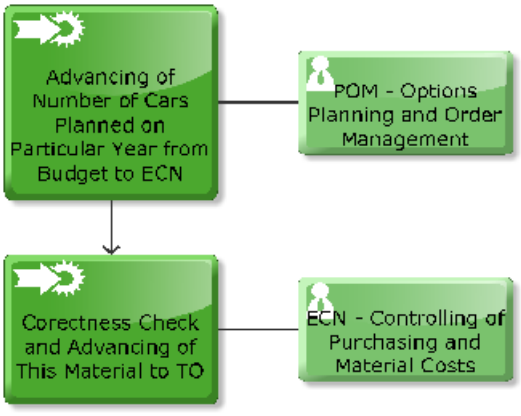
Examples of Possible Measures in the Year 2012:

- WS in dismantled car room and comparison with competitors
- Review of rejected measures (changes in conditions and priorities)
- Unification of connecting material in assembly
- Use of waste material from production in stamping factory
- Domestic production and assembly of aggregates
- Sealing of coachwork, reduction of material in painting facilities
- Optimization of process material (welding wire, glue - modification of prescribed amount)

4.7.2 Business Plan in Technical Development

Platforms' measures are administered by Technical Development Area. Options Planning and Order Management Department ("POM Department") manages LAP. As was described in Sections 4.2 and 4.3, information from LAP and PR are used during the preparation of Budget.

Figure 4.7.6: Number of Planned Cars



Author based on Škoda Auto a.s. data.

Now all relevant data are in TO Unit. Based on the last years and current supply of vehicles, they can calculate approximately how many Euros can particular area save on one car. The estimation of overall BP PKO savings could be presented to the Board of Management:

$$Target = \frac{TF.EF + TO.EO + TR.ER + TS.ES + TY.EY}{2}$$

Explanatory note for previous equation:

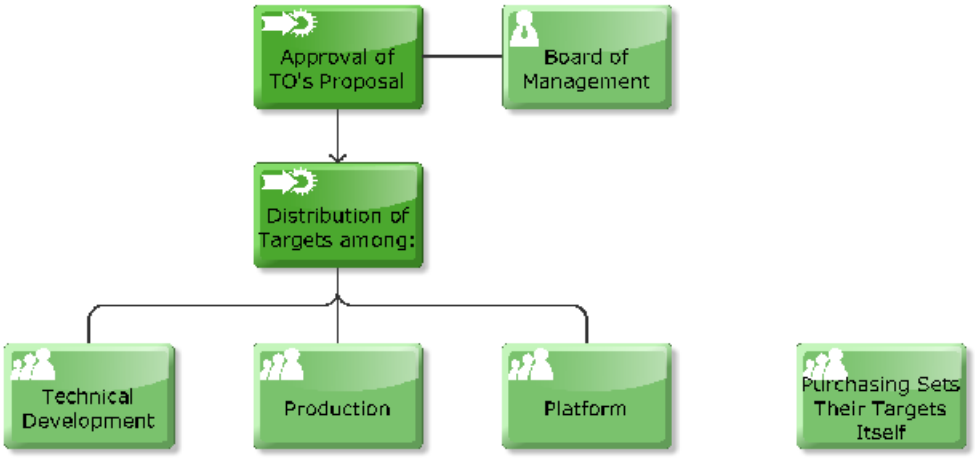
TF, TO, TR, TS, TY = number of total manufactured Fabias, Octavias, Roomsters, Superbs and Yetis

EF, EO, ER, ES, EY = estimated savings one one Fabia, Octavia, Roomster, Superb and Yeti

Targets are distributed approximately in this ratio[10]:

- Purchasing c. 75%
- Technical Development c. 13%
- Production and Logistics c. 8%
- Platform c. 4%

Figure 4.7.7: Distribution of Targets among Areas



Author based on Škoda Auto a.s. data.

[10]The percentage is in approximate ratio based of TO's overview of prime costs 2005 - 2010

Distribution of targets in Area "T" is not as simple as in Area "V". Targets are divided among model classes in the same way as in Production but they are further divided into sets.

Table 4.2: Distribution of Targets among Sets in Area "T" and Responsibilities

Set	Within Area T	Within Unit TO
Equipment	TK	Zdeňka Lislerová, Tomáš Klaus
Electricity	TM	Richard Nocar
Engine, Chassis, Gearbox	TP	Josef Dvořák
Coachwork	TK	Ladislav Huk

Author based on Škoda Auto a.s. data.

Abbreviations of Units and Departments:

- TK - Vehicle Development
- TM - Development of Electric/Electronic Systems and Services
- TP - Chassis and Power-train Development
- TK - Vehicle Development

Every department has its own targets on sets and is responsible for their fulfillment to the respective employee of TO Unit across all model classes. Every coordinator is responsible for some model classes, so every employee is responsible for one model class over all sets and also one set over all model classes (see Organization of TO Unit in Appendix). It is important to add that TO Unit doesn't deal with measures from pre-series, it operates only with measures from series thus at least three months after SOP.

4.7.3 Business Plan in Purchasing

Purchasing Area don't have PKO targets. They only discuss technical changes and according to them, they alter the selection of suppliers. Purchasing Area defines is own targets on every model class on the basis of LAP, Planning Round and experiences from past years, similarly as Technical Development Area. They also get number of cars planned to manufacture on particular year from ECN Department and on the basis of these information they make proposal for the approval of the Board of Management. Purchasing Area only advances approved targets to the TO Unit to monitor them. Targets are divided among model classes again and further among purchased commodities - Metal and Power-train, Interior, Exterior and Electric/Electronic (see Organization of Škoda Auto in Appendix), groups of materials, shopping responsibility and suppliers.

4.7.4 Proposal on Changes in Business Plan

Current system of Business plan is quite complicated. As Purchasing Area is separated from TO Unit and has only reporting obligation (mainly about fulfillment of their targets) towards it TO Unit, there isn't department managing all Business plans together. There is not a clear comparison with past years, so doing statistics is more complicated and nobody does that. The information are held in their departments because there is no obligation to proceed it further. Every Area has a little bit different system with many constructors involved who have nothing to do with the Business plan. One person in TO Unit has to process one model class over all sets and also one set over all model classes. In my opinion, responsibilities in Technical Development Area are not distributed clearly and people unfamiliar with the procedures could be little bit confused. This system of Business plan was established few years ago on the basis of Volkswagen model and the idea was to get people more motivated. If more people would be involved, more potentials and greater savings can be reached. But over time it seems that it has more likely the opposite effect. Everybody relies that somebody else will do his job, feels a little responsibility and doesn't attend meetings. In my opinion, this system of Business plan increases transaction costs (see Subsection 2.2.3). Too many people are involved into this process and that is reason why I suggest some changes in Business plan of Škoda Auto a.s.

Because of these facts I would suggest new, simpler, system of Business plan. Firstly, I would describe and clearly define all processes in new organizational norms to make work of the departments more efficient and automatic. If these materials were available also to employees of other departments, they could express their opinions and complaints, and thus a discussion leading to a compromise would emerge. Furthermore, I would cancel sets in Technical Development Area. I think that more effective is to distribute internal targets among Units similarly as in Production (VF, VA and VP) and in Purchasing (NM, NI, NX and NE). In Technical Development, Units TK, TM and TP should get their own targets and sets could be prepared only for FMK, if it Every Unit should have its own representative to attend regular Business plan meetings and he should present there new problems, possibilities and potentials. TO Unit should distribute targets among all Areas and gather information about Business plan from all of them. There should be three coordinators as today - first for Fabia and Roomster, second for Octavia and third for Superb and Yeti. Their partners from Purchasing, Technical Development and Production should regularly inform them about their current situation. To summarize, proposed Business plan should be managed by TO Unit and have 5 lists for every model class and one single list with information about fulfillment targets from all Areas. I give an example for Škoda Octavia in table 4.3.

Table 4.3: Proposal to New Business Plan: BP PKO Škoda Octavia in €/Vehicle

Area	**Target**	**Reality**	**Potential**
Purchasing	165	105	138
Technical Development	20	12	16
Production	10	3	6,5
Platform	5	2	4,5
TOTAL	200	122	165

5 Conclusion

We showed that production from both theoretical as well as practical point of view has a lot of in common. Primarily, each producer is always trying to maximize its profit and minimize its costs. However, he is restricted by technological constraints. Therefore he tries to reach technically and economically effective production. He deals with relations between outputs and inputs (particularly marginal and average product), changes in scale of production and calculates returns to scale. He distinguishes between long-term and short-term period in production (Cycle Plan, Budget), fixed and variable costs and others. At least basic theoretical knowledge is necessary for permanent economic growth of the company.

Furthermore, we were introduced to the the concept of Controlling and Marketing as the instruments which improve companys' financial results. We described the concepts of these instruments and the development of the approach to solutions of various tasks. Summarization and description of optimizing processes in Škoda Auto a.s. followed. The original contribution of this thesis is its uniqueness in the way that it combines the necessary theoretical background as well as the case study of one of the biggest companies in the Czech Republic. Similar studies don't provide such a detailed view on theory and simultaneously on practice. This thesis could be also used as educational material for managers and employees of Škoda Auto a.s.

After spending a year on the trainee position in Production Area in Škoda Auto a.s., I can say that their optimization processes are on very high level. Since the company became part of Volkswagen concern, great savings have been reached because of platform components and adoption of concern's known-how. We proved on an example in Section 4.7 that Production Area is constantly improving its results. They implement old PKO measures already from the beginning of the serial production and profitability of new measures decreases. This phenomenon could be explained by satisfactorily optimized components used for production of vehicles, amount of material and number of workers. This process successfully continues but finding of PKO measures will be more and more difficult. However even if the optimizing process is well managed, redundant costs could appear somewhere else.

This thesis aims on optimization of material costs. As I said above, today's possibilities of further optimization in material sphere are very limited. After the extensive

study of production processes and its optimization, I can say that main potentials are not on assembly line or in stamping factory but in the administrative processes. Sometimes could happen that we save great amount of money in production but overall savings are lower than this benefit. It could be caused by transaction costs as I mentioned in Subsection 2.2.3. These costs are not directly related to the production but they accompany it. The proposal on improvement of this problem is to ensure that employees have well specified and highly specialized positions, to employ rightly educated and motivated people or to continuously update departments' internal materials for other departments (their methods of work, internal data or changes in processes). Such information are often missing.

I would encourage other analysts to further study this problem because human resources and relations among them are, in such a big company, great potential for savings. In a long-term period, these costs may increase and it is necessary to continuously analyze and optimize all relevant processes.

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I can provide all used Škoda Auto a.s. internal materials on request.

7 Acronyms

MP_i - Marginal product of i-th input

$MRTS_{ji}$ - Marginal rate of technical substitution of input j for input i

AP_i - Average product

MC - Marginal costs

LTC - Total cost curve of long run period

LAC - Average costs of long run period

LMC - Marginal costs of long run period

FC - Fixed costs

VC - Variable costs

STC - Total cost curve of short run period

SAC - Average costs of short run period

SMC - Marginal costs of short run period

AVC - Average variable costs of short run period

AFC - Average fixed costs of short run period

PR - Planning Round (Plannungsrunde)

LAP - Long-term Sales Plan (Langfristige Absatzplannung)

PKO - Optimization of Material Costs (Produktkostenoptimierung)

FMK - Forum Material Costs (Forum Material Kosten)

BWA - Proposal to Allow the Investment (Bewilligungsantrag)

ON - Proposal to Order (objednací návrh)

PoBJ - Requirement to Order (požadavek na objednání)

TeZ - Technical Change (technická změna)

SOP - Start of Production

NZ - Proposal to Change (návrh změny)

PZ - Order of Change (příkaz změny)

AE - Authorization of Deviation (Abweichungserlaubnis)

Overview of abbreviations of Areas and Units is in Appendix in Organization of Škoda Auto a.s.

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8 Appendix

List of Most Important AVON Statuses:

030 - First save, TeZ gets date number

080 - The requirement for numbering

090 - Numbered technical change

240 - E-Team gets the TeZ to assessment

280 - TeZ passes off the E-Team without comments

400 - P-Team gets the TeZ to assessment, technical change in VSA Department

410 - Distribution of responsibilities in VSA Department

418 - VSA Department has all comments

465 - P-Team approves platform TeZ

466 - P-Team denies platform TeZ

480 - P-Team approves hat TeZ

496 - P-Team denies hat TeZ

700 - TeZ is in Technical Development Area for editing of technical documentation

710 - TeZ is canceled by proposer

800 - Implementation of TeZ in serial production

Figure No. 1: Organization of Škoda Auto a.s.

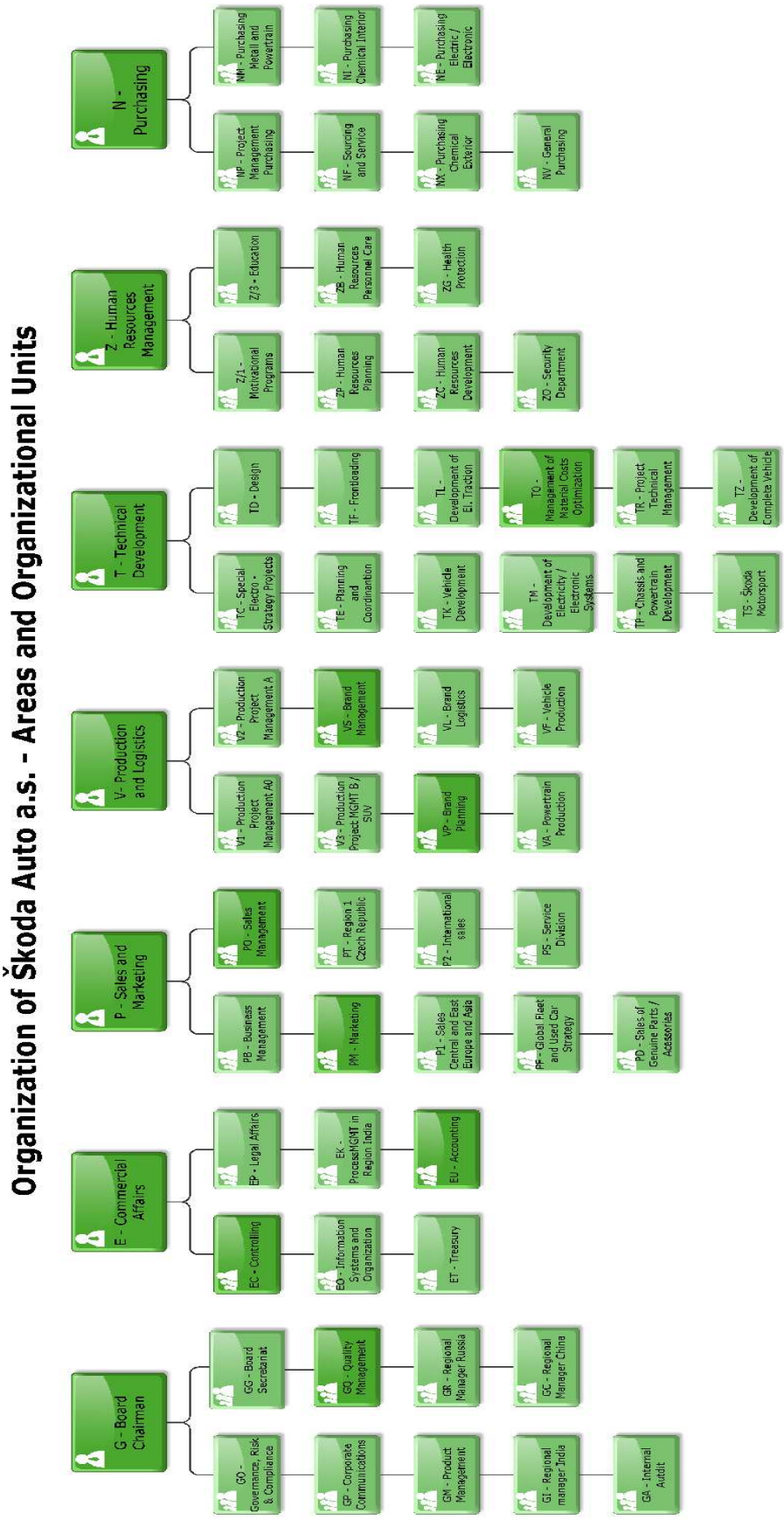

Figure No. 2: Structure of VSA Department

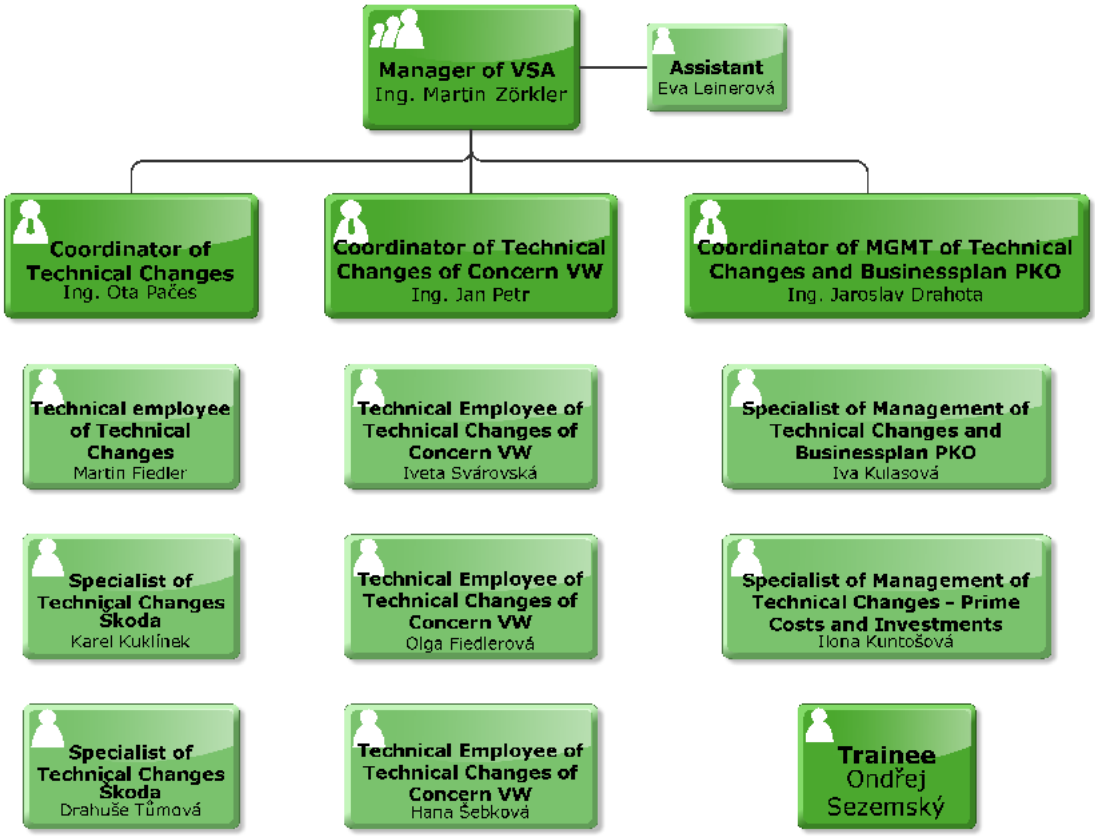

Figure No. 3: Structure of TO Unit

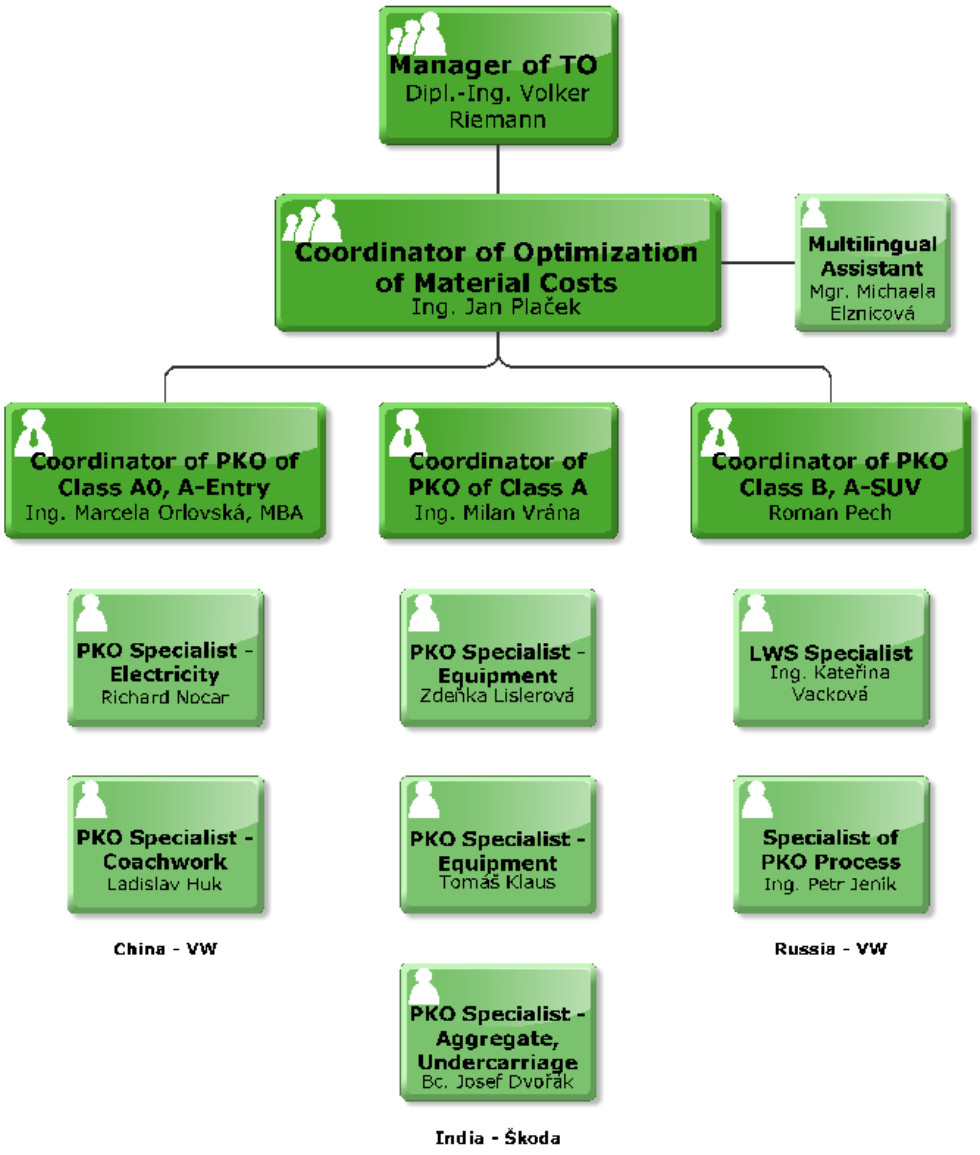

Figure No. 4: Map of the Plant in Mladá Boleslav