Profit maximization through economic incentives

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This master's thesis is carried out as a part of the education at the University of Agder and is therefore approved as a part of this education. However, this does not imply that the University answers for the methods that are used or the conclusions that are drawn.

Preface

I chose to write my thesis for Multivac because it was a relatively young company, which I assumed could have much potential for improvement. It also seemed to be relevant to the study "Industrial Economy and Technology Management". I also know the firm's economic controller personally, whom had given me a good impression of the company. Multivac wanted me to write the thesis in English, so it could be understood and used by the German management, as Multivac in Norway works closely with them.

I would like to thank Terje Heskestad for guidance, Elida from Multivac for close monitoring and counseling, and for answering questions thoroughly during the whole period. I also want to thank Multivac for taking me in and giving me an office. I have appreciated the opportunity and trust I was given, to get full insight into sensitive information. I would also like to thank Stig in Multivac for the willingness and openness to criticism, which made it easy for me to highlight the potential for improvement, without hesitation. As well as every employee in Multivac who has been helpful.

Lillesand, May 2015

Summary

Multivac's office in Norway are known to the use of bonus as motivator, but did recently remove their bonus system because they experienced more negative than positive effects. The former bonus was designed in a way that may have given incentives to do unprofitable actions, in addition to increase the level of internal conflicts and discourage cooperation. Some of this was due to the company not knowing exactly what kind of attitudes that lead to long-term profit. This thesis tries to evaluate the former and present situation, and to propose a new bonus system that fits the company according to incentive theory. Two research questions provide guidelines for the approach:

- Which Key Performance Indicators (KPIs) are appropriate to guide and motivate the employees to make long-term profitable decisions?
- What sort of behavior results in increased long-term profit for the different roles in the company?

With the research questions in mind, we have to find out what leads to long-term profit based on historical data, connect it to desired employee behavior and figure out how to motivate in the correct direction. This makes the research methodology two-fold. The first one is through interviews, and the second one is thorough review of financial data, especially previous projects. 26 projects dated from 2012 to 2013 was analyzed in order to categorize the customers, and evaluate profitability.

Since the long-term profit of a project consists of both sales and service the following approximately ten years, a method for calculating the expected service profit must be found, based on financial data over the past decade. Furthermore, it was found that rework charges because of lacking planning resulted it huge losses, making it an important focus for the bonus.

Table of content

1 Introduction

The usage of bonus as an incentive for the employees in a company have increased in the past years, both in numbers of companies using this tool, and the intensity. (Grini, 2007) Even though bonus may increase effectiveness and production control, it is not given that it will have a positive effect.

1.1 Research question

The main topic of this thesis is profit maximization. There are many ways to achieve improvement in a company, whether you focus on volume or efficiency, income or costs. A knowledge business like Multivac Norway rely mostly on their employees when pursuing the ultimate goal of profit maximization. This requires a motivating environment, targeted leadership, proper equipment, teamwork and of course individual competence.

I have created two research questions that both tries to pursue increased profit:

- Which Key Performance Indicators (KPIs) are appropriate to guide and motivate the employees to make long-term profitable decisions?
- What sort of behavior results in increased long-term profit for the different roles in the company?

This thesis will highlight relevant theories concerning the topic and use empirical data gathered from Multivac's leaders and staff to evaluate the current state and discuss future possibilities.

1.2 Limitations

The psychology of motivation and economic incentives will be briefly mentioned, but are not the primary focus of the thesis. It is assumed that economic incentives will have some effect on motivation, but also communicates to the employees certain instructions and company strategy.

1.3   About Multivac

Multivac is one of the world's leading suppliers of packaging solutions. This is what they say about themselves:

> *"Multivac's packaging solutions are used throughout the food industry, as well as for the packaging of medical and pharmaceutical products and of industrial and consumer items. We build our market position on innovative, state of the art technology as well as comprehensive product expertise and many years of experience in this field." (Multivac.com, 2015)*

The Multivac Group has more than 65 daughter companies with over 4400 employees, is represented in more than 140 countries and in all of the continents. It all started in 1961, when Sepp Hagenmüller and his partners built a vacuum chamber machine in their garage. The first distribution company was then established in 1972 in France, and Multivac Inc. was established in 1987.

Multivac has been represented in Norway since the early 70s, but it was headquartered in Sweden. However, in 1988, Multivac Norge AS was established as a separate daughter company, located in Drammen. Now their premises is located in Sandefjord. This is an organization with 25 employees, and consists of administrative, technical and sales division. In the recent years, they have had poor results, but is constantly improving. The organization seems to have a lack of control in the means of knowing which type of projects that leads to profit. Nevertheless, the technical expertise appears to be good. Multivac Norge is a relatively young company, and there is naturally much room for improvement. Especially considering the efficiency of their business, where they, due to their age, have not gotten very far.

Recently, Multivac Norway went through a change in their organization where they removed a bonus system that led to negative effects for both their profit and teamwork. Multivac implemented a low-intensity result-based bonus, distributed equally for everyone in the company, and compensated for the former bonus system with a raise in the salaries.

(Multivac.com, 2015) (Multivac.no, 2015)

2 Theory

2.1 Customer Segmentation

According to Kalsaas, many businesses vary their use of resources significantly for the different customers. This implies that even though two customers buy the same quantity of a product at the same price, the profitability may differ significantly. This is because some customers have a behavior pattern that drives more costs than others do. These customers may for example require special customization of products, be more likely to return a product or pose a high risk for expensive complications. Thus, customer profitability analysis is an important tool to assess which customers are most profitable, and who causes more costs than revenue.

A customer's profitability may be expressed as the difference between the revenues and expenses that the customer generates. However, this difference may vary over time. Ideally, one should look at customer profitability as an expected value for the timespan of the customer relationship. For example, a product sold to a new customer whom in the future will lead to additional sales or service. In these cases, it may be profitable to introduce lower rates of the sale of the first item, and compensate with higher rates on follow-up products. This allows incremental sales and service subsidize initial sales, which makes it easier to bring in new customers.

These calculations are rarely occurring in practice, due to the span of different customers and the uncertainty of the duration of the customer relationship. A more common approach is to do a cross-sectional analysis of all the customers at a given time, and analyze their profitability for a period. The main challenge is to calculate the customer costs, which may be directly or indirectly related to the customer. The indirectly costs must be allocated to the customers, which may be done using activity based calculations (ABC).

To do a customer profitability analysis it can often be useful to start with an overview of customer revenues and how it is distributed among them. To do this you need to express the size of the customers, measured in revenues. This can be done by using standard measurements like average revenue per customer and standard deviation from this, but these numbers actually does not say much. A more useful alternative is to combine a graphical presentation with descriptive key values. This may be done in a Lorentz curve.
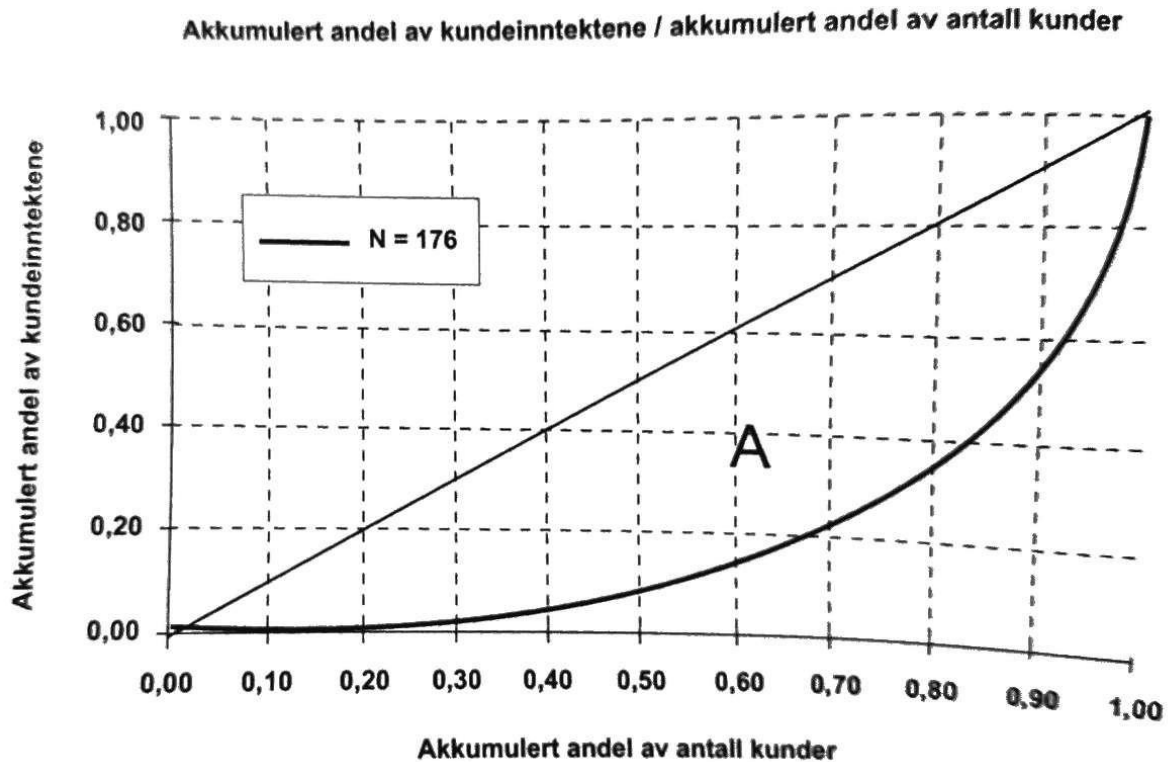
2.1 1: Model representing a Lorentz curve. (Kalsaas, 2009)

The x-axis shows the accumulated share of the number of customers, while the y-axis expresses the percentage of total customer revenue a given number of customers account for. If all the customers had provided the same revenue, the result would be the straight line, called the equality line, as shown on the figure. In this case, 20% of the customers would account for 20% of the revenue. When some customers generate more revenue than others we get a curve as the one below the equality line, this is called the Lorentz curve.

To express the differentials in the customer's revenue some key values needs to be calculated. This is often done with the Gini coefficient, which is the area A times 2. The area is the expression for the degree of variation in revenue per customer. The greater the area, the greater variation in customer revenue. If all the customers were equal, A would be 0, and with infinite variation, A would approach 0.5 and the Gini coefficient would approach 1. This may be used as a tool to measure how the customer revenue are allocated. The vulnerability factor can also be calculated, which is the percentage of customers below average customer revenue. This is at the point where the slope of the diagonal tangents the curve of the accumulated customer revenues. This will be a value between 0 and 1, and if it is approaching 1 it indicates that a few customers account for a large share of the turnover.

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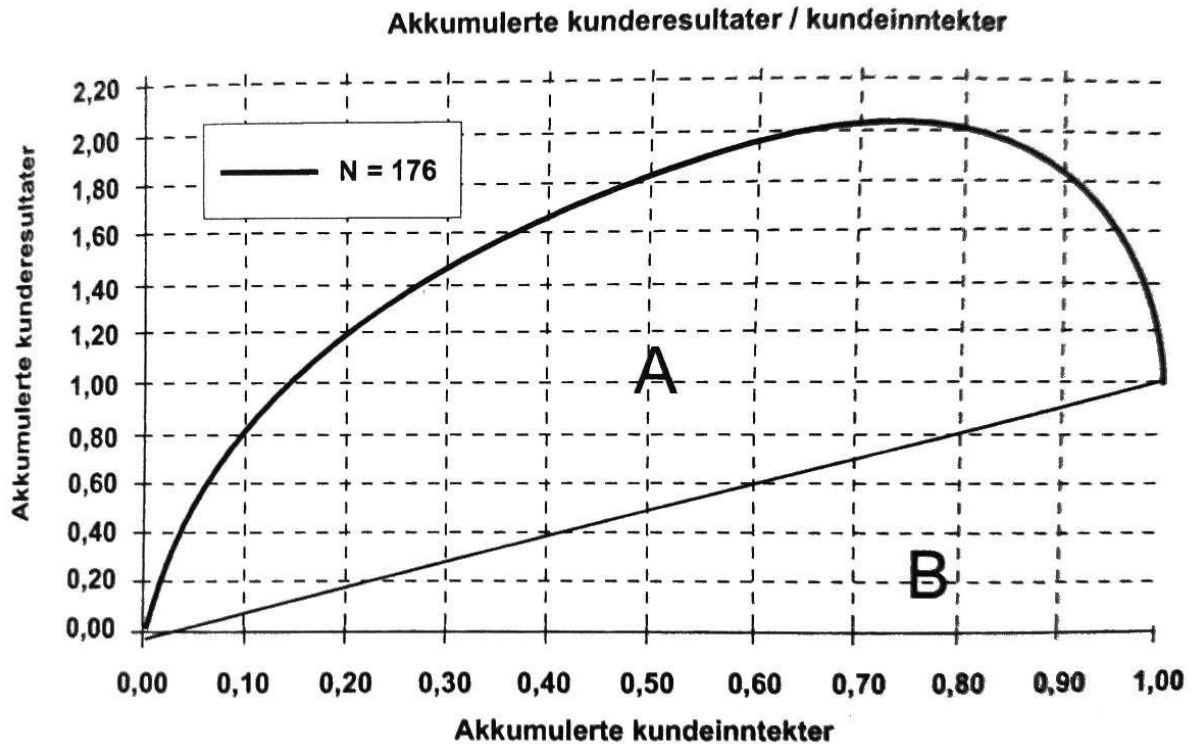
2.1 2: Model representing a Stobachoff curve. (Kalsaas, 2009)

Revenue is not the same as profitability, and therefore it may be more interesting to look at the variations in customer profitability. Customer results can be closer analyzed by looking at relative figures by studying the Stobachoff curve. The x-axis shows the accumulated share of the customer's turnover, while the y-axis is the total accumulated customer result measured as a share of total result. The equality line is how the curve would be if the results was proportional with revenue. There are two especially important abilities of this curve. Firstly, the proportion of revenues that are profitable and not, where the share that comes from the profitable customers is called the results turning point. The other ability is the degree of imbalance in customer profitability.

The Lorentz and Stobachoff curve provides a picture of a business' total customer base. The figures and key values may also be used on parts of customer portfolios. This insight shows how dependent the business is of some customers, and the potential in doing initiatives to increase revenue and profitability of individual customers.
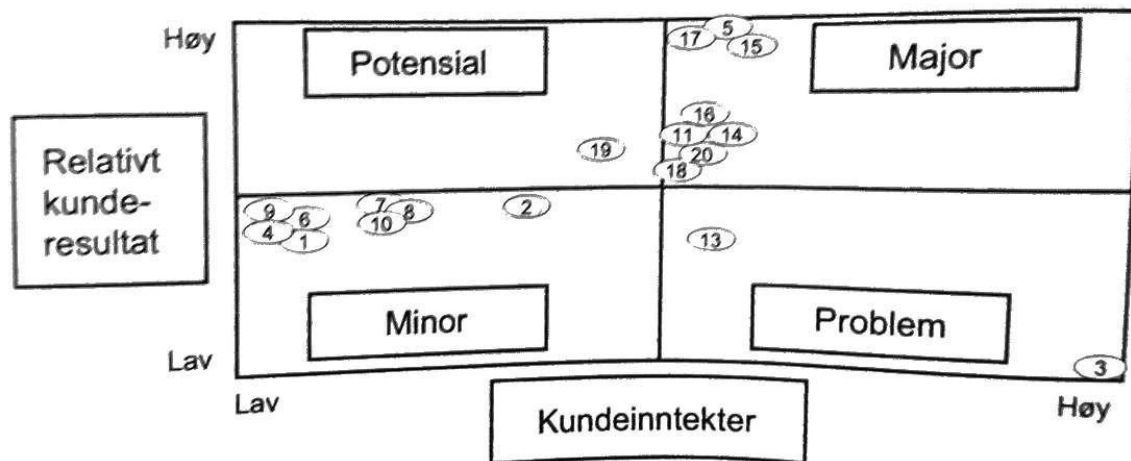
2.1 3: Customer segmentation matrix. (Kalsaas, 2009)

It is useful to use various measures for various customers. Thus, customers should be grouped according to different characteristics. A way of grouping is by degree of profitability. The most profitable customers will be identified and the business can build close relationships with them. While the unprofitable customers can be made more profitable by implementing various initiatives. The dimensions of profit ratio and total turnover is used for labelling the customers. Major customers have a high profit ratio and high total turnover. Problem customers are large customers with low margins. Minor customers provides low turnover and small margins, while the customers with the combination of good margins and low turnover are called potential customers since they are willing to pay and could potentially provide good contribution if turnover increases. The purpose of customer segmenting is to increase the weighting of the different actions for different groups.

(Kalsaas, 2009)

2.2   KPI

A Key Performance Indicator, KPI, is a measurable value that a company or industry uses to measure or compare performance in terms of achieving their strategic and operational goals. KPI can be compared to budget, balance scorecards or benchmarking in order to create a basis defining achievement. KPIs vary depending on priorities or performance criteria, and may be used on many levels to evaluate the success at reaching the firm's goals. The use of KPIs can be problematic, due to the focus at a specific target, it may lead to negative incentive effects, and because they are so specific, they may measure too much noise from variables that the individual employee had no opportunity to influence.

In order to cover more than one specific area, using multiple KPIs is an option; this will lower the chance of tasks being neglected. However, using too many of them will result in too complicated calculations for the individual member of the organization to comprehend, thus undermining the point of using KPIs.

(Klipfolio, 2015) (Investopedia, 2015)

2.3   Principal-Agent

Leading and motivating a group of employees can be a demanding task, and neither basic nor precise instructions may be enough to make sure that the employee does what his or her leader want them to do. Principal-Agent (PA) is a theory that attempts to describe a model for the relationship between leaders and followers in organizations and business. It contains some assumptions that may seem extreme and too simple regarding psychology and motivation theory, but it does address some interesting principles.

The principal is the leader, or the person delegating responsibility. The principal have certain thoughts into what results is expected, timeframe and methods. The agent is the one receiving the assignment and is supposed to ensure that the task is done within the framework given by the principal. However, the methods and the pace that the agent is supposed to use and work may not be the same as the agents interest, thus creating a conflict of interest. PA-theory states that every agent have to "pay" a personal cost according to his or her effort, this cost is transferred into an economic view. In other words: The agent want to struggle as little as possible relative to the payout. This theory ignores intrinsic motivation as it is too hard to translate into an economic value, and it relies on the assumption that extrinsic motivation is sufficient to keep the agent going. It also assumes that the agent behaves rational and with an economic mindset.

For an agent with fixed salary we get the following formula describing the agent's total payout for his or her effort:

$$U(e) = \propto -c(e)$$

Where $\propto$ is the regular salary and $c(e)$ is the personal cost of making an effort (e). If this were to be true, a rational and economic agent would try to lower $c(e)$ as much as possible without risking the position, job or other consequences. The conflict of interest is that the principal wants to keep $c(e)$ as high as possible to achieve increased profit. The PA-theory further suggest that the principal includes an economic incentive for the agent to

compensate for the agents added effort, assuming the cost of the incentive is lower than the increased profit of the added effort. The formula changes to:

$$U(e) = \propto + \beta * z(e) - c(e)$$

Where β is a fixed bonus and $z(e)$ is the performance indicator. If the performance indicator is designed in a way that it manages to measure the benefit of the agent's added effort, the economic and rational agent will strive harder and increase the effort.

Economic incentives comes in handy when the information between principal and agent is asymmetrical. Meaning that the agent has information critical to decisions that the principal does not have, and therefore cannot solve for the agent. A well-designed bonus system will in these cases lead the agent to make decisions that is beneficial for both parties. The same goes for regulating the agent's efficiency in the daily work.

The bonus system does not only motivate the agent, but it does also communicate what kind of behavior and results that is important to the principal, and makes sure the agent goes in that direction. The principal could just include it in the instructions, but bonus gives the agent a reason to carry it out.

(Ross)

2.4 Herzberg's two-factor theory

There is another theory evaluating the motivational effects certain areas have on the members of an organization or company. The two-factor theory was developed by Frederick Hertzberg in the late 50's. As opposed to the Principal-Agent theory, Hertzberg does not see motivation as something you can drain from an economic pool, but rather as a set of needs that require satisfaction. Herzberg points out that every condition in the work environment matters and influences motivation, but all in different ways and strengths. Through a study of over 200 engineers and accountants, he attempted to measure how specific environmental states affected their motivation, and he came up with this theory separating between motivators and hygiene factors. The motivators are factors that will increase motivation if further stimulated, and the hygiene factors demotivates if not present and have very little effect on motivation when raised above the employee's expected level.

A factor is never fully in one of the categories, but roughly, they are divided like this:

Motivators	Hygiene factors
• Achievement • Recongnition • Work itself • Responsibility • Advancement • Growth	• Company policy and administration • Supervision • Relationship with supervisor • Work conditions • Salary • Relationship with peers • Personal life • Relationship with subordinates • Status • Security

2.4 1: Herzberg's motivators and hygiene factors, see Attachment 4, Herzberg's two factor theory

The two-factor theory concerns many different parts of business strategy, but this section will focus on what it means to economy and incentive systems.

The fact that Herzberg places salary as a hygiene factor contradicts the economic Principal-Agent theory. However seeing bonus as an achievement and recognition rather than salary makes the theories conform to some extent. With that in mind, the bonus system must be made in such a way that the bonus output is proportional to the individual's achievement towards the organization's goals and visions. This is addressed further in the analysis chapter.

(Herzberg F. M., 1959)

2.5   The goal of a bonus system

The ultimate goal of a bonus system is to make the employees work harder and better. Increased effort is strictly a motivational problem with different psychological aspects, some addressed earlier. However, making someone work smarter and more effective is about more than just motivation, motivation will naturally affect the person's willingness and determination to be effective, but complex tasks might need assistance to find the best

direction. This is where company strategy comes in. The administration within a company does not know the details of the daily tasks, but they do know which paths to follow, and what kind of results that matter the most. The administration analyze historical data, compare with the company's vision and builds a strategy, this strategy is then transformed into goals providing direction for the bonus. This way, the bonus system attempts to solve the problem of asymmetrical information, into tangible instructions. Simply giving out the instruction is an option as well, but handing out bonus as well makes whatever that is important to the company, also important to the employee.

A bi-product of bonus is that it attracts talented labor, and repels the ones with lower performance. This is simply because the talented workers are rewarded and the employees that never generates bonus will often eventually quit out of dissatisfaction and lousy income. This is cynical values, but so is profit maximization.

Implementing a bonus system is done because the leadership want something to change within the company, and changing people's behavior is doomed to release both resistance and feelings. Change management theory for organizations states that the ones affected should have some kind of ownership to the change, and that they should experience and understand the positive outcomes of the change. Bonus does exactly that, it inflicts ownership because it is not only the company that profits, but also the individual directly, and they feel the progress towards the goal whenever the bonus hits.

(Kotter, 1996)

2.6 Requirements

The usage of bonus as an incentive for the employees in a company have increased over the past years, both in numbers of companies using this tool, and the intensity. (Grini, 2007) Even though bonus may increase effectiveness and production control, it is not given that it will have a positive effect. Heneman claims that the system have to meet some requirements to be effective. Diversions from these may result in no result at all, or even negative effects on motivation, efficiency and economy. These requirements are:

1. Precision. The achievement must be measured accurately. Inaccurate measurement results in bonus output that is non-conforming with the achievement, and leads to twisted feedback, dissatisfaction and confusion towards the bonus system.

2. Defined. The bonus system must be well defined and easy to understand. If the employees does not understand it, there will be no results to chase and it will affect neither motivation nor focus.
3. Controllable. Employees must be able to affect the outcome of the bonus. This one is particularly important and commonly executed poorly. If the result is non-controllable, there is no reason beyond instructions to perform well, and the bonus will be perceived as a gift given randomly. That may have some overall motivational effects, but it will have no behavior-regulating effect, hence removing half the purpose. The employee must also be equipped with the proper tools to improve. That might also include available mentoring and courses for the individual's personal development, which also is motivating and empowering.
4. Noise. Noise is any uncontrollable variable disturbing the bonus output. Noise is often the main reason the bonus output does not reflect the actual performance of the employee. In many cases, avoiding noise is either too difficult or it will disturb the other criteria, like a defined system or controllability. Alternatively, you might just end up measuring factors irrelevant to the company strategy and bottom line profit.
5. Relevance. The bonus system have to point at specific strategic areas that the company wants to improve. In most cases, this is long-term profit, but it can also be ethics, quality and staff environment. However, a bonus system does not have to cover every aspect of the daily work, as instructions and expectations still apply. The leadership should watch out for the possibility of non-measured activity being neglected.

A bonus may be money, gifts travel or feedback. When given money as a bonus, this is usually between 5% and 30% of the annual salary. Feedback is already a part of the expected incentives from the management, but it may be useful to systematically tie it to the strategic specified KPIs. The intensity of the bonus should vary according to how accurate the KPIs are in relation to the requirements given above. The more precise, the higher intensity. According to the requirements, a bonus system that is precise, defined and controllable but has a lot of noise should not result in the highest bonus intensities, but somewhere in the middle of the range.

The easiest way to design a bonus system is using bottom line result-based bonus. At the end of the year, or another defined period, a portion of the company's profit is either given to all employees equally or based on their salary. However, such bonus systems are believed to have very little, if any, influence on motivation for most of the staff. This focus are so far from the daily and weekly achievements that it will probably just feel distant. In addition, the individual worker can double his or her effectivity without being able to see the change, hence conflicting requirement number 3 as well as not giving a sense of mastery. Result-

based bonus does satisfy requirement 4 of relevance, attacking the main goal from the leaders and owners perspective, but for the average worker, this does close to nothing. Since everyone is rewarded or punished regardless of their contribution, the problem of free riders rises as well, and the very best ones will neither be noticed nor appreciated.

Bonuses can be given to groups of employees or individuals. The group-based reward system measure a team's performance and the individuals receive bonus based on this performance. This rewards cooperation between departments and individuals, and encourage individual effort towards the common goals. However, it may also reward free riders who lets the rest of the team do the work, and is less controllable. The individual-based reward system measure one individual's achievements, and should not be influenced by the colleague's results, this would in that case be considered noise.

There are two methods of measuring the performance, subjective and objective. The subjective method is useful when the job is not easily measured, and thus difficult to determine an appropriate KPI. The performance measurements needs qualitative examination, which is often done by interviewing the employees. This makes it vulnerable to personal opinions and defend mechanisms, which may cause an increase of conflict between the principal and the agent. It also makes it difficult for the agent to know how he or she stands, as he or she would not be able to calculate or predict this year's bonus. This may cause the agent to adopt a behavior pattern based on looking good rather than bringing profit to the firm. The objective method is considered the strongest, if done in an appropriate manner. This measurement works best in the situations where each employee's achievements can be compared to another's. But it may cause the loss of peripheral factors.

When implementing a bonus system, the management should, like when executing any organizational change, use change management theory in order to make every employee embrace it. John P. Kotter proposes an 8-step process for a successful change. The theory will not be described in-depth, but the steps are as following:

1. Create a sense of urgency
2. Build a guiding coalition
3. Form strategic vision and initiatives
4. Enlist volunteer army
5. Enable action by removing barriers
6. Generate short-term wins
7. Sustain acceleration
8. Institute change

(Robert Heneman, 1992) (Kotter, 1996) (Gillikin, 2015)

2.7 Time period

Seasons, and annual accounting in particular, creates many challenges for the economic strategy within a company. It is common to see the basis for decisions change when the end of a year approaches in order to meet goals and to appear better towards leaders, auditors, boards, owners and investors. This change of behavior can have a major impact on business politics and cooperation from other parties; however, it is mostly manipulation of numbers, and does not affect long-term profit, success or efficiency. A bonus system should not encourage such behavior, but rather reward actual advancements leading to increased long-term profit.

Another problem that annual bonus causes is how new projects can disrupt the measurement of previous projects, and then lead to adverse incentive effects. A great example is when using Return on Invested Capital (ROIC) as a Key Performance Indicator. Whenever a new project have an Internal Rate of Return (IRR) between the required rate of return for profit and the current average rate of return, this bonus system will encourage unprofitable action.
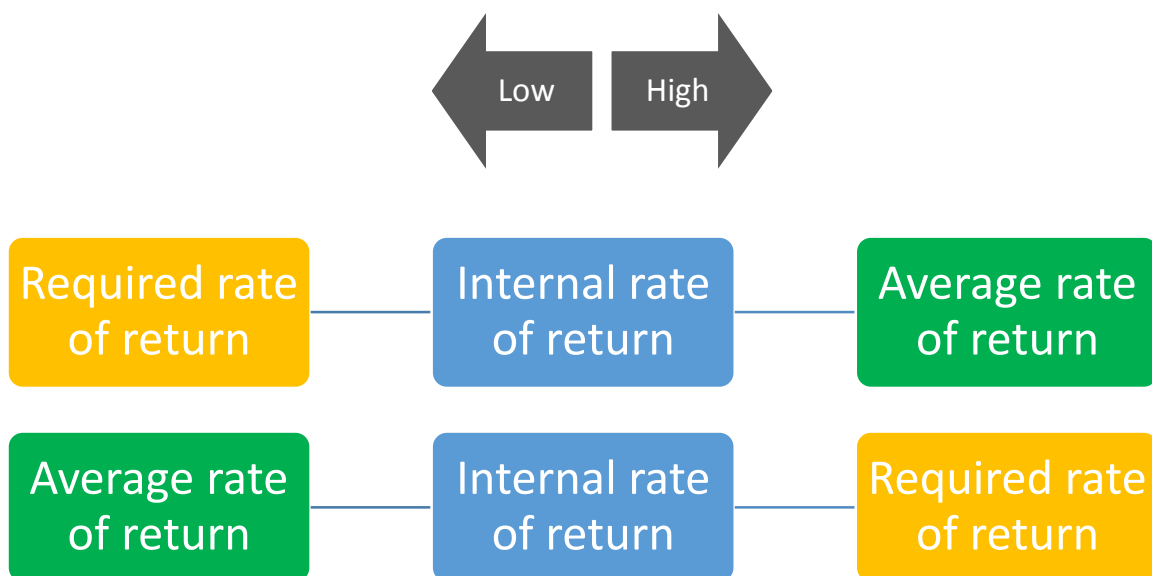
2.7 1: The return on investment problem

The problem is illustrated above with two scenarios resulting in bad incentive effects. For this example we will look into a situation where a leader gets bonus according to the average annual rate of return, it is November leaving few projects left to affect the bonus. In addition, the required rate of return is 10 %, meaning every project above leaves profit, and every project below would lose money because the resources could be invested elsewhere.

- Scenario 1: The average rate of return is so far 15 %, and a new project with IRR of 12 % is offered. This project is profitable; yet, the leader is encouraged by the bonus system to turn down the offer, as it will lower the average rate of return, and the leader's own bonus.
- Scenario 2: This year have not been so good, and the average rate of return is 8 % when a new project with IRR of 9 % is presented. This is not a profitable project, but for the sake of the bonus, the leader should take it anyway to strengthen the average rate of return.

If bonus were given for each project separated, the leader would benefit from only taking the profitable projects. This would also allow the bonus to be paid out more often, lowering the chance of the receiver having trouble understanding why it was given.

The last issue that will be addressed is seasons. Seasons, meaning both through the year and over the course of many years, creates disturbance in the basis for profit. This can be a change in the market price of commodities and finished product, weather conditions and governmental regulations. Seasonal disturbance have nothing to do with the employee's achievements, and should be filtered out of the calculation. This can be done by comparing results with competitors or compensate for the change in price with flexible budget analysis.

2.8 Dangers

Implementing a bonus system involves many dangers the company should be aware of in order to prevent and properly handle upcoming issues. The problem with measuring return on invested capital was addressed above, and a possible solution was presented. This section focus more on general issues rather than specific challenges.

Working for a company often involves a lot of teamwork and cooperation across disciplines, and requires the employees to help each other. Assuming that the bonus is individual, the system may discourage the mentioned important cooperation, and even start internal

conflicts. Internal conflicts can be devastating for a company if they get out of hand. Some conflicts are to be expected, but these are not likely to have a positive outcome. A possible solution is group bonus, which is a compromise between individual bonus and equal bonus to the entire staff. It is also possible to find key performance indicators that is not affected, or even positively affected by cooperation.

Although the company's vision and strategy points at long-term profit, the middle management and the remaining staff may not have the same perspective in mind, thus creating a minor conflict of interest. Bonus can be designed in such a way that long-term decision-making is beneficial, but it can also easily reward short-term behavior and punish investments. The general staff will in most cases be more likely to switch jobs than the leaders and owners, hence making their focus more short-term oriented, and therefore motivated by results within a reasonable period of time. Since the effects of investments often will not show before years later, a bonus based on the current profit might have bad incentive effects. Therefore, calculating future effects of current work proves important. Rewarding long-term profit instead of short-term profit makes every participants work for the same goal.

To determine what results are good, businesses usually use budgets to comparing. Flexible budget analysis helps with the issue of changed circumstances, but that is not the only weakness of the budget. Questions around who influences the budget, how realistic the budget is and if the directions given by the budget are appropriate, rises. If someone get to influence the foundation for his or her own bonus, it can easily head into a bad direction. Unrealistic goals will probably demotivate, and a skewed budget may mislead the employees into inexpedient focus.

2.9   Intrinsic and extrinsic motivation

When it comes to motivation, we distinguish between extrinsic and intrinsic. Extrinsic is the most common used model, and what is often associated with motivation. The idea is "carrot and sticks" where reward provides more desired behavior, and punishment less unwanted behavior. This is often seen in the upbringing of children and animals, but it also occurs in organizations and companies. Some examples are salaries, bonuses linked to performance and commission-based work. One of the advantages is that this often sharpens the focus in a specific task and helps desire for more efficiency. The problem is that it focuses on quantity rather than quality, which can provide ineffective results. If intrinsic motivation already is present, it may have a negative impact devouring the intrinsic motivation. Intrinsic motivation comes from the subject's own drive to carry out and complete a task. This is a

much stronger force than extrinsic motivation. However, since this is based on the individual's feelings, thoughts and attitudes, and not specific goals, there is a risk that the specific tasks lose their place. There is no use of a motivated team if they are not motivated towards their mission.

Self-Determination Theory (SDT) is a theory of how to create intrinsic motivation that does not require constant external action, but an ease of inner drive. Because this type of motivation is fully based on individuals' own instincts, it also has the potential to be very effective. Edward Deci, whom has had great impact on the development of SDT, explains that there are three factors that trigger intrinsic motivation: Autonomy, competence and relatedness.

Autonomy implicates that a person must be able to feel that he or she has control over their own life and is conducting a mission with their own desire to do so. The contradiction would be to do something because someone else wants them to do it. Using this kind of motivator is a challenge that requires a well thought out structure. Working independently means you get to work in the direction you find right, and in your own way, where micromanagement counteracts this entirely. A good attitude for a leader may be to give the employees the needed information and tools, and then get out of the way. It is optimal if there is a relationship of trust, where the manager can rely on the employees to deliver quality at the right time, and at the same time know they will ask for support when needed.

Competence is about feeling that one has the capabilities and expertise, which can be stimulated by positive feedback. Mastery will lead to satisfaction and commitment, where ongoing mistakes and poor results will be demotivating and destructive. To achieve a sense of empowerment among employees, they should have the opportunity of working with tasks that challenge their abilities within their interests. Constructive feedback and rewarding achievement may be the easiest way to stimulate mastery, and will furthermore enhance the relationship between the principal and agets. An employee's mastery is most likely something that serves the enterprise financially, a common response is therefore a bonus, which may be a poor initiative. Competence is an intrinsic motivation, and extrinsic motivation may change the focus so that the employee start to work driven by reward rather than on their own desire. This may weaken both the motivation and the results.

Relatedness describes people's need to feel that they achieve goals related to their personal passion. An example of extreme is non-profit and charity organizations that develop the local community, helps those who are in need or brings justice. However, it can also be

creating valuable projects for the society, increase safety and education. A way to pursue relatedness is to give the employees a feeling of influence in the business.

Bonus is primarily related to extrinsic motivation. However, considering Deci's theory of how to trigger intrinsic motivation, one may by a cautiously and well-designed bonus system trigger both competence and autonomy, thus also trigger intrinsic motivation. This is highly debatable, but the potential is present.

(Edward L. Deci, 2004)

3 Research methodology

3.1 Selecting research topic

At the starting point, working with Multivac was somewhat undefined, what we knew was that Multivac did not reach their potential, and that the latest development had been turbulent. At that point, the only thing I knew for sure was that the thesis had to research a method for increasing their profit within some areas. After a meeting and a round of questions, I made a document that I handed to general manager Stig Pedersen. The document contained suggested fields that would be valuable for Multivac to examine. Suggestions involved profitability analysis, supply chain management, analysis of customers and suppliers, risk analysis and bonus system development. See Attachment 1, suggestions for research fields; keep in mind that it is written in Norwegian.

Because of the recent removal of bonus, the confusion and feelings towards the topic and the close relation to profitability analysis, incentives and profitability became the center of the thesis. This topic was also believed to lead to increased success for Multivac if known properly.

3.2 Qualitative or quantitative

We distinguish between qualitative and quantitative research. By using a qualitative method, one goes in depth in a narrow field. This can be done with interviews, observation or by analyzing documents. This method is very useful if you are examining a topic on which you initially did not have much insight, the information gathered throughout the period will guide the further focus points and research question. The disadvantage of using this method is that statistical deviation may occur, as the information comes from a small number of people.

By using a quantitative method, the information that is collected is possible to express in terms of numbers, this is usually done by using surveys. Informants are often anonymous, and the focus lies on groups of people rather than the individuals. There are usually a lot of informants, but questions with limiting options. The information is then analyzed by statistical analysis techniques. The disadvantage of using this method is the loss of depth information in exchange for wide information, one may also miss information that cannot be quantified but still is important to the business. It is also necessary to have a lot of information in advance and surveys tend to provide leading results because of the questions and answer alternatives. You cannot choose who responds to the survey, which further

means that you do not know whether those responding are from the statistical sample you are seeking. (Mogstad, 2015)

For this thesis, qualitative method are chosen as the research method because the topic was somewhat undefined in the beginning, requiring progressive research. In addition, quantitate method did not make much sense for the company size.

3.3   Gathering data

As mentioned, gathering the data required for developing an analysis are twofold: Interviews and conversations with the leaders and employees, and thorough review of financial data. The first one consisted mostly of asking questions whenever information was needed. Getting to know Multivac's routines through a project, highlighting issues and understanding their decisions became the most important parts. The controller was the one who knew the most concerning the topic of the thesis, so she naturally became the main source of knowledge. I got the opportunity to talk to leaders and employees in all the different areas, and get to know their part in the daily work and in the projects.

I was told that the sales of spare parts and service on previously sold machines were an important income, and it was consistently the main excuse for executing projects with a very low coverage ratio. This excuse was often repeated for the company's decisions, and for their losses, but whenever I asked about the size of the future service income, I was told that it was significant. I was not pleased with decision-making concerning important strategy being based on vague assumptions, and found it impossible to calculate profitability without knowing the financial correlation between the two product groups; machines and service. It was clear that there was a correlation, since service can only be done on previously sold machines. By studying the machine sales and service the past decade, I was able to calculate a formula for estimating the expected profit of future service connected to a single project. This way, we know the approximate long-term profit a single project generates, thus also knowing the cost of decisions. Having this knowledge is crucial for the strategy, and it helps the company, and every employee, understand why changes are made, which further helps actually implementing the changes.

Having a better understanding of the long-term effects of sales, I wanted to analyze the customers. Multivac communicated that it was difficult to negotiate legal terms and prices with the largest customers, and that many projects had high levels of failure, causing huge rework charges. Being able to estimate long-term profit, some selected projects were

thoroughly analyzed and categorized. In an optimal situation, every single project within a defined period would be included, but since not every project had been revised by the administration, it would require going through every transaction and is not realistic. Instead, 26 projects from 2012 and 2013 were chosen as they had sufficient available figures. The years 2012 and 2013 was chosen to ensure the projects was completed and because the period could be considered a "normal period" in relation to present time, and makes a good base for drawing conclusions. Changes in the company at an earlier stages inflicted too much noise too make comparable results from before 2012. The 26 selected projects includes most medium-sized and large projects in the period, but the smallest ones are missing. This should not cause too much misdirection, as the smallest customers have the least impact. Normally, when calculating future income, it is needed to conduct a net present value analysis. However, the future cash flow is not predefined, allowing us to assume a price increase proportionally with the inflation, rendering it unnecessary.

3.4   Capacity and opportunity cost

Multivac's employees claim that they can take on new assignments with more time on their hands. That means full capacity can be assumed reached, and that the work hours of everyone working with new projects, meaning sales of machines, can be considered the limited resource. For Multivac, that includes sales engineers and administration. Administration is generally not included for analysis concerning decision-making, but being such a small company with knowledge as their main resource, the administration does in fact limit the practical capacity. This means that turning down a customer does not lead to waste, because other customers are available. Multivac operates in a business where the customers do not generally contact them for their products, but the other way around. In addition, they even create further demand by showing customers the potential of new systems and upgrades.

This is important because it shows that every customer have an opportunity cost. The opportunity cost refers to the value of the occupied resources when conducting a project, or the cost of losing another project. Often that is invested money or physical assets, but in this case, the occupied resource is the working hours of the sales and administration divisions. This value is not measured by personnel costs, but by the profit that would come from choosing a different project with the equivalent amount of occupied resource. The opportunity cost is easy to ignore, as it is not visible on the accounts, it is a hypothetical value, but nonetheless very real and important. Profit is therefore described in the following equation:

$$Profit = Total\ revenue - Total\ costs - Oppertunity\ costs$$

Therefore, in order to achieve maximized profit, it is not only about settling the sales, but also about finding the customers who holds the best potential for profit in relation to the work consumption needed for the assignment. Anticipating the risk and the potential of the customer is naturally difficult. Experience and precise agreements with the customer will help with the prediction and form the basis for whether to accept the offer or to risk losing the customer trough higher demands. It is important to understand that losing a customer that is calculated to be unprofitable is not a negative outcome, in addition, establishing demands does also increase the marked value of the product. This is easy to forget in the daily struggle to meet the customer's demands and developing well-designed technical solutions. But if never given proper attention, the company will end up choosing unprofitable customers and lose a lot of value in situations that had room for a higher price.

This mindset is close to non-existent in Multivac, and they rarely turn down a customer, but rather strive to make the project possible. This often leads to bad coverage ratio and cheap solutions with high risk of failure. In retrospect, these projects are considered slightly unsuccessful, but excusable because of positive result and expected future income from service. However, this is without considering the opportunity cost, which would reveal these projects as terrible project, and because of low focus on internal project analysis in the wake of the projects, these results are not given much attention. Because of this, the employees does not get the proper feedback required to regulate their behavior.

3.5 Long-term profit

In the previous section, the opportunity cost was highlighted to find the real value of a project, with a formula explaining it. However, it did not take into account the revenue and costs originating from future sales of spare parts and service. As mentioned, historical data was used to find the average expected value of future service. It was found that the total profit over the next decade is expected to be 12.03 % of the total revenue, resulting in the following equation:

$$Profit = Revenue\ sales - Costs\ sales - Opportunity\ costs$$
$$+ Profit\ of\ future\ service$$
$$= 1.0955 * Revenue\ sales - Costs\ sales - Opportunity\ costs$$

Keep in mind that the opportunity costs must include the service profit of the lost opportunity. It is also worth noticing that the ratio of 12.03 % only represent what is expected over time, and it is not by any means fixed at 12.03 %. Factors like deviant needs for service, and a change in the service division's profitability does affect the results, but for our purpose for creating this equation, it does not matter. Our goal is two-fold: Provide a foundation for creating company strategy, and measure the employee's performance. For the strategy, only the big picture is relevant, isolated projects is not. For performance monitoring, the mentioned factors cannot be controlled by the employees we want to monitor with this indicator, being the sales engineers.

In calculations where probability and mean values are included, it may be difficult to see that it makes sense to make such assumptions, especially when looking at single projects after the probabilities have settled. Such calculations only makes sense when looking at many projects over a large time span.

3.6   Customer segmentation

In order to fully understand the connection between income and profitability provided by the different customers, it is found beneficial to gather data from a series of projects in order to create Lorentz and Stobachoff curves. The Lorentz curve will uncover the balance in the customer range and show if the income is somewhat evenly spread, or if a few customers consume most of the company's resources. The Lorentz curve is interesting because it allows us to shift focus, and discover the flexibility in the balance of power between customer and supplier. There are already some known power issues in the relationship to a few of the largest industries, but that will be addressed later.

Perhaps more interesting is the Stobachoff analysis when the goal is maximized profit, as it provides insight to the profit. However, the immediate profit from selling a machine is only a part of the long-term profit since, as mentioned earlier; the service contracts for the following years represent a great portion of the profit. For the Stobachoff analysis, accumulated profit will therefore be replaced with the project's Residual Income.

3.7   The latest organizational development

There was recently a major change in the payment structure in Multivac that practically removed the whole bonus system. The reason it was changed was that Multivac experienced negative incentive effects from the bonus and the employees expressed dissatisfaction towards the system. Because of this, and some other factors that will be highlighted in the analysis chapter, the management decided to redesign the payrolls. The former bonus system was based on how much the sales engineers managed to generate, as well as a subjective dimension. This was changed to a result-based bonus equally distributed among every employee, and a significant raise was given to compensate for the lost bonus output.

4 Results

4.1 Sales division structure

It seems like the sales engineers have too many different tasks, resulting in them having a hard time developing specialist expertise. They are supposed to do well as sales men, design technical solutions, establish guidelines for the legal agreements and calculate costs and prices. The current leader for the sales division comes from a sales background, and does not specialize in the technical solutions, enabling him to concentrate on sales. He did during an interview express how the engineers had problems particularly as sales men. Their competence within technical solutions seems to be excellent, but the sales skills are lacking. The engineers can hardly be criticized for this since the current structure does not allow them to sharpen their focus into one single area. It was also told that Multivac's office in Sweden had a different structure with the tasks divided into two teams: Salesmen working mostly out of office, and a team doing the calculations at the office. It is hard to say which structure is the most beneficial one, but the problem is nonetheless important to address.

4.2 Hypotheses

As I was exploring Multivac, their behavior, the economy and the basis for their decisions, I developed some hypotheses that points to the core of the research questions:

1. Multivac does not earn enough from future sales of parts and service to defend conducting high turnover projects with high risk and low coverage ratio.
2. The current bonus system, and the raise the sales engineers got after the change, have no effect on their motivation besides removing the negative effects of the former system.

These hypotheses are based on the initial impression of Multivac, but the accuracy of the statements becomes clearer as the research goes on. The main guidelines are the research questions, but hypotheses does also make room for further reflection.

4.3 Long-term profit and opportunity cost

The results from the long-term profit analysis is shown on the next page, note that the customers' names are hidden to protect sensitive information. There are especially two observations that is particularly interesting with the long-term profit analysis:

- The profit from future service adds up to a huge part of the total profit for the project. See the right column. The service profit share is 51.32 % of the profit in

average. This result does confirm Multivac's statement of service profit being highly significant. In other words, maximizing the total possible annual turnover will bring high value in the long run.

- There is a correlation between the coverage ratio and the total long-term profitability. This means that future service profit might not be a valid excuse for low coverage, which entirely defies the acceptance of low immediate profit.

The results from the long-term profit analysis also makes us able to calculate an average coverage ratio, thus finding the opportunity cost. Any project with total long-term profit (the left side of the equation) higher than the average long-term profit (right side) will increase the average profit. When we assume full capacity reached, maximum average profit will mean maximum total profit. The equation is only correct under the assumption of capacity usage being proportional with the project size. This is however, an assumption that needs to be further discussed.

$$1.1203 * revenue - costs > 0.267 * revenue$$
$$-0.8533 * revenue < -costs$$
$$\frac{revenue - 0.8533 * revenue}{revenue} < \frac{revenue - costs}{revenue}$$
$$0.1467 < \frac{revenue - costs}{revenue}$$
$$\frac{revenue - costs}{revenue} < coverage\ ratio$$
$$coverage\ ratio > 14.67\%$$

The current opportunity cost is 14.67 % of the revenue.

#	PN	Revenue	Costs	Coverage	Coverage ratio	Sales cost (est.)	After salescost	Future service profit	Long-term profit	Profitability	Service profit share
1	73028	127 817,68	117 425,93	10 391,75	8,13 %	5 025	4 %	15 378,76	20 745,61	16,23 %	74 %
2	71111	767 560,00	629 407,62	138 152,38	18,00 %	30 175	14 %	92 351,25	200 328,50	26,10 %	46 %
3	74117	825 460,00	678 112,20	147 347,80	17,85 %	32 451	14 %	99 317,66	214 214,10	25,95 %	46 %
4	64736	176 740,00	163 082,06	13 657,94	7,73 %	6 948	4 %	21 265,00	27 974,75	15,83 %	76 %
5	72925	106 820,61	94 939,58	11 881,03	11,12 %	4 199	7 %	12 852,44	20 534,02	19,22 %	63 %
6	70543	391 838,25	303 037,45	88 800,80	22,66 %	15 404	19 %	47 145,18	120 541,62	30,76 %	39 %
7	71354	109 808,61	87 088,87	22 719,74	20,69 %	4 317	17 %	13 211,95	31 614,78	28,79 %	42 %
8	75883	303 040,00	266 541,65	36 498,35	12,04 %	11 913	8 %	36 461,15	61 046,07	20,14 %	60 %
9	72818	32 689,00	26 853,82	5 835,18	17,85 %	1 285	14 %	3 933,07	8 483,15	25,95 %	46 %
10	67499	25 380,20	20 170,35	5 209,85	20,53 %	998	17 %	3 053,69	7 265,77	28,63 %	42 %
11	74027	256 217,00	209 212,97	47 004,03	18,35 %	10 073	14 %	30 827,51	67 758,86	26,45 %	45 %
12	73088	214 542,28	215 645,33	-1 103,05	-0,51 %	8 434	-4 %	25 813,29	16 275,93	7,59 %	159 %
13	72141	245 669,93	177 844,04	67 825,89	27,61 %	9 658	24 %	29 558,50	87 726,36	35,71 %	34 %
14	65488	291 715,00	243 937,83	47 777,17	16,38 %	11 468	12 %	35 098,55	71 407,51	24,48 %	49 %
15	71896	188 038,60	151 360,72	36 677,88	19,51 %	7 392	16 %	22 624,42	51 909,93	27,61 %	44 %
16	71571	169 177,49	160 746,94	8 430,55	4,98 %	6 651	1 %	20 355,09	22 134,76	13,08 %	92 %
17	68866	134 762,07	97 711,62	37 050,45	27,49 %	5 298	24 %	16 214,30	47 966,84	35,59 %	34 %
18	72761	224 846,55	167 137,29	57 709,26	25,67 %	8 839	22 %	27 053,08	75 922,93	33,77 %	36 %
19	71340	86 769,78	62 846,93	23 922,85	27,57 %	3 411	24 %	10 439,96	30 951,63	35,67 %	34 %
20	68047	169 480,78	133 335,23	36 145,55	21,33 %	6 663	17 %	20 391,58	49 874,32	29,43 %	41 %
21	65057	199 394,00	159 717,65	39 676,35	19,90 %	7 839	16 %	23 990,68	55 828,24	28,00 %	43 %
22	77371	68 036,00	53 948,37	14 087,63	20,71 %	2 675	17 %	8 185,95	19 598,88	28,81 %	42 %
23	72834	23 317,00	17 886,34	5 430,66	23,29 %	917	19 %	2 805,45	7 319,45	31,39 %	38 %
24	64545	335 000,00	248 461,53	86 538,47	25,83 %	13 170	22 %	40 306,52	113 675,11	33,93 %	35 %
25	64608	53 750,00	38 338,20	15 411,80	28,67 %	2 113	25 %	6 467,09	19 765,81	36,77 %	33 %
26	66052	109 500,00	87 273,90	22 226,10	20,30 %	4 305	16 %	13 174,82	31 096,14	28,40 %	42 %

4.3 1: Long-term profit analysis calculation

4.4 Lorentz
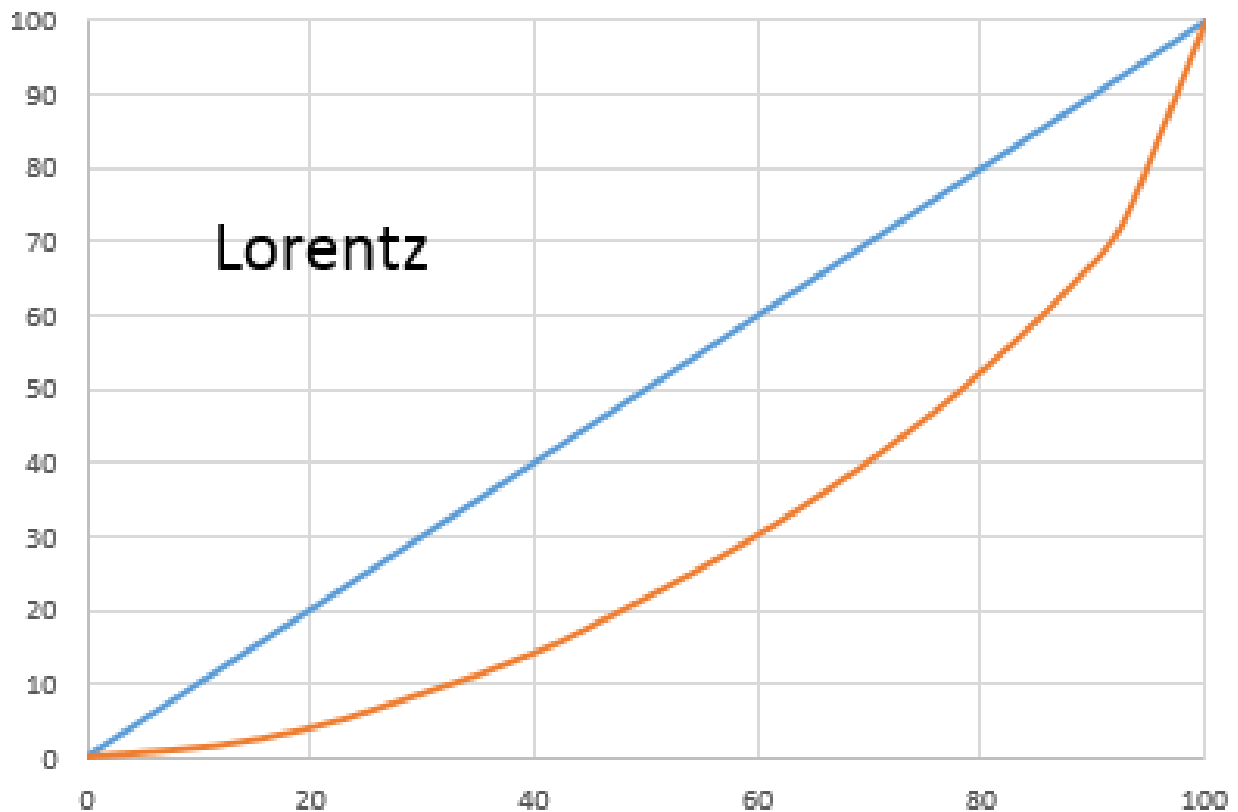
4.4 1: Multivac's Lorentz curve

At first sight, the Lorentz-curve looks decent, the sizes of the projects are distributed fairly well, and there are no signs that shows few customers dominating the demand, giving Multivac leeway without having to worry too much about customers with a lot of power towards them. Although the results are promising, the reality is a little different because of all the projects not included in the analysis. In chapter 3.3 gathering data, it is told that we were unable to include every project because of lacking project overview, and that small projects are missing. Knowing that there are many of these small projects, we can expect the real Lorentz-curve to stretch deeper, showing a more significant imbalance. The Gini-coefficient for the curve is 0.427, but the real one is expected to be somewhat higher.

4.5 Stobachoff
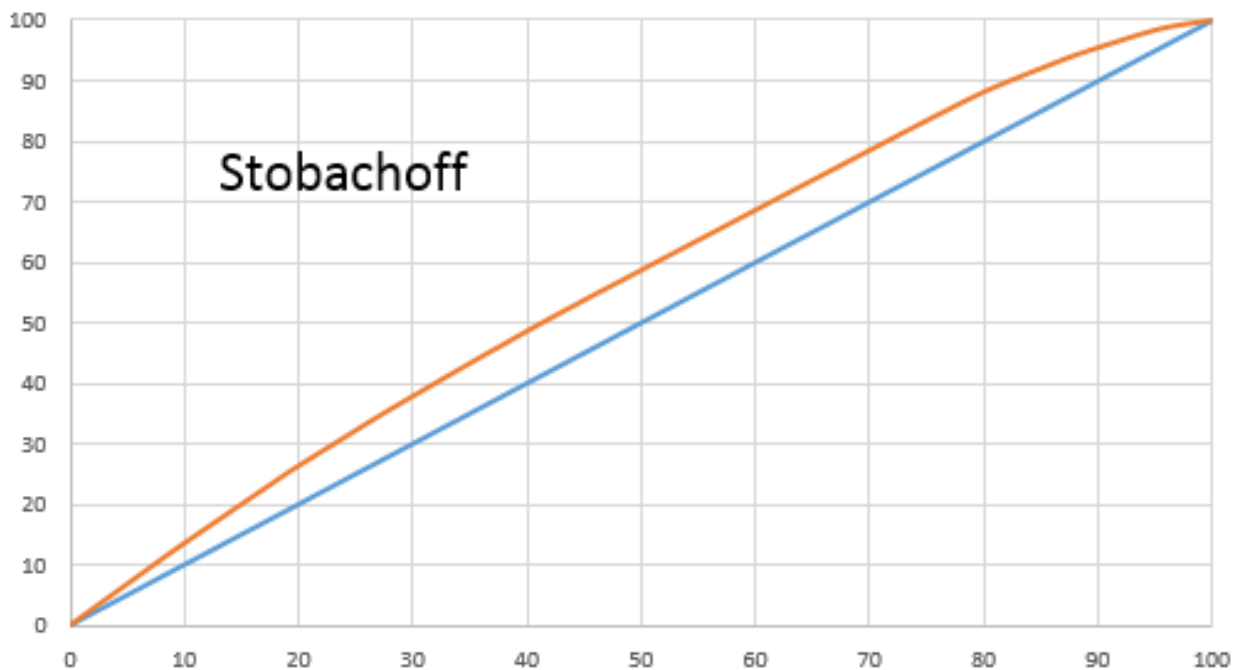
4.5 1: Multivac's Stobachoff curve

Out Stobachoff curve looks a lot different than the one presented in the theory, this is because no projects have a negative long-term profit, because of this there is no turning point. The fact that the Stobachoff curve just slightly hover above the equality line shows that the profits is quite evenly distributed which signalize a price tag closely related to the cost. What is interesting about this is that the price is calculated based on the cost, and not on the customer's willingness to pay. Because the information between customer and Multivac often is asymmetrical, it might be some potential in taking the willingness to pay more into account when giving a price. This require skills within sales and customer profiling. Given the results in chapter 4.1 sales division structure, the Stobachoff results does not surprise, as their tasks might be too extensive to specialize in sales skills.

4.6   Segmentation
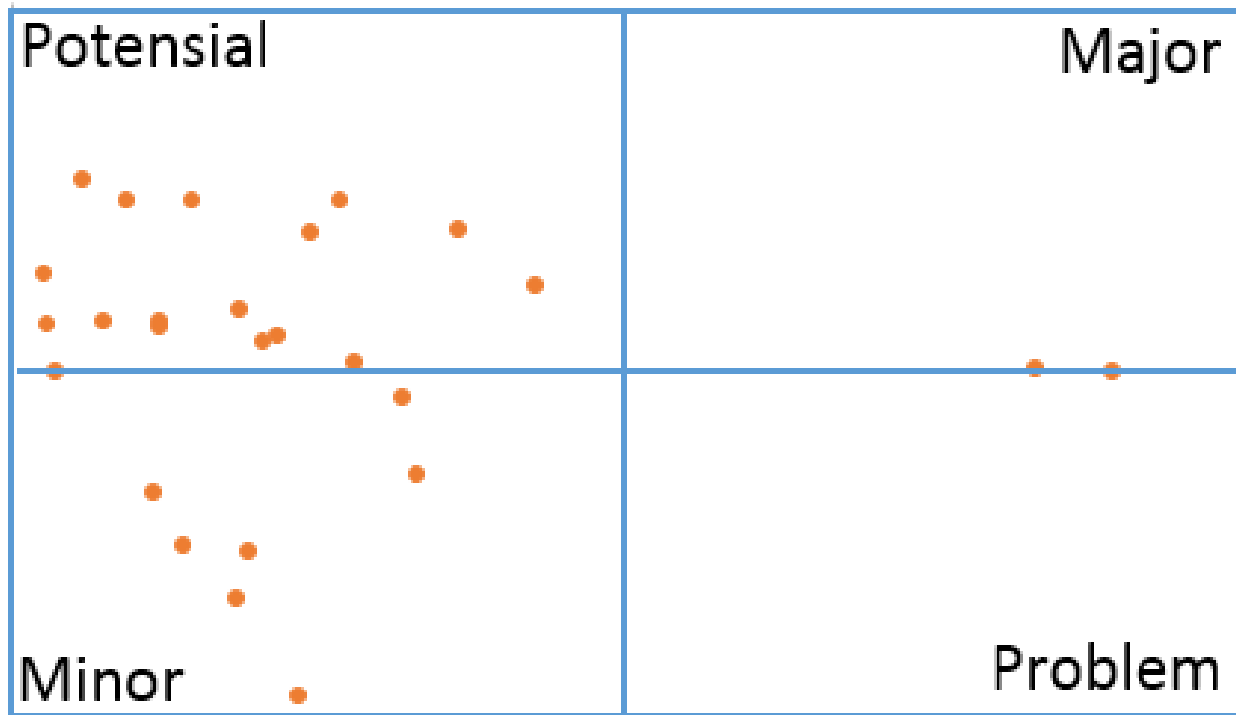
4.6 1: Multivac's customer segmentation matrix

The customer segmentation matrix for the selected project are shown above. This reveals that most projects lie within the same area of profitability, but a few projects having bad relative results. The projects in the group called minor consists mostly of projects that lost profit because of rework charges. This group appears to be the one that is easiest to improve, and judging on how much impact the poor results have on the relative profit, it seems to be significant winnings on improving them.

Lately, Multivac Norway have had focus on growing their marked share, with that focus in mind decisions have been made to accept sales with low contribution margin and with high risks. These sales are not represented in the selected projects for analysis. These projects would fit into the group "problem", highlighting that the focus on marked share and getting the big customers comes at a cost.

5 Analysis

5.1 Previous and current bonus systems

The former bonus system led to many problems, one of them was that it required a lot of resources in meetings where the employees defended their achievements. Subjective performance measurement are expected to build boundaries and may negatively affect the attitudes across different roles. Another problem was that the incentives was pointed towards increased sales, meaning any sales. This would reward sales of machines with a loss, and encourage the sales men to ignore the risks when calculating price in order to get the sale. Allocating commission only makes sense when every sold item generates profit and the seller cannot affect the price, but for Multivac, the seller is the one calculating the price and can definitely accept orders with losses. This makes seller's commission highly unsuitable for Multivac's sales engineers. The most obvious problem was the negative influence the incentive system had on teamwork. Because the bonus was shared among everyone involved in the project, the sales men would oppose coworker's involvement, hence tearing down the foundation for cooperation and creating negative tension in the company.

After the change, many of the problems mentioned above were improved, but not completely solved. The system does no longer discourage teamwork, but even though Multivac want to believe so, it does not encourage it either. Implementing result-based bonus was meant to give the employees reason to cooperate, but as the theory states in chapter 2.6 Requirements, result-based bonus can hardly have any effect at all, because the individual performance often feels like a drop in the ocean, and personal achievements will not be recognized. In addition, the level of noise in the measurement is huge, spanning from coworker's achievement to changes in the marked and even exchange rate for currencies. According to Multivac's economic controller, the decisive reason that no one was given bonus in 2014 was due to the exchange rate of the EUR. The past couple of years, the result was not good enough for any bonus at all, but that might be a good thing for Multivac as it would probably be a waste of money in terms of motivational effects. The raise that was given after the change makes sense because the average annual salary would be lower without the bonus, thus creating a need for compensation. However, when deciding the size of the raise Hertzberg's two-factor theory should be considered. Salary is labeled a hygiene factor, meaning that it would cause dissatisfaction if below the expected value, but not motivate if higher than expected. The raise given after the change will therefore probably not lead to any kind of motivation. David Russo from SAS once summarized this effect in a quote:

> *"A raise is only a raise for thirty days; after that, it's just your salary."*
> *- David Russo, VP of Human Resources at SAS Institute*

The approach Multivac decided when making the mentioned change clearly had the goal of getting rid of negative consequences, and was partly successful doing that. However, the thing that is weak about this strategy is that it did not implement any positive supplementations. Even at the current time, the company struggles with lack of proper cooperation and the company possesses a certain tension across the departments. This is believed to be because it has grown stuck into the company culture, which indeed is challenging to change. This is why removing discouraging incentives will not be enough, and teamwork enhancing incentives is needed to restore the sense of unity. Because of bad experience with an inappropriate bonus system, many of the employees holds a negative attitude towards bonuses in general, making implementation of a new one challenging. This topic is discussed in chapter 5.5 Building an incentive system.

5.2   Customer analysis

The method the sales engineers currently use to calculate the price to the customers is by calculating costs and adding a profit based on the desired coverage ratio. This is a rational method and the typical mind of an engineer. The most successful sales men however would not pay too much attention to the costs, but to a greater extent try to exploit and maximize the profit based on the customer's willingness to pay. I do not know exactly how flexible the customers are concerning price, but a mindset extending towards the customer's capabilities holds greater potential than focusing on our own expenses. When asking about the price and project negotiations with the customers, I was told that rework on previous projects caused customers to be less flexible, and forcing them to negotiate defensively. Rework-lowering measures, like increased planning, will therefore release potential in the negotiation.

5.3   Capacity usage

Because of lacking information on the capacity usage on the different projects, we had to assume that it was increasing proportionally with the size of the project. That is highly unlikely, as each project is executed different according to the size. We ignore deviations due to technical details, and will only consider average capacity usage in comparison to project size. The initial assumption are sketched as a graph below (graph 1), and a graph showing an imagined, and a more realistic shape is drawn as well (graph 2). There are mainly two factors that change the way to look at capacity consumption:

1. Every project are expected to have an initial consumption, independent from the size of the project. This work time consists mostly of travel and initial meeting with the customer, plus documentation and shipping. The only exception that comes to mind

is commission sales fully organized by a third party supplier, these sales have a much lower cost as it is handled by the administration. The profitability of such sales are very high.

2. The second factor is that the capacity consumption over revenue will slowly decrease because of mass production and mass design effects. It is also possible to make decisions concerning more machine value per meeting and one decision may cover multiple machines or parts.

The graphs below are only models for the initially assumed graph and the expected shape of the real capacity consumption.
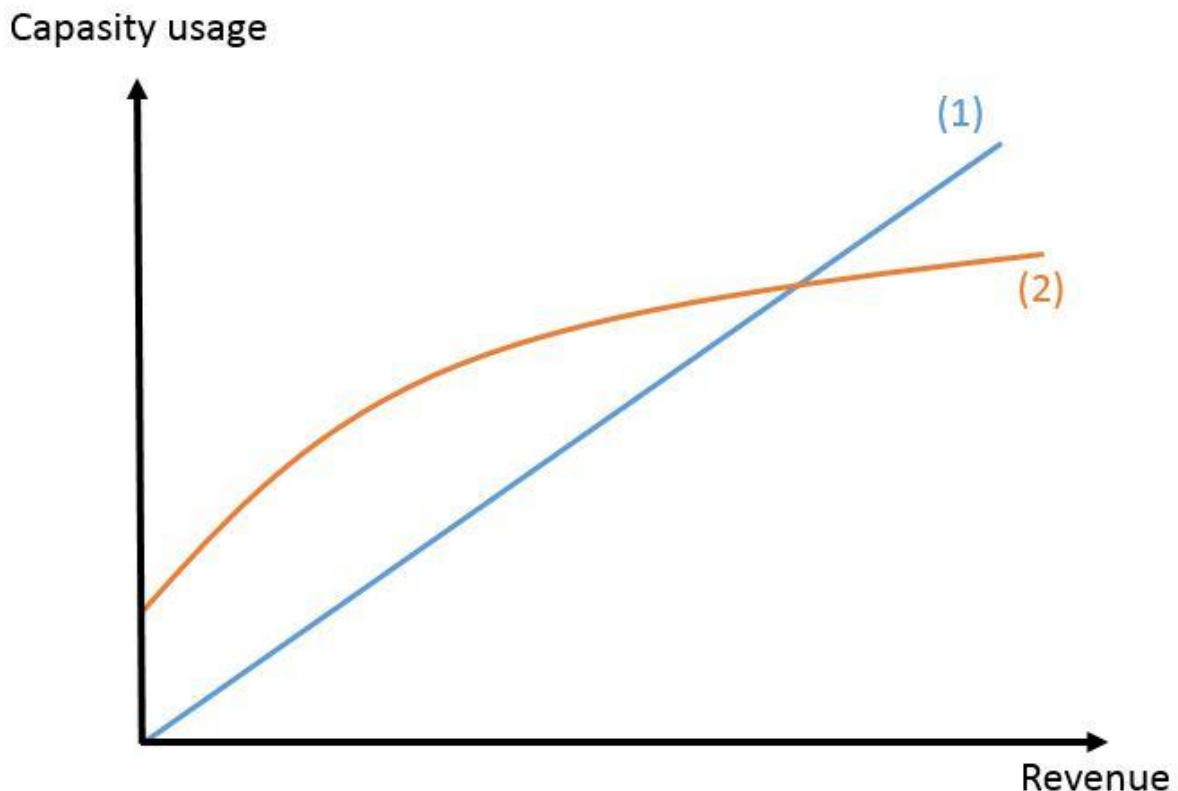
5.3 1: A more realistic representation of the capacity usage

This change the whole view on profitability compared to capacity usage, and the opportunity cost. However, if Multivac decides to record capacity usage in the future, it is fairly simple to make the appropriate adaptations to the equation. A new opportunity cost must be calculated based on the average long-term profit per unit of resource, resulting in a function of the revenue. The unit represent a defined quantity of man hours or a portion of the yearly available hours. We get the following equation:

$$Oppertunity\ cost = C(r) * U$$
$$C(r) = capacity\ usage\ per\ unit$$
$$r = revenue$$
$$U = requrired\ units$$

C(r) is the given function, r and U are the input variables.

5.4   Rework

Because of the significant losses from rework charges, countermeasures should be done, and one possibility is implementing bonus for completing projects with none, or low, rework charges. Rework bonus does however have some noise from possible errors in the technical department and from the supplier (Multivac Germany). Errors originating from third party suppliers are expected to be handled in such a way that the responsibility falls on the supplier, the same goes for other errors because of lacking legal agreement. This will therefore fall under sales engineer's responsibility and planning. The best way to prevent failure in a project is to increase the level of planning. The model on the right illustrate this principle. Increased investment in the planning phase results in lower failure costs. The earliest increments have the greatest impact and diminishes over time to a point where the cost of increased planning becomes higher than the value. This is the point we want to find, because it results in the lowest total cost. Keep in mind that the failure cost is a function of consequence and probability, and does only make sense in the long run. There is no way to know for sure where the cost of increased planning crosses failure cost reduction in a real situation, but having a mindset of achieving minimal total costs helps towards the goal.
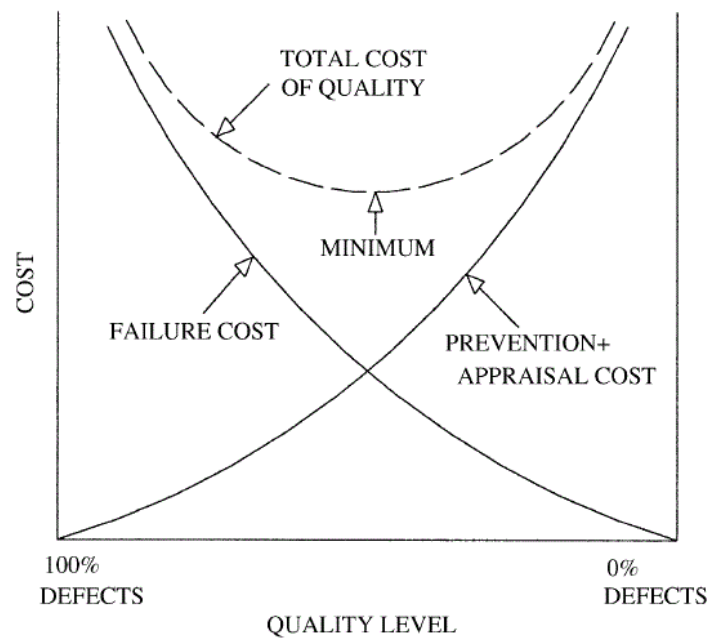
5.4 1: The correlation between planning cost and failure cost

$$Planning\ cost = Cost\ of\ occupied\ capasity + cost\ of\ delayed\ startup$$

$$Failure\ cost = Rework\ charges + negative\ market\ effects$$

$$Minimum\ total\ cost: Cost\ of\ additional\ planning = Failure\ cost\ reduction$$

(The quality portal, 2015)

5.5 Building an incentive system

With the goal of achieving maximum long-term profit, there are many different areas at Multivac that needs to be improved. Based on the results and the analysis we can see some particular fields that are likely to bring much profit compared to the effort needed:

- Identify the long-term profit of the customers. This includes the opportunity cost, and is needed in order to know which customers that either needs to be turned down, or demanded a higher price. This points to strictly rational decision-making, but the new factor for Multivac is considering an alternative cost mirroring a real loss. Knowing the capacity required for each project is crucial for the opportunity cost calculation. This requires monitoring of the time spent on the projects with the goal of proper cost estimation. It is however important that the employee's keep a sense of autonomy for their motivation.
- Lowering the rework charges. Rework inflicts huge losses for Multivac, both directly and indirectly. Whenever rework is required, Multivac gets the responsibility to fix the problem, generating immediate extra costs in travel, parts and installation. In addition, the full payment for the machines is postponed, and because the figures usually is in a few hundred thousand EUR, and the period postponed can be months and even years until confirmed completion, the interest expenses are highly significant. Additionally, rework causes negative market effects, and lowers customer's view on their quality.
- Increase cost efficiency. This applies for every employee, but mostly for the ones that travel a lot, being the technical department and the sales engineers. This can be a good basis for creating a KPI for the technical department, as it will directly affect the profit.

With the major strategies determined it is needed to develop a non-negotiable formula that is easy to understand. Subjective measurement is not necessary because the goals are possible to monitor financially. The simplest form for payout is with money, but it can easily be complimented with gifts and travel. In addition, specific feedback should be given when employees carries out achievements corresponding to the strategy. This will trigger intrinsic motivation through the competence dimension and because they are linked to certain KPIs, they are easy to recognize.

Because of the negative attitude towards bonus systems, change management methods like Kotter's 8 steps should be used. As mentioned earlier; every change in an organization are destined to provoke resistance, and it should be expected. Using Kotter's 8 steps helps implementing desired changes smoothly.

5.6   Vision and strategy

Strategy is how you approach the vision, and even though the vision stays the same over a longer period, the strategy should change continuously due to changing circumstances. When the performance of a business is developing, a dynamic strategy should be present to facilitate further development. Multivac is not aware of the full extent of their current situation, due to the lack of project analysis put into context. To solve this matter, I would recommend placing all the projects into a document with an overview of respective revenues, expenses, capacity usage, profit from future service and costs of rework charges associated to each project. It should also be possible to sort by relevant groupings. This will unveil the development, good or bad, and improve insight in which strategy to choose to achieve the chosen vision. This is the only way we can achieve maximized potential and continuous improvement in the long run.

6 Conclusion

Economic incentives seems to be the way to go in order to achieve long-term profit. With a proper analysis of what behavior that brings profit, we can design a bonus system that guides the employees to the desired decisions. One of the strengths of bonus is that the work is controlled without micro-management, and lets the employee find his or her own path to the given goal. This is also appropriate when the information is asymmetrical, and the employee holds knowledge the manager do not have, making the employee more suited to make the decision.

SALES. Chasing and giving incentives to increase turnover makes no sense, given our current capacity, and because high turnover does not necessary mean high profit. It does neither seem like putting incentives based on coverage ratio will have a good outcome, because of the different segments the sales engineers work in, and because it ignores capacity usage. It might also create unused capacity because the employees do not want to lower their average coverage ratio, thus inflicting the return on investment problem. A possibility is to give bonus once a year to the entire sales team, according to their total long-term profit, compared to the budget. The long-term profit should include estimated future service profit, opportunity cost and capacity usage. This has some challenges, but seems to push the performance towards profit. In addition, it can be a good idea to give bonus for each project finished with a low amount of rework charges. This has some noise from the performance of the technical department, so the intensity should be low, but the benefit of this bonus is that it encourages thorough planning and improved communication with technical department.

TECHNICAL. Return on invested capital seems like a good idea, since they cannot affect the denominator in the equation, but only reduce the costs. This KPI will give them incentives to work efficiently, get the work done quickly, and to avoid additional installation linked to bad quality of work. The technical department will lack incentives for cooperation with other departments, and that is a weakness, but it might also be practically inevitable. However, because this also is group based, they are encouraged to good teamwork internally.

ADMINISTRATION. This department is too difficult to measure, and there are no relevant key performance indicators that clearly shows their efforts. Either giving result-based bonus with low intensity or no bonus at all seems like the best options.

Group based bonus was suggested for every section. This results in a less effective incentive system, but may be the best alternative anyway. This is because Multivac have been struggling with the overall teamwork, and the suggested system encourage increased cooperation. In addition, the current structure of the company makes it difficult to measure performance fairly. Since Multivac is such a small company, and the teams consists of few members, the problems with group-based bonus is likely to be insignificant.

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8   Attachments

8.1   Attachment 1, suggestions for research fields

Masteroppgave for Multivac

Jeg, Øystein Kopstad, ønsker å skrive masteroppgave for Multivac i Sandefjord, på vegne av Universitetet i Agder. Studiet er Sivilingeniør; Industriell Økonomi og Teknologiledelse, som omfatter et fagområde som er svært relevant for Multivac sin virksomhet. Oppgaven vil ha et preg av forskning, med fokus på å se etter mulighet for å øke bedriftens lønnsomhet.

Fra universitetets side settes det krav til at oppgaven tar utgangspunkt i et av de sentralene fagene som er forelest det siste året. De mest relevante fagområdene vil derfor være verdikjede eller strategisk økonomistyring. Begge er omfattende områder, men jeg har satt opp 4 konkrete alternativer innenfor områdene, hvor jeg foreslår enten at en av dem velges, eller at to kombineres. Emnene vil være noe relaterte, slik at valg av område kun vil være veiledende for oppgavens fokus.

1. Evaluering av kunder med sikte på å kartlegge enkelte kunders langsiktige lønnsomhet, samt undersøke muligheter for å øke lønnsomheten. Et av problemområdene her er sene kundefordringer, samt at fremtidig omsetning i form av service er en såpass stor del av virksomheten at tradisjonelle økonomiske verktøy ikke nødvendigvis strekker til. At produktene er kundetilpassede gjør også økonomisk evaluering mer kompleks og interessant. Enkelte kunders krav til rask levering skaper problemer, da dette kan skyldes press fra deres kunder kan det være interessant å se på muligheter for å forbedre informasjonsstrømmen helt ned til kunders kunder. Dette området syntes å ha stort økonomisk potensiale, samt muligheter for økt stabilitet.

2. Evaluering av leverandører. Her kan det være nyttig å se på forholdene til de ulike leverandørene og kartlegge maktbalansene. Dette kan bidra til mer robuste langsiktige leverandørforhold. Målet kan være å redusere forsinkelser og feil, oppnå optimalt kostnadsnivå eller forsterke leveransemetodene. Hvis jeg har forstått korrekt benytter Multivac MRP-systemer gjennom ERP-programmet SAP, noe som legger til rette for en analyse av anskaffelsessystemet.

3. Økonomisk lønnsomhetsanalyse. Er Multivacs lønnsomhetsberegninger tilstrekkelig for å gjenspeile enkelte prosjekters langsiktige verdiskapning? Her kan det undersøkes om det er mer hensiktsmessig å bruke Estimated Value Added (EVA) / Residual Income. Hva med bonusordninger, og beregning av disse, på en måte som oppmuntrer til verdifulle beslutninger? Det kan også undersøkes om budsjettene utfører sin hensikt og legger grunnlag for produksjon- og kostnadseffektiv drift. Kan eventuelt Beyond Budgeting være en mulighet?

4. Kartlegging av hele verdikjeden fra anskaffelse av råvarer til levering og service. Dette har som formål å få fullstendig oversikt over alle prosesser. Dette danner også et grunnlag for å kunne effektivisere flaskehalser i prosesser, redusere «waste» og lager ved hjelp av Lean-verktøy. Det er vanskelig å si hva effekten av denne analysen har, spesielt siden det ikke er noe masseproduksjon av standardiserte produkter. Montasjeavdelingen kan allikevel være mulig å analysere.

Dere i Multivac har naturligvis langt mer innsikt i bedriftens behov og problemområder, og har derfor bedre mulighet enn meg til å se hvilke emner som egner seg best for analyse, slik at masteroppgaven kan ha en positiv effekt på lønnsomhet. Samtidig kan jeg stille med en teoretisk kompetanse som sammen med et personlig engasjement for tematikken kan ha verdi for bedriften. Oppgaven skal utarbeides over en periode på 4 måneder, uten forstyrrelser fra andre fag da alle eksamener er fullførte, derfor vil oppgaven bli en grundig forskning som ikke vil kreve mer av Multivac enn villighet og mulighet for å stille spørsmål.

Jeg ser fram til et samarbeid med dere i Multivac.

Mvh.
Øystein Kopstad

Serviceprofit	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998
Total omsetning	109 110	107 862	104 534	50 397	77 104	52 379	90 509	68 803	28 292	81871	53 354	34 741	47 432	36 727	30 019	27 020	29 485
Omsetning service	37 717	28 906	26 523	23 232	24 082	20 969	17 479	14 857	13 109	12 292							
Varekost service	14 406	10 936	10 031	10 070	10 419												
Driftskost service	16 289	14 457	14 217	12 669	11 053												
Resultat service	7 022	3 513	2 275	493	2 610								Average service period	10			
Rentabilitet service	18,62%	12,15%	8,58%	2,12%	10,84%												
Driftskost/omsetning	43,19%	50,01%	53,60%	54,53%	45,90%												
Varekost/omsetning	38,19%	37,83%	37,82%	43,35%	43,26%												
Oms service / total oms	34,57%	26,80%	25,37%	46,10%	31,23%	40,07%	19,31%	21,59%	46,33%	15,01%							
Forventet årlig serviceoms. lft sal	5,70%	4,76%	4,94%	4,35%	4,88%	4,45%	4,29%	4,03%									
Forventet årlig serviceresultat	1,06%																
Total omsetning i serviceperiode	51,30%																
Totalt resultat i serviceperiode	9,55%																
Årlig resultat før justering	7022	6444	5697	5665	5237												
Maskiner ute i markedet nå	863 424	782 582	707 533														
Endring i maskiner ute 2012–2014	155 891																
Endring i serviceomsetning 2012–	11194																
Serviceoms. endring per ending t	7,18%																
Forventet resultat per år	1,34%																
Forventet resultat 10 serviceår	12,03%																

49

8.3 Attachment 3, Customer segmentation calculations

| | Lorentz | | | | | | | Stobachoff | | | | | | Accumulated | |
Number	Revenue	%pop	%inc	%acc in	Long-term profit	%Long-term	%acc L-T	Profit ratio	Relative prof.rate	Prof.rate	%inc	Long-term profit	L-T/L-T-tot	L-T profit	%inc
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	23 317,00	4	0,41	0,41	7 319	0,49	0,49	31,39	1,18	36,77	0,95	19 766	1,33	1,33	0,95
2	25 380,20	8	0,45	0,86	7 266	0,49	0,98	28,63	1,07	35,71	4,36	87 726	5,92	7,25	5,31
3	32 689,00	12	0,58	1,44	8 483	0,57	1,56	25,95	0,97	35,67	1,54	30 952	2,09	9,34	6,85
4	53 750,00	15	0,95	2,40	19 766	1,33	2,89	36,77	1,38	35,59	2,39	47 967	3,24	12,58	9,24
5	68 036,00	19	1,21	3,60	19 539	1,32	4,21	28,81	1,08	33,93	5,94	113 675	7,67	20,25	15,18
6	86 769,78	23	1,54	5,14	30 952	2,09	6,30	35,67	1,34	33,77	3,99	75 923	5,12	25,37	19,17
7	106 820,61	27	1,89	7,04	20 534	1,39	7,63	19,22	0,72	31,39	0,41	7 319	0,49	25,87	19,59
8	109 500,00	31	1,94	8,98	31 096	2,10	9,79	28,40	1,06	30,76	6,95	120 542	8,13	34,00	26,54
9	109 808,61	35	1,95	10,93	31 615	2,13	11,92	28,79	1,08	29,43	3,01	49 874	3,37	37,37	29,54
10	127 817,68	38	2,27	13,20	20 746	1,40	13,32	16,23	0,61	28,81	1,21	19 539	1,32	38,69	30,75
11	134 762,07	42	2,39	15,59	47 967	3,24	16,56	35,59	1,33	28,79	1,95	31 615	2,13	40,82	32,70
12	169 177,49	46	3,00	18,59	22 135	1,49	18,05	13,08	0,49	28,63	0,45	7 266	0,49	41,31	33,15
13	169 480,78	50	3,01	21,59	49 874	3,37	21,41	29,43	1,10	28,40	1,94	31 096	2,10	43,41	35,09
14	176 740,00	54	3,14	24,73	27 975	1,89	23,30	15,83	0,59	28,00	3,54	55 828	3,77	47,18	38,63
15	188 038,60	58	3,34	28,06	51 910	3,50	26,80	27,61	1,03	27,61	3,34	51 910	3,50	50,68	41,96
16	199 384,00	62	3,54	31,60	55 828	3,77	30,57	28,00	1,05	26,45	4,54	67 759	4,57	55,25	46,51
17	214 542,28	65	3,81	35,41	16 276	1,10	31,67	7,59	0,28	26,10	13,62	200 328	13,52	68,77	60,12
18	224 846,55	69	3,99	39,40	75 923	5,12	36,79	33,77	1,26	25,95	0,58	8 483	0,57	69,34	60,70
19	245 669,93	73	4,36	43,75	87 726	5,92	42,71	35,71	1,34	25,95	14,64	214 214	14,45	83,80	75,35
20	256 217,00	77	4,54	48,30	67 759	4,57	47,29	26,45	0,99	24,48	5,17	71 408	4,82	88,62	80,52
21	291 715,00	81	5,17	53,47	71 408	4,82	52,10	24,48	0,92	20,14	5,38	61 046	4,12	92,73	85,90
22	303 040,00	85	5,38	58,85	61 046	4,12	56,22	20,14	0,75	19,22	1,89	20 534	1,39	94,12	87,79
23	335 000,00	88	5,94	64,79	113 675	7,67	63,89	33,93	1,27	16,23	2,27	20 746	1,40	95,52	90,06
24	391 838,25	92	6,95	71,74	120 542	8,13	72,03	30,76	1,15	15,83	3,14	27 975	1,89	97,41	93,19
25	767 560,00	96	13,62	85,36	200 328	13,52	85,55	26,10	0,98	13,08	3,00	22 135	1,49	98,90	96,19
26	825 460,00	100	14,64	100,00	214 214	14,45	100,00	25,95	0,97	7,59	3,81	16 276	1,10	100,00	100,00
Sum	5 637 370,83				1 481 961,05			26,70				1 481 961,05			

Average profit	26,70
Average revenue	216 821,36

8.4 Attachment 4, Herzberg's two factor theory

Exhibit I	Factors affecting job attitudes as reported in 12 investigations		
	Factors characterizing 1,844 events on the job that led to extreme dissatisfaction		Factors characterizing 1,753 events on the job that led to extreme satisfaction

Percentage frequency

50% 40 30 20 10 0 10 20 30 40 50%

- Achievement
- Recognition
- Work itself
- Responsibility
- Advancement
- Growth
- Company policy and administration
- Supervision
- Relationship with supervisor
- Work conditions
- Salary
- Relationship with peers
- Personal life
- Relationship with subordinates
- Status
- Security

All factors contributing to job dissatisfaction | All factors contributing to job satisfaction

69 — Hygiene — 19
31 — Motivators — 81

80% 60 40 20 0 20 40 60 80%
Ratio and percent

A part of Herzberg's research, downloaded from the internet: (Herzberg F. , 1987)