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The school of Industrial Engineering and Management  
The Department of Innovation Management  
Master's Thesis

# Working Capital Management Model in value chains

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## ABSTRACT

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**Keywords:** Value chain, Cash conversion cycle, Working capital management, Cash management, Cash flow forecasting, Return on investment, arvoketju, käytöpääomanhallinta, kassanhallinta, kassavirran ennustaminen

The objective of this Master's thesis is to create a calculation model for working capital management in value chains. The study has been executed using literature review and constructive research methods. Constructive research methods were mainly modeling. The theory in this thesis is founded in research articles and management literature. The model is developed for students and researchers. They can use the model for working capital management and comparing firms to each other. The model can also be used to cash management. The model tells who benefits and who suffers most in the value chain. Companies and value chains cash flows can be seen. By using the model can be seen are the set targets really achieved. The amount of operational working capital can be observed. The model enables user to simulate the amount of working capital.

The created model is based on cash conversion cycle, return on investment and cash flow forecasting. The model is tested with carefully considered figures which seem to be though realistic. The modeled value chain is literally a chain.

Implementing this model requires from the user that he/she have some kind of understanding about working capital management and some figures from balance sheet and income statement. By using this model users can improve their knowledge about working capital management in value chains.

## TIIVISTELMÄ

<b>Tekijä:</b> Timo Eskelinen	
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<p>Tämän diplomityön tarkoituksen on luoda laskentamalli käyttöpääomanhallintaan arvoketjuille. Työ on toteutettu hyödyntämällä kirjallisuuskatsausta ja konstruktivisia tutkimusmenetelmiä. Käytetyt konstruktiviset tutkimusmenetelmät olivat pääasiassa mallintamista. Työn teoria on tutkimusartikkeleista ja johtamiskirjallisuudesta. Malli on kehitetty opiskelijoille ja tutkijoille. Mallia voidaan käyttää käyttöpääomanhallintaan ja eri yritysten vertailuun toisiinsa. Malli kertoo kuka hyötyy ja kuka kärsii eniten arvoketjussa. Yritysten ja arvoketjujen kassavirrat pystytään ennustamaan mallin avulla. Malli kertoo ovatko asetetut tavoitteet toteutuneet. Operatiivinen käyttöpääoma saadaan selville mallin avulla. Mallin avulla voidaan simuloida käyttöpääoman määrään muutoksia. Näiden muutosten vaikutukset eri tunnuslukuihin ja kassavirtaan voidaan nähdä mallista.</p> <p>Luotu malli pohjautuu CCC:hen ja ROI:hin ja kassavirtojenennustamiseen. Malli on testattu tarkkaan harkituilla luvuilla, jotka vaikuttivat olevan realistisen oloisia. Mallinnettu arvoketju ajateltiin olevan kirjaimellisesti ketju.</p> <p>Implementoidessa tätä mallia käyttäjän tulee ymmärtää jotakin käyttöpääoman hallinnasta ja hän tarvitsee joitakin lukuja taseesta ja tuloslaskelmasta. Mallin avulla käyttäjä pystyy kehittämään tietämystään käyttöpääomanhallinnasta arvoketjuissa.</p>	

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## **LIST OF ABBREVIATIONS**

DAO	Days of advance payments outstanding
DSO	Days of receivables outstanding
DIO	Days of inventory outstanding
DPO	Days of payables outstanding
AP	Accounts payable
INV	Inventories
AR	Accounts receivable
SCM	Supply chain management
FSCM	Financial supply chain management
VCM	Value chain management
CCC	Cash conversion cycle
C2C	Cash to cash
NWC	Net working capital
WCM	Working capital management
CR	Current ratio
QR	Quick ratio
ROI	Return on investment
WACC	Weighted average cost of capital
EBIT	Earnings before interests and taxes

# 1 INTRODUCTION

This thesis objective is to develop a calculation model for working capital management. In first chapter is introduced this study's background, research questions, limitations, research methods, and structure of this thesis.

## 1.1 Background

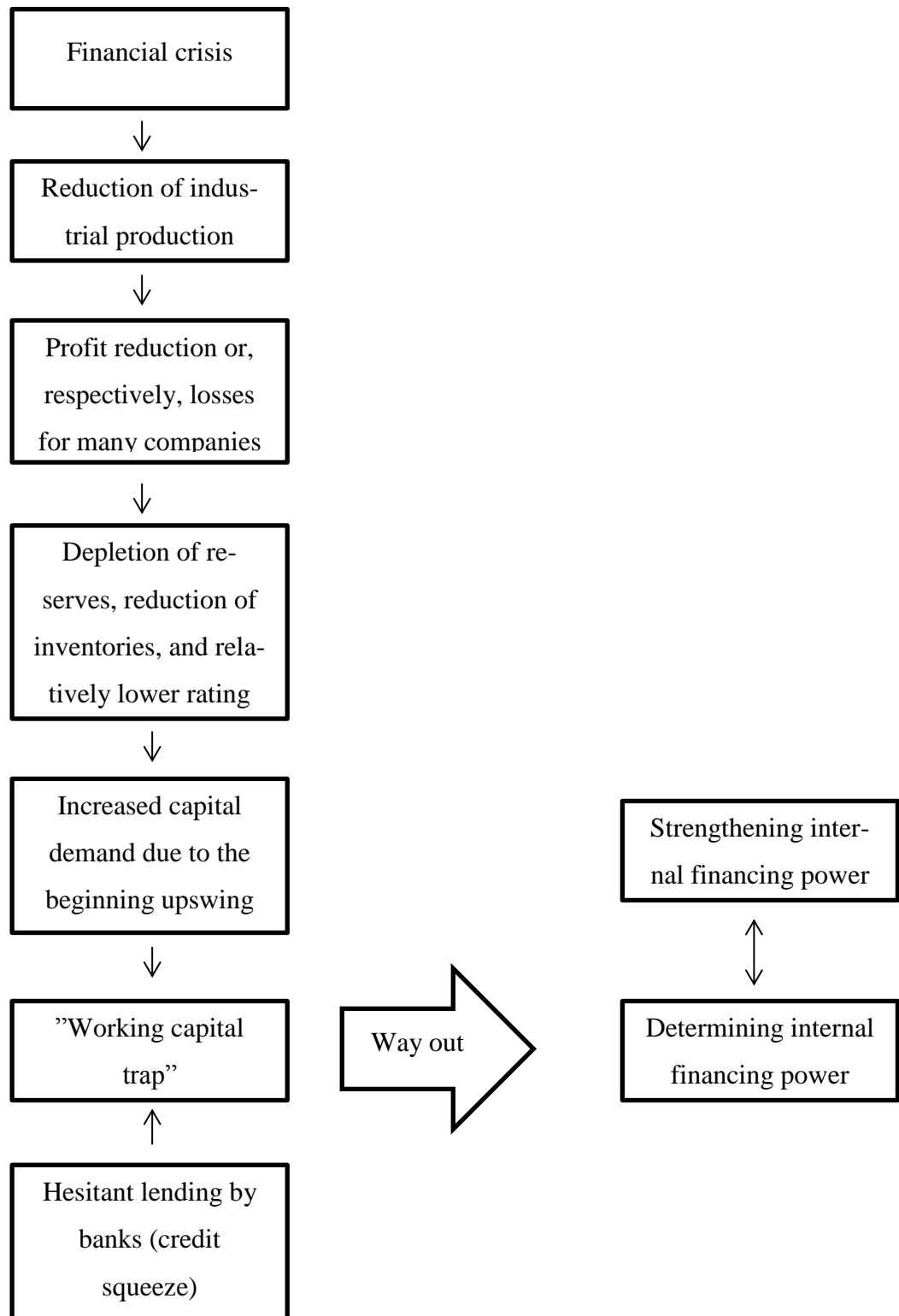
Financial crisis adds companies' financing problems and creates problems for the company's daily operations. Working capital management (WCM) is an important part of finance of a company. During the last financial and economic crisis in 2009 companies negotiated new prices with suppliers and inventories was decreased because of reduced sales. When growth again started after this crisis companies faced problems because they do not have the capacity to produce enough products because of the cost savings. If there is simultaneously demand for more liquidity, low stock levels and financial institutes will not lend money as easily as they did back in 2008, there could be so called working capital trap. (Hofmann et al. 2011, pp. 4-5) Interest towards WCM has increased because of the last financial crisis (Marttonen et al. 2011, p. 2). WCM has though highlighted by many companies. Because of the economic downturn firms are now forced to find new ways to secure adequate cash flows and ensure sufficient liquidity. By exploiting effective working capital management an enterprise can release capital for more important targets, decrease financial costs and hence improve company's profitability and liquidity.

Globalization and outsourcing has highlighted the need for financial supply chain management (FSCM) because it complicates cash management. There are great potential for cost savings when FSCM is implemented in value chains. (Wuttke et al. 2013, p. 774; Popa 2013, p. 141)

Many companies could improve their WCM. In particular in worse economic times things like cash management and WCM are important. According Hyun-

Han and Soenen (2000, p. 46) WCM can make a major impact on the liquidity and profitability of the company. Mullins (2009, p. 5) says that companies should concentrate more on cash flow than profit because lack of cash will affect destruction of the company very quickly. This amplifies in recession. The right way towards good cash management is to develop the visibility of working capital (WC). Figure 1 shows how economical or financial crisis effect on companies' WC and how that working capital trap forms and how companies can operate in this kind of situation.

Still there are not very many concrete calculation models for calculating working capital and especially forecasting it to the future. According Blankley (2008, p. 176) it is useful for a value chain to invest in supply chain management (SCM) technology. Helms et al. (2004, p. 405) says that there is a need to forecast more within the whole value chain. Also FSCM is highlighted in the literature by Popa (2013) and Wuttke et al. (2013). This improves efficiency of all members in the value chain. If all information is shared within a value chain uncertain forecasted demand could turn into known demand and forecasts can even be useless. So it could be said that there is a need for this kind of a model.



**Figure 1.** Effects of the economic crisis on companies' working capital (Adopted from Hofmann et al. 2011, p. 5)



## **1.2 Objectives and limitations of the thesis**

The objective of this thesis is to create a calculation model for working capital management. In the model is also some parts from cash management because working capital management and cash management are closely related to each other. This thesis includes testing the model with realistic figures. The calculation model should also be possible to enable for each user's own use and therefore the model should be able to modify for reasonable amount of work but this have not been very important issue in the model developing. The research questions of this thesis are:

- How value chain should be modeled?
- For what purposes the model could be used?

The target for this working capital management calculation model is to provide a practical tool for calculating value chain's or individual company's working capital and cash flows. This model could be used by researchers and students. The calculation model should provide information for future simulations and it should also enable comparing of firms to each other. The basic level of the calculation model is a product, a company, a corporation, or value chain level and the used time period in the model could be a month, a quarter, a half year or a whole year. For designed using purposes these time periods is sufficiently frequent for making future forecast and for seeing the changes in situations. The model will provide useful information about how changes in working capital will effect on company's or corporation's or product's or value chain's profitability and return on investment (ROI).

## **1.3 Research methodology**

This thesis has two parts which are theoretical and empirical. The theoretical part of this thesis is a literature review and it creates theoretical guidelines to this thesis. The empirical part is to develop working capital management model for value chains. The research method in this thesis is mainly quantitative. More precisely

this thesis's research method is constructive. Constructive research is according Kasanen, Lukka and Siitonen (1993, p. 245) a managerial problem which is solved through the construction of models, diagrams, plans, organizations and so on. The used research ways include creating and analyzing data. The theory in this study is founded in research articles and management literature. Articles were mainly about cash conversion cycle, supply chain management and working capital management. In management literature there was more about cash management than in research articles. The main sources were Hofmann et al. (2011), Ross et al. (2008), Scherr (1989), Richards and Laughlin (1980), Moss and Stine (1993), and Mullins and Komisar (2009).

#### **1.4 Structure of the thesis**

There are five chapters in this study. This thesis starts with this introduction chapter which contains the research's background and the research questions and methods. The second chapter is literature review about measuring working capital management (WCM). Third one tells about financial supply chain management. The third chapter based on theoretical foundation. The fourth chapter introduces the working capital management model. It includes also testing of the model and some suggestions for future development of the model. The last chapter discusses about the conclusions and results of the thesis. In table 1 is this thesis's structure.

**Table 1.** Structure of the thesis

<b>Input</b>	<b>Chapter</b>	<b>Output</b>
The reason for this study	1 Introduction	Background, research questions, limitations, methods, and the structure of the thesis
Literature	2 Measuring working capital	Review of literature written about measuring working capital management
Literature	3 Financial supply chain management	Review of literature written about financial supply chain management
Literature review from the chapter 2 and 3 and other collected data	4 Model	The calculation model for working capital management and suggestions to future research
Literature reviews and results from chapter 4	5 Conclusions	The summary of this study and answers to research questions

## 2 MEASURING WORKING CAPITAL

In this second chapter working capital (WC), net working capital (NWC), cash conversion cycle (CCC), working capital management, liquidity ratios current and quick ratio, and cash management is introduced. This is executed in the form of a literature review.

### 2.1 Working capital

Working capital is the cash an enterprise needs to have available in the short-term to maintain its business (Mullins and Komisar 2009, pp. 135). WC is also said to include things that are not intended to be permanently used for the business operations (Hofmann et al. 2011, pp. 13). With this cash a company for example pays its bills to suppliers and wages to employees. Every company needs cash, it does not matter how good your product is if you do not have cash to pay your expenses at the moment. If a company does not have cash, will the company be out of business soon. WC is current assets less current liabilities (Mullins and Komisar 2009, pp. 135-136; Karikorpi 2010, pp. 93 and 139). Current assets include money that is available to the company. Current assets usually consist of inventories, accounts receivables, marketable securities, and cash and bank balances. Current liabilities are commitments that the company will have to pay soon. Current liabilities include accounts payable, notes payable, accruals (for example accrued wages and taxes), short-term loans and other current liabilities. (Hofmann and Kotzab 2010, pp. 307-308; Ross et al. 2008, p. 747; Mullins and Komisar 2009, pp. 136) Advance payments are also current liabilities according White et al. (2003, pp. 324). Debts that are payable within 12 months are also current liabilities.

The amount of WC can be different depending on which valuation method company uses. For example if company uses last-in, first-out (LIFO) method on inventory valuation is working capital higher than compared to first-in, first-out (FIFO) method. FIFO means that inventory is valued according what are pur-

chased first. When inventory is valued according LIFO is inventory valued according what is purchased first. (White et al. 2003, pp. 194 and 198)

Working capital management deals with problems that originate from the planning, steering and control of short-term WC (Hofmann et al. 2011, pp. 13). WCM has straight effect on enterprise's liquidity and profitability (Marttonen, Viskari and Kärri 2012a, pp. 2). WCM contains two important issues. A company must first decide the target level for all of its current assets. The sources of financing these assets are important to think in each company. Because borrowing causes more costs, the method of borrowing, associated costs, and the sum to be borrowed varies. In this situation important questions are how much and when company must borrow money. Too early borrowed money decreases profitability and too late decreases solvency. (Chen et al. 2009, pp. 668; Mullins and Komisar 2009, pp. 137)

WCM target is lessening company's current asset to their lowest reasonable level but there is not a certain minimum level that apply to all situations and simultaneously provide adequate funding and liquidity to execute business. (Chen et al. 2009, p. 669; Karikorpi 2010, p. 139; Popa 2013, p. 146). Still the lowest possible WC is not necessary the best solution. Companies can for example compete against others for example longer payment times and larger inventories which enable faster shipments or secure the availability of raw materials. (Marttonen, Viskari and Kärri 2012b, p. 3) This target requires two steps: the identification of working capital and the decision of the target cash balance. The requirement of WC depends on three motives. These motives are transaction, precautionary and speculative motives. Transaction motives are the most common reason for a company to hold current assets. Some examples of transaction motives are outflow of cash to vendors, subcontractor and hired workers and inflows mainly from customers. Precautionary motives are for unplanned cash outflows and inflows and company has to set aside some current assets because of this. Two good examples of precautionary motives are surprising change in raw material prices or increase in debt payments to prevent short-term insolvency. Speculative motives form

from firm's opportunities for price negotiation in the process of procuring services or materials. A good example is price discount if transaction is made by cash. The company could be willing to accept the extra cost of borrowing in hopes of growing speculative return. (Chen et al. 2009, pp. 669-670)

### **2.1.1 Net working capital**

Net working capital is defined as current assets reduced current liabilities. This can be seen from formula 1. When current assets are greater than current liabilities is NWC positive. If NWC is positive cash that will become into a company in 12 months is greater than the cash that must be paid out in 12 months. (Ross et al. 2008, pp. 29 and 747; Karikorpi 2010, p. 139) If NWC is positive, it will be nice way to finance some of the WC. Negative NWC means that some part of fixed assets is financed with short-term available capital. (Hofmann et al. 2011, pp. 13) The greater the NWC is the better it is (Karikorpi 2010, p. 139). NWC measures company's financial health (Marttonen et al. 2011, p. 2). In figure 2 can be seen which parts NWC contains on the balance sheet.

$$NWC = \text{Cash} + \text{Other current assets} - \text{Currents liabilities} \quad (1)$$

Assets	Balance sheet	Liabilities
Fixed assets	<b>Net Working Capital</b>	Capital stock
<b>Current assets</b> - <i>Inventories</i> - <i>Accounts receivable and other assets</i> - <i>Securities</i> - <i>Liquid funds</i>		Long-term outside capital  <b>Short-term outside capital</b> - <i>Short-term financial lia- bilities</i> - <i>Accounts payable</i> - <i>Short-term reserves</i> - <i>Other short-term liabili- ties</i>

**Figure 2.** Net working capital on the balance sheet (Adopted Hofmann et al. 2011, p. 14)

Net working capital management or working capital management contains all viewpoints of the administration of current assets and liabilities. WCM targets at minimizing the cash tied up in the enterprise's sales process by subtracting current assets and increasing current liabilities. Reducing NWC must be aware that the following operations that targets diminishing NWC result in one-time outcome only. (Hofmann and Kotzab 2010, p. 308)

Most of the firms need certain number of working capital to handle variable and slightly unpredictable financial inflows and outflows. Disconnected supply chain processes, too big stocks, insufficient trade credit terms, and bad loan decisions require more working capital than necessary. Enterprises are trying to have as little as possible capital tied up in inventories. This could be done by shortening the collection period for accounts receivables and stretch cash payments for accounts payable as far as possible. (Farris and Hutchison 2002, pp. 291-294)

### 2.1.2 Current and Quick ratio

Current Ratio (CR) is one of the best-known and most widely spread ratios (Shin and Soenen 1998, p. 38; Ross et al. 2008, p. 47). CR measures a short-term liquidity, because current assets and liabilities are converted to cash over the following 12 months. CR is current assets divided by current liabilities and this can be observed from formula 2. (Ross et al. 2008, p. 49; Karikorpi 2010, p. 123-124) CR statistics have arguable value to financial analyst because there are quality differences in the liquidity attributes of current assets investments. A big relatively amount less liquid receivables in current assets and in stock could also increase current ratio value but the company's actual liquidity position is still bad. For this problem answer is quick ratio (QR). When less liquid inventories and prepaid operating expenses are not taken account of is quick ratio born. Its formula can be seen in formula 3. QR compares a company's current liabilities to its remaining current assets, cash, nearcash and receivables. (Ross et al. 2008, pp. 47 and 49; Karikorpi 2010, p. 123). QR is also called by acid-test ratio (Richards and Laughlin 1980, p. 33). Inventory is usually the least liquid current asset. Inventory's book value is also least reliable as measures of market value because the quality of the stock is not reflected. Some of the stock could be damaged, out of date or even lost. Large inventories are usually a sign of short-term trouble. Company could have overestimated sales. In this case stock is too big. Quick ratio is better indicator company's liquidity in this kind of situation than current ratio. For example buying inventories in cash does not effect on CR but it decreases the QR. (Ross et al. 2008, p. 48)

$$CR = \frac{\text{Current assets}}{\text{Current liabilities}} \quad (2)$$

$$QR = \frac{\text{Current assets} - \text{inventory}}{\text{Current liabilities}} \quad (3)$$



A very short-term lender could be interested in cash ratio. Cash ratio is cash and cash equivalents divided by current liabilities. Cash ratio is presented in formula 4. (Ross et al. 2008, p. 49)

$$\text{Cash ratio} = \frac{\text{Cash and cash equivalents}}{\text{Current liabilities}} \quad (4)$$

CR and QR are also called liquidity measures. QR and CR are developed for observe company's ability to pay its invoices over the short run. (Lancaster et al. 1999, p. 38). These ratios are interesting to short-term creditors. If CR value is under one, company's net working capital is negative. This is unusual in healthy enterprises. (Ross et al. 2008, p. 47)

Both Current ratio and Quick ratio do not provide information about liquidity of inventories and account receivables. Changing these balance sheet items into cash is different in every company. These items are more liquid in some firms than other firms. That difference bot CR or QR cannot measure adequate. (Richards and Laughlin 1980, p. 33) These static liquidity indicators focus on just liquidity and do not measure how well company can finance its processes by operating cash flow. Operating cash flow coverage is more important just for asset liquidation value in liquidity analysis. (Richards and Laughlin 1980, p. 33; Karikorpi 2010, p. 125) Current assets and liabilities do change quickly. Therefore nowadays values are not always reliable indicator to the future. (Ross et al. 2008, p. 47) In the past current and quick ratio have been seen as a key indicator of a company's liquidity position. Strong current and quick ratios are usually good thing but they could signal too large investments in working capital. (Moss and Stine 1993, p. 30) Also according Ross et al (2008, p. 47) high CR value could also be a sign of inefficient use of cash. CR has also other problems as all indicators. For example if company borrows long-time debt short-term effect is increase in cash and increase in long-term debt. Current liabilities stay same and CR would rise.

### 2.1.3 Cash Conversion cycle

Operating cycle is called the sum of average number of days necessary to buy on credit and sell a product and the average amount of days required to get sales. The days between purchasing a product and selling it is called inventory conversion period (DIO). Receivables conversion period (DSO) is the average amount of days demanded to collect sales. (Moss and Stine 1993, p. 25) Therefore can be said according Ross et al. (2008, p. 750) that operating cycle is equal the sum of the lengths of the inventory and receivables conversion periods. That is presented in formula 5. (Ross et al. 2008, p. 750).

$$\text{Operating cycle} = \text{DIO} + \text{DSO} \quad (5)$$

Traditionally capital is first invested in stocks. There is also varies payments to workers and other vendors. Funds that are paid to previous groups are accounts payable and accruals. Accounts payable grow, when acquisitions are made on credit. When products are sold on credit, accounts receivable increase. When accounts receivable are paid to a firm results it growth in a firm's cash account. The former due to the operating cycle measures the time period from acquisition of stock on credit to the cash gathering of accounts receivable. Operating cycle does not take account of liquidity requirements as affected by the time pattern of cash outflow requirements. Cash to cash (C2C) or also called cash conversion cycle (CCC) take further operating cycle's idea by shortening operating cycle by the length of the average days of the accounts payables. (Moss and Stine 1993, pp. 25-26)

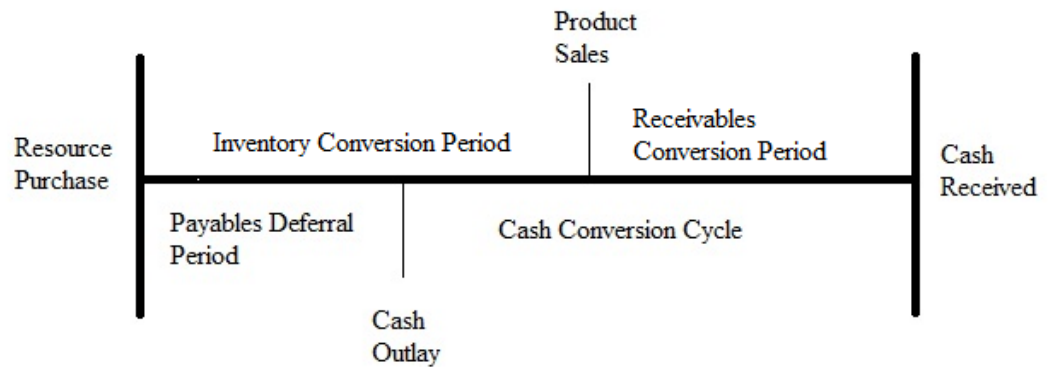
Cash conversion cycle (CCC) reflects the net time between cash expenditures on a company's purchase of a product input and customers payments from product sales. In other words the required time period to convert a dollar of cash outflows back into a dollar of cash payments from a company's normal course of operations. (Richards and Laughlin 1980, pp. 34; Hofmann et al. 2011, p. 14) According Viskari, Ruokola, Pirttilä and Kärri (2012, p. 4) CCC measures the efficiency

of working capital management. Cash conversion cycle had been said to mean also the number of days funds are tied up to inventories and receivables, less the number of days that payment to vendors is deferred (DPO). (Gentry et al. 1990, p. 90)

There are quite many other definitions for term CCC: “the average days required to turn a dollar invested in raw material into a dollar collected from a customer” (Stewart 1995, p. 43). Another definition according Moss and Stine (1993, p. 25) for CCC is “the length of time between cash payment for purchase of resalable goods and collection of accounts receivable generated by sale of these goods”. Also common definition for CCC according Gallinger (1997) is “the cash conversion cycle measures the number of the days the firm’s operating cycle requires costly financing to support it. You can think of the operating cycle as the number of days sales invested in inventories and receivables.” (Ross et al. 2008, p. 750). CCC is calculated in this thesis how it is presented in formula 6.

$$CCC = DIO + DSO - DPO \quad (6)$$

First step for calculating CCC is to find the inventory conversion period or the days of inventory outstanding. This happens by dividing inventory by the cost of goods sold and multiplying the result by 365. Secondly should calculate the receivables conversion period or days of receivables outstanding. This is found by dividing accounts receivable by net sales and multiplying the result by 365. Then must be calculated the payables deferral period or days of payables outstanding. This is performed by adding accounts payable and accrued expenses, dividing by cash operating expenditures, and then multiplying by 365. Lastly should sum these three periods to get C2C. (Moss and Stine 1993, pp. 27-28) Idea of the CCC can be seen from figure 3.



**Figure 3.** Cash Conversion Cycle (Adopted from Richards and Laughlin 1980, p. 35)

Liquidity analysis needs recognition of the extent to which four basic activities, which are production/purchasing, sales, collection, and payment, produce flows within the working capital accounts. Cash conversion cycle depicts these four basic flows by compounding certain time intervals are due to company's receivables, inventory, and payables turnover period. CCC concept portrays the residual time interval over which extra, nonspontaneous financing have to be bargained to compensate for noninstantaneous and unsynchronized nature of company's working capital investment flows. (Richards and Laughlin 1980, p. 34; Popa 2013, p. 146)

Working capital offered by suppliers in the company's normal operations is spontaneous financing that will increase and decrease automatically over time. This kind of financing's availability depends straight on the trade credit terms offered by suppliers to their customers. Usually this kind of financing does not have financing charges as long as customers pay within agreed credit period or within discount period when there is cash discount for early payment. Trade credit provides also flexibility to working capital management. Sometimes suppliers could be financing company's all working capital, but usually this portion is only part of the WC financing. The remaining WC investment must be financed by bargaining nonspontaneous financing from banks or other lenders. CCC and operating cycle concepts will help in this additional WC financing demand. (Richards and Laughlin 1980, pp. 34-35)

Short-term lenders are less willing to finance these additional WC investments because there is greater risk of default. Because of this operating cash flow constraints restrict a company's ability to support additional WC financing needs by supplementing trade credit with other short-term credit. That is why enterprises must rely more on longer-term financing arrangements to enable WC increase. Companies must keep some additional liquidity reserves in order to compete for additional nonspontaneous financing. These additional liquidity reserves will also protect company from unpredictable variations of future operating cash flows. (Richards and Laughlin 1980, p. 35)

Obviously longer CCC will result larger needed commitment to cash. In these circumstances financing this additional need for cash with current liabilities is harder than if CCC is shorter. Working capital management that creates longer CCC can be expected to create higher current and quick ratios. On the contrary in traditional view high current and quick ratios relay more liquid working capital investment position. This kind of analysis suggests that these higher ratios could be just the by-product of a larger commitment to less liquid form of current assets. (Richards and Laughlin 1980, p. 35) When CCC grows company's liquidity get worse and when CCC drops company's liquidity get better. Usually companies' good liquidity can be seen from higher values of current and quick ratios or a shorter CCC. (Moss and Stine 1993, pp. 30-31)

Long CCC will not be a problem to a firm if it can predict its operating cash flow precisely. Therefore company can have short-term financing more easily than if the future is more uncertain. Usually future is at least somehow uncertain and CCC will affect a lot on short-term borrowing. Longer CCC decrease the flexibility available to companies in managing their cash flows when there is economic downhill in sight. This kind of approach in liquidity management is really important especially if company faces big volatility in its sales revenue. This operating cash flows uncertainty could be solved by three interrelated ways. These ways are the relative amounts of variable and fixed cash operating expenses, the extent

of built rigidities in the current assets turnover, and the availability of lending capacity. CCC analysis takes account of these three factors. (Richards and Laughlin 1980, pp. 35-36) Proper CCC management improves company's cash flow position. Cash flow and CCC are inversely related. (Moss and Stine 1993, p. 33)

There is also strong connection between company's CCC and ROI (Marttonen, Viskari and Kärri 2013a, p. 67). Usually the longer CCC is the worse is company's profitability. Real benefits for the firm come from reducing assets rather than increases in payables. Reducing the company's CCC to practical minimum is one way to create shareholder value and it should be very important for every company. (Shin and Soenen 1998, pp. 37 and 43) Still longer CCC can increase company's profitability because it can cause more sales. If the costs of higher working capital rise faster than the benefits, for example larger inventories or granting more trade credit to customers, will company's profitability decrease because of that. (Deloof 2003, pp. 574-575)

The cycle times' components have been selected the cycle time of accounts payable, the cycle times of inventories and the cycle time of accounts receivable. Days of payables outstanding are the number of days between the purchase of an input from a supplier and payment to that supplier (Hofmann and Kotzab 2010, pp. 308; Deloof 2003, pp. 576; Farris and Hutchison 2003, pp 85). Days of inventory outstanding means the speed with the stock value of raw materials, work in progress and finished goods of a company are transformed into end products (Hofmann and Kotzab 2010, p. 308; Deloof 2003, p. 576; Farris and Hutchison 2003, p. 85). Days of receivables outstanding means the number of days between the sale of a product and when the payment is received (Hofmann and Kotzab 2010, p. 308; Deloof 2003, p. 576; Farris and Hutchison 2003, p. 85). These values could also be calculated by turnover times. For example Inventory turnover is cost of goods sold divided by inventory. This result is needed on following calculation. Days of inventory outstanding is 365 days divided by inventory turnover. (Ross et al. 2008, pp. 50) The cycle times' formulas can be seen from formulas 7,8, and 9.

$$DPO = \frac{\text{Accounts payable} * 365}{\text{Cost of goods sold}} \quad (7)$$

$$DIO = \frac{\text{Inventories} * 365}{\text{Cost of goods sold}} \quad (8)$$

$$DSO = \frac{\text{Accounts receivable} * 365}{\text{Sales}} \quad (9)$$

CCC metric is important for accounting and supply chain management. For accounting intents the metric can be applied to help measure liquidity and organizational valuation. For supply chain management requirements, it assists measurement as bridging the activities into and out of the company. CCC measurement is a dynamic view in accounting that can be utilized to capture ongoing liquidity from the company's processes. CCC metrics provide a good alternative for measuring company liquidity and describing a firm's average liquidity position. (Farris and Hutchison 2002, pp. 291-292)

CCC can be used also for evaluating changes in rotating capital and also assists monitoring and controlling of its components. Because it is very important that companies invest available resources to gain the best economic benefit, firms must find right mix between the volume of resources used to working capital and the volume used to capital investments. (Farris and Hutchison 2002, pp. 291-292) In other words company's goal should be to cut the CCC as much as possible but it should not harm firm's operations (Moss and Stine 1993, p. 25). Companies have to decide in daily operations between shortening C2C and operational decisions that can lengthen C2C and increase invested capital. To define minimum required liquidity, it is useful to start by calculating cash turnover. Cash turnover should divide into the annual cash expenditures. This could obtain the minimum liquidity needed. There is also a direct relationship between the length of the C2C and the minimum liquidity needed. If C2C increases, increases also the minimum liquidity required, and also the opposite. (Farris and Hutchison 2002, p. 292) Usually the longer the CCC is the greater the requirement firm for external financing.

Because of that shortening the time that capital is tied up in working capital, a company can perform more economically. (Moss and Stine 1993, p. 25)

In best case company's CCC is negative. That means the DPO is longer than operating cycle. Nonmanufacturing enterprises are more probable than manufacturing enterprises to have a negative CCC. Nonmanufacturers usually have smaller and faster selling stocks and often retail their products for cash. Because of that these companies have a shorter CCC. By negative WC company can finance its investments. For example retail company Costco could build a new store with every existing store's negative WC. If CCC is negative company can have good return on investment with lower profits because invested capital is smaller. Negative CCC enables easier way to get into the business and it is easier to get growth in the business. (Mullins and Komisar 2009, pp. 150 and 152).

Usually CCC is still positive. CCC is usually shorter in big companies measured by turnover than in small companies. (Moss and Stine 1993, p. 30) For example in 2006 when comparing four big companies, that are Amazon.com, Boeing, Dell and Wal-Mart, Wal-Mart had the highest relative level of stocks of current assets. This will not mean that Wal-Mart is necessarily the least efficient of these four companies. More likely this is typical for this kind of industry. Dell makes products to order and naturally its stock levels are lowest of the four. This is very likely typical for companies that makes products to order. Therefore also CCC differs in different enterprises. (Ross et al. 2008, p. 750) Hofmann et al. (2011, p. 15) says that mean value in 2005 for C2C was 63 days. In this study longest C2C was in Tobacco industry and shortest in Land-line telephony. Tobacco industry's C2C was 143 days and Land-line industry has negative C2C which was -14 days.

CCC has also some weaknesses. CCC does not precisely indicate the conversion period days in the NWC demand given in cash. CCC also does not separate enough cash and credit sales. For example if two companies have the same receivable period, but they have various shares of credit sales. CCC is same for the both companies but the company which has higher share of cash sales have better



liquidity because it can collect safely and quickly a larger share of sales. CCC does not take account of the profitability impact on the liquidity. (Tibor and Veronika 2011, pp. 534) CCC take note of only the length of time cash are committed in the cycle and it does not take account of the quantity of funds tied up to an output as it goes through the cycle (Gentry et al. 1990, pp. 90).

## **2.2 Cash management**

The term cash is inaccurate. According Ross et al. (2008, p. 771) “the economic definition of cash includes currency, checking account deposits at commercial banks, and undeposited checks.” Financial managers even though use the word cash to include short-term marketable securities. Short-term marketable securities usually include cash equivalents which are treasury bills, certificates of deposit, and repurchase agreements. The balance sheet cash normally contains cash equivalents.

The basic elements of net working capital management such as carrying, shortage, and opportunity costs are important also for cash management (Ross et al. 2008, pp. 771-772). Cash management is the most important part of WCM (Chen et al. 2009, p. 682). Cash management purpose is to control a company’s cash outflows and inflows so that solvency is ensured all the time (Hofmann et al. 2011, p. 65). Cash management is also about how to minimize cash balances by collecting and disbursing cash effectively (Ross et al. 2008, p. 771). WCM have a significant effect on company’s liquidity and profitability. There must be made important trade-off between decisions that add liquidity and decisions that add profitability. Concentration for too much only the liquidity will effect harmfully on the profitability and vice versa. (Shin and Soenen 2000, p. 46; Shin and Soenen 1998, p. 37) The liquidity ratios, NWC, cash flow analysis and the CCC are the foundation for liquidity risk measurement (Tibor and Veronika 2011, p. 531). At value chain level or at least at group level cash management should result decrease in financing costs and an addition in liquidity (Hofmann et al. 2011, p. 67).

Cash management could be wise to do at value chain level. This has been rare so far. There could be also an independent service provider that handles the payment flows to all that are in value chain. In any case there should be only one service provider for payments whether it be inside the value chain or some other service provider. The transparency of payment flows improves. Transparency is vital to value chain's cash management that every participant can see that it works. Companies in the value chain get only the net payments. Accounts payables are lessened from accounts receivables. There must be master account and this master account is connected to value chain's companies' accounts. This way service provider knows the liquidity situation in real time. Companies in the value chain should also grant loans to each other. In this case there are lots of potential to cost savings and liquidity could be easily improved compared to earlier. Value chains negotiation power will increase towards financial institutes. There is also potential savings in exchange rates, currency risks and decrease of payments to third parties through combined payments. Interest costs should also decrease because of this more centralized cash management. (Hofmann et al. 2011, pp. 66-70; Wuttke et al. 2013, pp. 773-775)

There are two main reasons for holding cash. First reason is transaction motive. Transaction-related requirements come from normal payment of invoices and collection activities of the company. The cash inflows and outflows are not exactly in phase and therefore there must be some level of cash holdings. (Ross et al. 2008, pp. 771-772; Weston and Copeland 1988, p. 251; Wuttke et al. 2013, pp. 775) Companies future cash needs for transaction intentions are often fairly uncertain. Enterprises must hedge against the possibility of these unsuspected demands. For example company can arrange a possibility to borrow money from bank on short notice. Another solution for this is keep surplus cash. (Scherr 1989, p. 25) If the cash balance is too small firm can run out of money. If this happens company must sell marketable securities or borrow. These actions involve trading costs. (Ross et al. 2008, pp. 771-772) Companies that keep fewer reserves are more likely to hold these reserves in cash. Companies with larger reserves keep these reserves rather in near-cash assets. Transaction costs have a fixed cost component

which is regardless of the size of the investment. The profitability of hedging part or all of the reserve cash in near-cash assets depends on the amount of money in reserve. Near-cash assets are securities for example repurchase agreements or nearly matured treasury bills. (Scherr 1989, pp. 25 and 102)

The other reason to hold cash is compensating balances. Cash balances are kept at banks to compensate for banking services rendered to the enterprise. A minimum required compensating balance at banks providing credit services to the firm may require a lower limit for the level of cash a company holds. For most of the companies the cash balance can be considered of as consisting of transaction balances and compensating balances. The cost of holding cash is of course loss of interest which is opportunity cost. Companies will have to compare the benefits of holding cash versus the costs. Usually it is a good idea to figure out first how much cash is needed to fulfill company's transaction needs. Next must think about compensating balance needs, which will define a lower limit of the company's cash holdings. (Ross et al. 2008, pp. 771-772) According Scherr (1989, p. 26) "if the company uses fee-based banking, it does not need to hold cash for the purposes of compensating balances."

Many companies face some seasonality in sales. Often there are times during the year when such companies have additional cash that is needed later in the year. When company has this kind of situation it has many options. One alternative is pay to its security holders and issue later in the year new securities. This strategy is usually costly and more common is to invest this cash in marketable securities until the cash is needed again. (Scherr 1989, p. 25) There is three ways to get extra money in the company's cash. Those ways are selling marketable securities, borrowing cash and getting money from owners via stock issue. Borrowing is probably more expensive than selling marketable securities because the interest rate is usually higher. Company requirements to borrow will depend on the company's desire to hold low cash balances. Company has to borrow more and frequently if it has greater cash flow variability and lower investment in marketable securities. Stock issue could be good way to finance a company if it cannot get

money from the markets or the cost of equity is less than the debt's interest rate. (Ross et al. 2008, p. 778; Weston and Copeland 1988, pp. 656-660)

The costs of trading securities are much below the lost income from holding cash for big companies. Therefore a big company will trade many times a day rather than leave significant amounts idle overnight. Still also most of the large companies hold more cash than cash balance models require. Couple of reasons could be that enterprises have cash in the bank as compensating balance in payment for banking services and big companies have thousands of bank accounts in many banks. Sometimes it is easier to leave cash alone than to manage each account daily. (Ross et al. 2008, p. 778)

There always exist some uncertainties regarding future cash flows. For this reason it is useful for a company to hedge its cash at least partly. If firm will not hedge anything, it will face costs that it could have avoided by hedging. And as usual there is trade-off between the costs of the hedge versus the expected costs that it avoids. It is not profitable to hedge against all possible future costs because some of these costs are very unlikely. There are many hedging possibilities and here are five examples about that: Holding a stock of extra cash, holding a stock of near-cash assets, extra borrowing capacity, investing temporary surplus in near-cash assets, using futures and options. Usually companies use mix of different hedging strategies. (Scherr 1989, pp. 101-103, 107 and 116)

When company has identified the needed WC, it needs to define their target cash balance. Deviations from this target level incur extra costs. (Chen et al. 2009, p. 670) The target cash balance is trade-off between the opportunity costs of holding too much cash and the trading costs of holding too little cash. If a company is trying to keep its cash holdings too low, it have to sell marketable securities more often and maybe later firm must buy marketable securities to compensate those sold. Trading costs will drop as cash balance becomes bigger. In the other hand the opportunity costs of holding cash increase as the cash holdings get bigger. Total cost of holding cash is lowest when in drawing opportunity costs and trad-

ing costs curves cut each other. This point is the target cash. The total cost of holding cash can be calculated by following: Total cost is opportunity cost added trading costs. (Ross et al. 2008, pp. 772 and 774)

When company has cash surplus, it can invest in short-term marketable securities. Short-term financial assets' market is called the money market. Short-term financial assets' maturity is one year or less. Most large companies manage their own short-term financial assets. Small companies and also some larger companies use money market funds. These funds are managed by professionals and for this expertise funds charge a management fee. Companies have temporary cash surplus at least because of following reasons: to aid finance cyclical or seasonal activities, to assist finance planned expenditures, and to protect company from unexpected expenditures. (Ross et al. 2008, p. 787)

The popular Miller-Orr model can be used to help the construction firm find cash balance. A company sets its cash limit based upon its operating characteristics and credit conditions. The target cash balance  $C$  are set based on transaction costs, variance of cash flow ( $\sigma^2$ ) and the opportunity costs ( $R$ ) of holding of cash. When the upper and lower thresholds are recognized a company can define their own best timing for investing cash for example in marketable securities. Miller-Orr model simplifies WCM into the mission of finding the target cash balance and the associated limits. The Miller-Orr model's formula can be seen from formula 10.  $F$  means transaction cost of trading valuable notes for cash.  $L$  means lower cash limit. Miller-Orr model's performance how well the conditional predictions come true and how well parameters are estimated. (Chen et al. 2009, p. 671; Weston and Copeland 1988, pp. 270-272)

$$C = L + \left(\frac{3}{4} * F * \frac{\sigma^2}{R}\right)^{1/3} \quad (10)$$

Cash forecasting is an important part of the company's business. If firm does not use cash forecasting there could be unanticipated cash shortages or surplus cash. When there occurs cash shortages company must slow down its cash outflows, dip

into reserves or get emergency financing. A normal method of slowing outflows in cash shortages situations is to delay payments to suppliers. Although these late payments could ruin firm's reputation among its stakeholders. Getting an emergency loan from the bank with reasonable term might be difficult. Normally this means high interest rate. When firm has unanticipated unplanned surplus cash there occurs also problems. Without cash forecasting firm cannot know when this surplus is gone. If the firm does not know how long surplus cash lasts, it could not make an investment plan that will maximize interest incomes. If the surplus money is available only for a week it is not affordable for example to buy 30-day instrument. In this case company must sell this instrument before its maturity and this effects unnecessary interest rate risk. On the other hand if surplus cash is available pretty long it is not the best solution put this money near-cash instruments because these instruments have low interest rates. These previous problems could be outcome by making cash forecast. (Scherr 1989, pp. 72-73; Weston and Copeland 1988, pp. 209-211; Gallanis 2003, p. 15)

Cash forecast is a part of the firm's cash control system which is part of firm's financial plan. The company's cash control system contains lockboxes, marketable securities portfolio, short-term borrowing structure, and cash management system and transfer system. Before making cash forecast, company must make many other forecasts for example sales forecast and production plan because cash forecast depend on this forecasts. (Scherr 1989, pp. 73-74) Before starting the forecasting process a company should think about the nature and objectives of this task. The firm's forecasting philosophy affects the accuracy and usefulness of its cash forecast and the methods used in the forecasting process. (Maness and Zietlow 2002, p. 382)

Cash forecast could be varied by two dimensions which are length of the periods included within the cash forecast and the approach to cash flows used in the cash forecast. The length of the periods mean the units of time into which the cash forecast is splatted. The length of the periods normally varies from one day to one year. The most popular forecast period is one month. Usually firm use many fore-

casts with various lengths. For cash forecasts important question is what the shortest period in use is. This depends on the company's size because there is some fixed transaction costs involved in short-term investments. If company is big enough that its investment of a day's surplus is profitable, the company will forecast its cash on a daily basis. For smaller companies it is wiser to use weekly or monthly forecasts' as the shortest forecast period. (Scherr 1989, p. 74; Gallanis 2003, p. 16) 3 months forecast's accuracy must be within 3 percent (Maness and Zietlow 2002, p. 382).

Another big question is if company makes several overlapping forecasts how one forecast relates to another. For example will the forecast start with weekly data and aggregate this into months and quarters or the opposite. Starting with data in longer periods and breaking it down into smaller periods is called distribution. And when forecasting is started shorter periods and aggregating into longer periods is called scheduling. Scheduling needs more data manipulation and distribution on the other hand needs more refined statistical techniques. Most sophisticated companies use combinations of the two methods. (Scherr 1989, p. 74)

Companies use two general approaches to cash flows in making the cash forecast. These approaches are the receipts and disbursement approach and the adjusted net income approach. (Scherr 1989, pp. 75; Maness and Zietlow 2002, p. 390) The third common forecast approach is the pro forma balance sheet approach (Maness and Zietlow 2002, p. 390). The receipts and disbursements approach are the most common approach. The receipts and disbursement approach utilizes the amount of cash expected to be received and spend by the company over the chosen period. This technique precisely follows the movement of cash and it is used more often by companies that exercise very close cash control. Usually this approach is used for cash forecasts with quite short period like day or month and short time horizons, usually under year. (Scherr 1989, p. 75; Gallanis 2003, p. 16; Maness and Zietlow 2002, p. 390)

The adjusted net income approach is also modified accrual method. The making of the forecast starts with projected net income on an accrual basis and adjust to cash basis. This system provides a representation of changes in asset and liability accounts. Because these accounts levels are of interest to the company, this aspect is an advantage compared to the receipts and disbursements method. On the other hand the adjusted net income method does not permit the tracing of the individual cash flows for any period, which is useful data for the company. The adjusted net income approach is used by enterprises for long-term cash forecasts. This type of forecast is quite accurate in quite long time periods compared to other forecasting approaches. (Scherr 1989, pp. 75-76; Maness and Zietlow 2002, pp. 393-395)

In the pro forma balance sheet method cash forecast starts by determination of the amount of cash and marketable securities by computing the difference between forecasted assets and the sum of forecasted liabilities and owner's equity. This approach is popular for long term forecasting. This method is basically a raw approximation of sources and uses of funds. This method is easy to implement. (Maness and Zietlow 2002, p. 395)

There are also other approaches to cash forecasting. These approaches belong usually to statistical techniques or balance sheet approach. Quite common statistical technique is time series methods. Time series methods focus on forecasting a response in a variable over a certain span of time. Time series methods are used to adjust means to smooth or remove some of the effects that would distort the data. Moving average techniques just calculate the mean average of a certain number of historical data elements within a time series. The averaging range shifts by one period every time the average computation is made. Regression techniques help the forecasting process so that they very effectively qualify the relationship between independent variables and the dependent variable. Balance sheet approach starts with the building of a pro forma balance sheet using information of past balance sheet line items and future expectations. All items in the pro forma balance are populated except for cash. The cash figure is used to bring the pro forma into balance. That cash represent "book" cash, not the real cash in the bank ac-



count. The balance sheet approach is good for companies interested in evaluating financial statement positions at certain point of time. The balance sheet approach needs lots of historical data because balance sheet changes just a little from period to period. (Gallanis 2003, pp. 16-18; Maness and Zietlow 2002, pp. 415-416)

In the receipts and disbursements cash forecasting method, estimates has to be made of the numerous items that company collects (receipts) and pays (disbursement). The more precisely company makes cash forecast the more accurate the forecast will be but the more costly the forecast will be to generate. (Scherr 1989, pp. 76-77; Gallanis 2003, p. 17) For most of the companies receipts portion contains far less items than disbursement portion. Primary source of receipts for most of the enterprises is the collection of monies from sales. Before making cash forecast, a company must think of their major types of inflows. Small inflows should be ignored in the cash forecast. Usually there are more different type of disbursement, for example payroll, payments to vendors, capital expenditures, and interest and principal payments. Type of receipts and disbursement vary a lot depending on the industry. When company has decided what inflows and outflows are important for it, it should forecast future levels to these flows. (Scherr 1989, pp. 76-77) The historical data which is gathered for the forecast should be at least three times more than what is the forecast's length. For example if forecast is for one year should there be data at least from three previous years. (Gallanis 2003, p. 17) This method takes accounts of beginning and ending cash, the period's cash flows, and needed minimal cash levels the (Maness and Zietlow 2002, p. 390).

Forecasting cash inflows are usually straightforward thing. The most challenging part is to estimate the receipts from the company's accounts receivables. One forecasting method for estimating this problem is the turnover method. In this method is assumed that all receivables will be collected based on the average turnover. For example if company's average receivables collection period is 30 days it is forecasted that all sales for one month will be collected in the next month. Still this method does not reflect very well the actual receivables collection and because of this it will not produce accurate forecast. This problem could

be solved by using the payment patterns approach. In this method analyst use data which tells about the actual payment times. And forecast will depend on this data. For example 30 % customers pay for cash, 50 % for in 30 days, and 20 % in 60 days. This kind of data is used in forecast. The second issue that must be notified in forecasting receivables collections is the level of aggregation. Companies that sell different types of products will use also different types of payment terms. In this case the company must use right proportions of product sold compared to its total sale and use the actual payment terms for each product. Usually most accurate forecast result is achieved when there is first separate forecast for every unit of the company. And after that this results will be added up. (Scherr 1989, pp. 80-82; Maness and Zietlow 2002, pp. 401-402)

In most cases cash forecast is made for one year. Even through time period is short there are a number of risks. At least there are these kinds of risks: sales uncertainty, collection rate uncertainty, production cost uncertainty, and capital outflow uncertainty. Sales uncertainty refers to the uncertainty regarding company's future levels of sales. Most of the companies try to forecast so that the forecast of sales' error is less than 10 %. Any errors in sales forecasts have multiple effects on the companies' cash flows. Sales affects also on receivable levels and on production costs. Collection rate uncertainty refers to a company's future collection patterns of receivables. A company could have collected an average of certain percent of its receivables in certain time frame. This average collection percent varies still considerable. Collection rate contains at least three sources of uncertainty. These sources are: how many units will be sold, what is the selling price per unit, and what is the collection rate for receivables. Production cost uncertainty refers to the risk of the labor and material costs that are caused by production of products. Labor productivity could be something else than expected, which makes labor costs uncertain. The cost of materials used could vary because of unexpected changes in price or in the volume of material necessary to produce products. Capital outflow uncertainty refers to the timing of cash disbursements. Construction programs are good example for this. From beginning of the project there is some estimated price. When building is in certain phase, buildings' total costs are re-

estimated. This estimation is usually different than the first estimation because of numerous uncertainties. (Scherr 1989, pp. 91-92; Maness and Zietlow 2002, pp. 388-389)

There are two basic methods to the evaluation of risk in cash forecasting. The risks could be estimated from individual sources of uncertainty. This is called by individual outcome variables. The other method is all the important outcome variables. In this method the all effects of uncertainties are estimated simultaneously. The first method requires sensitivity analysis and the second requires simulation. (Scherr 1989, pp. 93-94)

### 3 FINANCIAL SUPPLY CHAIN MANAGEMENT

Supply chain management (SCM) can be defined in many ways. Four main definitions are:

- “The internal supply chain that integrates business functions involved in the flow of materials and information from inbound to outbound ends of the business.”
- “The management of dyadic or two party relationships with immediate suppliers.”
- “The management of a chain of businesses including a supplier, a supplier’s suppliers, a customer and a customer’s customer, and so on.”
- “The management of a network of interconnected businesses involved in the ultimate provision of product and service packages required by end customers.” (Harland 1996, p. 64)

There is also many other definitions for supply chain management. According Al-Mudimigh et al. (2004, p. 310) SCM means “a contemporary concept that leads in achieving benefits of both operational and strategic nature”. SCM is all about smoothness, economically driven operations and maximizing value for the end user through quality delivery. SCM however do not take account of customer’s future needs and how these needs can be fulfilled. SCM ideology does not involve post-delivery, post-evaluation and relationship building aspects. According Jüttner, Christopher and Baker (2007, pp. 378-379) SCM target is “lowering the total amount of resources required to provide the necessary level of customer service”. SCM centralize on efficient supply and tries to be cost orientated. On the other hand according Helms et al. (2000, p. 392) SCM means that all strategy, decisions and measurements are done by reflecting effects to whole supply chain. The goal of SCM is to meet the needs of the consumer by supplying the product at the right place, time and price. Financial supply chain management focuses on activities that are related to cash flows. This means practically from customer’s order to payment, including cash forecasting and trend analysis. (Tudor and Cotis 2003, p. 57)

SCM can be either lean or agile. Lean supply chains target on doing more with less by reducing waste or through inventory reduction. A lean approach is suitable for markets with predictable demand, high volume and low requirements for product variety. Agile supply chains are needed in markets with volatile demand and high requirements for variety. (Jüttner et al. 2007, p. 378) Supply chains must be managed to maximize efficiency. Effective supply chain will guarantee sufficient customer satisfaction through reducing costs and therefore prices. (Rainbird 2004, p. 231)

FSC is not limited just inside a firm but it includes communication and cooperation with stakeholders. "Financial Supply Chain Management consists of the holistic and comprehensive activities of planning and controlling all financial processes, which are relevant within a company and for communication with other enterprises". (Popa 2013, p. 142) Global sourcing and outsourcing have increased the need of financial supply chain management and working capital management. This complicates financial flows and cash management. Although financial supply chain management is coming more important many companies do not focus enough in it. Without sufficient FSCM companies will not be competitive in long run. (Hartley-Urquhart 2006, pp. 19-20; Wuttke et al. 2013, p. 773)

There are three main areas that cause cost in financial supply chain. These three main areas are administrative costs, working capital and foreign exchange costs. Financial supply chain requires quite a bit of administration. (Blackman and Holland 2006, pp. 86 and 88) Globalization increases usually companies' administration costs. These costs relate to efforts to get the customers pay on time. Typically these kinds of costs are between 0.75 % and 2.5 % of the value of the invoices. The lack of certainty within the financial supply chain results in that companies must keep surplus cash. For example in the United Kingdom and United States typical credit term is 30 days. The collection time is usually over two weeks longer than credit term. Holding two weeks surplus cash means 0.8 % extra cost if cost of capital is 10 %. Most of the companies do not charge interest for this delay be-

cause they are concerned about effect on the sale. Converting foreign currency affect costs. Converting currency effect costs for small firms as 0.5 % to 2.5 % but big multinational companies can get this service a lot cheaper. Foreign exchange rates changes continuously and this can result a major difference in costs if payment and the price agreement are not done at the same time. The average delay between price agreed and actual payment is three months. This creates uncertainty on how much company will eventually get from customer. Companies can protect foreign currency accounts receivables. This affects costs but reduce uncertainty. For smaller companies this is harder because fixed costs are relatively high in this situation. For example big firms can use automated systems more efficiently. Usually smaller firms just add a bit products prices. The previously mentioned three main cost areas create for small firm average 3.8 % cost of the value of the invoices. (Blackman and Holland 2006, pp. 86 and 88; Hartley-Urquhart 2006, pp. 20 and 22)

Foreign trade increases the complexity of cash flow processes. FSC can reduce costs that are affected by this foreign trade. (Hartley-Urquhart 2006, p. 20-21) Foreign exchange transactions are relatively cheaper for big companies than small companies because of this in value chains the best solution is that the biggest player deals with foreign exchange and pays to suppliers and customers in their own currency if they use other currency than the big firm. As mentioned earlier big companies can also protect foreign currency rates cheaper than small companies. This kind of thinking requires a different way of thinking especially from the biggest company in the financial supply chain. When this occurs big companies should get discounts from suppliers or bigger price from customers because big firms have to deal with extra costs when their foreign exchange transactions will increase. In contrary suppliers and customers have to be certain that co-operation increases their financial certainty. (Blackman and Holland 2006, pp. 90-91)

Company which deals with foreign exchange should manage on real time rather than a periodic basis and it will lose the possibility to manage their own cash flow by manipulating supplier payments (Blackman and Holland 2006, pp. 90-91).

Some uncertainty concerning cash flows can be solved by FSC because individual companies can now predict more carefully their cash flows because the FSC is managed co-operatively (Wuttke et al. 2013, pp. 775). An implementation cooperative financial supply chain will face many organizational barriers. There have to be made some changes in the roles of the purchasing and finance functions. There must also be built trust with the finance functions of the suppliers and customers. The banks will also have to detect the advantages of automating the foreign exchange trading process. Big company has to accept some reduction in financial flexibility. Cooperative financial supply chain will decrease costs incurred within the whole supply chain. The purchase of financial services is moved to the company with the lowest costs of purchase. Then this company can also negotiate the bulk of the financial benefits. The financial advantages are potentially huge and early adopters of cooperative financial supply chain will get a comparative advantage over other competing supply chains. (Blackman and Holland 2006, pp. 90-91; Phillips 2008, p. 13)

Banks have to make big investment in complicated information systems that they are able to automate the financial process for cooperative financial supply chains. Biggest multinational banks have done this already and they could build major scale benefits. This development will also need building thrust between banks and their customers. Banks that can provide automated services to big companies will decrease its costs of distribution to the supply chain smaller firms. There is already some consolidation in the financial service industry and this will decrease cost ratios to maintain groups' financial performance. (Blackman and Holland 2006, p. 92; Phillips 2008, p. 13; Popa 2013, pp. 144-145)

The financial aspects of the supply chain must have to become transparent and much more information will be demanded that co-operative financial supply chain can be implemented. This will enable management of FSC as one entity rather than separated small transactions. (Blackman and Holland 2006, pp. 92; Tudor and Cotis 2003, p. 60). It will increase purchasing power of the largest company in supply chain and this could be used mutual benefit of the whole supply chain.

For example whole value chain can have better payment terms than separated firms and stronger companies can offer credit to weaker ones. (Blackman and Holland 2006, pp. 92-93; Hofmann et al. 2011, p. 57; Phillips 2008, p. 13; Hartley-Urquhart 2006, p. 20) Credit risks are also smaller if there is integrated financial supply chain. To achieve this supply chains must implement credit models which they use evaluate customer's credit risk. Even inside a company there is lack of information between financial supply chain. Credit and collection departments do not co-operate enough. (Cundiff 2004, pp. 38-39)

### **3.1 Managing current assets**

Managing current assets may be perceived by trade-off between costs that increase with the level of investment and costs that decrease with the level of investment. Costs that increase with the level of the investment are carrying costs. Shortages costs are costs that decrease with increases in the level of investment in current assets. There are usually two types of carrying costs. The other is an opportunity cost and the other is the cost of maintaining the economic value of the item. Opportunity cost caused by current assets low profit compared with other assets. (Ross et al. 2008, pp. 752-753). The cost of maintaining the economic value of the product is for example the cost of warehousing stock. Shortage costs very likely occur when investment in current assets is low. This could even result interruption of production or the loss of sales. These other hand could result loss of customers. There are two kinds of shortage costs; trading or order costs and costs related to safety reserves. Order costs are the costs of placing an order for more expensive or keeping more products in inventory. Costs of placing an order for more expensive is called brokerage costs and bigger inventory costs are called production setup costs. (Ross et al. 2008, pp. 752-753; Hofmann et al. 2011, p. 33) Storages could also exist because it is part of the manufacturing process. For example wines and cheese must be aged in storages before they are ready for sale. (Hofmann et al. 2011, p. 33). The total costs of investing in current assets are decided by adding the carrying costs and shortage costs. Finding the lowest point



of total costs is very hard and usually choices have to be made near of the optimum point. (Ross et al. 2008, pp. 752-753; Hofmann et al. 2011, pp. 37-41)

Short-term assets should always be financed with short-term debt and long-term assets should be financed with long term debt and equity in optimal situation. In this case net working capital is zero. Current assets will not drop to zero in real world because long-term increasing level of sales will result in some lasting investment in current assets. A growing company has also need of some permanent long-term assets. There are three major lines of which come to short-term borrowing. These three major ways are cash reserves, maturity hedging and term structure. In cash reserve situation there is surplus cash and little short-term borrowing. This strategy lessens the chance that a company will face financial distress. In other hand investments in cash have very low yield. When company is implementing maturity hedging strategy it will finance stocks with short-term loans and fixed assets with long-term financing. Companies are trying to avoid financing long-lived assets with short-term loans. This type mismatching is quite risky because short-term interest rates are more volatile than longer rates. When monitoring term structure companies follow simple guideline which is: short-term interest rates are usually lower than long-term interest rates. So on average it is cheaper relying on short-term borrowing than long-term borrowing. (Ross et al. 2008, pp. 755-756)

Companies can improve their cash flow by reducing the length of the CCC. Three ways to do this are shortening the inventory conversion period, reducing the receivables conversion period and increasing the payables deferral period. (Moss and Stine 1993, p. 31; Deloof 2003, p. 575) An important attention is that firms with long payable deferral period are usually less profitable than those firms that have short ones. The more profitable companies pay their bills sooner than less profitable. (Deloof 2003, p. 585). Accounts receivables conversion period tells the frequency with which a company's average receivables investment is converted into cash. Inventory conversion period measures the frequency with which enterprises convert their stocks into product sales. Account payables deferral period is

and indicator of the frequency with which company's customers pay their bills to company. (Richards and Laughlin 1980, p. 33)

The shortening in the inventory conversion period could be accomplished by turning over inventory as quick as possible still avoiding stock shortages that could reduce sales. If there exist seasonal sale pattern would wise to offer benefits to customers to buy earlier. This will speed up the turnover of stock. When there do not exist seasonal sale pattern or sale is hard to forecast improved forecasting models will assist improve the turnover of stock. Good way to diminish the size of safety stock is to find different supply source and bargain trade relationship with each vendor. Usually at least one of the vendors can deliver products and there is not so big need of the safety stock. Better inventory management models will also help to improve the turnover of stock. For example automatized point-of sale system where program order more products when in stock curtain number of this product. (Moss and Stine 1993, pp. 32) Bigger stock could still be profitable although it creates more costs than smaller stock. Company with a big stock can delivery quick products and hence may be able to charge higher prices or get more sales. For products' manufacturer big stock may result fewer production stoppages due to the stock shortages. (Ross et al. 2008, p. 752) Ways of shortening the inventory conversion period:

- Outsourcing: WC can be decreased by passing tasks to third-party companies
- Vendor-managed inventory: The vendor handles of the management of the company's inventories.
- Just-in-time: The goods will be delivered at the right time, in the right volume, to the right location.
- Cross docking: The goods are delivered to end user without intermediate stocks. This saves time and inventory costs.
- Optimization of materials requirements planning and order quantities planning by adjusting safety stock levels
- Optimization of inventory management by decreasing stock levels as well as the variety of parts and variants. (Hofmann et al. 2011, p. 19)

Inventory optimization is very important part of WCM. In inventories is also available additional liquidity. Inventories are the largest part in WC. Inventories share from WC is average 34 %. Inventories cause half of the logistic costs and 13-22 % of total costs are because of wrong stock levels. (Hofmann et al. 2011, pp. 31-32)

To shorten the receivables conversion period, it could be wise to offer benefits for early payment. Benefits like cash discounts are often used as bait for customers to pay early. There is also cost to retailer if it offers cash discounts because it gets less money but faster. (Mullins and Komisar 2009, p. 154; Moss and Stine 1993, p. 32). Then CCC will be shortened. Other solution to shorten the receivables conversion period is reduce the credit period. This is done by reducing customers' payment times. This could have effect on firm's sales because customers want to pay as late as possible or if customers will not get financing for the shortened payment period. This problem could be out came by offering better service and/or offering cheaper prices than other companies. Receivables conversion period could also been reduced by raising credit standards. This strategy results that customers will pay their bills faster because of stricter credit standards. Also this strategy could result lost in sales. This problem could be also out came by offering something more than competitors. (Moss and Stine 1993, p. 32) There is also possible try to sell products to customers before it has even produced. Example from this is newspapers and magazines. Customers pay their order before they get any edition. (Mullins and Komisar 2009, p. 140; Popa 2013, p. 148) Practical ways of shortening receivables conversion period are acceleration of the billing process, for example e-billing, implementation of a consistent collection strategy, sale of receivables to a financial services provider, use of instruments to avoid losses of receivables outstanding, for example advance payments and risk-minimizing payment terms, and granting discounts from paying earlier. (Hofmann et al. 2011, p. 18)

When setting credit period, company must think about three factors: The probability that customer will not pay, the size of account, and the extent to which the goods are perishable. Lengthening the credit period decreases the price paid by the customer. This usually adds sales. (Ross et al. 2008, p. 796) Increase in credit period will add company's customers' liquidity or if the company gets more time to pay from its suppliers, the company's liquidity will improve. (Hofmann et al. 2011, pp. 21-23).

Cash discounts are part of the terms of sale. These cash discounts are used also because they speed up the collection of receivables. Cash discounts must be compared to what the discount costs and how much that discount will speed collection period. Cash discounts could also increase sales and change cost structure. (Ross et al. 2008, pp. 796-797; Weston and Copeland 1988, p. 296) Any growth in granted discount rates will affect positive on company's liquidity (Hofmann et al. 2011, p. 21).

At the optimal amount of credit the cash flows from increased sales are precisely equal to the carrying costs from the rise in accounts receivable. There are two kinds of costs when granting credit: Carrying costs and opportunity costs. Carrying costs are for example the losses from bad debts, the delay in receiving cash, and the credit managing costs. Opportunity costs consist of the lost sales from refusing to offer credit. (Ross et al. 2008, pp. 801-803) These costs vary depending on company's credit terms. In theory the optimum terms of sale is set so they offer the highest net present value for the company. Still rarely companies know what this optimum point is. Proposed changes are done so the changes will likely improve nowadays situation and optimum point is a bit closer. (Scherr 1989, pp. 159-163) The optimal credit policy depends also greatly on characteristics of particular company. For example if a company can borrow money cheaper than its customers and competitors it is useful to the company offer longer credit period. Also the level of taxation affect the credit period because it is relatively cheaper for the firm to lend money if the firm have to pay high taxes. (Ross et al. 2008, pp. 801-803)

To shorten accounts payable period could be made by paying more than before when supplier can add their credit period. It also possible the supplier's customer is so big that it is very big compared to its turnover and this customer creates critical volume for this supplier. Or another supplier wants to win this customer and gives better terms than former supplier. Shortening accounts payable turnover must still be made in co-operative way that both benefits from the shortening. (Mullins and Komisar 2009, p. 154) One of increasing the payables deferral period is optimization of payment processes. This means that payments are made on right time. Another way of doing that is optimization of payment terms. This is implemented by renegotiating of payment term with vendors and preventing down payments. Using such contract clauses, like early deliveries, do not effect on payment terms or avoiding early deliveries is also a good way to add the accounts payable turnover. Cooperation from external and internal buyers to strengthen negotiating power will also increase accounts payable turnover. (Hofmann et al. 2011, pp. 19-20)

Many companies could increase their liquidity and ensure their financing. Every fifth insolvency is caused by financial errors. Companies could decrease their tied-up capital even 25-40 %. (Hofmann et al. 2011, p. 21)

The shortening in CCC of a company has effects for the other companies in the value chain. A decrease in DSO will reduce customers' DPO and increase in DPO will add suppliers' DSO. Although one company gets reduction in CCC some other companies' CCC will increase and this is called "zero sum game". Still it is not useless to optimize value chain's CCC because there are differences for example in inventory carrying costs and capital cost rates in the value chain. These differences could be used to minimize the total costs in the value chain. (Hofmann et al. 2011, pp. 20)

By optimizing value chain's CCC could be achieved more competitive value chain compared to other value chains. Reasons for value chain partnerships can be

many. Here are some of them: Securing long-term low and predictable prices, quality assurance, security of supply, offering innovative leads, and decreasing default risk or securing the vendor's existence. (Hofmann et al. 2011, pp. 55-56)

There are three main ways of financing accounting receivables. These ways are secured debt, a captive finance company, and securitization. When there is secured debt and borrower gets into financial difficulties the lender can repossess the asset and sell it for its market value. Much of big companies with good credit ratings use captive finance company. This finance company is subsidiary of the parent company. The captive finance company's creditor has a claim on its assets and also the accounts receivable of the parent company. A captive finance company is a good idea if economies of scale are important and if an independent subsidiary with limited liability warranted. When company sells its accounts receivables to a financial institution it is called securitization. (Ross et al. 2008, p. 806; Popa 2013, p. 149)

### **3.2 Value Chain**

The value chain for any company in any business is the merged set of value-creating actions from raw materials to the end-use product supplied to the consumers. The value chain framework is a way to divide the chain of actions into relevant segments that can be understood the nature of costs and the sources of differentiation. One company is usually only part of bigger value chain. The value chain framework underlines how a company's product fit into the customer's value chain. Value chain analysis recognizes that the separate value actions within a company are not separate but are dependent on each other. Recognizing these dependences could be noticed that increasing cost in one value chain activity could bring reduction in total costs in the value chain. Creating a value chain could be done as follows:

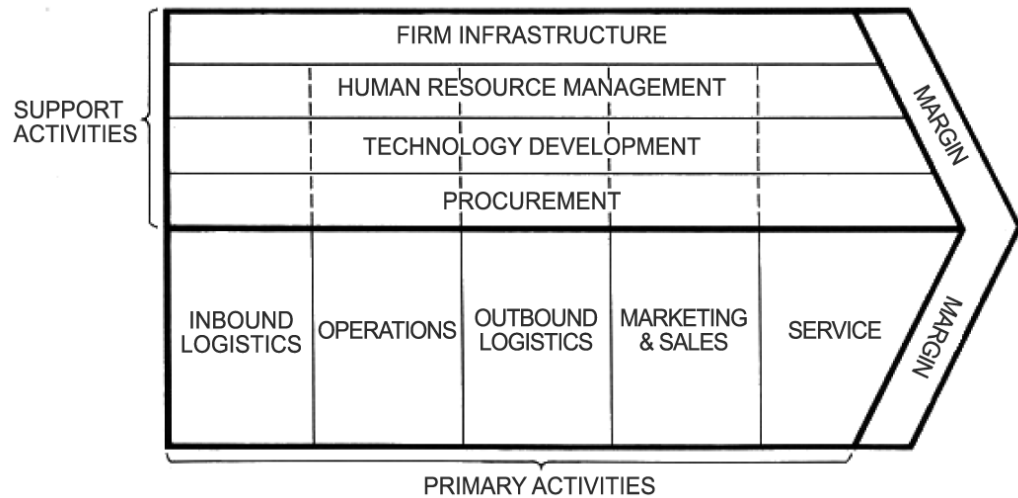
- Identify value chain stages
- Identify strategic options
- Assign costs and revenues to value chain stages

- Estimated market value transfer prices
- Estimated asset investment

(Shank and Govindarajan 1992, pp. 179-180, 183 and 192)

The word “value” has many definitions but there are three common themes in these definitions: Customer value is compounded to the use of a product, it is discovered by the customer and it usually contains a bargain between what the customer gets and what the customer pays for the product. Value is detected subjectively by customers. Different customer segments detect different values within the same product. Detecting value differs also within the whole value chain not only within customers. By understanding these differentials can improve companies’ products. Value must be measured as multidimensional construct. (Al-Mudimigh et al. 2004, p. 311; Sánchez-Fernández and Iniesta-Bonillo 2006, p. 43; Ulaga and Chacour 2001, pp. 529 and 538). According Ulaga and Chacour (2001, p. 527) “value is a trade-off between benefits and sacrifices perceived by the customer in a supplier’s offering”.

There are many concepts of managing the generating of value, such as supply chain management, value chain management (VCM), and customer chain management (Al Mudimigh et al. 2004, p. 311). Maybe the most famous of these is Porter’s (1985, p. 33) supply chain management. In figure 4 is introduced Porter’s generic value chain. In the generic value chain are support activities and primary activities. It describes a company on organization level. According Al-Mudimigh et al. (2004, p. 311) “the end goal of SCM is to deliver maximum value to the end users for the least possible cost”. According Ulaga and Chacour (2001, p. 526) value can make in three different ways: value creation with suppliers, value creation with alliance partners, and value creation with customers.



**Figure 4.** Porter's generic value chain (Porter 1985, p. 37)

A company must recognize the difference between price and value. Price is usually defined as the monetary value of a product. Price is just a component of consumer value. Price is given to products at a level to attract customers and to make profit from their sale. Value on the other hand reflects the benefits which buyer gets compared to the product's price. When value equals or exceeds the price, customer will probably buy the product. For an organization it is important to create improvements in the product that add the customer sense of product's value and reduce costs throughout the value chain. By offering better value to customers will help company to create permanent competitive advantage. Value creation is trade-off between quality and price. Value chain management is concerned from the beginning to the end all about the customer. (Al-Mudimigh et al. 2004, pp. 311-312; Sánchez-Fernández and Iniesta-Bonillo 2006, p. 44; Ulaga and Chacour 2001, pp. 529-530)

There are many benefits in VCM. First of these benefits is companies must recognize their core competencies and locate them in the market place based on company's strengths and competitive abilities. Secondly there is possible to build up synergy levels and seamlessness between the different actions in the value chain. Thirdly it creates customer focus and the information can flow both ways and this can add companies' flexibility and agility. VCM's other benefits are the im-



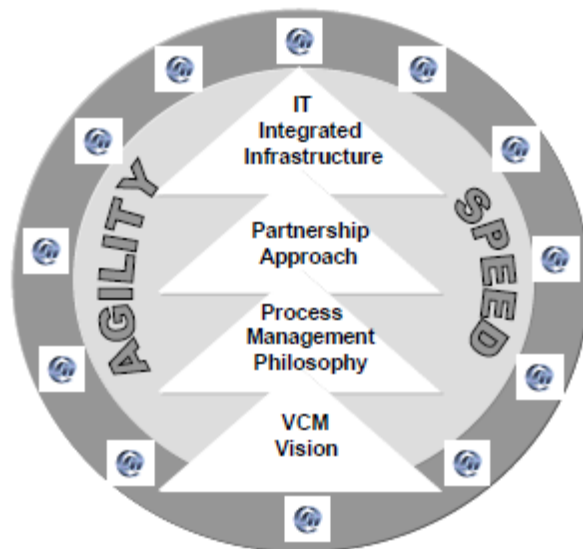
provement in relationship between companies' stakeholders. This guarantees that customer is better served. Cost advantage can be achieved by focusing on the customer. Optimizing actions and detecting interdependencies between the various processes can lead to cost savings and quality improvements. By managing a value chain through the information flow that stakeholders can access will enable companies to compete effectively. (Al-Mudimigh et al. 2004, p. 312)

There are also some other benefits from value chains. For example there is needed certain volume of production that business is profitable and this can be achieved by co-operation. The main idea in value chain is to find companies strengths and weaknesses and improve these together so that everyone benefits from this. These benefits are passed onto next company in the value chain and so on. (Hofmann et al. 2011, pp. 57 and 62-63)

There are some challenges to adopt VCM. First challenge is value chain optimization. This challenge is caused by for example technology incompatibility, lack of trust, corporate philosophical differences, lack of VCM leadership, poor communication and price pressures. Second challenge is value chain performance. Most of the organizations do not use very effective the VCM principles. Third challenge is value chain strategy. Many value chains do not have value chain strategy or it is inadequate. Fourth challenge is information sharing in the value chain. Most of the organizations share information related to product. There should be more information about strategies and visions of the partners. When information is about the customer the shared information is also about products when it should be more about strategic aspects and the sales forecasts. This is similar also about the supplier information. Fifth challenge is VCM road map which contains five key issues which are VCM vision, process management, partnership approach, IT integrated infrastructure and agility and speed. (Al-Mudimigh et al. 2004, pp. 316-318)

Organizations that seek excellence using value chain principles have to invest in VCM vision based on knowledge of the customer. They have to engage capabili-

ties which deliver their value proposition. Organizations must also do real time decisions which are based on their best information and knowledge. Process management means that organizations must detect what are their core activities. There should also do optimization across the value chain using modern tools for this. Processes should be surrounded with measurements that organization can be sure that their goals are achieved, cost effectiveness is established and the value added is measurable. In modern business it is vital to work through partnerships. VCM is based on the existence of partnerships. The information between the companies in the value chain should be transparent. In value chain should do also IT infrastructure integration that the shared information is easily seen by all companies in the value chain. This is one of the key issues in the value chain. Agility and speed are important for a company for example when it does mass customizations. By this it can create extra value for every customer. With internet and IT this is possible. Agility and speed is needed throughout the value chain. (Al-Mudimigh et al. 2004, pp. 317-318) In figure 5 can be seen the core idea of the VCM road map.



**Figure 5.** Value chain management road map (Al-Mudimigh et al. 2004, p. 317)

## **4 WORKING CAPITAL MANAGEMENT MODEL**

The target for this working capital management calculation model is to create a practical tool for calculating value chain's working capital and cash flows. This model is designed to use by researchers and students. One of the targets for the model is improve the students' understanding about working capital management. The calculation model should produce information for future simulations of working capital and it should also enable comparing of firms to each other. The basic level of the calculation model is a corporation, a value chain, or a product level and the used time period in the model could be a month, a quarter, a half year, or a whole year. The model will provide important information about how changes in working capital will effect on company's, corporation's, product's, or value chain's profitability and cash payments and collections.

### **4.1 Introduction to the model**

The model is strongly based on CCC and cash flow forecasting. CCC term is widely used in operating working capital management and therefore it is natural to use it for the base of this model. Therefore this model could be used by many purposes. The primary aim is to create a tool for working capital management. The model measures naturally CCC, Weighted average cost of capital (WACC), ROI, QR, CR and turnover times for payables, inventories, receivables and also company's and value chain's profitability. From these figures user could deduce how working capital effects on company's and value chain's profitability. The model could be also used to compare companies to each other. The model is capable of forecasting value chain and companies future values for the financial figures mentioned earlier. The changes in working capital could be simulated and the effect of these changes on company's profitability is also possible to detect.

The model contains six different kinds of sheets: Instructions for use, fill in data for companies, companies forecast & results, companies charts, value chain CCC and value chain WC + ROI. Fill in data for companies, companies forecast & re-

sults and companies charts are same style for every company. Of course figures and filled in data differ but style is same. In appendices 1, 2 and 3 can be seen examples from these sheets. Examples are from company 1 sheets. Appendices 4 and 5 introduce value chain sheets.

The model's user will need some balance sheet and income statements figures from the value chain or individual companies to start using the model. This data is public for listed companies in most of the world's countries. There may be some fees from this data though. This is good for model's designed user group because they cannot get value chains' or companies' inside data so easily. Of course if user is somebody inside a real value chain they should get that inside information easily but real life has proved that this is not necessary so. These figures are for example turnover, fixed and variable costs, working capital and profit. In figure 6 can be seen company 1 fill in data sheet from the model about working capital components. Only P-7-12 periods is seen in the picture. There are also periods from -6 to forecast period. -7 to -12 periods means that user fill in data from time periods that was 7 to 12 time periods ago. For example if used time period is a month means that in this cell should fill in data from 7 to 12 months ago from the present. This means that user should fill in data from six periods in total. In the green cells user should fill in data and in orange cells user should not fill in data. In this case only Working capital 1 is orange cell and information in it is calculated based on cells above it. In this case for example Accounts payable 1. Information is also needed about average loan maturity and shareholders' equity rate of return on capital. Other information needed is not vital for the model. These not vital input data are for example the companies' tax rate and the target for QR, CR, ROI and CCC. Model's maximum number of companies is ten in all using purposes.

**Working capital components**

	P-7-12 periods
Accounts payable 1	-3000
Raw materials 1	1050
Work-in-progress 1	1600
Finished goods 1	2800
Accounts receivable 1	3100
<hr/> Working Capital 1	<hr/> 5550

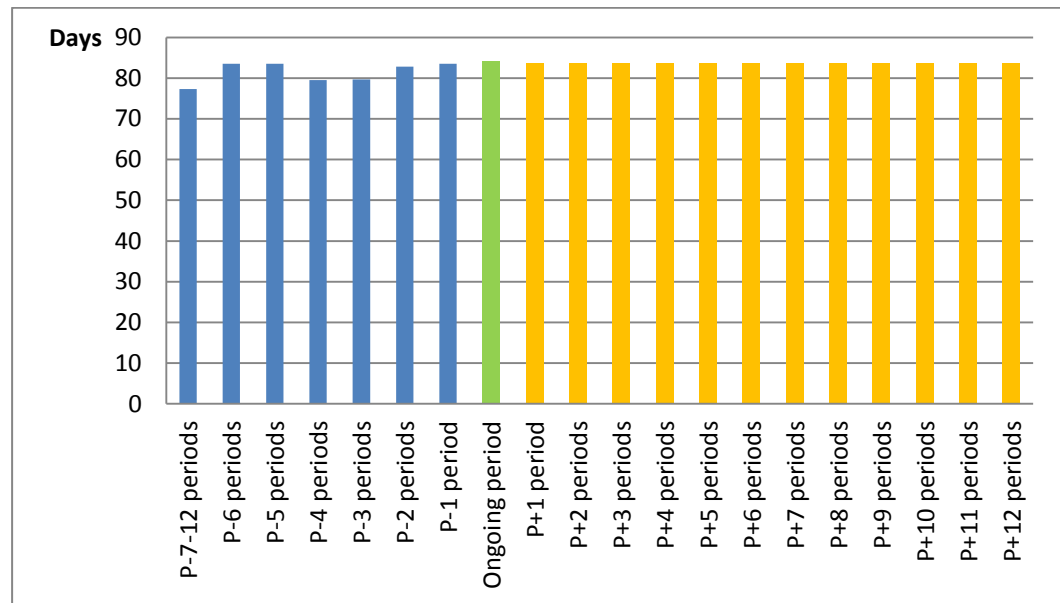
**Figure 6.** Working capital components from the Model's Company 1 sheet

In forecast sheet user must pick the number of periods that are used in sales forecast moving average. This number must be one to six. The moving average's time period is then one to six time period. If used time period is a quarter, is the used moving average one to six quarters. For example if the number of periods in moving average is 3 is sales forecast calculated based on three previous period's sales. It is also useful if user will think about the expected change in sales from previous period to next period, how much company will pay dividend, how much turnover changes will effect on fixed cost and the expected change in fixed cost from previous period to next period would be. The model will work also if these figures are not filled in. In cash forecast section it is important to fill planned investment to maintain sales. The model will also work if any data is not filled in but cash forecast is not so realistic if there is any investments involved unless there really is not any need to investment in for example production machines. An example from cash forecast can be seen in figure 7. Other information is calculated based on filled in data. In forecast sheet can be seen some results in figures. In company chart sheet can be seen some of these results from charts.

Cash forecast	P-1 period	Ongoing period
Total cost 1		-5600
Sales revenue 1		6400
Financing costs 1		-230
Planned investments to maintain sales 1		-250
Maturing loans 1		-2246
Pre-taxes 1		-114
Dividends 1		-91
Receipts 1		6400
Disbursements 1		-8531
Cash and cash equivalents 1	550	-1581
Financing need for period 1		1734

**Figure 7.** Cash forecast section from the Company 1 forecast & results sheet

In company chart sheets there is four charts and results based on filled in and calculated data. In figure 8 can be seen one of these four charts. In figure 8 is company 1 cash conversion cycle from periods P-7-12 periods to P+12 periods. The blue columns are historical data, the green column is ongoing period and the orange columns are forecast periods. In chart sheet from charts can be seen cash conversion cycle, return on investment, relative amount of working capital components compared to whole working capital, the amounts of working capital components and also whole working capital, and ROI and CCC in same chart.



**Figure 8.** Company 1 cash conversion cycle from the Company 1 charts sheet

So it can be said that in this thesis's theory part is detected a gap in theories and this created model can fill up at least a bit of it. Working capital forecasting compound with cash flow forecasting is a relatively new thing and it is introduced in this thesis. With this model user can simulate and forecast working capital and cash flows. This should be great tool for WCM.

## 4.2 Overview of the model

Now developed model provide vital information concerning working capital management. The model tells among other things which firm benefits most from the value chain and which suffers the most. The value chains' and companies' cash flows can be seen from the model. The model could also provide some information about acquisition targets. From the model's results user can easily see are the company's or the value chain's targets really achieved. With the model could also survey how working capital changes effect on profitability and cash flows. The model tells also operational working capital for each company and also for the whole value chain. With the model could study variable cost and fixed cost of the company or the whole value chain's costs.

Model contains some simplifications. Model's value chain is thought to be literally "a chain". So there is not thought to be any business between other companies that do not include to value chain and companies in the value chain do business only in certain order. So company 1 sells something to company 2 and company 2 refines products somehow and sells the product to company 3 and so on. The company 10, or some smaller number if the value chain is shorter, sells the product outside of the value chain, for example to end user. Working capital is divided to 5 pieces that are accounts payable, 3 different kinds of inventories and accounts receivable. This distribution can be seen from figure 2. The three inventories are raw materials, work-in-progress and finished goods. User can use all three or just one if he/she does not want to separate inventories. Variable cost is calculated in the forecast based on variable costs' filled in ratios average. Also loan and short-term loan maturities and liabilities interest rates are calculated in forecast based on filled data averages. Variable cost is calculated based on filled in data average variable cost ratio. So the model assumes that the variable cost ratio does not change in the future. Minimum level for cash and cash equivalent is defined based on how many days user want to the cash suffice on average cash consumption. From figure 9 can be seen an example from the calculation of minimum level for cash and cash equivalents.

Cash usage in one day 1	15	Meur
The level of safety stock in cash 1	10	Days
Cash and cash equivalents min 1	153	Meur

**Figure 9.** Example from minimum level for cash and cash equivalents

In company forecast & results sheet is also some simplifications and limitations. The expected change in sales per period means that the user assumes how many percent the sales change per period compared to previous period. The percent is same for all future periods. The change could be positive or negative. For example if filled in data is -3 % means that the sales shrink three percent for every future period from the last period. If used time period is one year then the sales shrink three percent for every year if the used moving average is one. When moving average is for example 3 will the sales change for period be roughly 40 % from the



filled change figure because the period's sale will be calculated based on 3 previous period and this expected sale change for period. In how much company pays dividend from its net profit should user fill in ratio how much company really pays dividend. The dividend is needed in cash forecast. For example if company pays 50 % of its net profit in dividend means that in cash forecast dividend is net profit times 50 %. How much turnover changes effect on fixed cost cell user should fill how many percent sales change effect on fixed cost. For example if filled in figure is 50 % and sales increases ten percent will fixed cost increase 5 % which means half of the sales change. The change can be negative or positive. If the filled in figure is 0 % fixed cost will maintain the same in future. Change in fixed cost per period cell user fills in how much fixed cost will change from previous period. For example if filled in figure is – 1 % the fixed cost will decrease one percent. The filled in figure could be positive or negative. From figure 10 can be seen example about these cells, which were introduced above, in the model.

<b>The amount of periods in sales forecast's moving average</b>	6
<b>The expected change in sales per period</b>	0,00 %
<b>How much company pays dividend from its net profit</b>	20,00 %
<b>How much turnover changes effect on fixed cost</b>	80,00 %
<b>Change in fixed cost per period</b>	0,00 %

**Figure 10.** Example from Company 1 forecast & result sheet

Total cost's cash flow in cash forecast is calculated based on accounts payable turnover times from two previous periods and the period which cash flow is being forecasted and the total cost from these three periods. Sales revenue is calculated based on the two previous periods and the period which cash flow is being forecasted sales for all products and of course accounts receivable turnover times. If days of payables outstanding or days of receivables outstanding change in the forecast over the used time period the cash flow forecast does not work correct in the second time period from the change but it is usable in the other periods. Financing cost are calculated based on average liabilities interest rate and the amount of the debt. Only filled in data in the cash forecast is planned investments to maintain sales. In this section user should fill in the amount of investment that

he thinks is mandatory to maintain current sale volume. Maturing loans are loans that mature on the used time period and they are calculated based on the company's total debt, the used time period, and the maturity times for the debts. The debt is divided on two, short-term loans and long-term loans. For both types have own maturity times which are filled in company 1-10 sheets. Pre-taxes are calculated based on tax rate and profit before taxes. Pre-taxes are thought to be same in the cash flow forecast than they are in income statement. Dividends are directly the amount what is paid to company's owners. It is calculated based on net profit and how much company pays dividend from its net profit. Receipts are the sum of all cash forecast's expenditures and disbursements are the sum of all cash forecast's revenues. Cash and cash equivalents are based on period's receipts, disbursements, and the previous time period's cash and cash equivalents. Financing need for period is calculated based on disbursement, receipts and the previous time period's cash and cash equivalents. Company 1 cash flow forecast from ongoing period could be seen from figure 11. The used cash forecasting method in the model is close to receipts and disbursement method. The used method forecasts when cash flows are paid and when collected. Previous period's ending cash balance is next period starting balance.

	P-1 period	Ongoing period
Total cost 1		-5600
Sales revenue 1		6400
Financing costs 1		-230
Planned investments to maintain sales 1		-250
Maturing loans 1		-2246
Pre-taxes 1		-114
Dividends 1		-91
Receipts 1		6400
Disbursements 1		-8531
Cash and cash equivalents 1	550	-1581
Financing need for period 1		1734

**Figure 11.** Company 1 cash flow forecast from ongoing period

Sales forecast for all products is calculated based on moving average which count average sales for 1 to 6 time periods. This average is the sales forecast for the time period. User can also fill in the expected change in sales per period compared to previous time period. This change will be same to all forecast periods. Variable cost is calculated based on sales forecast for all products and filled in data average for variable cost ratio. These two figures are multiplied by each other. Fixed cost is input data in company 1-10 sheet. In company 1-10 forecast & results sheets can be filled in how much fixed cost changes per period compared to previous period. This change will also be same for every forecast period. Total cost is simple to calculate. It is just sum of two figures, fixed cost and variable cost. Earnings before interests and taxes (EBIT) are just sales forecast for all products less total cost. Financing cost is naturally calculated based on the total amount of debt and average liabilities interest rate. Profit before taxes is just EBIT less financing cost. Taxes are calculated based on tax rate for company, which is input data, and the amount of profit before taxes. Net profit is profit before taxes less taxes. In figure 12 shows the model's sales forecast section from 2 periods.

Sales forecast for all products 1	6200	6600
Variable cost 1	-3500	-3700
Fixed cost 1	-2400	-2400
Total cost 1	-5900	-6100
Earnings before interests and taxes 1	300	500
Financing costs 1	230	220
Profit before taxes 1	70	280
Taxes 1	-14	-56
Net profit 1	56	224

**Figure 12.** Company 1 sales forecast section from company 1 forecast & result sheet

Days of payables outstanding is calculated based on total cost and the amount of accounts payable. Days of inventory outstanding is calculated based on the amount of inventories and total cost. Days of receivables outstanding is calculated based on sales forecast for all products and the amount accounts receivable. Cash

conversion cycle is days of inventory outstanding plus days of receivables outstanding reduced days of payables outstanding.

In financial target section's total assets in forecast periods are based on the previous period's amount of total assets and the change in sales compared to previous period. Return on investment is calculated based on financing cost, net profit, total assets. WACC is calculated based on input data shareholders' equity rate of return on capital, average liabilities interest rate, the amount of total debt, total assets, and shareholders' equity. Quick ratio is just sum of cash and cash equivalents, other financial assets, and accounts receivable and this sum is divided for another sum of short term liabilities and accounts payable. Current ratio differs from quick ratio so that inventories are added to numerator. So it is usually bigger than quick ratio. Working capital-% is the amount of working capital divided the sales forecast for all products times the amount of periods in one year. Figure 13 is good example from the model's financial target section. Figure 13 cells are calculated as above is told.

Financing costs + net profit 1	285	686	641
Return on investment 1	3,76 %	9,04 %	8,50 %
Weighted average cost of capital 1	7,37 %	7,42 %	7,04 %
Quick Ratio 1	0,55	0,49	0,49
Current Ratio 1	1,35	1,30	1,31
Working capital-% 1	22,4 %	21,7 %	21,7 %

**Figure 13.** Company 1 financial target section from company 1 forecast & result sheet

In figure 14 is the model's company 1 balance sheet section from 3 periods in forecast & result sheet. This sections' forecast periods other financial assets are calculated based on the amount of previous periods' other financial assets and the change in sales forecast for all products compared to previous period. Short-term liabilities are calculated based on filled in data short-term ratio compared to total debt. So the model assumes that short term ratio versus total debt remains standard in the future. Total assets are simply total debt adds shareholders' equity. To-

tal debt without working capital is like the name says total debt less the amount of working capital. Maturing loans and the financing need for the period of course effects on total debt. The model assumes that if financing need for the period is smaller than maturing loans for the period will company use this surplus cash for paying debt. Forecast periods' shareholder equity is affected by the amount of dividends to be paid and net profit.

Short-term ratio 1	18,7 %	18,7 %	18,7 %
Short-term liabilities 1	3753	3753	3649
Other financial assets 1	50	50	50
Total assets 1	30342	30342	30152
Total debt without working capital 1	14550	14550	14039
Total debt 1	20100	20100	19545
Shareholders' equity 1	10242	10242	10607

**Figure 14.** Company 1 balance sheet section from company 1 forecast & result sheet

All working capital components are calculated based on change of sales forecast for all products compared to previous period and the concerned working capital component, for example accounts receivable and accounts payable, previous period's amount. CCC change from last period tells the change of cash conversion cycle compared to previous period's CCC. Change in working capital from last period and ROI change from last period tell the same thing with regard to working capital and return on investment. Figure 15 contains four time periods. First one is one time period before present; the second is ongoing period and the third and fourth are future periods.

Accounts payable 1	-3000	-3000	-2977	-2988
Raw materials 1	1050	1050	1042	1046
Work-in-progress 1	1600	1600	1588	1594
Finished goods 1	2800	2800	2778	2789
Accounts receivable 1	3100	3100	3076	3088
Working Capital 1	5550	5550	5507	5528

**Figure 15.** Company 1 working capital components section from company 1 forecast & result sheet

With the model could simulate many things. It is easy just change individual firm's working capital only filling some percentage figure in "the simulated amount of working capital" cell. This will simulate what happens if company's working capital is for example only 80 % or 110 % from the original amount. There is also possible to change the amount of individual working capital component, for example raw material inventory. This is not though so easy as the whole working capital simulating. User must fill in changed figure in ongoing period's raw material inventory or in whatever working capital component he/she wants to change individually. Changes in WC can be detected both in CCC and ROI. A change in CCC effect to cash forecast, if DPO and DSO change, because changes in DPO and DSO effects how fast cash flows are paid or collected. In case that DPO and DSO are very close to each other and the amount of accounts payable and accounts receivable are also very similar changes in these values will effect just a little to CCC. DIO changes can be observed in total amount of WC and this effect naturally in ROI and CCC values. Changes in sales are also quite easy to simulate. The model's simulation for sale change is more like setting a trend for the sales growth than setting a sales change for every time period because the filled in figure is sales change for every future period. Cost changes could also be simulated. Especially simulating changes in fixed cost is easy to do. User just fill in the wanted change per period in "Change in fixed cost per period" –cell. The change should be filled in percentage. Of course user can also simulate costs by manipulating historical data in that direction that he or she wants. Also the amount of different assets could be varied and change in these can be detected at least from ROI. Tax rate could be changed. The effect of distributing dividends can be simulated by varying the amount of dividends and it effects to cash flows.

### **4.3 Model testing**

The model has tested by imaginary data. This used data can still be said to be realistic because this test data is carefully considered. Tested situation is for ten company value chain. Company 1 accounts receivables are company 2 accounts payables and so on. Company 1 accounts payables and company 10 accounts receiva-

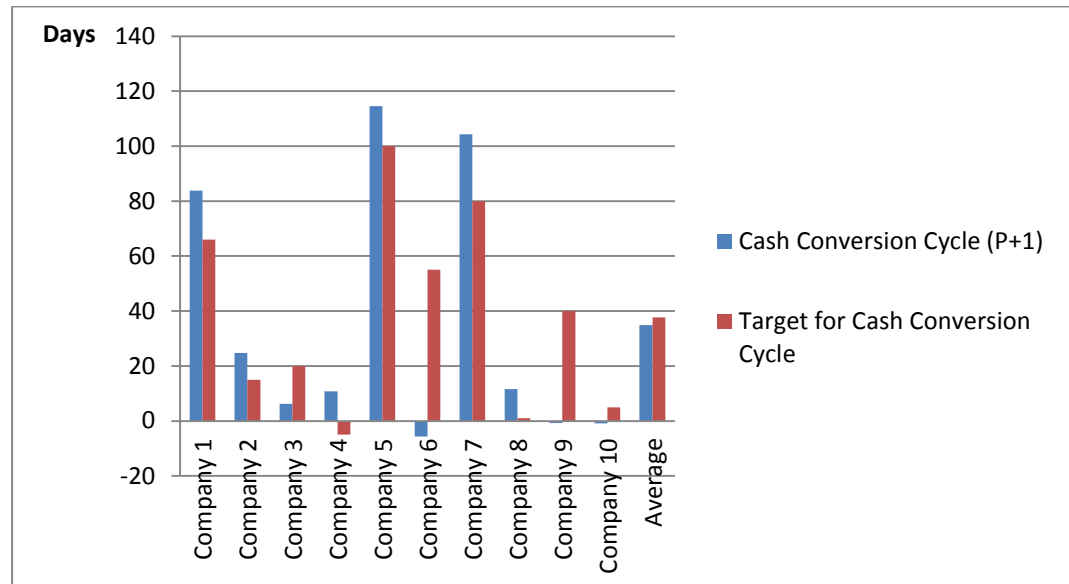
bles are outside of the value chain. Companies 2-9 do most of their business inside the value chain. Company one 1 buys its raw materials outside and company 10 sells its products outside of the value chain. The used time period in this model test is one quarter. In table 2 can be seen this test's key figures in ongoing period. Companies' data alternates a bit in some of the input data like how much sales growth and what is the tax rate and so on but those figures are not essential to introduce in here.

**Table 2.** Used key figures in model testing (Million euros except CCC)

	AP	INV	AR	TURN- OVER	Net prof- it	CCC (days)
C 1	-3 000	5 450	3 100	6 400	456	84
C 2	-3 100	1 800	3 000	6 000	171	25
C 3	-3 000	500	2 800	3 000	7	7
C 4	-2 800	300	3 000	4 000	4	1
C 5	-3 000	9 000	6 000	1 0000	245	115
C 6	-6 000	425	5 500	9 000	557	-6
C 7	-5 500	12 000	7 000	12 500	840	104
C 8	-7 000	300	8 000	10 000	-156	12
C 9	-8 000	150	8 000	15 000	282	-1
C 10	-8 000	4 000	4 000	20 000	800	-2

From table 2 can be seen that companies CCC vary a lot in ongoing period. Companies 1, 5 and 7 CCC are long and companies 3, 6, 9 and 10 CCC are short. In figure 16 could be observed that companies 1, 2, 4, 5, 7, and 8 do not achieve their CCC targets. Therefore whole value chain does not achieve its average CCC target. In figure 17 can be detected that companies 1, 5 and 7 have huge inventories. With the model can be tested what happens if these companies can decrease their inventories for example by 30 %. This change can be seen in figure 18. Now those companies are clearly under their CCC targets and value chain also achieves its average CCC target. With the model could be also tested how changes in sales or

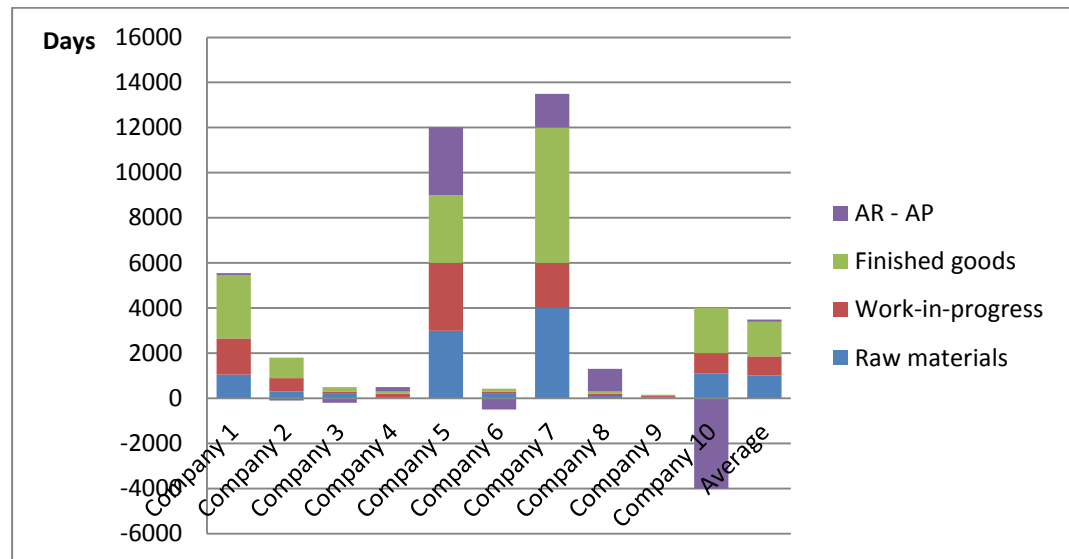
in costs effect on CCC or ROI or profitability. Model is better introduced in chapters 4.1 and 4.2.



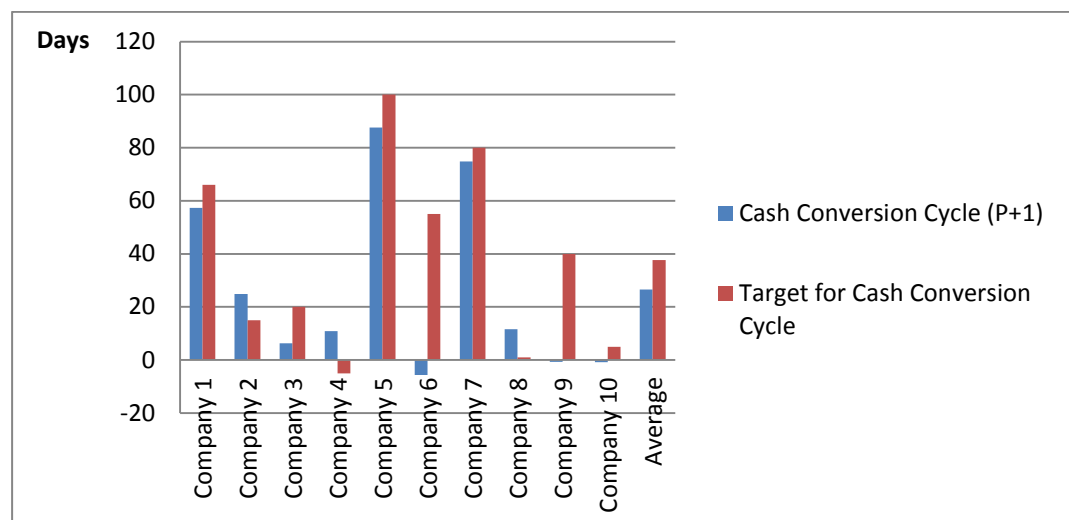
**Figure 16.** Value chain and individual companies CCC and target for CCC (Period + 1)

In figure 16, 17 and 18 can also be detected that company 6 benefits very much from the value chain. Companies 5 and 7, which are next to company 6, suffers from this. Companies 5 and 7 working capital and CCC are much bigger than other companies have in the value chain. From table 1 and figure 20 can be seen that company 7 is still very profitable but the company 6 is the value chain most profitable company. Company 8 has the weakest ROI. Most of the value chain's companies do not achieve their ROI targets but still whole value chain average target ROI is close to achieved ROI because of very profitable companies 6, 7 and 9. Companies 6 and 8 have also very short CCC which helps them to achieve good ROI. Company 10 is quite strong so it could be said that the whole value chain is strong because it can sell its products very profitable to others. Especially the difference between accounts payable and accounts receivables is big. Company 10 can force its customers to pay to it quickly.





**Figure 17.** Value chain operating working capital (Period + 1)



**Figure 18.** Companies 1, 5 and 7 inventories are decreased by 30 % from the original situation

From figure 19 can be seen that company 5 financing need for period is increasing quarter by quarter. The company 5 is not profitable enough. Maybe its production machineries are quite old and they need lots of investments that it could maintain its sales. Maybe it should not also pay dividends. From this cash flow forecast user can easily see that company is taking more debt in every period. The company 5 has about 3500 millions more loan in the last forecasting period than it had in ongoing period. The total debt is the in last period a bit over 60 billion. The least

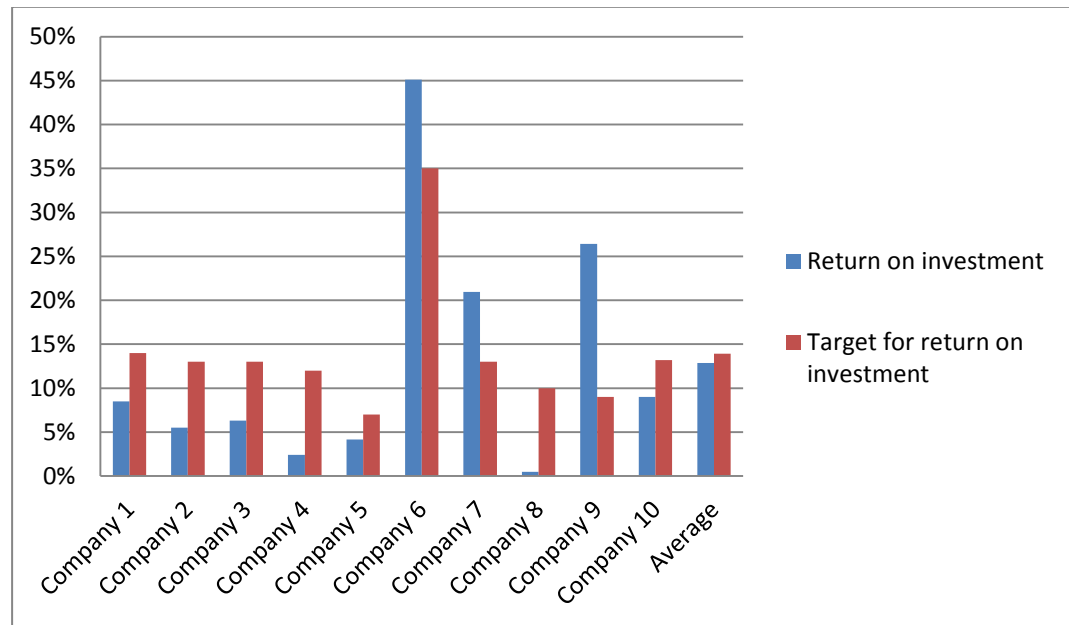
profitable company in the value chain is company 8. Its debt grows over 20 percent in three years which is the forecasting period when used time period is a quarter. The most profitable company 6 could pay almost 80 percent of its loans during the forecasting period although it is paying dividends which are 10 percent of its net profit. Maybe it should pay more dividends if it does not have any other use for its surplus cash. So there are huge differences also in cash flows between the value chain's companies.

	P+4 peri- ods	P+5 peri- ods	P+6 peri- ods
Total cost 5	-9150	-9150	-9150
Sales revenue 5	10000	10000	10000
Financing costs 5	-505	-509	-512
Planned investments to maintain sales 5	-500	-500	-500
Maturing loans 5	-6820	-6862	-6905
Pre-taxes 5	-103	-102	-101
Dividends 5	-48	-48	-47
Receipts 5	10000	10000	10000
Disbursements 5	-17127	-17171	-17215
Cash and cash equivalents 5	-7127	-7171	-7215
Financing need for period 5	7177	7221	7265

**Figure 19.** Company 5 cash flow forecast from three quarters.

Based on the test data, this value chain should consider that they share value chain's working capital more evenly and company 7 could be the role model in other things than amount of working capital because it can be very profitable although it has very long CCC. Of course everyone should improve their business functions. At least companies 1, 5 and 7 inventories could be too big. Their inventories could be big also for some important reason, for example value chain has already settled that these companies have big stocks and they get some compensation for that. This value chain should also consider some changes in credit terms because accounts payable and receivables turnover is quite long based on that normal credit period is 30 days and this value chain's DSO and DPO are about 55 days. Of course there are always some payment delays but 55 days compared to

quite normal credit term, which is 30 days, is very long. Though accounts payable and accounts receivable repeal each other. Cash flow forecasts also prove that something should be done for the least profitable companies' cash flows. They are running into debt quite fast.



**Figure 20.** Value chain's return on investment and targets for ROI (Period +1)

Based on this model test can be said that model works well. There were detected no more limitations which are not already mentioned earlier. Also based on this test could be said that this model is good tool for working capital management and cash management. In next chapter is some thinking about what could be done better in the model and what could develop in the future.

#### 4.4 Further development of the model

There is also some further development of the model that is important to consider. The model's value chain is too simple and in its place should develop more realistic value chain that could take account of real product and cash flows. The value chain should enable these flows between many companies and not only in certain order. For example company x could be supplier to companies a, b, and c and

these companies a, b, and c could also be company's x supplier or there could be also business between companies a, b, and c. It is also desirable to expand the model towards asset management. The base for this kind of extension could be flexible asset management model developed by Marttonen, Monto and Kärri (2013b, p. 436-437). Previous company's accounts payable should automatically be next company's accounts receivable when the model's using purpose is value chain. Of course there should be also mode for comparing companies to each other when those working capital components should not be automatically same.

There are also some problems in the model's cash flow forecast if company's profit before taxes is negative. When this occurs calculated taxes are not correct. Taxes are then positive cash flow and this makes some error in the model. This could be fixed by making cumulative tax account where taxes will be added up when profit is negative and this sum will be deducted from the amount of taxes when the profit turns again positive. There occur also problems with debts when company is very profitable and working capital is relatively small because model assumes that the company will use its surplus cash to pay back its loans and if the amount of loans is small will loans be negative and this means that maturing loans turn to positive cash flow in cash flow forecast. This occurs when used time period is one year and even then only quite far into future and also with shorter time periods if company is hugely profitable. This could be thought to be some kind of return on investment for this surplus cash. For this problem the solution could be for example that company will not use its surplus cash flows to repay its loans or the amount of loan cannot be negative. There could be for example some investment account where this surplus goes and it will generate some interest incomes.

Development of the forecast should also be one of the major targets. For the value chain or corporate there should be better forecasting sheet. A bit like the existing forecast & result sheet for every company but for a whole value chain. Also expanding already existing two value chain sheets would be important. The existing charts should contain more information about the future. Value chain's working capital could be wise to optimize in regard to whole value chain's interest costs.

This means practically that the company which get loan for lowest interest rate takes more loan than the others and so on. This could be also implemented through accounts payable and accounts receivable. The most powerful company has longest days of receivables outstanding and shortest days of payables outstanding and so on. When accounts payables or accounts receivables turnover times change over the used time period, for example one month, there are some problems with the cash flow forecast. The cash flow forecast will not work correctly in second time period from the change. This kind of error can be seen in figure 21. In P + 2 periods total cost and sales revenue are totally wrong. In this situation both days of payables outstanding and days of receivables outstanding changes from under 90 days to over 90 days and this affect this problem. This problem occurs with all used time periods if turnover times changes around the used time period. This could be solved for example using only the forecasted period's turnover times which will cause also some inaccuracies when those turnover times will change, especially if they change a lot, because other periods' turnover times will not be take account of. In forecasting accounts payables and inventories change is calculated based on turnover changes. The amount of accounts payable changes or inventories as much as the sales changes. It could be better if these components will be affected by changes in costs.

	Ongoing period	P+1 period	P+2 periods	P+3 periods
Total cost 1	-5600	-4750	-597	-7136
Sales revenue 1	6400	7013	94	8396
Financing costs 1	-230	-319	-327	-372
Planned investments to maintain sales 1	-250	-150	-200	-200
Maturing loans 1	-2246	-3164	-3242	-3681
Pre-taxes 1	-114	-122	-161	-202
Dividends 1	-91	-97	-129	-161

**Figure 21.** Cash flow forecast error when turnover times changes

To simplify the use of the model forecasting abilities there should be same kind of solution that there is already with the whole WC. Now user can change the amount of whole WC but not so easily for individual component of the WC, for example raw materials stock. This could be solved like the whole WC simulation is solved now. So there would be cell for every WC component where user can fill in the percentage figure he or she wants. For example 80 % or 150 % when this individual component is 80 % or 150 % what it was earlier. This kind of solution would be wise to implement also to whole value chain that user can simulate easy whole value chain's WC just changing one cell's figure or at least only few cells figures.

As almost always instructions could be better. Maybe it is easier for someone who has not developed the model to improve these instructions because the model's functions are not too obvious for him or her. There could be also some basic theory in the instructions or some calculation formulas that are not so familiar to the user group. Especially for students who are just starting build up their working capital management knowledge.

## 5 CONCLUSIONS

The model developed in this thesis seems to help researchers and students to improve their knowledge about working capital management and cash management which was the original objective of this thesis and they can easily test what happens if they change some of the input data. This model can also be used for cash forecasting and comparing firms to each other. The model enables user to use different time period. Time period can be a something between one month and one year. Shorter or longer time periods did not have tested. There can appear some problems if the time period is not between those mentioned time intervals. The model test, which was performed in chapter 4.3, proofed that the model gives results that seem to be reasonable. For example in figures 16 and 18 can be detected that the model helps user to optimize an individual company's or a value chain's working capital through CCC.

There are also some limitations concerning the model which could be fixed in the future. Modelling of the value chain was a great challenge. In this study value chain is literally a chain and first firm sells its products to second one and so on. To develop a realistic value chain is one of the most important future research objectives in this thesis. This model could be a base for wider comprehensive flexible asset model for value chains. There should be also more automated functions in the model. For example when the model is used in value chain purposes previous company's accounts payable should be the next firm's accounts receivable. In cash forecast occurs some limitations also. There are also some problems with debts when firm is very profitable and WC is relatively small and the used time period is one year. Now developed forecasting could be improved by expanding it concern more about the whole value chain. WC could be wise to optimize in value chain level with respect to interest rates. There are also some limitations with changes in working capital component's turnover times. Simulation of WC could be simpler. And as usually there should be done some work involving the model's instructions.

Model tells among other things that which firm benefits most from the value chain and which suffers the most. The value chains' and companies' cash flows can be seen from the model. The model could also provide some information about acquisition targets. From the model's results can easily be seen are the company's or the value chain's targets really achieved. The model tells also operational working capital for each company and also for the whole value chain. Variable and fixed cost of the company or the whole value chain's costs can be optimized. WC can be optimized by many ways. The model enables simulating WC and cash forecast and changes in input data will effect to model's results logically. This is unique and magnificent result from this study. Changes in WC effect at least to value chain's and companies' ROI and CCC. Changes in DPO and DSO can be observed in cash flow forecast and of course in CCC. DPO and DSO effect how fast cash flows are collected and paid. Changes in DIO effect straight to CCC and ROI. The used tax rate can be changed and the effect to cash flow could be easily seen. The amount of assets can be also varied and effect of these changes can be detected from ROI. Also the amount of paid dividend could be varied and this effect to cash forecast. Simulating sales changes is also possible with this model. All this can be simulated with this developed model and all refers that this kind of data will help a value chain or a firm improve their working capital management. The model seems to be practical tool for WCM and this means that one of this thesis targets is fulfilled. The user group should benefit greatly from this created model.

The model's user needs some data from balance sheet and income statement. All these data is public at least in most of the countries. This is good for model's user group, students and researchers, because they cannot get so easily companies' or value chains' inside information. The model needs very few data that are not public data and this data are not vital for using this model. For example shareholder's equity rate of return on capital is not necessary public data. Beside this can be used imaginary figure or some common figure to this kind of industry or just ignore whole thing.



This kind of calculation model is unique by far. The created model combines working capital management and cash management, especially cash flow forecasting. The simulating and forecasting of working capital is not common nowadays. When this is combined with cash flow forecasting is it even more sophisticated tool for working capital management and cash management.

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## Appendix 1. Company 1 sheet.

### Company 1

The simulated amount of working capital	100 %
The amount of time periods in one year	4
The amount of days in one year	365
The amount of days in one period	91,25
Tax rate for company	20,00 %

### Working capital components

	Ongoing period
Accounts payable 1	-3000
Raw materials 1	1050
Work-in-progress 1	1600
Finished goods 1	2800
Accounts receivable 1	3100
<hr/> Working Capital 1	<hr/> 5550

### Cash forecast

Average loan maturity 1	7,66
Average short-term loan maturity excluding AP 1	200

### Financial statements

Turnover 1	6400
Fixed cost 1	2000
Variable cost 1	3600
Total cost 1	5600
Variable cost ratio 1	56,3 %
Earnings before interests and taxes 1	800
Financing costs 1	230
Profit before taxes 1	570
Taxes 1	114
Net profit 1	456



## Balance sheet

Cash and cash equivalents 1	550
Other financial assets 1	50
Short-term liabilities 1	3753
Short-term ratio 1	18,7 %
Total debt without working capital 1	14550
Working Capital 1	5550
Total debt 1	20100
Shareholders' equity 1	10242
Total assets 1	30342

## Financial targets

Weighted average cost of capital 1	7,42 %
Return on investment 1	14,00 %
Cash conversion cycle 1	66
Shareholder's equity rate of return on capital 1	13,00 %
Liabilities interest rate 1	4,58 %

## Minimum levels

Cash usage in one day 1	15
The level of safety stock in cash 1	10
Cash and cash equivalents min 1	153

## Appendix 2. Company 1 forecast & results sheet.

### Company 1 forecast

<b>The amount of periods in s moving average</b>	6
<b>The expected change in sales per period</b>	0,00 %
<b>How much company pays dividend from its net profit</b>	20,00 %
<b>How much turnover changes effect on fixed cost</b>	80,00 %
<b>Change in fixed cost per period</b>	0,00 %

### Cash forecast

Ongoing pe-  
riod

Total cost 1	-5600
Sales revenue 1	6400
Financing costs 1	-230
Planned investments to maintain sales 1	-250
Maturing loans 1	-2246
Pre-taxes 1	-114
Dividends 1	-91
Receipts 1	6400
Disbursements 1	-8531
Cash and cash equivalents 1	-1581
Financing need for period 1	1734

### Sales forecast

Sales forecast for all products 1	6400
Variable cost 1	-3600
Fixed cost 1	-2000
Total cost 1	-5600
Earnings before interests and taxes 1	800
Financing costs 1	230
Profit before taxes 1	570
Taxes 1	-114
Net profit 1	456

### Turnover times

Days of payables outstanding 1	48,9
Days of inventory outstanding 1	88,8
Days of receivables outstanding 1	44,2
Cash conversion cycle 1	84,1
Accounts payable turnover 1	7,47
Inventory turnover 1	4,11
Receivables turnover 1	8,26

### Financial targets

Financing costs + net profit 1	686
Return on investment 1	9,04 %
Weighted average cost of capital 1	7,42 %
Quick Ratio 1	0,49
Current Ratio 1	1,30
Working capital-% 1	21,7 %

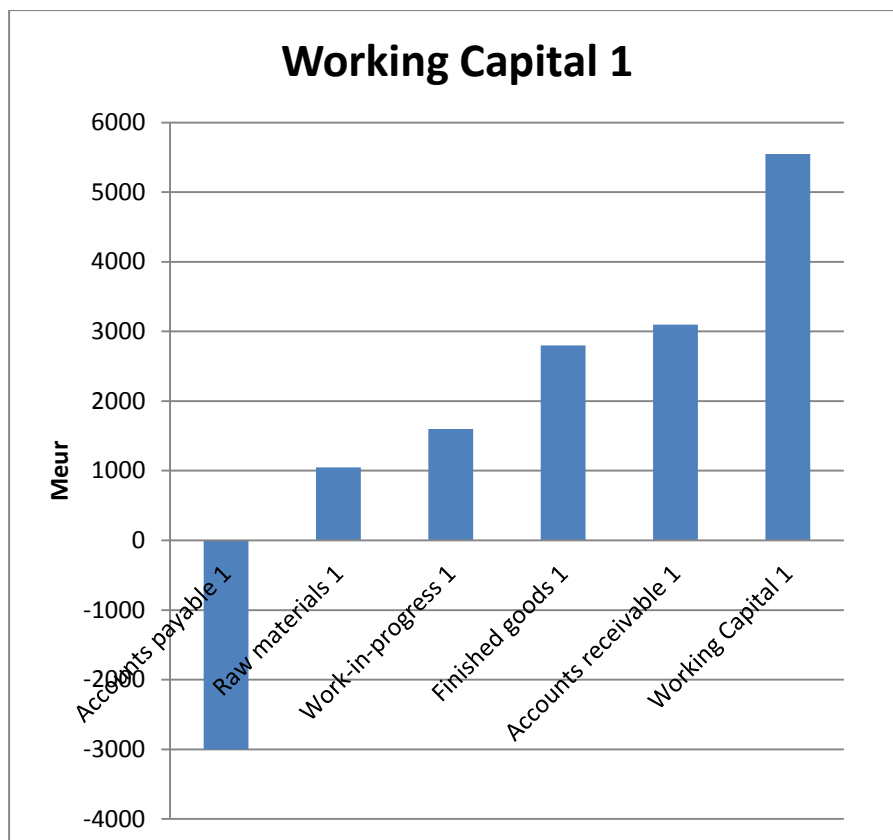
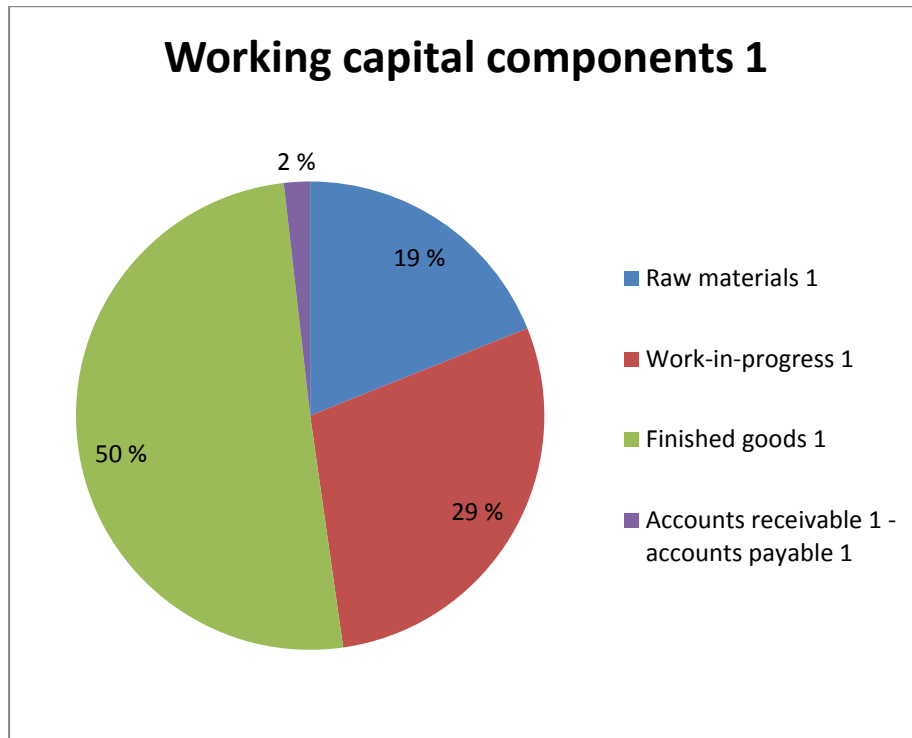
### Balance sheet

Short-term ratio 1	18,7 %
Short-term liabilities 1	3753
Other financial assets 1	50
Total assets 1	30342
Total debt without working capital 1	14550
Total debt 1	20100
Shareholders' equity 1	10242

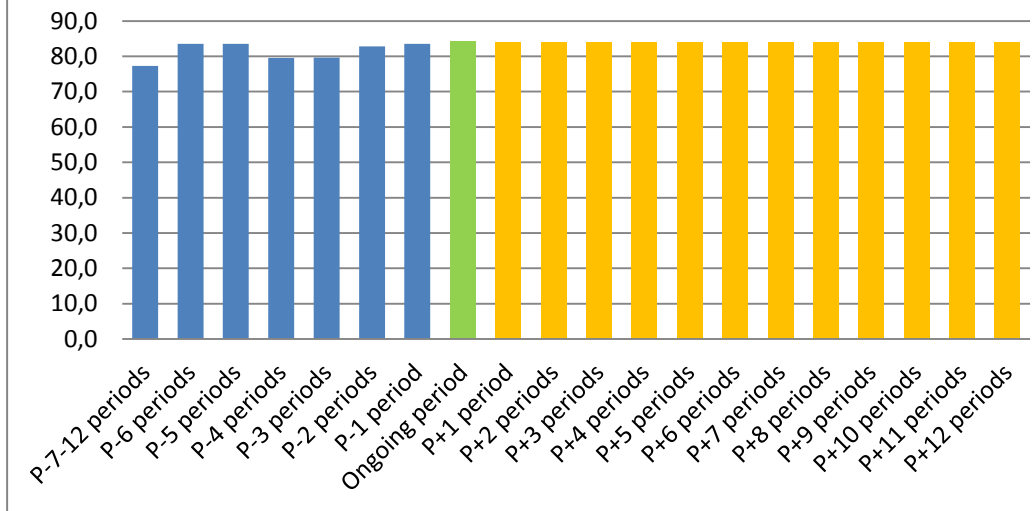
### Working capital components

Accounts payable 1	-3000
Raw materials 1	1050
Work-in-progress 1	1600
Finished goods 1	2800
Accounts receivable 1	3100
Working Capital 1	5550
CCC change from last period 1	0,6
Change in working capital from last period 1	0,0
ROI change from last period 1	5,28 %

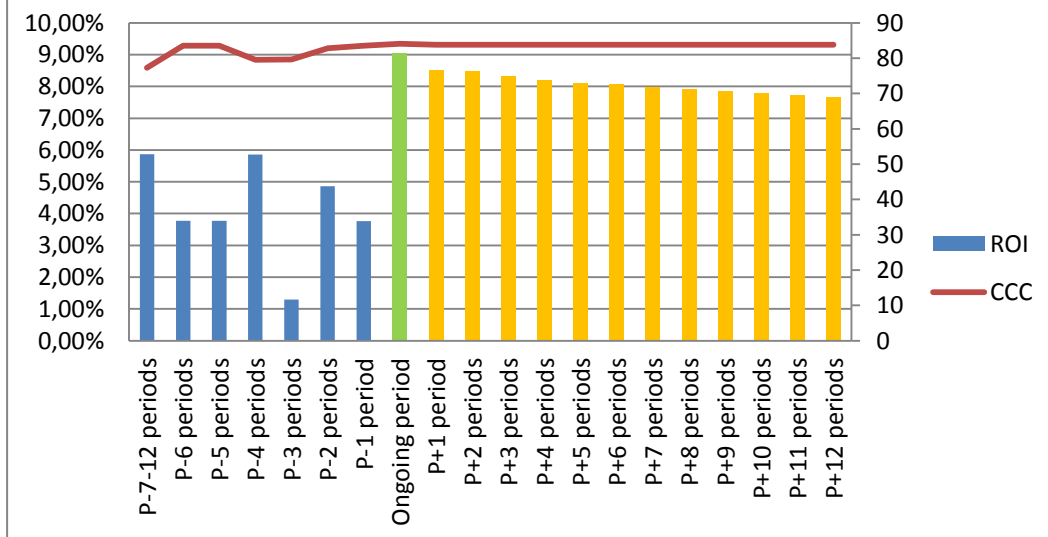
Appendix 3. Figures from Company 1 charts sheet.



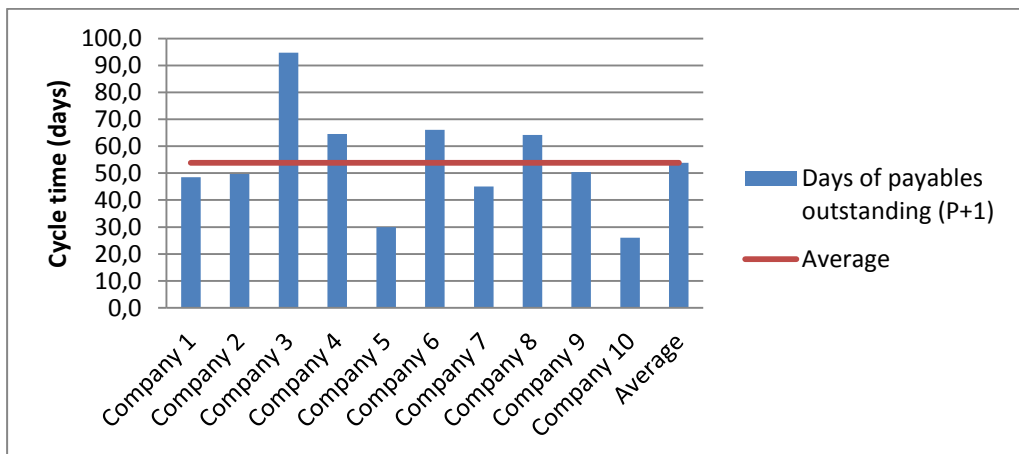
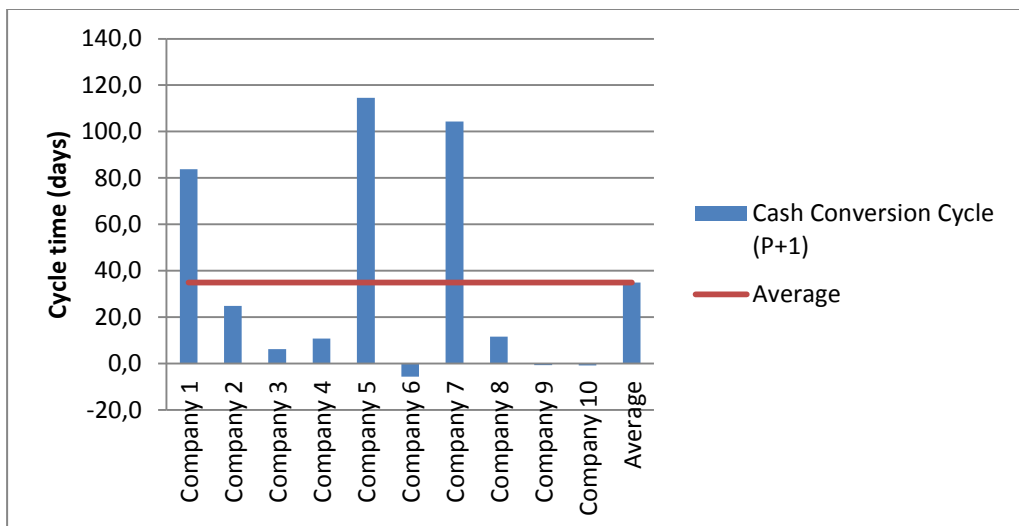
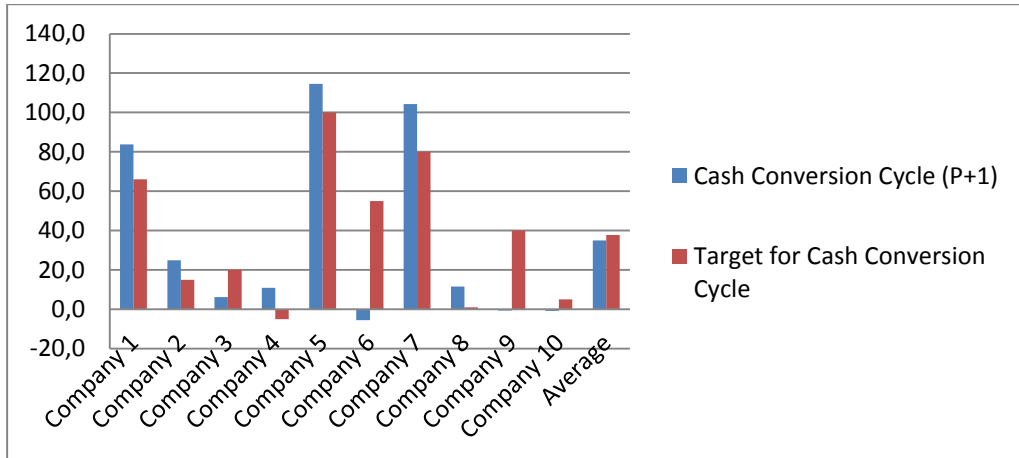
## Cash conversion cycle 1

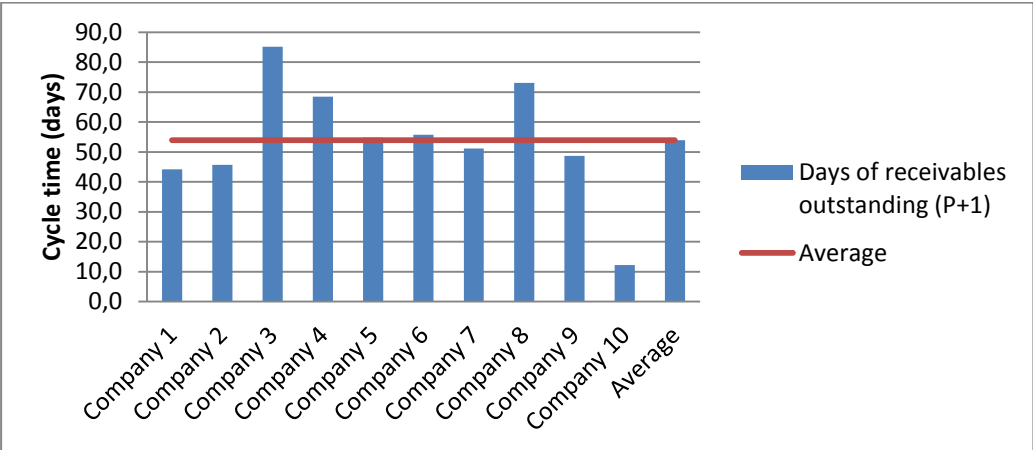
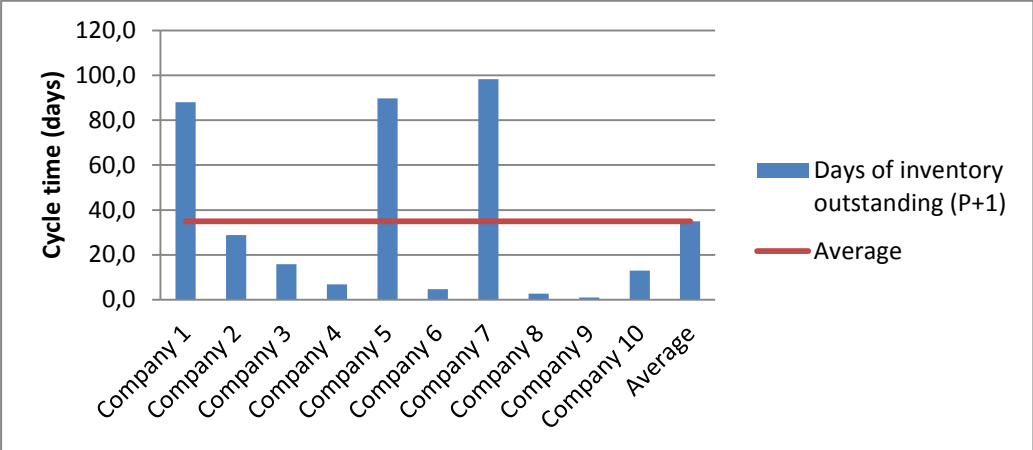


## ROI compared to CCC

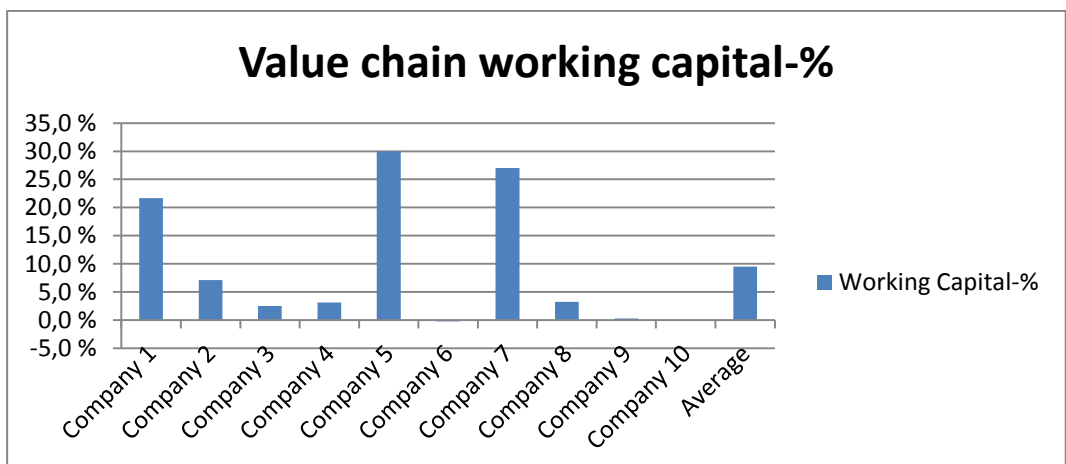
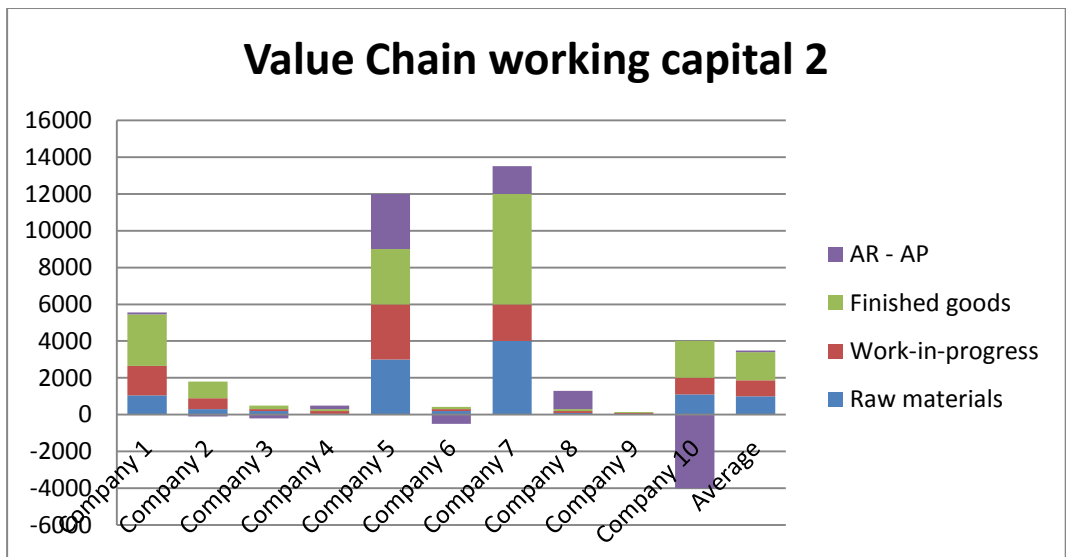
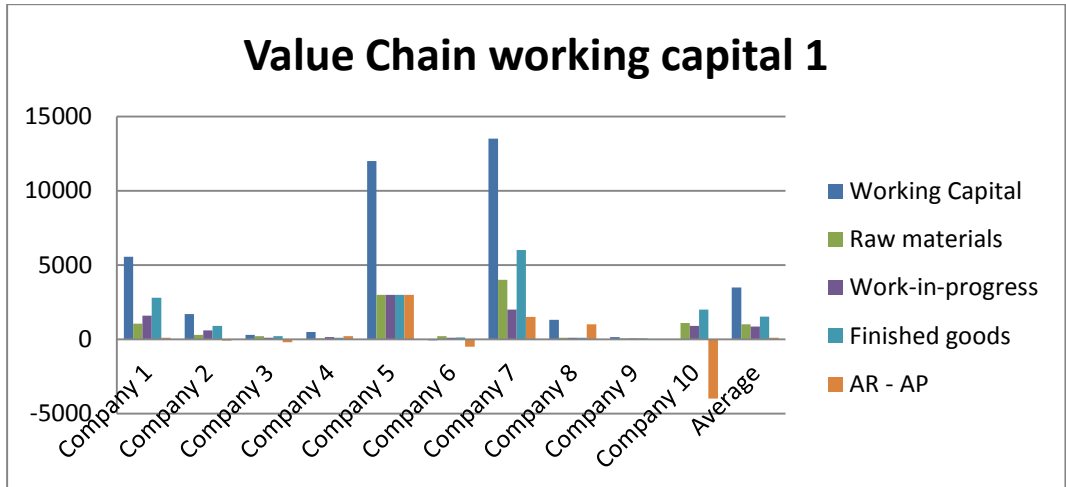


**Appendix 4.** Figures from Value Chain CCC sheet.





**Appendix 5.** Figures from Value Chain WC + ROI sheet.





# Return on investment

