Shall we integrate?

ERASMUS UNIVERSITY ROTTERDAM
ERASMUS SCHOOL OF ECONOMICS

Master Thesis Urban, Port & Transport Economics

Research question: What is the effect of a vertically integrated supply chain on holistic firm performance, for various stakeholders, in U.S. manufacturing companies?

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Abstract: *"In this research, the relationship between vertical integration and firm performance (for various stakeholders) will be identified. A holistic firm performance measure is created and consequently identified by making use of three performance measures: financial, organizational and environmental performance. Vertical integration is identified by creating an index, making use of SSIC-codes and identifying the number of segments that are integrated within a product line. Literature review concludes a positive relationship with financial & environmental – and negative relationship with organizational performance. From the results can be concluded that there exists a negative relationship between vertical integration and financial and environmental performance, which negative effect is stronger for little to highly vertically integrated firms. From this research's results can be concluded that vertical integration has a negative effect on firm performance"*

Keywords: vertical integration; firm performance; SSIC; financial, organizational and environmental performance; vertical integration index; supply chain; stakeholders

JEL Classification Codes: L14, L22, L25 & L60

Table of content

Preface

Whenever in study-related stress my mother used to always tell me: ‘you cannot do more than your best’ (as translated in English). However, that is precisely the crux of the matter when writing a thesis: “what is your absolute best?” Eventually, I noticed you can always go one step further than you initially thought, resulting in hereby presenting this Urban, Port & Transport economics master thesis, as my best. I earnestly hope that readers of this thesis are able to find the same interest and enthusiasm in this topic as I initially had and that this thesis, through that spirit, has an impact on current academic knowledge concerning this subject.

I would like to express my sincerest gratitude towards my thesis supervisor Dr. Martijn van der Horst for his flexible attitude, elaborate feedback and open-minded vision when guiding me in my master thesis research.

Finally, I would like to thank my family, friends and girlfriend for their unlimited support throughout my study career.

Wessel van den Broek
July 2017

Executive summary

Vertical integration is one of the most hotly-debated topics in academic literature over the past 30 years. In light of globalization and extending firm boundaries many firms do not confide in one sector or one stage of the supply chain to generate revenue, contrarily: they integrate. Though vertical integration is widely-researched and much research has been performed on the effect of vertical integration on firm performance (Forbes & Ledermand, 2010); (Schoenberg & Cartwright, 2006); (Stuckley & White, 1993) many contradicting results are found. In this research's opinion previous research on vertical integration and firm performance coherently lack two important factors. To begin with, the researches fail to create a proper measurement tool for vertical integration. Secondly, firm performance, even to this moment, is conservatively defined as the maximization of the value of only one stakeholder, namely the shareholder. Though in 1988 Clarkson already identified such a single-measurement-mindset eventually is self-defeating.

Consequently, this research will create a vertical integration measurement index, both overcoming the shortcomings of previous measurement tools as well as providing an insight as in the level of integration, making use of the methodology of Davis & Duhaime (1992), Frank & Henderson (1992) and Myopi et al. (2004). Also, this research creates a holistic measurement tool to define firm performance (making use of the methodology by Clarkson (1995) and Santos & Brito (2012)), where firm performance represents the maximization of value for all stakeholders and consequently can be deduced in: financial, organizational and environmental performance.

This research finds a negative relationship between vertical integration and financial & environmental performance, whereas no significant results are found for organizational performance. This negative relationship worsens (i.e. becomes more negative in sign) when the firms are highly and little-vertically integrated.

Important to note that this negative relationship can also be heavily affected by both industry-specific-factors (industry-effect), strategic implications and the product life cycle theory, contributing to the negative relationship between firm performance and vertical integration.

Abbreviations

ADR – American Depositary Receipt

EP – Environmental Performance

FASB – Financial Accounting Standards Board

FDI – Foreign Direct Investment

FP – Financial Performance

GDP – Gross Domestic Product

GMI – Global Mapping International

IV – Instrumental Variables

KLD – KLD Research & Analytics Inc.

M&A – Mergers & Acquisitions

MSCI – Morgan Stanley Capital International

OP – Organizational Performance

R&D – Research & Development

ROA – Return On Assets

ROE – Return On Equity

SIC – Standard Industry Classification

SSIC – Singapore Standard Industry Classification

TCE – Transaction Cost Economics

U.S. – United States

USD – United States Dollar

VI – Vertical Integration

VIF – Variance Inflation Factor

WRDS – Wharton Research Data Services

List of Figures & Tables

1.0 - Introduction

"Who owns the NY Post?- 20th Century Fox. Talk about vertical integration" – said the American actor Joe Pantaliano (known from The Matrix, Memento, The Sopranos). Although not completely accurate, some form of truth can be found in this quote. 20th Century Fox and the NY Post are both owned by American media conglomerate News Corp., also owning: The Wall Street Journal, Fox News, The Sun, The Times, National Geographic, Sky Radio and many other subsidiaries. News Corp. is the striking metaphor for present-day companies. Companies strive for 'growth' and 'success', and when, to their opinion, one of the two is exhausted in their sector, they will move to a new one, or in other words: integrate. While leaving the political consequences of the before-mentioned example to the reader's imagination, much research has been performed on the effect of integration on firm performance (Forbes & Ledermand, 2010); (Schoenberg & Cartwright, 2006); (Stuckley & White, 1993). However, these researches coherently lack two important factors. Firstly, they fail to create a proper measure for vertical integration (when regressing against firm performance). As will be discussed in the Literature Review, either 'ratio-estimates' (Tucker & Wilder 1977);(D'Avenia & Ravenscraft 1994); (Sumner & Wolf 2002) or 'percentage of production in the vertical chain' (Rumelt 1974); (Monteverde & Teece 1982) were used in common literature. Both these measurement variables fail to exogenously and properly represent the degree of vertical integration. Secondly, firm performance, even to this moment, is conservatively defined as the maximization of the value of only one stakeholder, namely the shareholder. Though in 1988 Clarkson already identified such a single-measurement-mindset eventually is self-defeating. Building on Clarkson's (1988) argumentation, this research makes use of a holistic manner to define firm performance, where firm performance represents the maximization of value for all stakeholders. Thus, in that case, results of this research may be interesting to a wide spectrum of stakeholders, such as policymakers, employees, shareholders, environmental and public organizations. Also, to overcome the shortcoming of the improperly used vertical integration measurement variables, this research makes use of research by Davis & Duhaime (1992) and Myopi & Bullington (2004), making use of a widely-used dataset, to create a vertical integration index.

Further building on previous research, the research question of this research will look as follows:

"What is the effect of a vertically integrated supply chain on holistic firm performance, for various stakeholders, in U.S. manufacturing companies?"

The research will be performed in the U.S. manufacturing sector. The manufacturing industry specifically is identified as an important industry when it comes to integration or segregation (MacDonald, 1985); (Caves & Bradburd, 1988); (Weiss, 1992); (Helpman & Grossman, 2002); (Vachon & Klassen, 2006); (Lof & Ostensson, 2017). In this research, the manufacturing industry is chosen because of its overall relevance. To begin with research by Tucker & Wilder (1977) and Lanfontaine & Shaw (2007) indicated both a high degree of vertical integration as well as an upward trend of vertical integration in the manufacturing industry. Following that the manufacturing sector is between the 'origin' and 'destination' of the product and thus two-way, forward and backward vertical integration, accompanied by possible cost reductions are possible: making it a very interesting and relevant sector to research according to Coase's theorem (as will be discussed later). Besides the opportunity to integrate in the manufacturing sector, also the economic societal relevance must not be underestimated. Research indicated that the U.S. manufacturing sector accounts for both a very large share of the generated national GDP as well as employment opportunities. The U.S. manufacturing sector accounts for roughly 12.5% of the U.S. generated GDP, 21.3% of the total (in)direct employment and by distance the largest and most important sector in terms of output, herewith emphasizing on this sector's economic and societal relevance. When comparing the US manufacturing industry with other countries, the US, over the past 10 years, has been the largest contributor in terms of value added (2068.08 billion USD in 2015). (Scott, 2015). These numbers strongly reflect the societal and economic relevance of (vertical integration in) the manufacturing industry.

In the next section, the Literature Review will identify the relevant concepts of ‘vertical integration’ and deduce the created ‘holistic firm performance’. Consequently, the relationship in the current literature between both concepts will be investigated and the manner of vertical integration measurement will be discussed. In the section Data and Methodology, this research will identify the used datasets and consequently the methodology in both creating the ‘vertical integration index’ and the ‘firm performance measures’. Afterwards, this research will present the analyses in the section Results. Following the presentation of results, the results will be discussed in the section Discussion. Finally, proper conclusions will be drawn and limitations & recommendations concerning the research will be discussed in the section Conclusion.

2.0 – Literature Review

In the following paragraph, the literature review of this research is presented. To begin with each of the concepts used in this research will be identified and analysed, secondly the potential relationship existing between the concepts in current literature will be examined.

2.1 - Vertical integration: the concept explained

Vertical integration is a widely-discussed topic in the research literature. All this research is in some form a derivative of the first literature on vertical integration by Ronald H. Coase (1937), currently known as 'the Coase Theorem'; which identifies firms as market players who will select an efficient set of in- and output relations and production-optimal distribution, assuming no transaction costs and complete competitive markets (Coase, 1937). Since then, a rich set of theories has accompanied the Coase's theorem in explaining the concept of vertical integration. The existing literature has focused on a twofold of research questions in effort of explaining vertical integration. To begin with, many literature exists in explaining the circumstances (i.e. types of transactions) that are optimally produced in the firm (i.e. integrate). Secondly, many literature exists on the consequences of vertical integration on both the micro- and macro-environment of the firm (Lanfontaine & Slade, 2007). To examine the concept of vertical integration, it will be in place to first define what vertical integration is, as opposed to the concept of a 'regular' market transaction. A meta-analysis by Lanfontaine & Slade (2007) identifies a firm to be able to choose between the 'market' and 'vertical integration' in each transaction, where a transaction is "an agreement between a buyer and a seller to exchange goods, services or financial instruments" (Lanfontaine & Slade, 2007). Lanfontaine & Slade (2007) make the distinction based on ownership and control rights; when participating in vertical integration ownership is joint and control rights are integrated (in-house), whereas in a market transaction both are separate. Harrigan (1986) makes the distinction between 4 types of integration, namely: forward, backward, horizontal and vertical integration. Forward (backward) integration is to integrate with a business further up (back) in the supply chain.

Vertical (horizontal) integration is to integrate with a business in a different (the same) stage of the supply chain/production process (Harrigan, 1986). The following figure presents a visual representation of the earlier-discussed theory.

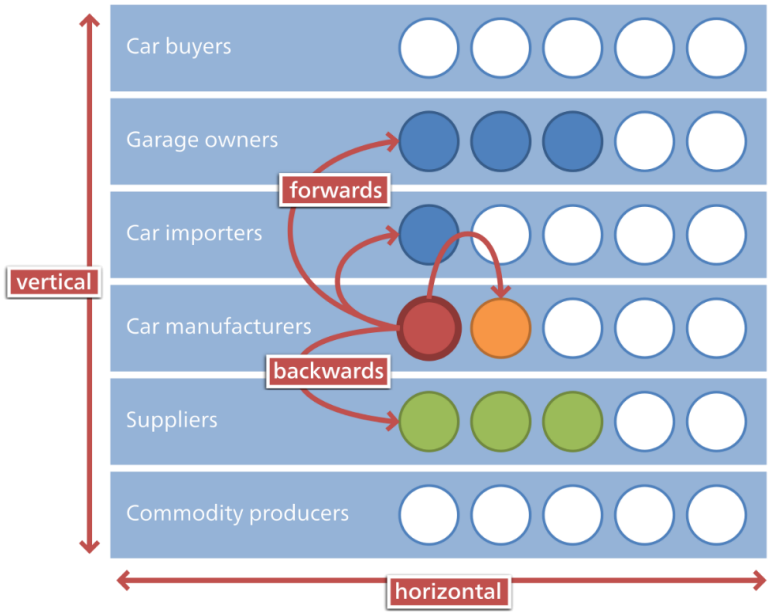

Figure 1 – Types of integration (Bhasin, 2016)

Another well-known and more recent research by Williamson (1989) builds on the Coase Theorem by extending the behaviour of the firm with the concept of transaction cost economics (TCE). In other words, transforming the 'complete and competitive markets without transaction costs' (=Neo-Classical approach) from Coase's Theorem to more 'realistic' markets. Williamson (1989) identified the following differences with the Neo-Classical approach, namely: bounded rationality (vs. rational agents), incomplete contracts (vs. complete contracts), costly transactions (vs. costless transactions) and costly judicial system (vs. costless judicial system) (Williamson, 1989). TCE focusses her attention on how ex-post quasi-rents can create a potential (moral) hazard for long-term contracts (as will be discussed in the coming paragraphs) when contracts are incomplete, agents are bounded in rationality and judicial system is costly. The aim of TCE is therefore to find the discriminating alignment; transactions with different characteristics are aligned with governance structures, which reproduce an efficient, transactions cost economizing way (Whinston, 2003). Promptly, after Williamson's TCE approach, empirical work assessing transaction characteristics and fitting governance structures followed. Research assessing this issue will be discussed in the following paragraphs (2.1.1.).

As discussed in paragraph 2.1, Coase's (1937) and Williamson's (1989) is commonly used to describe and explain vertical integration. However, these theories are not without flaws, research that assesses these flaws is summarized in the research by Masten (1996). Masten (1996) acknowledged that when integration and different theories surrounding integration were a widely-discussed topic, very few research was done into the hurdles and shortcomings of the theories on vertical integration, such as (the most influential) theories of Coase (1937) and Williamson (1989). Masten (1996) mentioned that the known integration theories contain a number of hurdles and shortcomings. These shortcomings are supported by research on empirical studies examining the transaction cost economic theory (TCE), in which very contradicting results are found, that contradict with fundamental TCE arguments (Shelanski & Klein, 1995). The first and foremost criticism of Masten (1996) on Coase's theorem is that it did not provide an assessment of the alternative of governance modes and consequently result in an optimum of governance mode in any given circumstance. Coase's theorem provided a theoretical framework surrounding transaction costs in which the merits of an alternative governance mode could be assessed. However, two problems arise with such a theoretical framework. To begin with, transaction costs in itself can be very difficult to measure; many hazards or effort involved in the exchange is hard to quantify. Secondly, even if all transaction costs could (in utopian) setting be measured, the transaction costs that would have been occurred when the transaction would have been made under a different governance mode, cannot be observed (Masten, 1996). Another criticism of Masten (1996) is on Williamson's (1989) theory, on which Masten (1996) mentions the shortcoming of the underlying assumptions of Williamson's (1989) hypotheses. The assumption underlying the idea that asset specificity favours integration is that i) relationship-specific investments always give rise to opportunism and ii) opportunism is attenuated by internal organizations as opposed to market exchange (Masten, 1996). Masten (1996) finally mentions that most researches (on vertical integration versus firm performance) lack generality and invite for ex-post rationalization; the performed researches are too profound for simple analysis and high-quality case studies would be more in place. Other researches, like Noorderhaven's (1996) research, confirm Masten's (1996) doubt on the traditional transaction cost economics model.

Noorderhaven (1996) gives rise to the idea of making use of 'New Institutional Economics' for analysing governance modes; concepts such as asset specificity, uncertainty and complexity are important factors in determining the governance mode, however many more forces need to be taken into considerations such as power, strategic behaviour, and all other (in)tangible resources used to create a competitive advantage (resource-based-theory, Wernerfelt, 1984) to explain the variability of governance modes (Masten, 1996). Noorderhaven (1996) mentions the need for a behavioural theory of transaction cost economics in order to make the theories more reliable to the practice.

In line with criticism exerted by Masten (1996) and Noorderhaven (1996) on the theories on motives to vertical integration, one last theory should be explained. In research literature, this theory does not have a clearly identifiable origin or name. From this point on, this theory will be referred to as: 'strategic implications theory'. The strategic implications theory evaluates strategic implications as motives to vertically integrate. These motives, different as discussed in Coase's (1937) and Williamson's (1989) theorems, can be identified as a large part of Masten's (1996) and Noorderhaven's (1996) criticism. These motives will be further discussed in section 2.1.1.2.

2.1.1 - Motives of vertical integration

Following the identification of the different specializations of economics/theories committed to explaining the motives of vertical integration, this paragraph will identify the specific motives for vertical integration. Regarding the reader's ease, the distinction between backward and forward integration will be made to divide this section.

2.1.1.1 - Backward integration

Williamson extended his research with the effect of an imperfect market and rational behaviour on vertical integration. He thereby focused on the make-or-buy-decision (i.e. backward vertical integration). Williamson presents three factors to influence the make-or-buy-decision in transaction cost economics: frequency, uncertainty and asset specificity. Frequency is defined as the rate at which specific transactions occur (Williamson, 1989). Uncertainty is defined as the unreliability surrounding a specific transaction, which encompasses three types of uncertainty, namely: primary (state-contingent uncertainty: environmental factors), secondary (information asymmetry: lack of (honest) communication) and tertiary (behavioural uncertainty: moral hazard) (Williamson, 1989). Asset specificity is defined as the degree to which an asset can be redeployed to alternative uses and used by alternative users without sacrifice of productive value (Williamson, 1989). Williamson argued that a higher degree of frequency, will give rise to efficiency advantages (e.g. economies of scale) and thus higher degrees of frequency will lead to 'make' instead of 'buy' (i.e. vertical integration) (Williamson, 1989). This finding is confirmed by Stuckley & White's (1993) empirical research; they find that increased frequency of transactions leads to increased transaction costs and therewith exploitation opportunities (through negotiation). Consequently, they conclude that vertical integration here is in place (Stuckley & White, 1993). Following, Williamson (1989) identified uncertainty to be a motive for vertical integration. Other research by Coles & Hesterly (1997) on the make-or-buy-decision in public and private hospitals, confirmed the expected effect of uncertainty on vertical integration. Finally, Williamson (1989) identified asset specificity as a motive for vertical integration. His research identified 7 types of asset specificity, namely: site (e.g. oil refinery), physical (e.g. specialized component), dedicated (e.g. client-specific investments), human (e.g. human capital investments), temporal (e.g. just-in-time supply chain),

and general (all other cases of) asset specificity. When asset specificity is low, many potential suppliers are present due to the 'ordinarity' of the product, however, if asset specificity is high a bilateral dependency is created. Not only will a supplier be unable to realize equivalent value on the 'outside' market since specialized assets cannot be redeployed, also the buyer must find a potential supplier to make such a specific investment (as can be seen in Figure 2). This transformation from many suppliers to bilateral dependency is called the fundamental transformation and has an expected positive effect on vertical integration (Williamson, 1989). Research by Monteverde & Teece (1982) on vertical integration in the automobile industry, making use of a dataset including Ford and General Motors, indicated that asset specificity, measured in the specificity of the parts, increased the likelihood of in-house production.

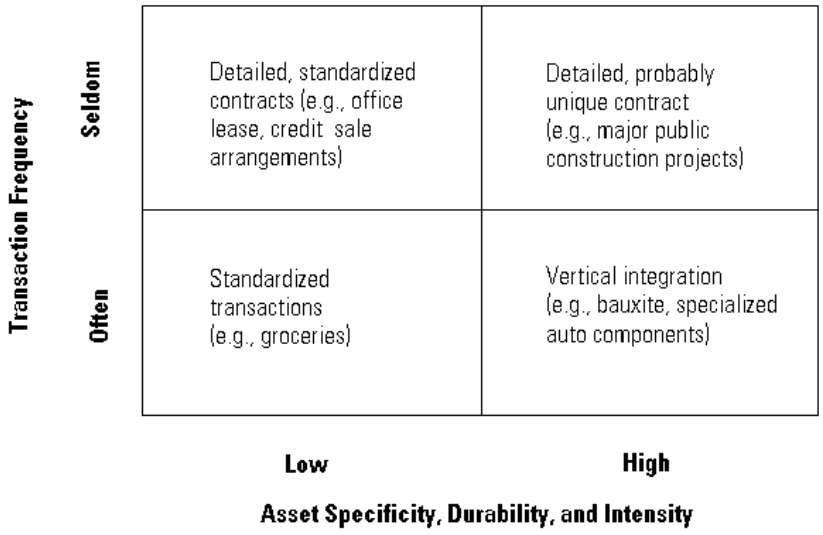

Figure 2 – Asset-frequency matrix (Stuckey & White, 1993)

2.1.1.2 - Forward integration

In the following sections, the motives for franchising (forward integration) are discussed. Making use of the meta-analysis by Lanfontaine & Slade (2007) and other empirical researches, the results are discussed. Research by Lanfontaine & Slade (2007), building on the TCE approach, investigated potential motives to commit to forward integration. Here they found the following factors to influence the motives to forwardly integrate: downstream effort, upstream effort, risk, outlet size, behavioural and output monitoring costs, task diversity, asset specificity,

complexity, uncertainty, brand value and moral hazard. Lanfontaine & Slade (2007) expect that increases in the importance of downstream effort (i.e. retailer effort) will decrease the likelihood of vertical integration and induce franchisees to bargain for higher-powered incentive contracts. Proxies for downstream effort in empirical researches include labour intensity or value addition. Logically, when downstream effort plays an important role in future sales, vertical integration is less likely (Lanfontaine & Slade, 2007). Research on franchising in the restaurant and motel industry found that the rate of franchising is positively correlated with employee-to-sales-ratio (downstream effort) (Norton, 1988). Secondly, Lanfontaine & Slade (2007) found that upstream effort increases the likelihood of vertical integration. The reasoning behind this expected result is involved in the brand value, the upstream company wants to maintain. If much effort is put in the creation of a valuable brand, the potential destruction created by moral hazard (discussed later) is worth more and thus vertical integration is in place. Research by Minkler & Park (1994) on company-owned outlets in the hotel, restaurant and business provider industry found a positive relationship between company-owned outlets (vertical integration) and intangible assets (upstream effort). As the level of risk increases, the assumed risk-averse firms will opt for the less-risky vertical integrated governance mode and thus a positive relationship is expected. Research by Martin (1988) however, on the relationship between company-owned outlets and dispersion in detrended sales (risk) find a negative relationship. Other researches investigating the relationship between risk and vertical integration also find a negative relationship (Lanfontaine, 1992); (Norton, 1988); (Woodruff, 2002). However, this unexpected result can be explained by the lack of a proper proxy for measuring risk, as sales variability is usually used, which makes the proxy endogenous (Lanfontaine & Slade, 2007). Consequently, Lanfontaine & Slade (2007) expect outlet size to have a positive effect on vertical integration, where a larger outlet is accompanied by greater risk, which makes it efficient to integrate (for the risk-averse franchisor). Research on hotel chains and franchising, making use of the number of rooms as a proxy for outlet size find a positive relationship with vertical integration (Kehoe, 1996). Lanfontaine & Slade (2007) also argue that higher task diversity (i.e. multitasking) will decrease the likelihood of vertical integration. Research by Clarissa A. Yeap (2006) on multitasking in restaurant chains find a negative relationship between the percentage of co-owned restaurants and multitasking in the restaurants, arguing that higher task diversity, if not tended to properly, have a large negative effect on the restaurant chain as a whole.

Following the previously discussed concepts of asset specificity and uncertainty in the previous paragraph, Lanfontaine & Slade (2007) expect the complexity of the production process to increase 'specificity' of the process and therefore have a positive effect on vertical integration. Research by Hortacsu & Syverson (2007) on complex inputs in manufacturing firms indeed find a positive relationship.

Another very important concept motive for vertical integration is moral hazard. Moral hazard is defined as a franchisee maximizing his own utility, while not considering the effect on the brand (i.e. free-riding). Moral hazard incentivises, through a combination of reasons, to integrate, namely through: risk, uncertainty and upstream and downstream effort (Lanfontaine & Slade, 2007). Moral hazard is best represented by the following mathematical representation:

$$\text{Total production function: } q = \beta 0 + \beta M\, aM + \beta R aR + u$$

$$\text{Cost of effort: } c(ai) = \frac{1}{2} * (ai)^2, i = M, R$$

$$\pi M = (1 - \alpha)q + W - \frac{1}{2} * (aM)^2$$

$$\pi R = \alpha q - W - \frac{1}{2} * (aR)^2$$

$$S = \pi R + \pi M = q - \frac{1}{2} * (aR)^2 - \frac{1}{2} * (aM)^2$$

$$Where:$$

$M = manufacturer,\ R = retailer,\ aM = effort\ M,\ aR = effort\ R,\ \beta 0, \beta M, \beta R =$ production elasticities, $\alpha =$ division surplus (where $1 > \alpha > 0$), $W =$ fee,

$$\pi M, R = \text{profit under cooperation}$$

$$Optimal\ (non - cooperative)\ effort:$$

$$\frac{\delta S}{\delta aM} => aM = \beta M$$

$$\frac{\delta S}{\delta aR} => aR = \beta R$$

$$Optimal\ effort\ under\ cooperation:$$

$$\frac{\delta \pi M}{\delta aM} = aM = (1-\alpha)\beta \mathrm{M}$$

$$\frac{\delta \pi R}{\delta aR} = aR = \alpha\beta \mathrm{R}$$

Here we clearly see that the effort under cooperation will always be lower than the effort in the optimal (non-cooperative) scenario (i.e. vertically integrated), which thus gives incentive to the franchisee (retailer) to take part in free-riding (i.e. moral hazard).

Following, Lanfontaine & Slade (2007) argue that if the cost of monitoring behaviour of the franchisee is low, more monitoring and therewith vertical integration will be in place. Also, if, as most franchising contracts are based on pay-per-performance (sales volume), the cost of monitoring output (sales) is low, less vertical integration is expected and more monitoring of output (Lanfontaine & Slade, 2007). Indeed, research on output monitoring and behavioural monitoring respectively find a positive and negative relationship with vertical integration, respectively (John & Weitz, 1988); (Lanfontaine & Shaw, 2005). At last, Lanfontaine & Slade (2007) expect the brand value to have a positive effect on vertical integration, where they argue that firms with a high brand value have more incentive to protect the brand against free-riding (moral hazard). These expected results are confirmed by research by Lanfontaine & Shaw (2005), where media expenditure is used as a proxy for brand value and a positive relationship with company-owned outlets (vertical integration) is found.

As mentioned before some motives fall under the strategic implication theorem. The strategic implication theorem is not clearly definable as whether it only accounts for forward or backward vertical integration, as the motives can occur throughout the complete supply chain. Two very important strategic motives for a firm to vertically integrate are economies of scale and scope (Roder, 2007). Economies of scale and scope are formed when the firm (vertically) integrates, which naturally results in a larger company and more resources, where after adequate and improved utilization of those increased resources, size effects can be exploited (Scherer & Ross, 1990). Case research by Roder (2007) on media conglomerates found that content creation requires large incremental up-front costs, however the marginal costs of reaching an extra consumer are negligible (economies of scale), also the R&D, creation costs and other overhead is negligible and comparable for different products.

She found that multiple companies (News Corporation, Disney and Bertelsmann AG) have profited from cost reductions and increased profitability by engaging in vertical integration through economies of scale and scope. Other motives for vertical integration under the strategic implication theory are because of other cost reductions. These cost reductions are obvious, however still worth to be mentioned. These cost reductions entail cost reductions because of elimination of markups in each productions step and cost reductions as a result not allocation resources to pricing, contracting, paying, and coordinating with third-party vendors (Roder, 2007).

Mahoney (1992) also mentions the importance of strategic considerations in the choice of vertical integration. Vertical integration may be used to create barriers to entry the market and foreclosing competitors. By reducing the number of suppliers, one can increase their rivals' costs, moreover by combining two stages of the production process companies can induce large capital requirements when willing to enter the market, therewith creating a barrier to entry (Mahoney, 1992). Another concept closely linked these strategic implications is 'price squeezing'. Vertical integration ownership allows firms to simultaneously lower the price of the output while increasing the price of the input. Independent operating firms in the 'middle supply chain' (i.e. between output and input) are 'squeezed out' (Joskow, 1985). The strategic vertical integration considerations also have a downside. Vertical integration requires investment to ensure the stability of operations, it however also heavily affects the organization's flexibility. The investment in specific and specialized assets cause sunk costs, physiological commitment and administrative difficulties of divestments which all lead to excessively high exit barriers, reducing the organization's strategic flexibility (Mahoney, 1992). Another theory supported by the downside of the strategic vertical integration implications is the theory of bureaucracy costs (D'Aveni & Ravenscraft, 1994). The savings of vertical integration may be (party) overshadowed by the increase in overhead and bureaucracy costs associated with the increasingly difficult internal coordination. By integrating away from a firm's core business, an increase in the distance of most subordinates from their superiors is created and, hence, communication distortion and therewith bureaucracy costs occur. Also by controlling these new operations, investments are required and administrative overhead costs increased; raising the costs of production (D'Aveni & Ravenscraft, 1994).

It is therefore very important to note that the strategic implications of vertical integration may cause effects to backfire. Certainly, the strategic implications may cause to negatively affect the firm's (financial) well-being in the short run (to improve in the long run). Vertical integration should, therefore, be correctly classified as a strategy (Oster, 1990).

In the past paragraphs, this research investigated different motives to perform in (forward and backward) vertical integration, an overview of the motives can be found in Table 1.

Factor	Effect on VI	Confirmed by literature
Frequency	+	YES
Uncertainty	+	YES
Asset specificity	+	YES
Downstream effort	-	YES
Upstream effort	+	YES
Risk	+	NO
Outlet size	+	YES
Behavioural monitoring costs	-	YES
Output monitoring costs	+	YES
Task diversity	+	YES
Complexity	+	YES
Brand value	+	YES
Moral hazard	+	YES
Economies of scale	+	YES
Economies of scope	+	YES
Cost reductions	+	YES
Strategic flexibility	-	YES
Bureaucracy costs	-	YES

Table 1 – Factors affecting VI

2.1.2 - Measurement of vertical integration: the transformation

In the following paragraph, this research will identify possible techniques to measure vertical integration and reason which technique will be most probable to be used in this research. Throughout the existing literature globally 2 measurement techniques are used when it comes to measurement of 'integration', namely: 'ratio-estimates' and 'percentage of production in the vertical chain'. Ratio-estimates make use ratios, such as 'value added over sales', which are assumed to be moving consistently with the number of production process that is performed in-house (i.e. vertical integration), researches such as Sumner & Wolf (2002), D'Avenia & Ravenscraft (1994) and Tucker & Wilder (1977) make use of this technique. The drawbacks with this technique, however, is that the ratio is influenced by other factors than vertical integration (such as profitability) and the ratio is greater when a firm is nearer to the end of the production process, as value added tends to be larger at primary level (Maddigan, 1981). Another technique is to make use of a percentage of the product that is produced in the firm's vertical chain to reflect vertical integration. This technique makes use of a more direct manner to identify vertical integration, as used by researches such as Monteverde & Teece (1982) and Rumelt (1974). The problem with this measurement technique, however, is the fact that it tends to both consider vertical and horizontal integration. As a firm horizontally integrates the percentage of the products produced in the vertical chain (e.g. in-house) can increase (measurement variable for vertical integration increases) while the vertical integration index should remain the same (Maddigan, 1981). As in this research, the effect of vertical integration instead of total integration should be identified, this technique will not be used. Following Adelman's (1955) seminal methodology and consequently Maddigan's (1981) improvements, based on national input-output tables, the 'vertical industry connection index' arose. This index specified revealed in which industries a firm operated and making use of national input-output tables vertical interdependencies could be identified and an index for vertical integration could be established (Bhuyan, 2005). Following Maddigan (1981), Frank & Henderson (1992) and Davis & Duhaime (1992) improved Maddigan's methodology by making use of SSIC-codes to identify the degree of relatedness and vertical integration in the production process (Bhuyan, 2005).

This method is based on the idea that vertical integration is revealed by larger flows of output that take place within a firm's different plants in successive stages of production and distribution, something that is represented by SSIC-codes (Bhuyan, 2005). Research by Davis & Duhaime (1992) indicated that each company, in the Compustat-Segments dataset, is divided into at least 1 business segment (SSIC1) and at most 2 business segments (SSIC1 and SSIC2), depending on the number of lines of product and/or service the company offers, as represented in the company's annual report. Paragraph 11 of FASB 14 (Financial Accounting Standards Board), mentions:

"The reportable segments of an enterprise shall be determined by (a) identifying the individual products and services from which the enterprise derives its revenue, (b) grouping those products and services by industry lines into industry segments, and (c) selecting those industry segments that are significant with respect to the enterprise as a whole" (FASB 14, paragraph 11, p. 8)

Davis & Duhaime (1992) conclude that the FASB definition specifies that segments should be formed such that they provide products or services to unaffiliated customers. Therefore, any vertical integration (products and services provided to affiliated customers) should be aggregated within the segment of the end product for purpose of reporting and disclosure; where the SSIC must represent the integration in this line of products and services. The SSIC code consists of a 4-digit number, assigned by the Compustat staff, resembling a business segment. Their research also indicated that if a company has to business segments; there must be a relationship between them. Consequently, they concluded that if both business segment 1 and 2, are similar at a 2-digit level, it can be said that these business units are similar as in activities undertaken (i.e. 3322-Malleable Iron Foundries and 3324-Steel Investment Foundries). However, if the business segments of the same company differ at a 2-digit level, integration can be assumed (i.e. 2200-Textile Mill Products and 2330-Women's Apparel) (Davis & Duhaime, 1992). Following the identification of integration, the level of integration has to be established. Making use of the methodology of Davis & Duhaime (1992) and Myopi & Bullington (2004) the level of integration will be assessed.

In their research, the level of integration will be presented by creating an index, where they divide the integrated segments by the total number of segments.
As can be concluded from this paragraph, different measures exist to assess vertical integration. This research will make use of the methodology Davis & Duhaime (1992) and consequently the measurement index of Myopi & Bullington (2004) to assess the level of vertical integration. This method is not biased by making use of endogenous elements such as 'sales' and 'value added', and does not incorporate horizontal integration by not building conclusions on 'percentage of production in the vertical chain'. Appropriate usage of these methodologies will be further discussed in the section Methodology.

2.2 – The relationship between vertical integration and firm performance re-investigated

In the following paragraph, the relationship between vertical integration and firm performance will be established. To begin with, the concept of firm performance is explained. Following this definition, the relationship between vertical integration and the different dimensions of firm performance will be investigated.

2.2.1 - Firm performance

In the following section, the concept of firm performance will be investigated in existing literature. Clarkson (1995) was the first to acknowledge that corporate social performance fulfilled an extremely important role in firm performance, however was still unidentified in existing literature. He mentioned the (thereupon) corporate success to be limited in satisfying in and creating wealth for only one stakeholder, namely the shareholder. However, it is found that this single-measurement-mindset eventually is self-defeating (Clarkson, 1988). Clarkson (1995) continued the argumentation; the main social and economic purpose of corporations is to create and distribute wealth for their primary stakeholders. He identifies corporate social performance to holistically resemble the performance of the firm on 'social issues'. Many existing research papers in this field struggle to narrow down this concept and therefore many definitions exist.

As mentioned before, Clarkson (1995) presented corporate social performance as the performance in satisfying each stakeholder adequately without favouring one over another, the stakeholders being: companies, employees, shareholders, customers and public stakeholders, and as such affect company success; this is currently known as the 'stakeholder approach to firm performance'.

Santos & Brito (2012) build on Clarkson's (1995), and other, research, in creating a measurement model for firm performance. Santos & Brito (2012) conclude their model to be a model of multi-dimensionality, with three dimensions. As can be seen in the figure below, the third-order dimensions, although different from each other are symptoms of a general higher (first-order) dimension, namely: firm performance. Within firm performance, there exist two second-order dimensions, consequently representing different symptoms: financial and strategic performance. The third-order dimensions are the dimensions that are measurable. Also, indicated by Santos & Brito (2012), they provide several fitting indicators in explaining and representing these third-order dimensions. Summarizing their methodology, one can find a visual representation in Figure 3.

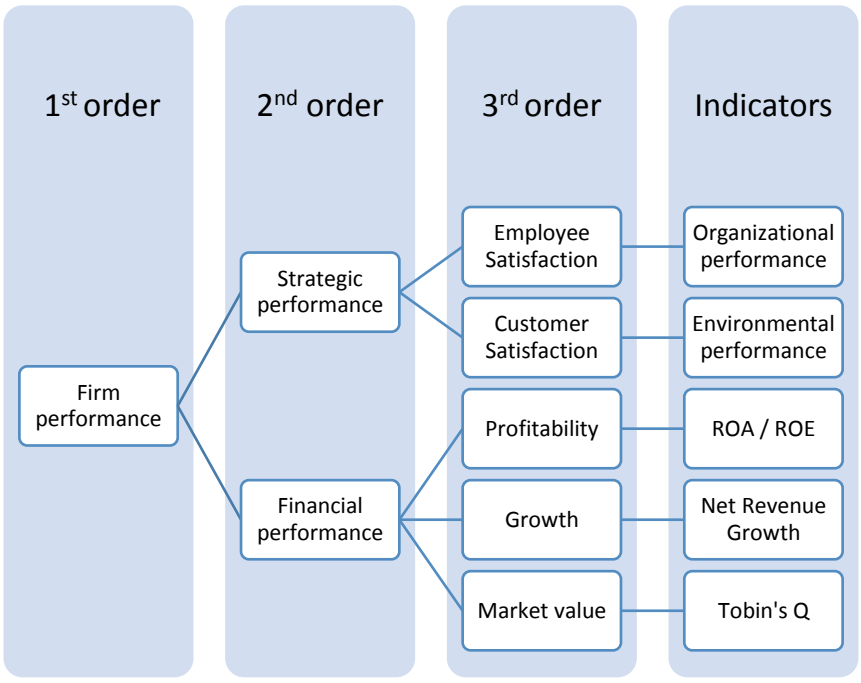

Figure 3 - Firm Performance Measurement Model (Santos & Brito, 2012)

This research aims at internalizing each stakeholder in one of the different firm performance measures in the following manner (stakeholder theory) and makes use of Santos & Brito's (2012) model to identify the different 'symptoms' and their fitting indicators and Clarkson (1995) and Santos & Brito (2012) to identify stakeholders. Consequently, three performance measures are created that subsequently satisfy the stakeholder issues. The measurement variables of the performance measures will be clarified in the following paragraphs. The following table identifies the primary stakeholder issues and consequently their performance measure, as discussed in the next paragraphs, per stakeholder, as derived from Clarkson (1995) and Santos & Brito (2012).

Stakeholder	**Organizational performance**	**Financial performance**	**Environmental performance**
Company		V	
Employees	V		
Shareholders		V	
Customers			V
Public	V		V

Table 2 – Stakeholders in firm performance

2.2.1.1 - Financial performance

In the following section, the relationship between vertical integration and financial performance and the measurement of financial performance will be investigated in existing literature. Though one would expect a significant body of literature existing around the relationship between vertical integration and (financial) performance, the opposite is true. This lack of research literature on this specific relationship has two reasons. To begin with, it proves very difficult to gather data on the organizational form of a firm. Secondly, as mentioned before in section 2.1.2, firm boundary decisions will be typically endogenous with firm performance (Forbes & Ledermand, 2010). However, in the literature that does exist, very contradicting results are found. Levin (1981) in his research into U.S. oil & refining companies reviewed 53 large oil companies' annual reports over 25 years. Also, making use of in-/output methodology, Levin is able to create an instrumental variable for vertical integration. His research finds that there exists a negative relationship between profitability and the degree of vertical integration. This result is unexpected in the previously-discussed theories, as one would expect each firm to choose its organizational structure generating the most optimal payoff (Coase, 1937). Levin (1981) concluded that the data in his sample (post-WO-II era) was subject to unique circumstances, such as price and allocation controls on crude oil and the absence of market clearing. During this uncertain time, vertical integration was used as a protective measure, rather than wealth-increasing measure. From this research, we see a clear example of strategic implications, affecting the degree of vertical integration where short-run losses are undergone to survive in the market.

Research by Buzzell (1983) investigated the relationship between vertical integration and portability, this author investigated 1964 manufacturing processing units and found a negative relationship between the two concepts. Buzzell (1983) mentions that, in his research, the cons of vertical integration (financially) outweigh the pros. He also mentions that, unless the company gains much insurance (less uncertainty) as well as costs due to the vertical integrated acquisitions, the strategy of vertical integration is not worth it.

Other research, however, investigating the same relationship, however, making use of a widely different instrumental variable for profitability (Standard&Poor's stock rating) in the same sector (U.S. oil & refining) found a (weak) positive relationship of vertical integration of stock ratings.

Other research performed by Vickery & Jayaram & Droge & Calantone (2003) on vertical integration in the supply chain and financial performance, focus on the automotive sector, making use of a dataset of 150 first tier automotive suppliers in North America, making use of moderating variables. Here the research finds that financial performance is positively correlated with supply chain integration, through the moderating variable customer service. Vickery & Jayaram & Droge & Calantone (2003) indicated that existence of cooperative purchasing/supplier relationships enhanced the service quality to internal customers (integration). This enhancement, in turn, affected the ability to deliver service quality to external customers. One can conclude from this section that many contradicting research results exist in relevant literature, however, as basing this research's arguments on the fundamentals of vertical integration (Coase, 1937), this research expects the following to be true:

H1: The degree of vertical integration will be positively correlated with financial performance

2.2.1.2 - Organizational performance

In the following section, the concept of organizational performance will be defined and the relationship with vertical integration will be discussed.
In this research, organizational performance will thus resemble the satisfaction of employees. There are many different concepts and definitions resembling the social issue of employee satisfaction, however, one concept is defined as most fitting by Clarkson (1988) namely: employee relations. Employee relations is defined by Clakson (1988) as all interests in:

"Communications with employees; training and development; career planning; retirement and termination counseling; layoffs, redundancies, and plant closings; stress and mental health; absenteeism and turnover; health and safety; employment equity and discrimination; women in management; performance appraisal; day care" (Clarkson, 1988)

As there has never been an acknowledged identification of organizational performance, little to no research has been done towards the effects of vertical integration on organizational performance.

Mergers & Acquisitions (M&A) is the concept of integration, in any manner, in purpose of wealth creation (Schoenberg & Cartwright, 2006). As M&A research represent integration in any direction (horizontal and vertical) this will not provide the most optimal results when assessing the effect of vertical integration on firm performance. Also, M&A evolves around companies (friendly or hostile) acquiring other companies, thus do not account for a company expanding his current supply chain to other departments and assertively integration within the firm. However, due to the lack of research evidence in the relationship between these firm performance concepts and vertical integration, M&A research evidence will be used, relying on their resemblance with (vertical) integration.

Research by Cartwright & Cooper (1992), identified mergers and acquisition to weigh heavily on the employees. Cartwright & Cooper (1992) mentioned mergers and acquisitions to: i) emotionally and potentially stressful, ii) create an expectancy of change for employees, iii) management teams are overconfident in the estimation of speed and ease with which they achieve integration and iv) result in unplanned losses on all departments, which apart from talent loss, result in demotivation. Mergers and acquisitions as indicated by Marks & Mirvis (2011), can possibly go accompanied by the 'Merger Syndrome'. The Merger Syndrome is a fusion of uncertainty and the likelihood of change. This syndrome, fuelled by change and uncertainty, produces stress and ultimately affects judgments & perceptions, interpersonal relationships and other developments in the combination of both. At the organizational level, the Merger Syndrome is manifested by lessened communication and increased centralization. All of this incentivizes worst-case-scenario-thinking and distracts employees from regular activities, eventually leading to obstruction in integration in reduced productivity.

From research can be concluded that organizational performance is very difficult to define and therefore little research in the effects of vertical integration on organizational performance has been performed. However, from research into mergers and acquisitions, one can conclude that change in organizational structure, as a consequence of some form of merger or acquisition, will have, through theories like the 'Merger Syndrome', potentially very destructive effects on employees and thus a firm's organizational performance. This leads to the first hypothesis:

H2: The degree of vertical integration will be negatively correlated with organizational performance

2.2.1.3 - Environmental performance

In the following section, the relationship between vertical integration and environmental performance will be assessed. To begin with, environmental performance will be defined as a concept, following the relationship with vertical integration will be analysed.
As mentioned before in section 2.2.1.3, environmental performance is also part of the concept of corporate social performance and is of great importance to several stakeholders. Again, many different definitions and explanations of environmental performance exist in the prior literature. Lober (1996) describes that many customers have a judgement ready as in which companies are 'green', however, no proper definition of 'greenness' exists. Thus, to define the concept of environmental performance, a first step into the definition of 'green' versus 'non-green' companies has to be made. A widely-used approach to identify environmental performance in a company is by making use of Ceres' principles, as designed by Metcalf et al. (1995). This methodology provides 10 principles in which 'green' companies should invest, namely: minimize pollutants, conserve resources, reduce waste, conserve energy, market safe products, compensate for damage, disclosure potential hazards, obtain management commitment and evaluate progress (Metcalf, 1995). Lober (1996) suggests, building on the ten principles, that companies can make use of four dimensions when considering their environmental effectiveness, namely: "i) how well an organization meets its stated goals (output-based approach), ii) how organizations capture resources to gain competitive advantage (system resource-based approach), iii) information flows and employee communication (internal processed-based approach) and iv) the degree to which stakeholder needs are met (strategic constituency-based approach)" (Lober, 1996). Again, when considering environmental performance little to no research has been performed on the relationship with vertical integration and again research literature of M&A is used. Research by Deng et al. (2012) review two contradicting theories, namely the stakeholder value maximization and stakeholder expense theory. The first theory assumes that firms with a high environmental performance, value other stakeholders than themselves and thus participate in mergers that maximize stakeholder's satisfaction and eventually benefit the shareholders. The stakeholder expense view suggests that firms increase environmental performance at expense of shareholders and thus mergers taken by these companies, reduce shareholder wealth.

By making use of a dataset of 1556 U.S. companies and an KLD index to represent the environmental performance (similar as in this research), they find strong evidence of the environmental performance having a significant positive effect on announcement stock returns and the value-weighted portfolio of the acquirer and the target, post-merger operating performance and long-term stock returns. Furthermore, they find that mergers performed by companies with high environmental performance take less time to undergo and are less likely to fail. Concluding the existence of the stakeholder value maximization (Deng, Kang, & Low, 2012).

From this paragraph can be concluded that ten principles and four dimensions exist to define and evaluate environmental performance, respectively. Following from literature research into mergers and environmental performance, one can prudently conclude a positive relationship. Consequently, the following third research hypothesis is formed:

H3: The degree of vertical integration will be positively correlated with environmental performance

3. 0 - Data

In the following section, the data that will be used in this research will be presented, following from the data analysis the methodology of this research is identified.
In this research, there will be made use of two datasets, namely: Standard & Poor's Compustat and the MSCI database. All these datasets are available to students making use of the EUR-WRDS access account.
Standard & Poor's Compustat is a database designed by the company Standard & Poor's, an American financial services company, that provides market, financial and statistical information on (in)active companies all over the world. The database is a time-series database, where specific companies are closely monitored over the years, with the earliest information dating back to 1962. Compustat covers over 88.000 global securities and 56.000 companies globally (Standard & Poor's, 2017). Compustat is regularly used by many different stakeholders, ranging from investors, bankers, advisors and researchers. The dataset consists of three sub-divisions, namely: fundamentals, integrated databases and proprietary data. The fundamentals database provides us with long-term datasets of several different regions (North America, Global and International); very suitable for analysis over time and/or macro-analysis (between companies). The integrated databases provide us with monthly and daily pricing data and other investor information, this database is usually used by investors to analyse investment opportunities. The proprietary data is a combination of data that provides use with: industry surveys, stock reports and other qualitative data. Compustat is widely used in purpose to identify financial performance in companies (Waddock & Graves, 1997); (Fullerton, Watters, & Fawson, 2003); (Uotila, Maula, & Keil, 2009); (Akisik & Gal, 2017).
For our research, we will make use of two specific sub-division of the Compustat database: Compustat-Segments and Compustat-Fundamentals (North America). The Compustat-Segments database allows us to make segments based on Standard Industry Classification (SIC) codes and consequently provides us with Ticker codes. This specific segmentation will be further discussed in the Methodology section. Compustat-Fundamentals (North America) provides us with data of U.S., Canadian and American Depositary Receipt (ADRs), which are non-U.S. companies that trade U.S. securities, in a calendar year.

The North America database specifically is used for her extensive information over time and diversity of measured variables, as opposed to the other datasets (Global and International).
The second database used in this research, the MSCI (formerly the KLD and GMI) database is a database, by the KLD Research & Analytics Inc., representing over 3100 US corporations and providing over 80 indicators in the 7 researched fields of: community, corporate governance, diversity, employee relations, environment, human rights, product (NTU Libraries, 2015). The MSCI database is constructed from both qualitative (i.e. company announcements, media publicity) and quantitative data (i.e. annual reports). The MSCI database also is a time-series database with data ranging from 1991 to the most current data in 2015. The MSCI is most often used to analyse the social, environmental, governance and sustainability markers of these 3100 US corporations. KLD makes use of a number of positive (i.e. strengths) and negative (i.e. concerns) indicators. Each indicator is summarized in the MSCI database as a binary variable to reflect whether the company participates in the criterion (positive/negative) or not (Semenova & Hassel, 2014). For example, in the division environment; energy efficiency is a strength and hazardous waste is a concern, where companies can participate in both concern and strengths at the same time. Besides the above-mentioned business issues, the dataset also represents specific controversial business issues, namely: alcohol, firearms, gambling, military, nuclear power, and tobacco. In line with previous research, making use of a KLD environmental/organizational ratio, only the dimension 'environment' and 'employee relations' will be used (as further explained in section 4.2), the controversial business issues will be excluded from this research due to their non-informative aspect on the other dimensions (Galema, Plantinga, & Scholtens, 2008).
The data, for this cross-sectional analysis, will be gathered in the year 2015 (most recent data). Compustat-Segments does not provide us with the SSIC codes per year, and if multiple years are entered, all SSIC codes that the company is/was involved in will be presented (even if that product line is stopped). Due to this fact, the research methodology of Davis & Duhaime (1992) and Frank & Henderson (1992) will result not reliable vertical integration indices, as the vertical integration index, in that case, will represent the integration index, if all product lines that have ever been undertaken (also currently inactive product lines) would be considered. For this reason, cross-sectional analysis over time-series analysis is chosen.

In addition, cross-sectional over a time-series analysis is chosen as it is more imprecise to correct for company-specific-characteristics (time-series) than for time-specific characteristics (cross-sectional). This choice is in line with other research, as other researches making use of the vertical integration index, also choose cross-section over time-series (Lamont, 1997) (Myopi, 2003); (Bhuyan, 2005). The organizational and environmental performance of the firms in the dataset will not change rapidly over the years, however to account for the volatility of the financial variables, multiple financial measures are created.

4.0 - Methodology

In the following paragraph, the methodology that will be used in this research will be clarified. To begin with, the operationalization of the concept of vertical integration will be explained, followed by the operationalization of firm performance. Finally, the control variables used in this research will be discussed, following the presentation of the variable overview and used models.

4.1 – The vertical integration index: a new approach

As mentioned in the Theoretical Framework to identify the concept of vertical integration the research of Davis & Duhaime (1992) and Frank & Henderson (1992) is used, following the degree of vertical integration is investigated making use of the research by Myopi & Bullington (2004). As indicated by the methodologies, used in research of Davis & Duhaime (1992) and Frank & Henderson (1992), a dataset has to be created with companies, of which each company has at least two business segments. Vertical integration can only be measured when the option of vertical integration is present (i.e. at least 2 business segments). As also reasoned in the Introduction the manufacturing sector is chosen as sample sector due to its societal, economic and research relevance. For this reason, each company in the final dataset has to be present in the manufacturing sector and must thus have standard industry classification (SIC) between 2000-3999 (Sic Codes, 2017). As this research is focused on the relevant data, all companies in the dataset must be still active in the industry, as (in)active companies could corrupt the data. In light of workability reasoning, a random sample of 168 companies is extracted from this extremely large dataset, by making use of the Excel Random function.
Following this dataset, the segment standard classification 1 and 2 per company (SSIC 1 and 2) has to be found by making use of the Compustat-Segments dataset. As mentioned before, research by Davis & Duhaime (1992) and Frank & Henderson (2009) indicated that each company, in the Compustat-Segments dataset, is divided into at least 1 business segment (SSIC1) and at most 2 business segments (SSIC1 and SSIC2), depending on the number of lines of product and/or service the company offers. If the SSIC codes differ at 2-digit level integration can be assumed and if the SSIC codes are similar at 2-digit level similarity can be assumed. Following this identification of integration, the level of integration has to be established.

Making use of the methodology of Myopi et al. (2004), the level of integration will be presented by creating an index, where this research divides the integrated segments by the total number of segments. As an example, let us review the manufacturing company LVHM (Louis Vuitton Moët Hennessy), who besides women's accessories also manufactures jewellery, spirits and writing accessories:

SSIC1	**Business SSIC1**	**SSIC2**	**Business SSIC2**	**Vertical Integration?**	**VI-INDEX**
2084	Wines, Brandy, and Brandy Spirits	*2085*	Distilled and Blended Liquors	NO	
2330	Rubber and Miscellaneous Plastic Products	*3171*	Women's Handbags and Purses	YES	
2721	Periodicals: Publishing, or Publishing and Printing	*2711*	Newspapers: Publishing, or Publishing and Printing	NO	
3873	Watches, Clocks, Clockwork Operated Devices, and Parts	*3911*	Jewellery, Precious Metal	YES	
5311	Department Stores	*5632*	Women's Accessory and Specialty Stores	YES	
					(3/5)=0.6

Figure 4 - LVHM Case example

In the example above one can clearly identify where the vertical integration is taking place, namely: LMVH manufactures her own watches and handbags/purses (2330&3771 and 3873&3911) and has own retail stores (5311&5632).

Another example would be Shell, which is considered to be a very vertically integrated firm:

SSIC1	Business SSIC1	SSIC2	Business SSIC2	Vertical Integration?	VI-INDEX
1311	Crude Petroleum & Natural Gas	*4922*	Natural Gas Transmission	YES	
2911	Petroleum Refining	*2800*	Chemical & Allied Products	YES	
4991	Co-Generation Services & Small power suppliers	*7375*	Information Retrieval Services	YES	
					3/3=1

Figure 5 - Shell Case Example

In the previous example one can identify that Shell is very vertically integrated as she: collects, refines, transports and distributes oil (products) and chemicals (1311&4922 and 2911&2800), also Shell operates in co-generation (surplus of energy from factories redistributed to private users) which is integrated with their information technology department (4991&7375). In this methodology, the VI-index represents the level of integration, the closer to 1; the higher the level of vertical integration.

4.2 – Holistic firm performance measurement tools

Following the identification of vertical integration, the independent variable, the indicator variables for firm performance have to be established. As mentioned before in section 2.2.1, this research will make use of a holistic firm performance measurement tool, as indicated by Clarkson (1995) Santos & Britos (2012). Firm performance will be measured by making use of the following dimensions: financial, organizational and environmental performance. All companies from the final (Compustat) dataset will be linked to the MSCI database, based on their ticker symbol. The ticker symbol is a unique arrangement of characters representing a specific company. Following the linking of the companies, the organizational (OP) and environmental performance (EP) of the companies have to be examined. The MSCI database has been widely used in common literature to acquire the organizational and/or environmental performance. The common methodology is to aggregate both the concerns and the strengths (from the needed dimensions) and consequently subtract the concerns from the strengths, to acquire one environmental/organizational performance index, such as in Griffin & Mahon (1997); Waddock & Graves (1997); Hillman & Keim (2001); Chatterji et al. (2009); Statman & Glushkov (2009); Semenova & Hassel (2014). All zero values will be dropped from the calculation, as many researches share their doubt in whether these companies have been properly researched by KLD Research & Analitics (Statman & Glushkov, 2009). Following this methodology, a higher OP/EP will be reflected by a higher index. At last, the dimensions used to calculate both the OP/EP index have to be identified. To calculate the EP index the dimension environment is used, subsequently identifying the firm's strength and weaknesses in: environmentally friendly products, renewable energies, recycling, pollution prevention, energy efficiency, and environmental policies and programs (Semenova & Hassel, 2014). To calculate the OP index the dimension we follow methodology from Derwall & Verwijmeren (2010) making use of the dimensions employee relations and consequently identifying: (i) the firm's decisions and penalties involving employee safety, (ii) the degree to which employees are involved in the firm, (iii) the strength or weakness of the retirement benefits program, (iv) profit sharing programs, (v) work reduction policies, and (vi) a firm's relations with unions (Derwall & Verwijmeren, 2010).

At last the measurement indicators for financial performance have to be established. Financial performance is a very broad concept to define, especially when it comes to measuring this concept. As there is not one specific variable that represents 'financial performance', in all cases one can conclude to use an instrumental variable. All instrumental variables are categorizable in three broad areas, in order of macro to micro analysis respectively: environment, strategic and organization (Capon, Farley, & Hoenig, 1990). Environmental instrumental variables (IVs) are IVs that are measured at industry-level and are defined as developments in the industry which have a positive impact on the firm and in turn on the firm's financial performance, e.g. industry growth, industry advertising, industry dispersion and industry entry barriers. Strategic IVs, measured on the firm level, are variables that variables that affect the firm directly and therewith affect financial performance, e.g. research & development, firm advertising and market share. Organization IVs (the most micro analysed instrumental variables) are variables, measured at firm-level, which follow from organizational choices of the firm that affect financial performance, e.g. capacity utilization (Capon, Farley, & Hoenig, 1990). Considering the reliability of the research, it would be valuable to include an instrumental from each area. Unfortunately, as discussed in the section Data, Compustat only provides us with firm-level data on firm-specific strategic data, for this reason, this research will make use of strategic IVs. Besides the areas in which an IV can exist, from also the specific measurement has to be investigated. Orlitzky, Schmidt and Rynes (2003) in their research have identified three subdivisions in which financial performance can be measured (applicable to all areas), namely: market-based (investor returns), accounting-based (accounting returns) or perceptual-based (survey) measurement. Perceptual-based is the most subject manner to measure financial performance and when possible, one should first try to exploit other measurements. Again, considering the reliability of this research both accounting-based measurements and market-based measurements will be included in the measurement of financial performance. In light of the used methodology of Santos & Britos (2012), several example indicators are provided in this research for the third dimension of growth, market value and profitability, which together form the second dimension of financial performance. Consequently, three indicator variables are chosen, which respectively: are strategic instrumental variables and of which several result from accounting-based measurements and market-based measurements.

Following this research confides in four strategic instrumental indicator variables for financial performance: return on assets/return on equity/net revenue (accounting based measurement) and Tobin's Q (market-based measurements).

4.3 - Control variables

In this research, several variables will be used to control for confounders affecting the relationship between vertical integration and firm performance. To begin with, the two control variables present in all regressions will be discussed, namely: firm size and risk. As discussed in previous research, discussed in section 2.1.1, firm size, through other factors, has an effect on vertical integration. Lanfontaine & Slade (2007) discuss outlet size and asset frequency (also related to size) to have an effect on the level of vertical integration. Also, as discussed in other research, firm size can have a significant effect of FP/OP/EP. Wu (2006) discusses larger firms to have more resources available and therefore have more opportunity to engage in organizational, financial and environmental investments, in comparison to smaller firms. Burke, Reiner & Logsdon (1990) discuss the effect of stakeholder demands and consequently a firm's strategic response. As discussed earlier, a firm will engage in improving any of the second-order dimensions because of the demands of the several stakeholders (Table 2). Burke, Reiner & Logsdon (1990) mention that larger firms attract more attention of the society, and therefore have more stakeholders, on whose demands they have to respond more openly than small firms. In line with previous research, making use of the Compustat database, the natural logarithm of total assets will be used to operationalize firm size (Anderson & Reeb, 2003); (Han, 1998); (Orlitzky, Schmidt, & Rynes, 2003).

The second control variable used in all regressions is risk. Again, as discussed in Lanfontaine & Slade (2007) (although not widely confirmed by literature) risk can have an effect on the level of vertical integration, assuming that risk-averse firms will tend to opt for the less risky vertically integrated governance mode. Several researches discuss how risk affects financial performance (Waddock & Graves, 1997); (Mahoney, Fauzi, & Rahman, 2009); (Cai, Jo, & Pan, 2012). From these researches can be concluded that risk affects financial performance via two manners.

To begin with, risk forces the firm to take decisions that could be harmful to stakeholders in order to not default.

Secondly, it provokes competitors to acquire a larger market share, at the cost of the debilitated condition of the firm. Also, research confirms the relationship between environmental/organizational performance and risk (Aupperle, Hatfield, & Carroll, 1985); (Husted, 2005) (Jo & Na, 2012). Two explanations can be given for this relationship. Firstly, engagement in environmental or organizational performance investment, or any other investment that improve the well-being of stakeholders or society at large, will infer 'insurance-like-benefits', i.e. by engaging in creating moral capital, a firm can create an insurance-like-protection, and lower risk, for their relationship-based intangible assets and this protection contributes to a higher stakeholder wealth (Godfrey, 2005). Secondly, several researches conclude that engagement in environmental/organizational investments decrease the cost of cost of equity (Chava et al., 2010); (Dhaliwal et al., 2011) and decrease the cost of debt (Chava et al., 2010); (Goss et al., 2011). Because the reduced cost of capital is highly related to the risk of a firm, this factor should be considered. In line with previous research, risk will be operationalized by calculating the ratio of total debt over total assets (Mahoney, Fauzi, & Rahman, 2009); (Waddock & Graves, 1997).

Two control variables that will be included in the financial performance regressions are average sales and capital structure. Sales is a common measurement of transactions within a firm. As discussed in Lanfontaine & Slade (2007), asset frequency (=sales) affects the level of vertical integration. In line with previous research sales will be operationalized by taking the average of sales of the past 4 years (Mahon & Griffin, 1997). In accordance with the pecking-order theory, firms are assumed to prefer internal financing over external financing and firms, therefore, prefer internal financing over debt over equity issuance (Myers & Majluf, 1984). Research confirms the relationship between financial performance and the debt-equity-ratio, where equity issuance is used to improve financial performance (Bhandari, 1988). Also, however, in the same line of reasoning as the 'risk' control variable, companies that are too leveraged (rely too much on external financing) put themselves at risk, which can affect the choice of vertical integration (Lanfontaine & Slade, 2007).

The regression of organizational and environmental performance will also contain two extra control variables, namely: advertising expense and research and development. Advertising expense can be seen as a proxy for brand value, where a higher advertising expense resembles a higher brand value.

Brand value, as mentioned in Lanfontaine & Slade (2007), affects vertical integration by protecting the valuable brand through owning more outlets and thus integrating. Advertising expenses also affect organizational and environmental performance. McWilliams & Siegel (2001) mention that investing in environmental/organizational factors is not enough. The advantage of the products/services also have to be communicated to stakeholders in turn to increase stakeholders' wealth. Larger companies and companies closer to the consumer (=further up the supply chain) consequently have more too loose when not communicating this 'investment', and as such advertising expense is related to vertical integration. In line with previous research advertising expense (Harjoto & Jo, 2011) will be incorporated in the regressions as a proxy for communication, and with that affecting the relationship with OP/EP, of the advantageous product/services. Finally, research and development, as a ratio divided by total assets will be incorporated in the OP/EP regressions. McWilliams & Siegel (2001) also conclude a positive relationship between OP/EP engagement and research and development expenditure. Padgett & Galan (2001) further investigate the relationship between research and development and OP/EP engagement. They conclude that R&D expenditures can be seen as a form of knowledge investment. The thereafter acquired knowledge, in turn, leads to product and process innovations, which in their turn potentially lead to OP/EP improvements. Other research, by Armour & Teece (1980), finds a positive relationship between R&D expenditures and degree of vertical integration, where organizational structure and R&D expenditures are highly intertwined. In line with previous research, R&D expenditures, as ratio divided by total assets will be included as control variable for R&D differences between firms (Harjoto & Jo, 2011).

4.4 – Variables, data sources & operationalization

From the before-mentioned datasets and used methodology, several variables/datasets are operationalized to function in the analysis of this research. The table below gives an overview of the variables/datasets that are used, as discussed in the previous paragraphs.

Concept	Variable	Operationalization	Database	Description
Vertical integration	Vertical integration index (VIINDEX)	Transformation of SSIC codes	Compustat-Segments	*An index that represents the level of integration. The closer to 1, the higher the degree of integration in the firm*
Financial performance	ROE	Net Income / Shareholder's Equity	Compustat-Fundamentals	*A measure of financial performance, representing the profitability of equity. A high ROE represents a financially healthy firm*
	ROA	Net Income/ Average Total Assets	Compustat-Fundamentals	*A measure of financial performance, representing the profitability of assets. A high ROA represents a financially healthy firm*
	Tobin's Q	Total Market Value/ Total Asset value	Compustat-Fundamentals	*A measure of financial performance, making use of the actual and market value of asset to determine stock valuation. A high Tobin's Q represents a financially healthy firm*
	Net Revenue	Total Net Revenue	Compustat-Fundamentals	*A measure of financial performance, represented by the total net revenue. A high Net Revenue represents a financially healthy firm*

Organizational performance	MSCI dimension: Employee relations	MSCI OP INDEX	MSCI	*An index representing the level of organizational performance, the higher the index, the better the firm performs in the dimension employee relations*
Environmental performance	MSCI dimension: Environment	MSCI EP INDEX	MSCI	*An index representing the level of organizational performance, the higher the index, the better the firm performs in the dimension environment*
Control variables (FP/OP/EP)	Firm size ((Ln(ASSETS))	Ln(assets)	Compustat-Fundamentals	*Control variable representing the firm size. The larger the Ln(assets), the larger the firm*
	Risk (DEBTASSETS)	Total Debt/Total Assets	Compustat-Fundamentals	*Control variable representing risk, where a higher DEBTASSETS represents a higher risk factor*
Extra control variables (FP)	Average sales (AVGS)	Average of sales of last 4 years	Compustat-Fundamentals	*Control variable representing sales, where a higher AVGS represents higher average sales*
	Capital structure ((LN(CAPS))	Ln(Total Debt/Equity)	Compustat-Fundamentals	*Control variable representing the capital structure, where a higher LN(CAPS), represents a more externally-financed (leveraged) firm*
Extra control variables OP/EP	Advertising expenditure (AVERT)	Total advertising expense	Compustat-Fundamentals	*Control variable representing advertising, where a higher AVERT represents higher advertising expenses*
	Research and development (RDASSETS)	Total R&D expense/Total Assets	Compustat-Fundamentals	*Control variable representing R&D investment, where a higher RDASSETS represents a higher R&D-ratio (divided by total assets)*

Table 3 - Variable Overview

4.5 - Models

Each of the models as presented in results will be introduced in a specific manner. The first regressions will only include the dependent and control variables; to check for the effect of the control variables on the dependent variable (before entering the vertical integration variable). Here one can also check the explanatory value of the vertical integration variable, by assessing the change in R^2. Following the regression equation will look as follows:

Model I

$$FP = \beta 0 + \beta 1 * DEBTASSETS + \beta 2 * Ln(ASSETS) + \beta 3 * AVGS + \beta 4 * Ln(LEV) + \epsilon$$

$$OP, EP = \beta 0 + \beta 1 * DEBTASSETS + \beta 2 * Ln(ASSETS) + \beta 3 * AVERT + \beta 4 * RDASSETS + \epsilon$$

In the second models, the independent variable of interest is entered in the model. Due to the fact that the control variables are already entered in the model, one could see if the effect of the independent variable holds when controlled for other covariates. The regression equation of model 2 will look as follows:

Model II

$$FP = \beta 0 + \beta 1 * VIINDEX + \beta 2 * DEBTASSETS + \beta 3 * Ln(ASSETS) + \beta 4 * AVGS + \beta 5 * Ln(LEV) + \epsilon$$

$$OP, EP = \beta 0 + \beta 1 * VIINDEX + \beta 2 * DEBTASSETS + \beta 3 * Ln(ASSETS) + \beta 4 * AVERT + \beta 5 * RDASSETS + \epsilon$$

In order to assess the effect of the level of vertical integration on the dependent variables, a categorical variable (VICAT) is created, where VIINDEX is sub-divided into 10 categories, where 1 represents 'no vertical integration' (i.e. market governance mode) and 10 'fully integrated' (i.e. hierarchy governance mode). In the model where the vertical integration categorical variable is entered, the market governance mode (class 1) will be used as a reference group. In other words, all results from other classes will be interpreted relative to a market governance mode. The regression equation of model 3 will look as follows:

Model III

$$FP = \beta 0 + \beta 1 * VICAT + \beta 2 * DEBTASSETS + \beta 3 * Ln(ASSETS) + \beta 4 * AVGS + \beta 5 * Ln(LEV) + \epsilon$$

$$OP, EP = \beta 0 + \beta 1 * VICAT + \beta 2 * DEBTASSETS + \beta 3 * Ln(ASSETS) + \beta 4 * AVERT + \beta 5 * RDASSETS + \epsilon$$

The variable advertising expense contains many missing values, however, contains a huge explanatory value (increase in R^2). For this reason, firstly the regression without AVERT will be performed (model II), where after AVERT is entered in the regression model, to intervalidate for any inconsistencies (model II-b).

5.0 - Results

In the following section the results, as found making use of the before-introduced methodology will be presented. Firstly, descriptive analytics and robustness tests on the data will be presented. Following the regression including financial performance will be presented, followed by strategic performance (organizational & environmental performance). In both the financial and strategic performance section, an assessment of hypotheses will be made.

5.1 - Descriptive analytics

To begin with, descriptive statistics (observations, mean, standard deviation, minimum and maximum) of the data will be presented. Following the correlation matrix, the data is checked for robustness.

	Obs.	Mean	St. Dev.	Min.	Max.
VIINDEX	168	0.49	0.43	0.00	1
ROA (%)	168	0.01	0.15	-0.70	0.28
ROE (%)	168	0.07	0.27	-0.87	0.94
Tobin's Q	114	27.66	34.41	0.28	144.04
Net Revenue (million USD)	148	9577.47	27754.53	0	236810
OP	168	0.02	0.08	-0.3	0.36
EP	151	0.05	0.08	-0.02	0.29
Size	168	7.56	1.78	3.95	12.73
Risk	168	0.20	0.18	0.00	0.68
Average sales (million USD)	148	10644.80	35241.78	0.00	353133.5
Capital structure	49	-1.64	2.37	-9.37	3.45
Advertising expenditure (million USD)	64	307.04	1194.497	0.13	8290
R&D expenditure	139	0.10	0.13	0.00	5.58

Table 4 - Descriptive statistics

In Table 4 the descriptive statistics of our data can be found. The first thing to acknowledge is the sample size. Most regression will include a sample size of 168 observations. However, the variable advertising includes some missing values. Following Green's (1991) rule of thumb where: N>50+8*m (m=independent variables), one can conclude that model II/III (5 independent variables) must contain a sample size of 90. Most regressions have a sufficient sample size of at least 101. Advertising expenditure, unfortunately, is a variable that contains many missing values. When checking this variable in other datasets, we also see many missing values. This is probably due to the fact that companies do not have a clear overview of their specific advertising costs and the difficulty in measuring this variable. Still, as for the fact that advertising expenditure exerts much explanatory value, an extra model is created (II-b), where the effect of vertical integration on the dependent variable can be checked in- and excluded of the variable advertising expense.

When investigating the specific variables in the dataset we find that size has a spread from 3.95 to 12.73 and a mean of 7.56. As size is a natural logarithm of assets ((LN(ASSETS)), one can conclude from the original dataset (with ASSETS) that size is distributed over 51,937 USD to 336,758,000 USD, with a mean of 11,893,000 USD. Considering the World Bank classification for company size segmentation one can see that: micro (<100,000 USD), small (100,000 – 3,000,000 USD), medium (3,000,000 – 50,000,000 USD) and large enterprises (50,000,000> USD) (World Bank Data, 2016). From here we can see that our sample is fairly balanced, containing firms from each size group. The vertical integration index is correctly distributed over a 0 to 1 ratio, with a mean of 0.49. When investigating capital structure we see a mean of -1.64 and a minimum of -9.37 and maximum of 3.45. As capital structure is also transformed with a natural logarithm, one can conclude that capital structure has a mean 0.20, a minimum of 0.00 and a maximum of 31.65. The average capital structure ratio among manufacturing companies is 1:6 (0.17). However, the manufacturing sector is known for their highly-leveraged firms due to their capital-intensive operating structure and widespread of the ratio (ranging from 1:10 to 3:1), therewith explaining the slight difference in our sample (Maverick, 2015). When investigating the ROA and ROE, one can find that the average ROA&ROE in US companies is around 4% (0.04) and 12% (0.12) respectively (CSI Market, 2017). Compared to our sample, where ROA&ROE is 1% and 7% respectively, the sample can be concluded to be distributed around a realistic mean.

5.2 - Robustness tests

In the following section, the data is checked for assumptions underlying the BLUE (best-linear-unbiased-estimator) ordinary-least-squares regression methodology. The assumptions that will be checked are: normality, heteroscedasticity, autocorrelation and multicollinearity (Field, 2009). In Field's book 'Discovering Statistics' the assumption underlying the BLUE OLS methodology are presented and fitting test to test for these assumptions are used. This research will make use of the same tests as Field (2009) proposes.

5.2.1 - Normality

To begin with, the data is checked whether the residuals are normally distributed around a mean. Normality is checked by making use of the Jarque-Bera test, which tests for the null hypothesis of non-normality in the data. As can be seen in Table 5, for the financial and environmental performance measures we find non-normality to be true ($P<0.05$), for the organizational performance, however, we find the data to be normally distributed ($P>0.05$). A possible explanation is the common problem when having created a ratio which has a peak at 0 and 1 (a double leptokurtic distribution), which results in the data is not being normally distributed. However, under the assumption of the central limit theorem, which describes an increasing sample size to autonomously imitate normality (starting from 30+ observations), the financial and environmental performance measures still have a reliable outcome, as those sample sizes far exceeds 30 observations (and Green's (1991) minimum) (Heyde, 2006). Finally, when checking the residuals plots of each variable individually, it is found that size ((Ln(ASSETS)) (as also indicated by research of (Anderson & Reeb, 2003); (Han, 1998); (Orlitzky, Schmidt, & Rynes, 2003)), also capital structure ((Ln(CAPS)) needs a natural logarithm to conform the data to normality and have a better residual fit.

Model	P-value Jarque-Bera test
FP	0.00** - 1.3*10^-13**
OP	0.11
EP	0.027*

Table 5 – Jarque-Bera test

5.2.2 - Heteroscedasticity

The data used in the regression will also be checked for heteroscedasticity. Heteroscedasticity signifies that the variability of a variable is unequal across a range of values (Field, 2009). Heteroscedasticity will be checked for making use of the Breusch-Pagan test, which tests for the null hypothesis of heteroscedasticity. As can be seen in Table 6, unfortunately, the regressions of FP, OP and EP contain a form of heteroscedasticity. Very important to note is that heteroscedasticity does not cause ordinary least squares coefficient estimates to be biased. Still, it does cause ordinary least squares estimates of the variance of coefficients to be biased. Concluding that regressions containing heteroscedasticity can potentially affect the power of a test, however, will still give unbiased estimates of the relationship between the predictor variable and the outcome (Field, 2009). The most user-friendly and most common technique to deal with heteroscedasticity is to make use of robust-standard-errors developed by White (1984). Robust-standard-errors allow for heteroscedasticity in the regression and will give unbiased and efficient estimates.

Model	P-value Breusch-Pagan test
FP	0.00**
OP	0.02*
EP	0.00**

Table 6 - Breusch-Pagan test

5.2.3 - Autocorrelation

Autocorrelation signifies the problem of values of variables being related to the prediction of each other over a given interval (Field, 2009). As there is no specific interval over which this data is measured (as it is a cross-sectional research), no test can be performed. Autocorrelation is usually present in the interval of time. However, as this is a cross-sectional research, which investigates differences in one year (2015), one can assume that time autocorrelation is not present (Cross Sectional Data Analysis and Regression, 2015). Concluding that autocorrelation will not be present in this data sample and consequently cannot bias the results.

5.2.4 - Multicollinearity

Multicollinearity is identifiable as the problem of two or more predictor variables in a multiple regression analysis being highly correlated (Field, 2009). To identify multicollinearity, one can make use of a variance-inflation-factor (VIF) test. This test does not give a P-value, however, a number is presented. Generally, can be assumed that a VIF above 10 is used as a common threshold for the indication of the presence of multicollinearity (Hair, Black, Babin, & Anderson, 2009). Multicollinearity can be rejected as all VIF-values, as can be seen in Table 7, are far below 4.

VIF	Model	VI-INDEX	Ln (ASSETS)	DEBT-ASSETS	AVGS	LN (CAPS)	RD-ASSETS	AVERT
ROA	A	1.03	2.06	3.52	1.05	1.90		
ROE	B	1.03	2.06	3.52	1.05	1.90		
Tobin's Q	C	1.09	3.22	3.31	1.13	1.92		
REV	D	1.03	2.06	3.52	1.05	1.90		
OP	E	1.13	2.22	1.07			1.10	1.06
EP	F	1.16	1.16	1.07			1.10	1.07

Table 7 - VIF test

Concluding this section with the note that all the regressions are excluded of multicollinearity and autocorrelation. In the FP, OP and EP regression heteroscedasticity can be identified, however, these regressions will, therefore, be performed making use of robust-standard-errors and will still allow for unbiased estimated. For FP and EP regressions, also non-normality can be assumed, however because of the large sample size (30+), the data is driven to normality, under the assumption of the central limit theorem (Heyde, 2006).

5.3 - Financial performance

In the following section, an analysis of the results investigating hypothesis 1 will be performed.
Hypothesis 1:
The degree of vertical integration will be positively correlated with financial performance

To research this hypothesis, 4 dependent variables that, making Clarkson's (1995) and Santos & Brito's (2012) methodology, resemble financial performance; ROA, ROE, Tobin's Q and Net Revenue. As explained before the four indicators of financial performance represent the use of strategic instrumental variables and a variety of accounting-based (ROA, ROE, Net Revenue) and market-based measurements (Tobin's Q). Consequently, 4 models will be presented, each containing one of the financial indicators: ROA (model A), ROE (model B), Tobin's Q (model C) and Net Revenue (model D). The results of the complete models (including control variables) can be found in Appendix Table 11-14. In each of the tables the coefficient, including the significance at 1% significance level (**) and 5% significance level (*), is given. Also, the standard error, between brackets, will be presented. As mentioned before in section 4.5, firstly only the control variables will be entered (model I), following the vertical integration index and the control variables (model II) and finally the categorical vertical integration variable and the control variables (model III). Below in Table 8, one can find all the summarized results for financial performance, in this table only the effect of VIINDEX (model II) and VICAT is included (model III).

Financial performance	II	III
A - ROA	-0.154**	2**,3*,4*,6**,8**,9**,10**
	(0.023)	
B - ROE	-0.278**	2**,3*,8**,9**,10**
	(0.040)	
C - Tobin's Q	-16.357*	2*,3**,5*,8**,10**
	(7.369)	
D - Net Revenue	-788.530	8**
	(603.665)	

Table 8 - Financial performance results

From the results in Table 8 one can see that the vertical integration index (model II), as can be seen in model A has a negative significant effect on ROA, also when entered as a categorical variable (model III), we see classes 2, 3, 4, 6, 8, 9 and 10 to have an extra negative effect as compared to the base category (class 1).
In model B, we can find vertical integration to have significant negative effect on ROE, which, as can be seen in model III, will have a more negative effect in the lower (2, 3) and highest classes (8, 9, 10) of vertical integration.
When investigating model C (Tobin's Q), we can conclude that vertical integration has a negative significant effect on Tobin's Q, which especially seems to be true for the highest vertical integration classes (8, 10) and the lower vertical integration classes (2, 3, 5).
Also, one can see that vertical integration does not has a significant effect on net revenue, only when entered as a categorical variable (class 8)

From the analysis of the results, one can conclude the following: in all significant models, vertical integration on (VIINDEX) has a negative effect on the financial performance measures. This significant negative effect especially seems to be true for the lower: 2, 3 and the higher vertical integrated classes: 8, 9, 10. The negative effect of vertical integration can be summarized as a decrease of -16.9% (for ROA), -30.5% (for ROE), -17,329 (for Tobin's Q) and -1543, 724 (for Net Revenue); this effect can be interpreted as the difference between a non-integrated firm (class 1) and a fully integrated firm (10). Investigating the descriptive statistics in Table 4, the negative effects can be concluded to be large in magnitude. Based on these results, hypothesis 1 can be rejected where, when assessing the results of this research, vertical integration is negatively correlated with financial performance. Also can be concluded that the negative effect of vertical integration on financial performance is more negative in the lower (2, 3) and higher vertically integrated firms (class 8-10), as in comparison to non-vertically integrated companies.

5.4 - Strategic performance: organizational & environmental performance

In the following section, an analysis of the results investigating hypothesis 2 and 3 will be performed.

Hypothesis 2:

The degree of vertical integration will be negatively correlated with organizational performance

Hypothesis 3:

The degree of vertical integration will be positively correlated with environmental performance

To research these hypotheses, strategic performance, consisting of organizational (OP – model E) and environmental (EP – model F) performance will be analysed. An MSCI environmental and organizational index is created and again regressed against the vertical integration index (model II / II-b) and the categorical variable of vertical integration (model III). As mentioned in section 4.5 first the control variables will be entered in the regression (model I), following the vertical integration index, control variables (excluding advertising expense) (model II), following all the control variables (including advertising expense) and the vertical integration index (model II-b) and lastly the control variables and the categorical variable for vertical integration (model III). In the Appendix Table 15 and 16, the complete results of the regressions can be found, in Table 9 below one can find the summarized results for strategic performance, in this table only the effect of VIINDEX excluding advertising expense (model II), VIINDEX including advertising expense (model II-b) and VICAT is included (model III).

Strategic performance	II	II-b	III
E - OP	0.007 (0.019)	0.039 (0.038)	-
F - EP	-0.029* (0.012)	-0.043* (0.017)	7**,10**

Table 9 - Strategic performance results

To begin with, when investigating model E (OP), we find that none of the included variables, in any of the models are statistically significant. This research can therefore not reject nor confirm this hypothesis, based on the results presented in model E, as none of the variables are statistically

Following, when assessing the vertical integration variables of model F, one can conclude that vertical integration has a significant negative effect on EP (model II), of which the effect holds in both the models including and excluding advertising expense. This significant negative effect on EP seems to be specifically true for higher vertical integration groups (7, 10). Based on the results presented in model F, one can find a significant negative relationship between vertical integration and environmental performance, therewith rejecting hypothesis 3. The negative effect of vertical integration, considering the spread of data on environmental performance, can be summarized as a decrease of -0.043 (for EP), which again can be interpreted as the difference between a non-integrated firm (class 1) and a fully integrated firm (class 10). Again, consulting the descriptive statistics in Table 4, this effect of vertical integration on EP can be concluded to be large in magnitude. This result can be concluded to be specifically more negative for the higher vertically integrated groups as compared to the non-integrated class (1), namely: 7 and 10.

6.0 – Discussion

In the following section, the results of the analysis will be summarized (section 6.1) and the most particular and important results (and their causes) will be discussed and interpreted accordingly (sections 6.2-6.6). In section 6.2 the negative effect of financial performance will be assessed, following effect of organizational performance in section 6.3, the negative relationship with environmental performance in section 6.4, the vertical integration class effect in section 6.5 and the overall negative relationship with firm performance in section 6.6.

6.1 – Summary of results

In each of the different models, the vertical integration index (model II) and the categorical variable (model III) are regressed against any of the firm performance measures, including control variables. The results of all regressions can be found in Table 10.

	II	III	Overall result of VI
A - ROA	-0.154**	2**,3*,4*,6**,8**,9**,10**	(-)
	(0.023)		
B - ROE	-0.278**	2**,3*,8**,9**,10**	(-)
	(0.040)		
C - Tobin's Q	-16.357*	2*,3**,5*,8**,10**	(-)
	(7.369)		
D - Net Revenue	-788.530	8**	
	(603.665)		
E - OP	0.039		
	(0.038)		
F- EP	-0.043*	7**,10**	(-)
	(0.017)		

Table 10 - All results

To begin with, this research will start by analysing and interpreting the results of the financial performance measures: ROA, ROE, Tobin's Q and Net Revenue. Though the relative magnitude of the relationships with the vertical integration index differs, each of the significant models clearly represents a negative relationship between the vertical integration index and the financial performance measure. This negative effect results in hypothesis 1 being rejected.

When investigating the organizational performance regressions, we find that the vertical integration variable (continuous and categorical) is not significant in any of the models. Hypothesis 2 can, therefore, be neither confirmed nor rejected. However, as no prior research has been done towards the relationship between vertical integration (only M&A research) and organizational performance; this non-significant result, therefore, does have a valuable meaning as a non-associated relationship, as will be further discussed in section 6.3.

Finally, this research will analyse the effect of vertical integration on environmental performance. Here, this research finds that vertical integration has a negative effect on environmental performance. Based on these results, hypothesis 3, where a positive effect of vertical integration on environmental performance was expected, can be rejected.

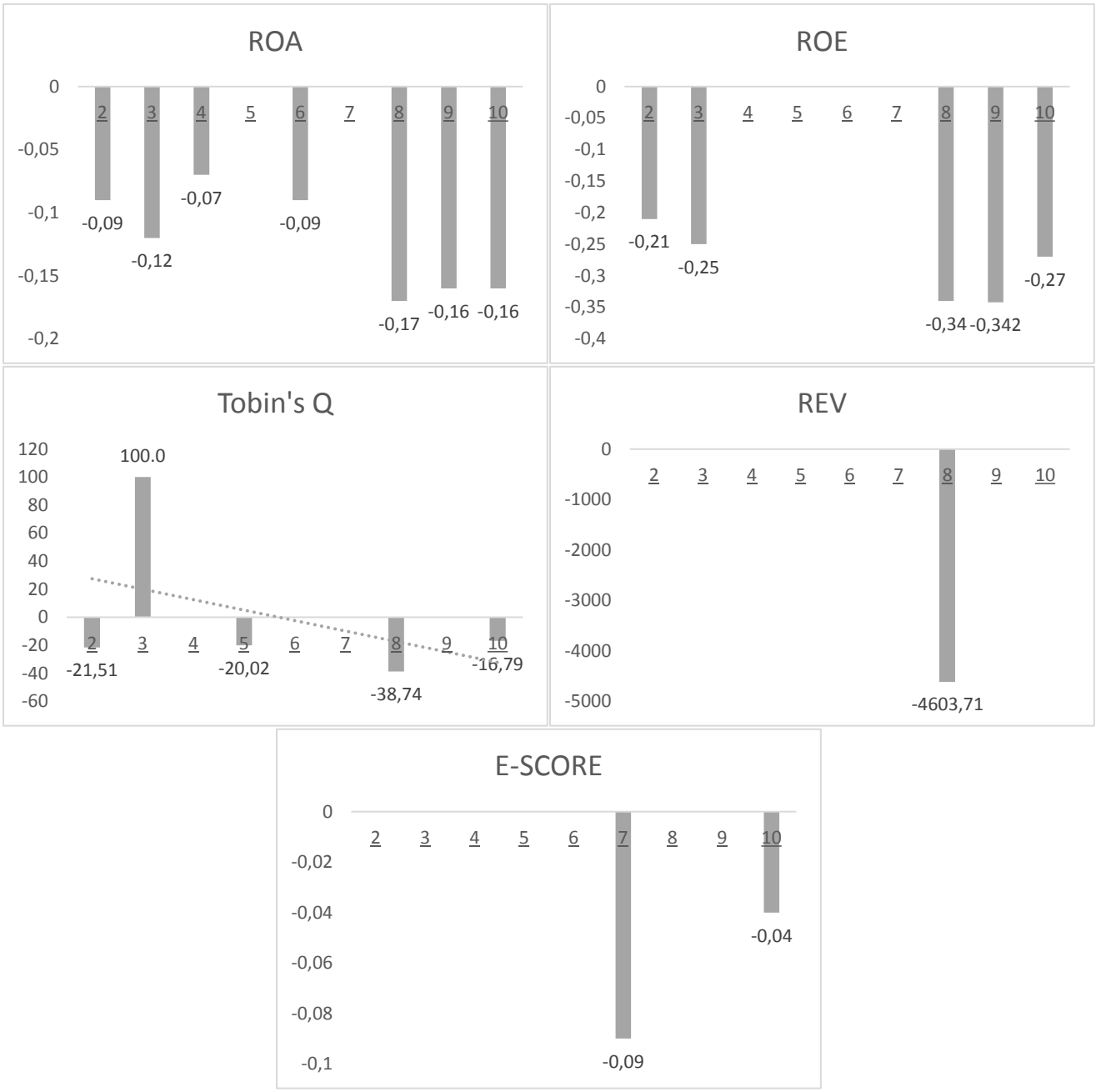

Figure 6 - Results per category

In Figure 6, each of the effect of the different classes, as relative to the reference group (class 1) is presented. When investigating Figure 6, one can conclude that most of the relative differences occur in the lowest integrated classes (2, 3) and the highest integrated classes (8, 9, 10).
This relative difference for the different performance measures entails that low- and high-integrated firms have a more negative relationship than non-integrated firms.

In other words, if a firm is little- (class 2, 3) and more (to fully) vertically integrated (class 8-10), the already negative effect on financial performance will become more negative, i.e. worsen. For environmental performance, this effect is only present in the higher vertically integrated classes (7, 10). Thus, if a firm is more/fully integrated (7, 10) the already negative effect of environmental performance will become more negative, as compared to non-integrated firms. One anomaly, however, must be noted. The third class, as measured with financial performance measure Tobin's Q as can be seen in Figure 6, has a significant increase as relative to the reference group (class 1), however as can be seen from the trend line, this does not affect the negative relationship. From the following section on, the particular and most important results will be discussed.

6.2 – Financial performance

The results from section 6.1 at first glance contradict with common knowledge and the earlier-presented hypotheses. By all means, which company would undergo an action (e.g. vertical integration) that would not satisfy his wants (e.g. decrease her financial performance)? One of the answers to this question probably lies in line with the criticism of Masten (1996) and Noorderhaven (1996) on TCE and within the specifics of the manufacturing sector. These authors mention that strategic (instead of rational economic) reasons, thus reasons other than immediate wealth creation, can cause companies to vertically integrate. In this theory, firms integrate to protect or enlarge their market share. However, as mentioned in section 2.1.1.2, we know that the vertical integration strategy has a significant threat of backfiring, e.g. bureaucracy costs and strategic inflexibility. Some of these strategies are used to undergo short-term losses, under the assumption of long-term wealth creation. Such examples like 'price squeezing', entry barriers and foreclosing competitors are very common strategies exerted in the manufacturing industry (Joskow, 1985); (Mahoney, 1992). Also, Mahoney (1992) mentions vertical integration to require a substantial investment, on itself already depleting financial resources.
When investigating the results; the negative relationship between vertical integration and financial performance could be rationalized. As this research is one year only, this year could have been heavily influenced by companies integrating under strategic implications rather than under the assumption of wealth creation (Coase's theorem).

The possibility of the strategic implications to backfire and the substantial investment costs when vertically integrating herewith explain the negative relationship between vertical integration and financial performance.

Secondly, in addition to the effect of strategic implications, research by Myopi (2003) indicated that the manufacturing industry itself has a significant influence on the choice of vertical integration. Many companies' choice of vertical integration is influenced by the average in the manufacturing industry, which can be mentioned to be the 'industry effect'. In other words, if the manufacturing industry suddenly decides to vertically integrate, the rest will follow (Myopi, 2003). This specific of the manufacturing industry is able to heavily affect this research's results. When investigating the sub-sectors in this manufacturing dataset (automobile, food & beverages, oil & gas, chemical, furniture, health care, industrial, agriculture, aerospace, metal, technology/IT, coating, apparel, transportation, energy, plastics & rubber, electronics and miscellaneous), one finds an explanation for this industry effect. Abdel-Raouf (2009) investigated the competitiveness of the U.S. manufacturing sector. She finds the U.S. manufacturing sector to be a sector dominated with oligopolies (42% operate in oligopolies), as opposed to other sectors. She also mentions the sectors oil & gas, apparel, plastics & rubber, technology/IT, electronics, aerospace and automobile to specifically operate in oligopolies (Abdel-Raouf, 2009). Other research mentions that oligopolies invite for a 'follow-the-leader-strategy' in pricing strategies (e.g. 'price squeezing') (Mukherjee, 2002) but also for other strategic behaviour (e.g. FDI, foreclosing competitors and vertical integration) (Park & Hennarts, 1994). Herewith thus explaining the industry effect; where the oligopolistic U.S. manufacturing industry invites for a 'follow-the-leader-strategy' in strategic decisions and as such also influences the decision to vertically integrate.

It is therefore very possible that during this research's year, 'the manufacturing industry' decided to price squeeze, create entry barriers and foreclose competitors, and thus must undergo short-term financial losses, by the means of vertical integration. This would result in the rest of the industry to follow and also vertically integrate to remain competitive and undergo the same financial short-term losses. When one combines both the effect of strategic implications and the industry effect, the negative effect of financial performance can be explained. To begin with, due to substantial investment costs and the effect of backfiring, strategic implications can cause short-term losses and thus a negative relationship with financial performance.

Besides that, the manufacturing industry, through the industry effect, heavily influences each other's choices. This creates the scenario where the vertical integration, and the therewith negative relationship with financial performance of one firm, lead to more vertical integration of other firms, and therewith an increasingly negative relationship with financial performance. In this scenario the industry effect functions as an 'amplification effect' in the negative relationship with financial performance. As such, the strategic implications and industry effect are able to explain the negative relationship with vertical integration in the results.
Concluding these sections with the note that the manufacturing sector is a highly-influential sector concerning vertical integration, and the choice of vertical integration is a highly-influenceable concept concerning strategic implications. This influential relationship between the two concepts, therefore, can have affected the before presented results of financial performance.

6.3 – Organizational performance

In the following section, the non-significant effect of vertical integration on organizational performance will be assessed.
To begin with should be mentioned that from the non-significant result explanatory value can be deduced. Because of the fact that the relationship between vertical integration and organizational performance has never been investigated, one can conclude, from this research, that no significant association exists between these factors, which at itself is a result worth to be mentioned. Again, the hypothesis on organizational performance in section 2.2.1.2 is built on research on M&A, not solely vertical integration research. And as mentioned before, vertical integration can involve more integrative measures apart from M&A (e.g. setting up their own extra supply chain stage). This, to begin with, could explain the different expectations from the literature review concerning the relationship between organizational performance and vertical integration.
Research by Odunlami & Matthew (2014) on the manufacturing sector indicated a positive relationship between the well-being of employees (i.e. organizational performance) and firm performance. It is known that employees are important assets when it comes to firm performance, however, the importance can differ from one sector to another.

One can argue that in the manufacturing sector employees are of relatively higher importance due to their direct output than for instance financial service employees. Research by the Bureau of Economic analysis estimates the U.S. manufacturing sector to have the second highest real value-added per employee (real GDP per employee), therewith being a major contributor to the real GDP and have a high labour productivity.
At the same time, employment in U.S. manufacturing sector is dropping (-0.8%), while growth rates of productivity and output are steadily rising over the past 20 years, 2.8% and 2.5% respectively in 2015 (BEA NIPA, 2017). Knowing the importance of the well-being of the employee to firm performance in the manufacturing sector, one can expect firms to act accordingly by maintaining high organizational performance, no matter the degree of vertical integration. This could consequently also explain the non-significant effect of vertical integration on organizational performance.

6.4 – Environmental performance

In the following section, the negative relationship between vertical integration and environmental performance will be discussed.
According to Porter & Kramer (2011), the current business landscape is trapped in an outdated idea of value creation. In line with Clarkson (1995), Porter & Kramer (2011) also mention that even until now, companies focus on short-term financial performance as their main value creation, while missing important customer needs and ignoring a broader perspective to long-term success. Also as discussed before in section 2.2.1; very few companies acknowledge the concept of the 'stakeholder theory', where a stakeholder-maximizing approach will lead to increased firm performance. This outdated idea of value creation of companies leads to the needs of the companies and the needs of society to be counterproductive and investment in environmental-sustainable practices to have very low priority (Porter & Kramer, 2011).
Likewise, Clarkson's (1995) stakeholder theory, Porter & Kramer (2011) propose the concept of shared value, where value maximization of the society and companies go hand in hand. Such theories advocate investment in environmentally improving practices, which in turn thus would improve the companies' environmental performance and consequently firm performance.

One can conclude that this narrow-minded vision on value creation is specifically true for the U.S. manufacturing industry. Research by Egilmez, Kucukvar & Tatari (2013) rated the different sectors in the U.S. manufacturing industry on their eco-efficiency (environmental performance). Their research concludes that approximately 90% of the U.S. manufacturing sectors are found to be inefficient when it comes to their eco-efficiency score, herewith implying the major backlog on theories as proposed by Clarkson (1995) and Porter & Kramer (2011).
When re-evaluating the consequence of the before mentioned ideas on the relationship between vertical integration and environmental performance, one can conclude the following: as mentioned in section Forward integration (2.1.1.2), the choice of vertical integration requires large capital requirement and investment costs (Mahoney, 1992). These investments will be able to deplete the financial resources of the companies. As the U.S. manufacturing industry is momentarily still pursuing the narrow-minded vision on value creation, environmental-sustainable investment will be given extremely low priority. Consequently, in times of financial resources' depletion, due to the vertical integration strategy, very few firms in the U.S. manufacturing industry will invest in environmental opportunities, therewith decreasing their environmental performance. The before mentioned reasons, therefore, explain the negative relationship between vertical integration and environmental performance. Consequently, for the relationship between vertical integration and environmental performance to become positive, capitalism has to be re-invented in the U.S. manufacturing industry.

6.5 – The vertical integration class effect

Finally, the increased negative effect in little- and highly vertically integrated companies of environmental & financial performance will be discussed. This effect entails, as can be seen in Table 10, that low (2, 3) and highly (8, 9, 10) vertically integrated companies, exert a more negative relationship with financial & environmental performance, as in comparison to non-vertically integrated companies.
In explaining this result, a theory by Vernon (1966) named the 'product life cycle theory' is of great importance. This theory depicts the development of a product in a certain market, with each stage having their own characteristics. As such, according to Vernon (1966), each product follows 4 stages: introduction, growth, maturity and decline.

In the introduction stage, the product is newly introduced in the market. In the growth stage demand for the product grows, the product is known and competitors enter the market with their own version. In the maturity stage, the product is widely known and in spite of competition the market remains very profitable due to high demand. In the decline stage, the sales begin to decline due to the increasingly fierce competition to the point where a firm must choose to forfeit the market or re-innovate (Klepper, 1996).
As such the product life cycle theory also has an influence on the profit function, it should be noted that profits reach a peak in the maturity phase and decline afterwards, as can be seen in Figure 7. Logically companies want to extend the (early) maturity stage as long as possible and will adjust strategies accordingly (Carole, 1997).

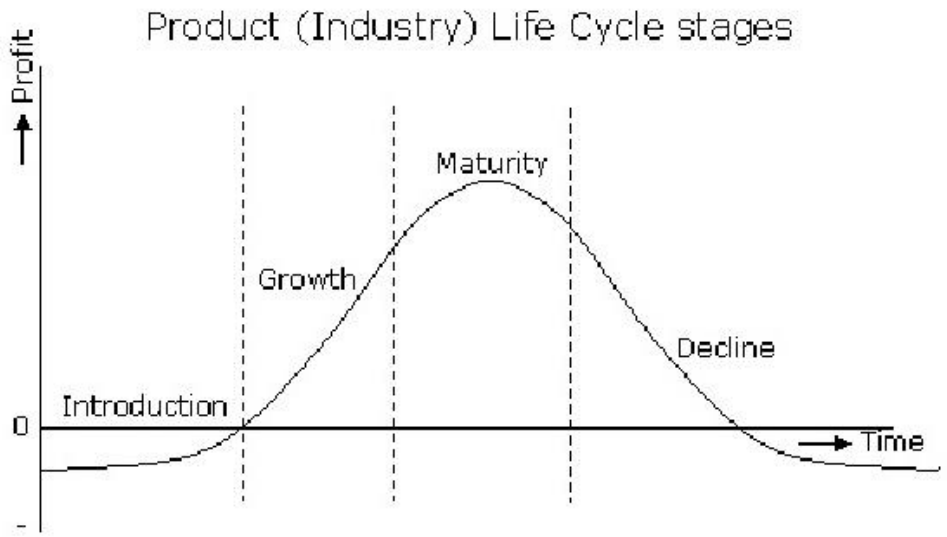

Figure 7 - Product life cycle theory and profit (12Manage, 2016)

Interesting, however, is the link of this theory with vertical integration in the manufacturing industry. Many researches (Langlois & Robertson, 1989); (Anderson & Weitz, 1998); (Toulan, 2002) on the U.S. manufacturing industry confirm the following: in the early stages of production, where product technology is still in development and market demand is low, firms can be expected to commit to vertical integration. To begin with, because the level of production in the early stages of the product life cycle in the firms is not large enough to satisfy external specialized suppliers.

Besides that, usually because of the highly innovative product in the introduction phase, outside suppliers cannot be found due to the high degree of complexity (Toulan, 2002). Later stages of the product life cycle are characterized by reduced complexity and specificity (due to knowledge spill-overs), reduced uncertainty, and reduced output monitoring costs. Also in later stages of the product life cycle, when product development slows down, new entrants will not face the same need for vertical integration as there now will be sufficient knowledge and possibility to economies of scale, to suit independent suppliers (Langlois & Robertson, 1989). Reflecting on section 2.1.1, we can conclude that reduced complexity, specificity, uncertainty and output monitoring costs will give preference to market transactions instead of vertical integration. As such, earlier stages of the product life cycle will give rise to vertical integration, where vertical integration decreases gradually over the product life cycle stages (Langlois & Robertson, 1989); (Anderson & Weitz, 1998); (Toulan, 2002).

When dividing the classes of this research over the product life cycle stages, accounting for their relative time length, one can roughly assume the following: introduction (class 10-8), growth (class 7-6), maturity (class 5-4) and decline (class 3-1). From here one can conclude that in the vertical integration classes 4 & 5 the highest profits are gained. However, in the classes 1-3 (decline) and 8-10 (introduction), the lowest profits (even losses) are acquired. This consequently gives an explanation for the results where low (2, 3) and highly (8, 9, 10) vertically integrated companies, exert a more negative relationship with financial performance. Concluding that, according to the product life cycle theory, companies in the introduction and decline phase, gain the least (or negative) profit; logically the classes of vertical integration assigned to these phases exert a more negative relationship with financial performance. Consequently, in the same line of reasoning as section 6.4, where vertical integration investments deplete the financial resources of a company and following exclude room for environmental investments, also the higher classes of vertical integration exert a more negative relationship with environmental performance.

6.7 – The effect on firm performance: the specialist's advantage

In this final section, one more argument is given for the negative effect of vertical integration on firm performance (financial & environmental).

As already mentioned in section 2.1.1 vertical integration should be considered as a strategy that could potentially backfire. As such, vertical integration has certain disadvantages, namely: strategic inflexibility, considerable investment in new operations (which depletes financial resources) and increases in bureaucracy costs (Mahoney, 1992). Logically when these disadvantages are overshadowed by the advantages, vertical integration should be considered. However, interpreting the result from this research, one can conclude differently.

A strong advocator of outsourcing (market transactions), as opposed to vertical integration, is Quinn (1995). Quinn (1995) mentioned that 'strategic outsourcing' creates considerate cost and strategic advantages over vertically integrated companies. Through outsourcing, manufacturing costs decline and the level of investment in plant and equipment can be reduced. By lowering investment costs, one will lower fixed costs and thus equilibrate at a lower break-even point (Bettis, Bradley, & Hamel, 1992). Besides that, firms that outsource can react more responsively to changes in the external environment, as they can easily switch suppliers when needed. In this manner creating a long-run strategic flexibility advantage over firms with internal production (Gilley & Rasheed, 2000). As the advocate of outsourcing, Quinn (1995) mentioned: "virtually all staff and value chain activities are activities that an outside entity, by concentrating specialists and technologies in the area, can perform better than all but a few companies for whom that activity is only one of many" (Quinn & Hilmer, 1995). Lastly, thus, the importance of remaining a specialist over a generalist on a firm's core competencies should be noted. By outsourcing noncore activities a firm will allow itself to direct her managerial attention and resources to those activities that it does best, while as at the same time relying on other firms to perform your noncore activities in which they have the relative advantage (Quinn & Hilmer, 1995).

The manufacturing industry is known as a highly innovative and fast-moving sector. Research by Becheikh, Landry & Amara (2005) indicated that innovation in the U.S. manufacturing sector is high due to the technological dynamism and demand growth. As a result, the U.S. manufacturing industry accounts for roughly 60% of the total U.S. R&D expenditures (Strategy&, 2015).

Other research investigated the differences of innovation per sector. Here they created an innovation rate defined as: “the undertaking of an activity that resulted in the development/introduction of a new product, process or method” (Strategy&, 2015). This research found the manufacturing industry to be 12% above the average innovation rate and the fifth best performing sector (out of 19 sectors) (Statsnz, 2011). Needless to mention that in such a highly-innovative sector, strategic flexibility is of utter importance. This consequently explains the negative effect of vertical integration on firm performance. Where vertical integration leads to strategic inflexibility and therewith induces the inability of a firm to compete in the innovative manufacturing sector. Concluding this section with the note that in the manufacturing sector, where strategic flexibility is able to create a large competitive advantage, the vertical integration strategy is able to work counterproductive.

7.0 - Conclusion

In the following section, this research will conclude this investigation by proposing fitting recommendations on the following research question:

"What is the effect of a vertically integrated supply chain on holistic firm performance, for various stakeholders, in U.S. manufacturing companies?"

From literature research can be concluded that since Coase's theorem, vertical integration is a widely-discussed topic. Consequently, Coase's theorem is improved making use of more realistic parameters, such as bounded rationality, costly transactions and incomplete contracts, resulting in the TCE. Research making use of these theories found many reasons in explaining the motives behind vertical integration, as can be found in Table 1. However, the TCE and Coase approach to explaining vertical integration received much criticism mainly on measurability and her applicability to reality. Following, this research concluded the measurement of vertical integration to be insufficient, due to only relying on 'ratio-estimates' and 'percentage of production in the vertical chain' to explain vertical integration. Also firm performance, even to this moment, is conservatively defined as the maximization of the value of only one stakeholder, namely the shareholder and thus focussing on short-term financial performance. Though in 1988 Clarkson already identified such a single-measurement-mindset eventually is self-defeating. This research thus has, making use of the methodology Davis & Duhaime (1992), Frank & Henderson (1992) and Myopi et al. (2004), created an index representing the level of vertical integration and brought this methodology in practice by investigating the relationship with firm performance. Firm performance is created under the assumption of the stakeholder theory by Clarkson (1995). Also making use of the methodology by Santos & Brito (2012) fitting indicators are found to satisfy the needs of the different stakeholders from the stakeholder theory. Consequently, this research presented three firm performance measures, namely: financial, organizational and environmental performance. The methodology of the created vertical integration index has never before been used in research towards firm performance and besides that, vertical integration has not been before investigated against organizational and environmental performance, herewith making this research unique and emphasizing on the added value of this research.

Also, as mentioned in section 2.2.1.1 many contradicting results are found when investing the relationship between vertical integration and financial performance.
For the creation of the vertical integration index and firm performance measurements, the Compustat, Compustat-Segments and MSCI database is used.
A negative relationship between financial & environmental performance and vertical integration is found, which is increasingly present in the lower (2, 3) and higher (8, 9, 10) vertically integrated companies. Also, no significant results are found between vertical integration and organizational performance. Thus one can conclude that by integrating in the U.S. manufacturing industry, one does not satisfy the stakeholders: the company, the shareholders, the customers and the public (partly), due to the negative effect of vertical integration on financial & environmental performance.
This research, therefore, can conclude that, although firms should consider other factors that may influence the decision to vertically integrate (e.g. the industry-effect, strategic implications), one should not vertically integrate when willing to improve financial & environmental performance. During which lower- and highly – integrated firms are at the highest risk of this negative relationship. Companies in the manufacturing section should focus on their strategic flexibility as a competitive advantage in a highly innovative sector such as the manufacturing sector. Besides that, they should consider their product life cycle when integrating, as this has a major influence on their financial, and consequently environmental, performance. Companies in the manufacturing industry should thus independently decide on their motive for the vertical integration strategy, such as protection of supply (strategic implications), asset specificity, complexity or any of the other motives as mentioned in Table 1, and consider the external environment, concerning the product life cycle theory and innovation, instead of assuming the vertical integration strategy to be wealth creating. Because, as can be concluded from this research's results, the opposite could be true. For environmental performance to become an important determinant in making strategic decisions, such as vertical integration, value creation in the manufacturing industry has to be thoroughly revised. Also, as no association is found between vertical integration and organizational performance, one can conclude that no significant association exists between these concepts in the U.S. manufacturing industry (in a cross-sectional research).

7.1 - Limitations & Recommendations

In the following section, the limitations of this research and consequently the recommendations for future research are presented.

To begin with, this research investigates by performing a cross-sectional research and therefore only one year is investigated. This choice is made due to the fact that many of the performance measures (environmental & organizational) and the vertical integration index (in relationship to firm performance) have never been used before. Besides that, it involves immense work to individually calculate a vertical integration index per company. As only one year is used, there can only be spoken of an associated relationship and not a causal relationship. Also, it is difficult to exclude the motive of strategic implications from the research. Herewith also comes the first recommendation for future research; it would be very valuable to investigate this relationship over both many companies (such as in this research) and more years.

Secondly, this research is limited to one sector and geographical scope, namely the U.S. manufacturing sector, again as a result of labour-intensity. From Myopi (2003) (industry-effect) one can see that specific sectors exert a specific influence on strategic choices. By making use of only one sector, this research limits itself in the applicability to other (sub)sectors worldwide. It would, therefore, be advised to future researches to investigate different and/or multiple sectors and sub-sectors (of manufacturing).

Thirdly, this research chose to make use of the stakeholder theory by Clarkson (1995) and Santos & Britos (2012) methodology to formulate firm performance. As already mentioned before in section 2.2.1, firm performance is a widely-discussed concept with many different (and other) indicators as used in this research. To intra-validate the results from this research it would be useful to make use of different indicators to describe firm performance.

Following, in this research a negative relationship is found between vertical integration and financial & environmental performance. As discussed in section 2.1.1.2, other motives, such as strategic implications, can move companies to integrate even when it is counter-productive (in the short run). It would be very useful to investigate which of the different motives of vertical integration weigh the heaviest under which circumstance (e.g. geographical scope, sector, economic conjuncture).

To investigate the different motives under different circumstances, in-depth case studies would be a valuable mean of investigation, as also qualitative results can be easily incorporated that function as motives for vertical integration.

Though, as each research consists of limitations and consequently recommendations, I sincerely hope to have done my contribution in further developing the insight in the relationship between vertical integration and firm performance.

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9.0 – Appendices

Model A - ROA	I	II	III
VIINDEX		-0.154**	
		(0.023)	
VICAT (1-10)			2**,3*,4*,6**,8**,9**,10**
DEBTASSETS	0.091	0.070	0.051
	(0.073)	(0.065)	(0.06)
Ln(ASSETS)	0.047**	0.037**	0.042**
	(0.011)	(0.009)	(0.011)
AVGS	-9.75*10^-7	-8.01*10^-7	-1.09*10^-9*
	(4.37*10^-7)	(1.98*10^-7)	(4.31*10^-7)
Ln(CAPS)	-0.001	-0.006	0.001
	(0.002)	(0.002)	(0.002)
Constant	-0.369**	-0.212*	0.248*
	(0.111)	(0.089)	(0.098)
R^2	0.22	0.39	0.41
N	148	148	148

**=significant at 1% significance level

*=significant at 5% significance level

Table 11 – ROA

Model B - ROE	I	II	III
VIINDEX		-0.278**	
		(0.040)	
VICAT (1-10)			2**,3*,8**,9**,10**
DEBTASSETS	0.369*	0.331**	0.287**
	(0.142)	(0.120)	(0.125)
Ln(ASSETS)	0.080**	0.062**	0.076**
	(0.019)	(0.016)	(0.019)
AVGS	-1.24*10^-6*	-9.29*10^-7	-1.50*10^-6**
	(5.05*10^-7)	(5.05*10^-7)	(4.36*10^-7)
Ln(CAPS)	-0.003	-0.001	-0.002
	(0.003)	(0.003)	(0.003)
Constant	-0.621**	-0.338*	-0.431**
	(0.167)	(0.138)	(0.156)
R^2	0.27	0.43	0.46
N	148	148	148

Table 12 - ROE

Model C – Tobin's Q	I	II	III
VIINDEX		-16.357*	
		(7.369)	
VICAT (1-10)			2*,3**,5*,8**,9*,10**
DEBTASSETS	64.393*	62.127*	53.197
	(31.727)	(29.525)	(31.289)
Ln(ASSETS)	3.593	2.237	2.310
	(2.354)	(2.600)	(2.814)
AVGS	-0.0003*	-0.0002*	-0.0001
	(0.0001)	(0.0001)	(0.0001)
Ln(CAPS)	-0.200	-0.127	-0.251
	(0.404)	(0.388)	(0.368)
Constant	-9.357	9.455	7.776
	(16.860)	(19.797)	(20.649)
R^2	0.13	0.17	0.33
N	101	101	101

**=significant at 1% significance level
*=significant at 5% significance level

Table 13- Tobin's Q

Model D – Net Revenue	I	II	III
VIINDEX		-788.530 (603.665)	
VICAT (1-10)			8**
DEBTASSETS	422.246 (4202.666)	313.361 (4137.784)	810.355 (4351.938)
Ln(ASSETS)	1712.643** (579.236)	1661.794** (573.852)	1744.829** (537.374)
AVGS	0.722** (0.075)	0.075** (0.075)	0.730** (0.072)
Ln(CAPS)	-63.097 (55.460)	-59.689 (53.975)	-49.228 (59.882)
Constant	-11572.74** (3971.692)	-10767.66** (3774.114)	-11441.79** (3736.878)
R^2	0.97	0.96	0.97
N	148	148	148

**=significant at 1% significance level
*=significant at 5% significance level

Table 14 - Net Revenue

Model E - OP	I	II	II-b	III
VIINDEX		0.007 (0.019)	0.039 (0.038)	
VICAT				-
DEBTASSETS	-0.088 (0.080)	0.007 (0.044)	-0.094 (0.079)	-0.083 (0.084)
Ln(ASSETS)	0.027* (0.012)	0.008 (0.007)	0.030* (0.013)	0.028 (0.013)
RDASSETS	0.302* (0.130)	0.072 (0.058)	0.272 (0.150)	0.314 (0.167)
AVERT	-3.0*10^-5** (9.82*10^-6)		-3.0*10^-5** (1.01*10^-5)	-3.35*10^-5** (1.17*10^-5)
Constant	-0.157 (0.079)	-0.044 (0.048)	-0.192* (0.086)	-0.192* (0.091)
R^2	0.19	0.02	0.19	0.19
N	50	139	50	50

**=significant at 1% significance level
*=significant at 5% significance level

Table 15 - OP

Model F - EP	I	II	II-b	III
VIINDEX		-0.029* (0.012)	-0.043* (0.017)	
VICAT				7**,10*
DEBTASSETS	-0.012 (0.067)	-0.17 (0.033)	0.001 (0.059)	0.033 (0.064)
Ln(ASSETS)	0.037** (0.008)	0.029** (0.005)	0.033** (0.008)	0.031** (0.007)
RDASSETS	0.156 (0.127)	0.114 (0.037)	0.199 (0.126)	0.176 (0.114)
AVERT	6.36*10^-6 (6.30*10^-6)		7.49*10^-6 (6.33*10^-6)	2.57*10^-6 (6.81*10^-6)
Constant	-0.227 (0.052)	-0.160** (0.035)	-0.184** (0.047)	-0.175** (0.045)
Adjusted R^2	0.62	0.43	0.66	0.70
N	45	126	45	45

**=significant at 1% significance level
*=significant at 5% significance level
Table 16 - EP

	ROA	ROE	ESCORE	Tobin's Q	REV
2	-0.09	-0.21		-21.51	
3	-0.12	-0.25		100	
4	-0.07				
5				-20.02	
6	-0.09				
7			-0.09		
8	-0.17	-0.34		-38.74	-4603.71
9	-0.16	-0.342			
10	-0.16	-0.27	-0.04	-16.79	

Table 17 - Categorical results

A	Agilent Technologies Inc
ABT	Abbott Laboratories
ADI	Analog Devices Inc.
ADM	Archer-Daniels-Midland Co
ADXS	Advaxis Inc
AFFX	Affymetrix Inc
AJRD	Aerojet Rocketdyne Holdings Inc
ALXN	Alexion Pharmaceuticals Inc
ARWR	Arrowhead Pharmaceuticals Inc
ASTE	Astec Industries Inc.
ATRO	Astronics Corp
AVAV	AeroVironment Inc
AVD	American Vanguard Corp
AVGO	Broadcom Ltd
AVY	Avery Dennison Corp
AXDX	Accelerate Diagnostics Inc
AXL	American Axle & Manufacturing Holdings Inc
AXTA	Axalta Coating Systems Ltd
AYI	Acuity Brands Inc.
BA	Boeing Co
BC	Brunswick Corp
BCPC	Balchem Corp
BCR	Bard (C.R.) Inc
BDC	Belden Inc
BGS	B&G Foods Inc.
BIO	Bio-Rad Laboratories Inc.
BLUE	bluebird bio Inc
BRCD	Brocade Communications Systems Inc
BRKR	Bruker Corp
BRSS	Global Brass and Copper Holdings Inc
BSX	Boston Scientific Corp
CAT	Caterpillar Inc
CAVM	Cavium Inc
CBM	Cambrex Corp
CCMP	Cabot Microelectronics Corp
CELG	Celgene Corp
CEMP	Cempra Inc
CERS	Cerus Corp

CMC	Commercial Metals Co
CMCO	Columbus McKinnon Corp
CMI	Cummins Inc.
COH	Coach Inc
COKE	Coca-Cola Bottling Co Consolidated
CORT	Corcept Therapeutics Inc
CROX	Crocs Inc
CRUS	Cirrus Logic Inc.
CTLT	Catalent Inc
DAKT	Daktronics Inc
DD	E. I. du Pont de Nemours and Co
DE	Deere & Co
DEL	Deltic Timber Corp
DEPO	DepoMed Inc.
EPZM	Epizyme Inc
ETH	Ethan Allen Interiors Inc
EW	Edwards Lifesciences Corp
F	Ford Motor Co
FARO	FARO Technologies Inc
FCEL	FuelCell Energy Inc
FF	FutureFuel Corp
FIZZ	National Beverage Corp
FLOW	SPX FLOW Inc
FN	Fabrinet
FOE	Ferro Corp.
GNMK	GenMark Diagnostics Inc
GNRC	Generac Holdings Inc
GNTX	Gentex Corp
HAE	Haemonetics Corp
HAIN	Hain Celestial Group Inc (The)
HALO	Halozyme Therapeutics Inc
HAS	Hasbro Inc.
HEI	HEICO Corp
HI	Hillenbrand Inc
HII	Huntington Ingalls Industries Inc
HLIT	Harmonic Inc
HMHC	Houghton Mifflin Harcourt Co
HPQ	HP Inc

INCY	Incyte Corp
INFN	Infinera Corp
INTC	Intel Corp
IPAR	Inter Parfums Inc
ITT	ITT Inc
ITW	Illinois Tool Works Inc.
IXYS	IXYS Corp
JCI	Johnson Controls International Plc
JNJ	Johnson & Johnson
KE	Kimball Electronics Inc
KLIC	Kulicke and Soffa Industries Inc
KODK	Eastman Kodak Co
LABL	Multi-Color Corp
LEG	Leggett & Platt Inc
LITE	Lumentum Holdings Inc
LLTC	Linear Technology Corp
LNDC	Landec Corp
LUK	Leucadia National Corp
LULU	lululemon athletica inc
LZB	La-Z-Boy Inc
MGNX	MacroGenics Inc
MHK	Mohawk Industries Inc.
MKC	McCormick & Co Inc
MLI	Mueller Industries Inc.
MLNX	Mellanox Technologies Ltd
MNTA	Momenta Pharmaceuticals Inc
MRTX	Mirati Therapeutics Inc
MSA	MSA Safety Inc
MTX	Minerals Technologies Inc.
MYE	Myers Industries Inc.
NANO	Nanometrics Inc
NCS	NCI Building Systems Inc.
NEOG	Neogen Corp
NEU	NewMarket Corp
NEWM	New Media Investment Group Inc
NOV	National Oilwell Varco Inc
NTAP	NetApp Inc
NVDA	NVIDIA Corp

NWSA	News Corp
OFIX	Orthofix International NV
OI	Owens-Illinois Inc.
ON	ON Semiconductor Corp
OSK	Oshkosh Corp
OSUR	OraSure Technologies Inc
PANW	Palo Alto Networks Inc
PATK	Patrick Industries Inc
PDFS	PDF Solutions Inc
PG	Procter & Gamble Co (The)
PGNX	Progenics Pharmaceuticals Inc
PKG	Packaging Corp Of America
PLCM	Polycom Inc
PPG	PPG Industries Inc.
PTLA	Portola Pharmaceuticals Inc
PVH	PVH Corp
QLGC	QLogic Corp
QRVO	Qorvo Inc
RGEN	Repligen Corp
RGR	Sturm Ruger & Co Inc.
RLD	RealD Inc
ROP	Roper Technologies Inc
RSTI	Rofin Sinar Technologies Inc
RTRX	Retrophin Inc
SCTY	SolarCity Corp
SENEA	Seneca Foods Corp.
SLAB	Silicon Laboratories Inc.
SMP	Standard Motor Products Inc.
STX	Seagate Technology Plc
SUP	Superior Industries International Inc.
TEL	TE Connectivity Ltd
TEX	Terex Corp
TOWR	Tower International Inc
TRN	Trinity Industries Inc.
TRS	TriMas Corp
TSE	Trinseo SA
TSN	Tyson Foods Inc.
TTPH	Tetraphase Pharmaceuticals Inc

UBNT	Ubiquiti Networks Inc
UFPI	Universal Forest Products Inc
USNA	USANA Health Sciences Inc
UTEK	Ultratech Inc
VASC	Vascular Solutions Inc
VECO	Veeco Instruments Inc
VICR	Vicor Corp.
VNDA	Vanda Pharmaceuticals Inc
VRA	Vera Bradley Inc
WAT	Waters Corp
WBC	WABCO Holdings Inc
WLK	Westlake Chemical Corp
WNR	Western Refining Inc
XOM	Exxon Mobil Corp
XON	Intrexon Corp
XRX	Xerox Corp

Figure 8 - Companies in sample

Environment	***Strengths***	***Concerns***
	Beneficial Products and Services	Hazardous Waste
	Pollution Prevention	Regulatory Problems
	Recycling	Ozone Depleting Chemicals
	Clean Energy	Substantial Emissions
	Communications	Agricultural Chemicals
	Property, Plant, and Equipment	Climate Change
	Management Systems	Other Concern
	Other Strength	
Employee Relations		
	Union Relation	Union Relations
	No-Layoff Policy	Health and Safety Concern
	Cash Profit Sharing	Workforce Reductions
	Employee Involvement	Retirement Benefits Concern
	Retirement Benefits Strength	Other concern
	Health and Safety Strength	
	Other Strength	

Table 18 - MSCI dimensions (KLD Stats, 2010)