

An Empirical Analysis of the Board Composition Concerning Logistics Competencies

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Abstract—Empirical insights into the implementation of logistics competencies at the top management level are scarce. This paper addresses this issue with an explorative approach which is based on a dataset of 872 observations in the years 2000, 2004 and 2008 using quantitative content analysis from annual reports of the 500 publicly listed firms with the highest global research and development expenditures according to the British Department for Business Innovation and Skills. We find that logistics competencies are more pronounced in Asian companies than in their European or American counterparts. On an industrial level the results are quite mixed. Using partial point-biserial correlations we show that logistics competencies are positively related to financial performance.

Keywords—Logistics, supply chain management, content analysis, executive boards, multinational corporations.

I. INTRODUCTION

LOGISTICS and supply chain management have become increasingly important in recent years. The growing internationalization and globalization process has led to a further rise in relevance [1]-[4]. Especially the growing distances between the participating companies result in increasing problems in ensuring a most efficient and effective supply at each value-added step. The same applies for the information flow between the companies involved in an increasingly complex and global supply chain.

To ensure an efficient flow of goods and information the alignment of the management is becoming more flow-oriented [5],[6] and is not limited to the single company itself, but rather all strategic important suppliers as well as customers have to be integrated into the decision process [7],[8]. Following the concept of a flow-based process optimization, logistics as an instrument for ensuring an effective and efficient flow of objects is gaining further importance. Therefore logistics is no longer limited to the realization of operative transport, handling, and storage activities, but has emerged in terms of a flow-oriented leadership as a new

management paradigm [9],[10]. Supply chain management – as a new, modern level of logistics – with a clear company overarching orientation is subject to the same developments and is already playing an important role in corporate management. Supply chain management will become even more significant in the future [11],[12].

Multinational corporations are often characterized by very complex international linkages between independent companies. Therefore, the management of the various object and information flows is of particular relevance for these companies and the problems described are especially relevant in this area [13],[14].

The aim of the paper is to analyze how logistics, respectively supply chain management, is established at the top management level of multinational corporations. In this paper we define logistics competencies as the implementation of executive board members being assigned to logistics tasks, leading to the following research question:

RQ₁. To what extent are logistics competencies implemented in the executive boards of multinational corporations?

Furthermore we examined if the implementation of logistics competencies on the top management level is related to financial performance indicators:

RQ₂. Is the implementation of logistics competencies related to financial performance?

This paper is structured as follows. We are providing a literature review on the subjects of logistics and supply chain management as well as content analyses in this area. In the methodological part we describe the composition of our sample, and the content analysis as a research approach. This is followed by a presentation of the results and a conclusion, providing some academic and practical contributions.

II. LITERATURE REVIEW

A. Logistics and Supply Chain Management

The evolutionary process of logistics can be divided into three main stages [15]. The first stage describes logistics as a functional specialization on activities associated with the spatial and temporal transformation of goods. Logistics departments in companies are mostly aimed directly at operational, material flow-related activities and play only a minor role in the context of strategic planning [16]. The second stage extends logistics to an enterprise-divisional and

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cross-company coordination of all flows of materials, goods and information. In this function, logistics gains significantly strategic relevance [17],[18]. In the latest stage logistics is seen as a new leadership doctrine. Logistics is now interpreted as the management of flow systems. The entire company is designed flow-oriented and the corporate management is focused on logistics objectives [19],[20]. According to the third stage logistics can be described as a modern management concept for the development, design, management, and implementation of effective and efficient flows of objects (goods, information, money and financial flows) in enterprise-wide and cross-company value added systems [21].

Definitions of supply chain management can be divided into two alternative schools of thought. Authors of the first group define supply chain management as a special form of logistics or even as synonymous [22],[23]. The second group interprets supply chain management more broadly as a kind of general cooperation or relationship management. As representatives of the second group, Johnson/Wood/Wardlow/Murphy (1999) describe supply chain management as "... somewhat larger concept than logistics, because it deals with managing both the flow of materials and the relationships among channel intermediaries from the point of origin of raw materials through to the final consumer" [24].

In this paper we are following the definition of Simchi-Levi/Kaminsky/Simchi-Levi (2009), who emphasize that "... we will not distinguish between logistics and supply chain management ..." [25]. Considering both terms as synonymous, supply chain management can be defined as a modern concept for corporate networks to exploit cross-company success potentials by the development, design, management, and implementation of effective and efficient goods, information, money, and financial flows [26]. This definition shows the close relationship to logistics. For that reason we will only use the term logistics in the remainder of the article.

B. Content Analysis in Logistics

While content analysis has been well established in various areas of management and social sciences [27],[28]; in the field of logistics it is limited to only a few studies [29]. These papers are mainly focused on the determination of different research methodologies or approaches and the influence of other disciplines on logistics.

Spens/Kovács (2006) for instance observed three journals from 1998 to 2002 identifying different research approaches in logistics. The authors distinguished between deductive, inductive and abductive research processes [30]. Seuring and Gold (2012) instead analyzed different literature review papers and compared them in terms of primary research approaches [31]. Focused on the influence of other disciplines onto logistics – for example marketing, accounting, psychology or sociology – Stock (1997) analyzed four journals over a period of 16 years (1980 – 1996) [32]. Further examples of the use of content analysis in logistics are

Craighead/Hanna/Gibson/Meredith (2007) [33], Croom/Romano/Giannakis (2000) [34], Sachan/Data (2005) [35], Frankel/Naslund/Bolumole (2005) [36] and Anderson/Jolly/Fairhurst (2007) [37]. To date, we could not find any logistics study using content analysis in the area of board composition or annual reports in general. All existing studies only examined academic journals.

Corporate reporting plays a significant role within content analysis in the area of business communication research [38], [39]. These papers cover for instance the examination of the readability of annual reports [40], the use of negative or positive expressions [41] and special linguistic structures as well as rhetorical elements [42]. Other studies examine social responsibility efforts [43],[44], environmental aspects [45],[46] or risk reporting [47],[48].

Papers concerning the composition of the companies' boards are mostly focused on cultural characteristics [49],[50] or the gender composition of the boards and its influence on corporate effectiveness, social responsibility and firm reputation [51]-[53]. Most studies in this area are related to the board of directors and only a few articles examine the composition of executive boards [54]-[56]. So far, the analysis of the impact of logistics on the companies' board composition still represents an unexplored field of research.

III. METHODOLOGY

A. Data Collection

Choosing a sample that will suit our research purpose we were looking at companies with high expenditures on research & development. Since logistics is a highly dynamic process [57], firms with high expenditures on research & development tend to be more adaptive to an ever-changing business environment [58]. We chose the 500 publicly listed firms with the highest expenditures on research & development worldwide, according to the British Department for Business Innovation & Skills. Financial data was taken from the Bureau van Dijk and their Osiris database. Thereby we had 360 companies in the final sample. To examine, if logistics competencies vary across industries, we grouped the firms according to the Global Industry Classification Standard (GICS). To derive a comparable international overview, we were only examining annual reports, no form 10-K or 20-F was included. Due to data availability we were focusing on three specific years: 2000, 2004 and 2008. Since not all annual reports from the companies were accessible within the sample period, 872 annual reports were in the final sample. The annual reports were analyzed regarding the existence of an executive board member responsible for logistics tasks. Therefore, we only examined the parts of the annual reports which contain information about the executive boards. The titles or descriptions of the board vary heavily; they range from board of management [59] to executive committee [60] or just the term officers [61]. Despite the variety of names their functions are largely identical [62].

B. Measurement

To examine, if logistics competencies are implemented at the top management level, we used content analysis with the software MAXQDA. Content analysis as a research method is a systematic and objective technique to describe and quantify phenomena [63]-[65]. The quantitative part focuses on fixed selected characteristics, such as word frequencies, to ensure a high degree of reproducibility [66]. This method is based upon the thought that the occurrence of specific words and the encompassing structure are important indicators for the identification of hidden agendas and coherences [67]. Most findings suggest that the quantitative content analysis is a suitable instrument for analyzing strategic alignments of companies [68]-[70]. We were not solely searching for the terms “logistics” and “supply chain management”, but also include the terminologies “distribution”, “procurement”, “supply”, “supply chain”, and “transportation” [71]-[73] to cover a wide range of task descriptions.

IV. RESULTS

A. Summary Statistics

Table I provides a short overview of the relevant variables. Logistics competencies (Log. Comp.) is a dichotomous variable, where 1 indicates that logistics operations are implemented on the executive board, whereas 0 indicates the

TABLE I
 SUMMARY STATISTICS

Variable	Mean	Std. Dev.
2000		
Log. Comp.	.278	.450
Revenue	17,570,226.22	27,381,141.40
Employees	52,849.40	74,372.76
2004		
Log. Comp.	.258	.438
Revenue	23,581,341.42	36,115,968.24
Employees	54,805.93	71,428.67
2008		
Log. Comp.	.277	.447
Revenue	33,439,220.40	5,449,6357.54
Employees	62,697.87	76,760.12

contradictory. The mean values for all years range from .278 in 2000 to .258 in 2004 and .277 in 2008. This indicates that slightly above 70% of the companies within the sample do not have a board member responsible for logistics competencies. Revenue and employees are metric variables; the mean values increased sharply within the sample period. Revenue rose from 17,570,226.22 (2000) over 23,581,341.42 (2004) to 33,439,220.40 (2008). The mean values for employees also received a strong increase, but the increase is staying well below the increase for revenues. Employees increased from 52,849.40 (2000) over 54,805.93 (2004) to 62,697.87 (2008).

B. Board Composition

Not all companies within the sample follow the same disclosure policy; therefore, we examined at first the differences among geographical regions and industries in terms of the functional description of the board responsibilities. Table II describes the percentage of companies which provide information about their functional board composition.

TABLE II
 PERCENTAGE OF COMPANIES PROVIDING INFORMATION ON THE FUNCTIONAL COMPOSITION OF THE BOARDS

Year	2000 ^a (%)	(n)	2004 ^a (%)	(n)	2008 ^a (%)	(n)
Region						
North America	92.77	(83)	96.40	(111)	96.15	(104)
Europe	85.11	(94)	91.82	(110)	91.67	(120)
Asia	26.56	(64)	36.71	(79)	51.16	(86)
GICS						
Cons. Dis.	62.50	(32)	75.00	(48)	73.74	(49)
Cons. Staples	50.00	(4)	85.71	(7)	75.00	(8)
Energy	77.78	(9)	83.33	(12)	83.33	(12)
Health Care	82.35	(34)	86.36	(44)	88.00	(50)
Industrials	74.60	(63)	81.08	(74)	87.01	(77)
Inform. Tech.	70.00	(60)	73.55	(68)	72.73	(66)
Materials	68.00	(25)	78.79	(33)	84.38	(32)
Telecom. Serv.	81.82	(11)	81.82	(11)	91.67	(12)
Utilities	50.00	(4)	66.67	(6)	100	(6)
Total sample^b	71.72	(244)	78.96	(309)	81.82	(319)

^aNumbers of the functional composition of the boards are provided in percentage. Numbers in parentheses represent the total number of available annual reports for the respective unit.

^bDue to the fact that not all companies are directly assignable, the number of companies within the total sample differs from the accumulated total of all industries. The difference to the accumulated total of all geographical regions is attributed to the limitation of three main regions. Due to an insufficient representation, Africa, South America and Oceania are not included.

In the year 2000 71.72% of all companies published information about the functional composition of their executive boards. This number rose to 78.96% in 2004 and even to 81.82% in 2008. Therefore, a growing overall determination to disclose information can be recognized.

Among the geographical regions clear differences become apparent. More than 90% of the companies in North America depict information to their stakeholders. In Europe the numbers are slightly lower, but still range around 90%. For Asia the picture is quite different. In 2000 only 26.56% of the companies published functional information on the composition of their executive boards. The numbers are rising consistently throughout the sample period to 36.71% in 2004 and even 51.56% in 2008.

Between the industry sectors the differences are quite smaller. The majority of the numbers range from 100% in utilities (2008) to 62.50% in the consumer discretionary (cons. dis.) sector (2000). Values below 60% occur only twice, once in the consumer staples (cons. staples) sector and once in the utilities sector, each with 50% in the year 2000. The highest values could be identified within the sectors health care and telecommunication services (telecom. serv.) with more than 80%. Overall, across all sectors except for minor exceptions

within the sectors cons. dis., cons. staples and information technology (inform. tech.), a positive trend in the observed period is obvious.

Table III shows the distribution of the board members holding logistics competencies in the sample. Since data was not available for all years the figures below are pictured in percentage to allow a comparable overview. The percentages represent the relative frequency of the board members assigned to logistics tasks divided by the number of companies providing information on the composition of the board.

TABLE III
 DISTRIBUTION OF BOARD MEMBERS FOR LOGISTICS BY REGION AND GICS

Year	2000 ^a (%)	(n)	2004 ^a (%)	(n)	2008 ^a (%)	(n)
Region						
North America	23.88	(77)	25.23	(107)	24.00	(100)
Europe	31.25	(80)	24.75	(101)	28.18	(110)
Asia	35.29	(17)	37.93	(29)	38.64	(44)
GICS						
Cons. Dis.	40.00	(20)	41.67	(36)	41.67	(36)
Cons. Staples	100	(2)	66.67	(6)	50.00	(6)
Energy	14.29	(7)	20.00	(10)	20.00	(10)
Health Care	32.14	(28)	21.05	(38)	20.45	(44)
Industrials	23.40	(47)	31.67	(60)	35.82	(67)
Inform. Tech.	19.05	(42)	16.00	(50)	14.58	(48)
Materials	41.18	(17)	26.92	(26)	37.04	(27)
Telecom. Serv.	11.11	(9)	0.00	(9)	0.00	(11)
Utilities	100	(2)	25.00	(4)	33.33	(6)
Total sample^b	28.00	(175)	26.23	(244)	28.20	(261)

^aNumbers of the functional composition of the boards are provided in percentage. Numbers in parentheses represent the total number of available annual reports for the respective unit.

^bFor the explanation of the differences between the numbers of companies within the total sample and the accumulated total of all industries and geographical regions see table II.

Looking at the sample means for all years, it becomes evident that less than every third company employed someone responsible for logistics within their executive board. In 2000 28% of the companies providing functional information had logistics competencies implemented within their executive boards. This rate drops slightly to 26.23% in 2004 and rises again to 28.20% in 2008. Therefore, neither a positive nor a negative trend can be derived.

Even though North American and European companies are more open to depict information on their board composition, they are less likely to hold logistics competencies in their top management level than Asian companies. In Asia more than 35% of the board members are assigned to logistics within the entire sample period. This rate is considerably higher than in Europe and North America with values below 30% with the exception of 31.25% for Europe in the year 2000.

Regarding the different industries, there are also clear differences observable. For further analysis the sectors cons. staples, energy, telecom. serv. and utilities are not considered anymore due to insufficient representation.

The establishment of logistics competencies within the executive boards seems to be most important for the cons. dis. sector. During the entire sample period the numbers range

above 40%, with a maximum of 41.67% in 2004 and 2008. The lowest values occur within the inform tech sector with less than 20% in each observed year. The high percentage within the cons. dis. sector is attributable to the fact that this sector includes the automobiles and components subsector. The automotive industry is usually considered as the role model for logistics. Therefore it is no surprise that the

TABLE IV
 RESULTS OF THE PARTIAL POINT-BISERIAL CORRELATIONS

Control Variable	BML	Revenue
2000	2000	2000
	BML	1
<i>Employees 2000</i>	Revenue	.117*
		1
2004	2004	2004
	BML	1
<i>Employees 2004</i>	Revenue	.106**
		1
2008	2008	2008
	BML	1
<i>Employees 2008</i>	Revenue	.104*
		1

*Correlation is significant at the .1 level (1-tailed);** Correlation is significant at the .05 level (1-tailed).

implementation of logistics is already very advanced in this sector.

The development in the sectors health care and industrials is contrary. In the sector health care a strong decrease of -37.77% is identified during the sample period. In the industrials sector instead a large increase of 53.08% is observable. For the sectors inform. tech. (-23.46%) and materials (-10.05%) declines are reported; however the materials sector recorded the highest value in 2000 (41.18%) and still the second highest value in 2008 (37.04%).

C. Logistics Competencies and Financial Performance

Table IV shows the results of the point-biserial correlation using SPSS v.21. We controlled for possible size effects by using partial correlations with the variable employees. Since we assume that revenue is positively correlated to logistics competencies, we used one-tailed tests [74].

Table IV shows that there is a significant relationship between revenue and the implementation of logistics competencies at the top management level. In 2000 logistics competencies was significantly correlated to revenue, $r = .117$ ($p < .1$). In 2004 and 2008 revenue was again significantly correlated with logistics competencies, 2004: $r = .106$ ($p < .05$), 2008: $r = .104$ ($p < .1$). All correlation coefficients contain positive signs; still the strength of the relationship is weak. The results indicate that companies that have logistics competencies implemented in the executive boards are associated with higher revenues.

D. Contributions and Limitations

To our knowledge, this is the first study that quantifies and specifically concentrates on the board composition concerning logistics assignments. This could provide a framework for

further research in this area. From a business perspective, our research might be used as an overview or even benchmark for the relevance of logistics within multinational corporations.

Due to data and resource availability we examined only the years 2000, 2004 and 2008, while further research might include a larger period. In addition, the concentration on multinational corporations could also be a shortcoming of this study; the results might be different for small and medium size enterprises. Since we conducted a highly explanatory study across various industries and geographical regions, a specified research focus, for instance on single countries or single industries might lead to different results.

V. CONCLUSION AND FUTURE RESEARCH

The role of logistics within multinational corporations has rapidly evolved over the past couple of decades. Coming from a limited functional specialization, it has developed into a modern flow-oriented management philosophy. Logistics is today regarded as the management of flow systems. The entire company and especially the corporate management is flow-oriented. For that reason, we analyzed in our study how logistics is implemented within the executive boards as a proxy for organizational structure.

The results can be summarized within the following points:

- The observed companies are becoming more transparent concerning the functional composition of their executive boards. The percentage of companies that provide information rose from 71.72% (2000) to 78.96% (2004) and 81.82% (2008). This might be due to the increased relevance of corporate governance and transparency efforts made by multinational corporations.
- Based on the geographical differentiation Asian companies are more likely to establish logistics competencies at the executive level. The values for Asian companies increased from 35.29% (2000) to 37.93% (2004) and 38.64% (2008). For European and American companies the values are profoundly lower with all values staying below 30%, except the year 2000 with 31.25% for Europe. These results indicate that in Asian companies logistics is more valued at the executive level.
- On the industrial differentiation the picture is quite mixed. The sectors cons. dis. and materials stand out being well above the others. Cons. dis ranges from 40% (2000) to 41.67% in 2004 and 2008, whereas the materials sector ranges from 41.18% (2000) to 26.92% (2004) and 37.04% (2008). The lowest values could be identified within the inform. tech. sector with 19.05% (2000), 16.00% (2004) and 14.58% (2008).
- Overall, the implementation rate of logistics competencies is ranging around 28%. In 2000 the value was 28%; in 2004 it slightly declined to 26.23% and rose again to 28.20% (2008).
- The partial point-biserial correlations show that a significant positive relationship between logistics competencies and revenue exists. This means that

multinational corporations with someone assigned to logistics tasks perform financially better; showing the utmost importance of logistics for multinational corporations today.

This study provides evidence that logistics is already widely established within the executive boards of the observed companies. Due to the increasing complexity of the companies' environments and the observed relationship between logistics competencies and revenue, it might be assumed that in the near future logistics will receive more relevance on an executive level.

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