VERTICAL INTEGRATION AND INFORMATION SHARING – AN EMPIRICAL INVESTIGATION IN THE GERMAN APPAREL INDUSTRY

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Abstract
Despite the astounding success of the fast fashion retailers, the management practices leading to these results have not been subject to extensive research so far. Given this background, we analyze the impact of information sharing and vertical integration on the performance of 51 German apparel companies. We find that the positive impact of vertical integration is mediated by information sharing, i.e. that the ability to improve the information flow is a key success factor of vertically integrated apparel supply chains. Thus, the success of an expansion strategy based on vertical integration critically depends on effective ways to share logistical information.

1. Introduction

The astounding success of fast fashion retailers such as Zara and H&M is attracting the attention of the fashion industry worldwide. The triumph of these companies, expressed in 2-digit margins and constant growth, is tightly connected to the implementation of a supply chain strategy optimally aligned with consumer needs: quickly changing demand for fashion is translated into products at a reasonable price. Attracted by their success, many apparel companies currently try to mimic fast fashion practices. For some of them, improving supply chain performance is even a matter of survival: traditional clothing retailers, including major department store chains such as Galeria Kaufhof in Germany are suffering from steadily shrinking margins in their apparel business. The main reason for this development is the apparent inability of traditional retailers to satisfy current consumer wishes with respect to fashion and pricing. On the one hand, consumers increasingly long for choice and are becoming more fashion-savvy. A recent article of 'The Economist' [30] confirms the views of many fashion executives who feel a constant pressure to quickly pick up the latest trends and immediately supply clothing that adheres to them. On the other hand, consumers behave highly price sensitive when it comes to spending money on apparel. This is documented by the share of household income spent on apparel and footwear which has steadily declined in recent years [7]. The EU and U.S. consumer price indices for these product categories speak a similar language: they lag behind the average price index for consumer goods [7][31].
One of the key strategic questions in today's apparel business is which building blocks of the fast fashion strategy should be adopted in order to improve performance. Thus, management practices

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and organizational configurations that have a significant effect on firm performance have to be identified. A closer look at the management practices and organizational features of fast fashion retailers reveals at least two differences compared to traditional retailers: vertical integration and intensive information sharing between the manufacturing and retailing stage of the supply chain.

In the traditional apparel supply chain, brand manufacturers are responsible for the design and manufacturing of products, whereas specialized retailers are responsible for selling the garments to the consumers. This task division has the advantage that each company can concentrate on their core competencies: while brand manufacturers apply their design and production know-how, retailers use their marketing expertise for presenting and selling different brands. In sharp contrast to this, the typical fast fashion company distributes its own brand all by itself. For this purpose it either operates its own stores or uses a distribution model based on concessions or franchising. Ferdows et al. [9] claim that the vertical integration of industry champions like Zara and H&M and the resulting control over the distribution process represents the key for their tremendous success.

Vertical integration certainly plays a role in the fast fashion success formula. We hypothesize that it is rather an enabler for value generating management practices rather than a cause for superior performance by itself. In particular, companies that control the entire distribution process of their brand are able to access all relevant data related to the production and distribution of their products and thus have an informational advantage. Our interviews with industry insiders as well as earlier case study research support this hypothesis. For instance, Zara's global store network can be conceived as a giant data collection device. The POS data is transmitted by hundreds of stores to the headquarters on a daily basis. This information enables detailed sales trend analyses as well as triggers design and production processes without any delay [13]. This of course is only possible when taking advantage of modern information technology [9][25].

In this paper, we investigate the impact of vertical integration and information sharing practices on the performance of apparel supply chains. In particular, we focus on the relationship between the degrees of control that brand manufacturers are able to exert over the distribution of their products and the intensity of information sharing between the production and distribution part of the supply chain. Our central hypothesis is that vertical integration is positively related to performance partly because it enables more intensive information sharing along the supply chain. We test our hypotheses using a data sample from the German apparel industry.

In Section 2 we provide an overview of related literature. Our hypotheses and a conceptual model are presented in Section 3. In Section 4 we describe the employed methodology and the results of an empirical study in the German apparel industry. Section 5 discusses managerial implications of our work. Section 6 concludes.

2. Related Work

Apparel supply chains are a popular topic in operations management research because the demand for fashionable apparel is usually highly uncertain, which calls for effective measures to cope with the resulting risk of over- and underage [22]. Fisher et al. [10] were the first to analytically show the positive effect of using the information on early sales to improve the accuracy of forecasts. A meanwhile well-known case study at Sport Obermeyer has demonstrated that the 'accurate response' technique truly works [11]. More recent case studies on supply chains and strategies in the apparel sector reveal the increasing influence of agile thinking in the business, mainly inspired by the success of fast fashion retailers [9][19].

Vertical integration is usually equated with the concentration of ownership of facilities and assets along the supply chain in the hands of a single organization. Zara for instance can be considered as an almost fully vertically integrated apparel company since they own manufacturing and distribution facilities as well as a dedicated store network [9]. Richardson [27] analyses the advantages and disadvantages of vertical integration in the apparel sector. He sees its main drawback in the risk of exclusion from an efficient buyer market. Thus, vertical integration can impede the optimal allocation of the resources, which depends on the competition in corresponding markets (production, warehousing, transportation, retailing etc.) combined with the superior expertise of the specialized manufacturers, logistics providers and retailers. He explains the apparent success of vertically integrated fashion companies like Zara by observing that vertical integration facilitates quick response strategies. Vertical integration, he argues, enables these organizations to link design and production closely to retailing which makes them more responsive.

The benefits of fast and accurate transmission of demand information along the supply chain have been shown by various authors [23][33]. We contribute to this research by considering the impact of vertical integration on this relationship. To the best of our knowledge, no study of this kind has been attempted so far.

3. Hypotheses and Conceptual Model

Our conceptual model is made up of four interdependent hypotheses referring to three conceptual concepts. These concepts are *Vertical Forward Integration* (VFI), *Intensity of Information Sharing* (IIS), and *Performance of Brand Owner* (PBO). The exact meaning of these concepts as well as our hypotheses will be described in the following.

The impact of information sharing on the business performance has been tested in various empirical studies (e.g. [23][33]), albeit not in our specific context. Based on their case study at Zara, Ferdows et al. [9] claim that intensive information sharing is particularly important in apparel supply chains since these have to cope with highly uncertain demand. We therefore hypothesize that: (H1) the intensity of the *Information Sharing* between the brand owner and the retailers is positively related to the *Performance of the Brand Owner*.

Our second and third hypotheses refer to the impact of vertical integration. Richardson [27] considers a firm as vertically integrated if it owns assets, organizes activity, or controls activities in successive stages of the value chain. We focus on a special type of vertical integration, namely the *Vertical Forward Integration* of brand owners. *Vertical Forward Integration* refers to all measures taken by the brand owner to increase the control over the distribution channel including the acquisition of facilities and assets. This definition is in line with the common understanding of this term across industry (see [15]). Whereas Zara or H&M certainly mark an extreme of the vertical integration scale, most brand owners are somewhere in between, i.e. they neither own *all* points of sale nor do they act like the traditional clothing wholesaler who exerts no influence on sales operations at all.

The positive connection between *Vertical Forward Integration* and Performance in the apparel sector is intensively discussed by Richardson [27], although not tested statistically. Extending his study we hypothesize that: (H2) *Vertical Forward Integration* is positively related to the *Performance of the Brand Owners*.

A basic result of agency theory predicts that in situations when exchanges are characterized by uncertainty over inputs, infrequent exchange, and the need for transaction specific investments,

vertical integration can be efficient. This is because vertical integration reduces the incentives for information hiding and misrepresentation [14]. Here, the tradeoff is between improved information and reduced performance incentives. The assumption of uncertainty is certainly applicable to the apparel sector, where the demand is very uncertain. In line with this finding, information systems and information sharing processes can certainly be implemented more easily within one company than between several different companies. We can therefore hypothesize that: (H3) *Vertical Forward Integration* is positively related to the *Intensity of Information Sharing* between the apparel brand owner and the retailers.

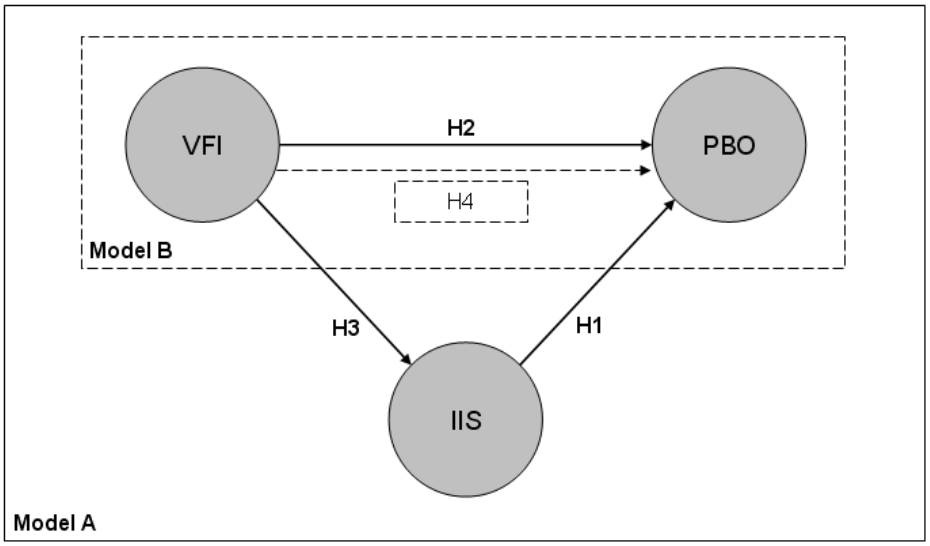

Figure 1. The conceptual model

Hypothesis 4 summarizes the relationships described above (H1-H3) and is central for our work. It tests the assumption that vertical integration per se is an important but not a sufficient condition of the success of the brand owner. In other words, we assume that that the positive influence of vertical integration in the apparel industry is largely due to the improved information flow it enables. We therefore hypothesize that: (H4) the expected positive influence of the *Vertical Forward Integration* on the *Performance of the Brand Owners* is mediated by the *Intensity of the Information Sharing* between the apparel brand owner and the retailers.

Figure 1 summarizes the hypotheses (H1, H2, H3) into a conceptual model (Model A). Additionally, in order to prove hypothesis H4, Model B, consisting of a simple direct link from the *Vertical Forward Integration* to the *Performance of the Brand Owners,* is tested as explained in Section 4.3.

4. Empirical Study

4.1 Survey Design and Sampling

We developed a survey instrument which aimed to capture the *Vertical Forward Integration*, *Intensity of Information Sharing*, and the *Performance of the Brand Owner* constructs as well as some descriptive statistics. In the forefront of the survey several industry experts and representatives were interviewed, partly in person, partly over the phone. The interviews served for gaining a better understanding of the drivers of the current vertical integration trend in the apparel industry as well as to fulfil formal requirements. In particular, the survey questions were discussed one by one to ensure the content validity of the measured constructs. This procedure also ensured

that the terms used in the survey were clear and equally interpreted by the practitioners. As a second step, general contact details and company descriptions of 440 medium and large-sized apparel companies operating in Germany were extracted from various publicly available databases. After eliminating the companies which didn't match the research objectives (e.g. company turnover), 350 companies were contacted by phone in order to identify a competent contact person (usually the head of logistics or marketing). Finally, 307 verified contacts were asked for participation in a standardized online questionnaire per mail and phone. The data collection effort resulted in 88 answered questionnaires out of which 51 were usable. Thus, the response rate was 16.6%. The survey was conducted in an anonymous manner to encourage participants to honestly answer the questions. Data collection took place from January until April 2008. In order to evaluate the representativeness of the sample, we analyzed its distribution with respect to four basic company profile indicators: size of revenue, number of employees, product life cycle, and price segment of goods sold as shown in Table 1. None of the four indicators exhibits any unexpected concentration. According to the opinion of interviewed fashion executives, the sample represents the brand owner side of the German apparel industry fairly well. Additional sample profiling data can be obtained from the authors upon request.

Table 1. Sample characteristics

Revenues in mln. Euro	% of companies	Employees	% of companies	No of assortments per year	% of companies	Pricing Segment	% of companies
<50	18.6%	<200	28.3%	1-2	23.4%	lower price	14.6%
50 - 100	34.9%	200 -500	41.3%	3-4	40.4%	medium price	60.4%
100 - 200	18.6%	500 -1,000	10.9%	>4	36.2%	high price	25%
>200	27.9%	>1,000	19.6%				

4.2 Measurement Scales

The three constructs which our hypotheses are based on – *Vertical Forward Integration*, *Intensity of Information Sharing*, and the *Performance of the Brand Owner* – were measured using multiple indicators. These indicators formed the corresponding measurement scales. In accordance with our definition of *Vertical Forward Integration*, the items we used to operationalize the corresponding conceptual construct reflect the degree of control exerted by the brand owner over distribution activities of the retailers as well as the degree of vertical forward integration of the brand owner in terms of assets and facilities. The items measuring the control over the distribution process were adopted from the work of Etgar [8]. These items were complimented by the self-developed scales for asset and facility possession. The scales used to measure the *Intensity of Information Sharing* construct were adopted from the work of Li and Lin [23]. They cover completeness, detail, timeliness, and reliability of the information sharing activities between the retailers or POSs and the brand owner. Not surprisingly, company performance has been measured many times before; thus there exists an abundance of tested scales in the literature. The items of the *Performance* construct were drawn from the pool of the already available items of Bhatnagar and Sohal [3], Mattila et al. [24], and Hallén et al. [17]. All metrics were chosen keeping the targeted industry in mind but are sufficiently general to allow for comparability.

4.3 Statistical Methodology

The purpose of the statistical analysis is to explain the links between exogenous and endogenous variables. In our conceptual model, these are the constructs *Vertical Forward Integration, Intensity of Information Sharing* and *Performance of the Brand Owner*. None of these so-called latent

variables can be observed directly but are measured by indicators (measurement scales). The relationship of the latent variables and the indicators is specified by the Measurement Model. The overall model which includes the defined relationships between the latent variables reflecting the hypotheses is called Structural Equation Model (SEM). Estimation of the SEMs can be done on the basis of two different methodologies: analysis of covariance [16] or the analysis of variance [32]. The latter is also referred to as the Partial Least Squares (PLS) approach. In this study we evaluate our model using the PLS approach for several specific reasons. First, PLS methodology is a preferred option when the theory behind the model is not strong [12]. Taking into account the novelty of our research terrain PLS was a straightforward choice. Second, as opposed to the covariance-based approach, the PLS does not place very high sample size constraints. Barclay et al. [2] mention the rule of thumb that the required sample size for using PLS has to be at least ten times the number of exogenous constructs having an impact on the most complex endogenous construct which amounts to a minimum of 20 observations in our case. With 51 observations this criterion was easily fulfilled. All calculations were carried out using SmartPLS version 2.0.M3, a statistical package developed for the estimation of SEMs using the PLS approach [28].

As proposed by Chin [6], evaluation of the structural equation model is done in two steps. First, the statistically measurable validity of the measurement model is tested. Thereafter, the structural model is evaluated. This procedure allows us to test hypotheses H1, H2 and H3. Furthermore we evaluate the mediation effect of the *Intensity of Information Sharing* variable (H4), i.e. whether the positive impact of vertical forward integration on performance can be explained by a higher degree of information sharing enabled by it. This mediation effect is tested based on the approach outlined by Baron and Kenny [4][18]. Thus, a simple model (Model B) with a direct causal link from the VFI construct to the PBO construct is additionally evaluated. The mediation effect exists if the significant VFI → PBO path in Model B becomes insignificant once the mediator variable (IIS) is integrated into the model (Model A) [4][18].

4.4 Evaluation of the Measurement Model

According to the standard validation procedure, the evaluation of the measurement model comprises the evaluation of the Convergent and Discriminant Validity. The criteria used to test the Convergent Validity are the Indicator Reliability of the chosen items, the Composite Reliability and the Average Variance Extracted (AVE) for each latent variable, and Cronbach's Alpha. In order to test hypothesis H4, two models (Model A and Model B) are evaluated.

In order to assure Indicator Reliability, each latent variable should be accountable for at least 50 percent of the variance of the corresponding indicator. Thus, the loading of a latent variable on the individual indicator should return a value larger than 0.7 [5][21]. According to Hulland [21] indicators with loadings less than 0.4 should be eliminated. 15 indicators fulfilled the former requirement exceeding the threshold of 0,7. We have left 3 other indicators with the loading values of 0.61; 0.57; 0.62 in the model to ensure the content validity of the measured constructs. Furthermore, Cronbach's Alpha, a measure of Internal Consistency, for all constructs was assessed. As can be seen in Table 2, its values were higher than the required threshold of 0.7 for all latent constructs [26]. In order to ensure Composite Reliability, its value should exceed 0.6 for all constructs [20]. Additionally, the AVE values of all constructs should to be at least 0.5 since otherwise the variance due to the measurement error would be higher than the variance captured by the corresponding construct [12]. As can be seen in Table 2, the Composite Reliability and AVE thresholds were surpassed by all constructs. Discriminant Validity refers to the degree to which measures of distinct concepts differ [1]. According to Fornell and Larcker [12], Discriminant Validity is ensured when the AVE values for all latent variables stay greater than the squared

correlation between the latent variable and any of the other latent variables in the same model. This criterion was ensured for all constructs (see Table 3). The second criterion to assure Discriminant Validity requires that the factor loadings of every indicator are greater than any of the cross-loadings, i.e. the loading of the indicator on another than the construct it is supposed to measure. This criterion was also met by both of the estimated models (A and B).

Table 2. Quality criteria of the constructs

Model	Construct	Number of indicators	Composite Reliability	Average Variance Extracted (AVE)	Cronbach's Alpha
A	VFI	6	0.866	0.526	0.815
	IIS	6	0.970	0.844	0.963
	PBO	6	0.948	0.755	0.934
B	VFI	6	0.867	0.524	0.815
	PBO	6	0.948	0.755	0.934

Table 3. Square root of AVE (diagonal elements) and correlations between latent variables (off-diagonal elements)

Model A				Model B			
Construct	VFI	IIS	PBO	Construct	VFI	PBO	
VFI	*0.73*			VFI	*0.72*		
IIS	0.563	*0.92*		PBO	0.44	*0.87*	
PBO	0.417	0.632	*0.87*				

4.5 Evaluation of the Structural Model and the Mediation Effect

As opposed to the covariance-based approach, no overall measures of goodness of fit are available when using PLS. Chin [6] argues that in Structural Equation Modeling the importance of goodness of fit measures is generally overestimated. The model validity in PLS can be evaluated by examining the resulting R^2 values and the structural paths [29]. Evaluation of the significance of the path coefficients is done via a bootstrapping procedure, since there are no assumptions on how the latent variables are distributed. Evaluation results concerning the Structural Models (Models A and B) are presented in Figure 2.

The results of the PLS analysis show that 40.4% of the variance in the dependent variable (*Performance of the Brand Owner*) is explained by the variables in the model. Recommendations for an acceptable level of R^2 range from 33% to 67% and above [29]. Taking into account the novelty of the research topic, such explanatory power of the model is high.

At the next step the values of the path coefficients and their significance were evaluated for Models A and B. It is recommended that the values of the path coefficients exceed the 0.2 threshold [29]. We find that the path coefficient between *Vertical Forward Integration and Intensity of Information Sharing* (VFI → IIS) is high (0.563) and significant. Similarly, there exists a strong significant link(0.582) between *Intensity of Information Sharing* and the *Performance of the Brand Owner* (IIS →PBO). Thus, hypotheses H3 and H1 are supported. We find the link between *Vertical Forward Integration* and the *Performance of the Brand Owner* to be insignificant for model A, which rejects hypothesis 2 (H2). The evaluation of the Model B, when the IIS construct is removed, rendered a strong (0.431) and significant link between both constructs. The explained variance in the dependent variable (*Performance of the Brand Owner*) drops to R^2=0.191. The comparison of Models A and B clearly confirms the presence of a strong mediation effect of the IIS variable. Thus, hypothesis H4 is confirmed.

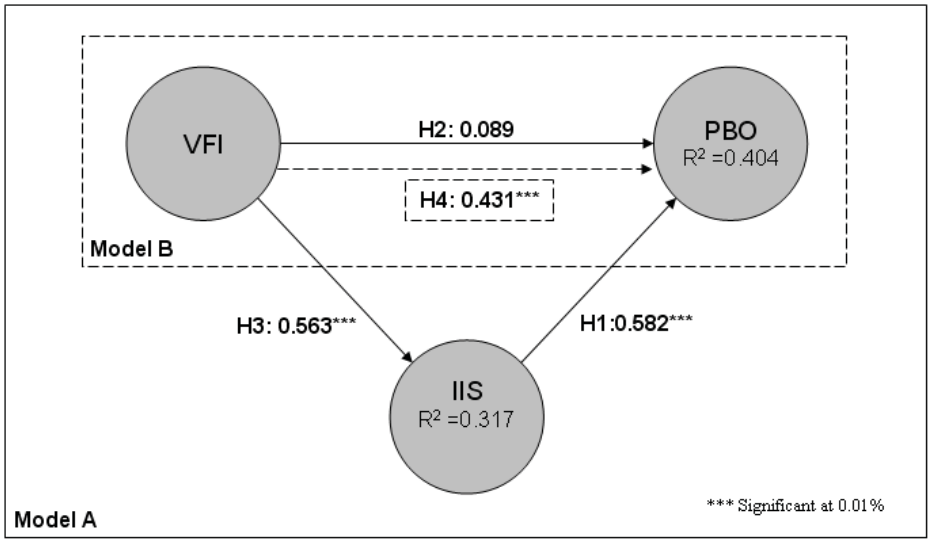

Figure 2. Results of Structural Models' Evaluations (PLS)

5. Discussion and Managerial Implications

The statistical results show that Vertical Forward Integration alone is not a sufficient condition for the success in the fashion business: H2 was not supported by out data. However, our model shows that vertical integration does have an indirect impact on performance because it enables profitable information sharing practices (H3, H1). Indeed, we find that Intensity of Information Sharing along the supply chain mediates the relationship between Vertical Forward Integration and Performance (H4). The importance of free information flow in the apparel supply chain is an important finding of our study: a high intensity of information sharing activities between the brand owner and the retailers involved in the distribution of apparel leads to increased performance of the brand manufacturer (H1). The high and significant path coefficient is an indication of the extremely high relevance of timely demand signals in the fashion business. Our results suggest that while logistical information seems to be shared intensively within vertically integrated fashion companies, it is usually not shared in distribution systems where the brand owner exerts little control over the retailers. If their superior information flow is what distinguishes fast fashion retailers, the performance of the traditional apparel manufacturers and/or wholesalers could be improved by inter-organizational information sharing and collaboration. Information sharing across organizational borders requires both: information technology that supports the fast and reliable exchange of data (e.g. EDI, RFID) and setting the right incentives for sharing information reliably and truthfully.

6. Conclusions

Motivated by the astounding achievements of the fast fashion companies, the aim of this paper was to empirically identify important drivers of success in the apparel industry. We find that solely exerting more control over subsequent supply chain stages is an important but not a sufficient condition for the success of brand owners. The increase of supply chain control, which is usually achieved by vertical forward integration, is found to be an enabler of information sharing practices along the supply chain. Intensive information sharing in turn is a crucial ingredient of a successful supply chain strategy in the apparel sector. Our results motivate further research on how to enable effective information sharing among apparel manufacturers and retailers without the need for manufacturers to open their own stores.

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