

HOW TO SECURE CRITICAL SUPPLY? MARKET EXCHANGE OR VERTICAL INTEGRATION

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ABSTRACT

Securing critical input is assumed important, particular for firms embedded in turbulent settings. Vertical integration, i.e. internalising functions and value creating activities instead of acquisition through market exchanges, is often proposed as a rational organisational design to secure essential supply, i.e. a key challenge in logistics. Vertical integration implies that supply is handled within, rather than outside, the borders of the firm.

Empirical studies regarding the vertical integration performance relationship (VIP) yield, however, rather confusing findings. The mixed findings have been explained in different ways, for example variations in empirical settings. It has long been recognised that firm specific factors may influence performance. However, inspecting the recent literature reveals that surprisingly few studies have examined this empirically.

This paper represents an effort to enlighten our insights regarding firm specific factors' impact on the VIP-relationship.

Here, two firms embedded in the same industrial context are examined in a longitudinal study, applying both secondary and primary data-sources. The two firms have chosen to organise differently to secure critical input: one firm is vertically integrated, while the other utilises the market to acquire the needed input. However, both firms are high performers in the actual industry. Our findings may be seen as an example of equifinality, i.e. there is no single best way of organising economic activities, rather that "the best way" depends on a variety of factors including firm specific resources. Implications for theory development regarding vertical integration versus alternative strategies for securing input, as well as managerial implications are highlighted.

Key Words: Raw material supply, Organisational design, Firm specific resources, Equifinality, Fish processing industry

1. Introduction

This paper departs from the observation that some firms embedded in turbulent environments integrate vertically, as predicted from the research literature, while other firms mainly use the market to secure critical inputs. Improved understanding of this apparent paradox is important for several reasons. First, past research yields mixed findings regarding the relationship between vertical integration and performance (i.e. the VIP relationship). Several explanations of the rather mixed and confusing findings have been advanced without being able to arrive at a satisfactory one. Second, the surprising observation that vertically integrated as well as non-integrated firms embedded in the same industrial context can perform equally well may indicate that factors left out in most studies examining the VIP relationship are important. Further insights regarding the stated paradox is important to improve decisions concerning organisational design aimed at securing efficient supply of critical input, i.e. a key challenge for firms' logistics, influencing their performance. Within the field of logistics the presence of vertical integration has been claimed to be a key explanatory factor when assessing reduced transportation and management costs, and can be viewed as an alternative to supply chain management (Ellram, 1991). Further, high levels of vertical integration in the supply chain can realise logistics benefits unattainable for stand-alone organisations, (Ross, 1998).

To enhance our understanding of the observed paradox, a theory-driven exploratory study is conducted, by identifying possible explanatory factors obviously omitted in past research. Two classes of factors are identified as "promising": *unique firm specific factors*, together with *flexibility* (as an alternative to vertical integration). Studies of these factors are challenging when it comes how to balance the need for detailed information at firm level and need for external validity. Here, a longitudinal study encompassing two firms is conducted. One firm is vertical integrated, the other not. They are both embedded in the same industrial context, i.e. the Norwegian fish processing industry, and belong to the group of best performers in the industry during the last decade. In order to recognise the two firms' resource position and their doing unique and very detailed firm specific data are required.

The paper is organised as follows. In the next section we give a brief review of literature relevant for our research problem. Thereafter we argue for the research methodology chosen, the setting under study and the data applied for our purpose. In section four we develop a set of empirical hypotheses derived from theory, which are tested and analysed in section five. Finally we give some implications for theory development and managerial issues together with some concluding remarks.

2. Literature review

The literature dealing with market operations versus hierarchical in-house organisation is extensive. To secure critical input – a major logistic challenge – scholars tend to explain choice of organisational structure by the level of uncertainty in the supply conditions, i.e. *environmental* or *primary* uncertainty (Ottesen & Grønhaug, 2003). Here we briefly address three perspectives contributing to explain the existence of vertical integration of firms. We do so because elements from these perspectives will be applied in our effort to understand the problem under scrutiny.

First, and perhaps the perspective that most explicitly addresses this problem, is the **contingency view** – as reflected in various Structure-Conduct-Performance models. Porter (1980) is probably the one that has had the greatest influence in advancing this perspective. According to this view vertical integration can help to reduce external uncertainty, and thus create competitive advantages, e.g. by allowing acquisition of critical input, reducing costs by avoiding the market, by combining operations in the value system, by increasing internal control and co-ordination, by sharing information and by creating stable relationship.

Second, and the first one to explicitly address vertical integration is the **transaction cost economics** perspective originating from the early work of Coase (1937), and further developed by Williamson (1971) and others. According to this perspective the firm may under specific conditions, e.g. to safe-guard transactions decide to bypass the market and resort to hierarchical modes of organising its economic activities. As such, the vertical integrated firm may economise transactions through improved control and reduced market uncertainty. The mere existence of vertically integrated firms suggests that operating in competitive markets induces costs above zero. Within this stream of research the structure of vertical relationships is explained on basis of variations in the importance of asset specificity, uncertainty, product complexity, and degree of repeated purchase activity (Joskow, 1988).

A third perspective to explain the existence of vertical integration is the **resource based view** of strategic management. This stream of research gives no particular rule of thumb as to when it is profitable to integrate vertically, but rather emphasise the need for thorough examination of pros and cons of the actual situation when the integration decision is to be evaluated. According to the resource based view firms may create a competitive advantage by utilising heterogeneous, valuable and/or rare resources that are difficult to imitate (Barney, 1991). In contrast to the other two perspectives the resource based view does not content that vertical integration will be effective in reducing environmental risk. In contrast, authors subscribing to this perspective even claim that vertical integration may enhance risk and may even increase risk compared to market operations (Chatterjee *et al.*, 1992). According to this approach, the ability to profit from vertical integration is strongly related to firm specific resource (Leiblein & Miller, 2003).

The above theoretical contributions, however, all identify both gains and drawbacks from integrating vertically as compared with open market transaction. Recommendations regarding when and when not to integrate, however, are ambiguous. This coincides with findings from the empirical literature on performance effects from vertical integration. Most empirical studies have, however, concentrated on issues like transaction costs, foreclosure, and causes for vertical integration, rather than on performance effects from hierarchical organising. Researchers representing all three perspectives have analysed the VIP relationship. Some report positive covariance between vertical integration and performance (D'Aveni & Ravenscraft, 1994; Edwards *et al.*, 2000), some find that vertical integration have indecisive or no impact on performance (Harrigan, 1986; Chatterjee, 1991), while still others find that vertical integration and performance is negatively correlated (Fan & Lang, 2000; Bhuyan, 2002).

The way vertical integration affects firms' external uncertainty has also been studied. Helfat & Teece (1987:49) found that: "*If vertical integration reduces a firm's exposure to uncertainty (...) there are theoretical and empirical reasons for believing that its cost of capital will be lower than otherwise. In a competitive market these savings will tend to be translated into lower product prices...*" They found that the risk of the acquiring firm was

significantly reduced when integrating backwards. Lubatkin & O'Neill (1987) found, however, an insignificant change in profitability, while Levy (1985) reported that firms with higher levels of asset specificity¹ and environmental uncertainty were more apt to integrate vertically. Walker & Weber (1987) found that high levels of volume uncertainty significantly influenced firms' decisions whether to make or buy production components. According to Towill & McCullen (1999:86) "*The supply chain which best succeeds in reducing uncertainty and variability is likely to be most successful in improving its competitive position*", entering the stream of researchers underlining uncertainty reduction as a source for competitive advantages.

Vertically integrated firm may also be exposed for increased production costs due to different capacity in integrated stages of production (Stuckey & White, 1993). While a "free" firm can adjust its open market purchases to the adequate in-house capacity, a vertically integrated firm might be prevented from doing so. Such imbalances may give rise to inefficiencies that increase costs. The cost structure of a vertically integrated firm may also be influenced by increased overhead costs from managing different technologies, different control- and incentive systems as well as different types of employees. Needed flexibility might be lost because of rigidity established by "in-locked" single suppliers reducing the ability for advantageous technology changes or market price reductions. On the other hand, such shortcomings can be inverted to gains by focusing on income side advantages: Integration can absorb margins earlier awarded from non-integrated firms and may as well reduce transaction costs and taxes imposed on transactions with former trade partners, now in-house suppliers (Hayes & Wheelwright, 1984).

The 'market and hierarchy' dichotomy reveals – after closer inspection – the encompassment of a great variety of organisation forms. Sole ownership and proprietary rights are not the only ways to achieve vertical integration advantages and the perfect markets only exists by exceptions. Moving along the great variety of organisational forms – from vertical integration at one end to open market transaction at the other – it is observed that autonomy is lost as integration increases (de Koning, 1994). Along this continuum we find a variety of organisational forms and contractual cooperation, relation or equity based alliances (Peterson *et al.*, 2001), analogous to what de Koning depicts as network, interdependency, federation, holdings and concern. Pure spot market operations are seldom utilised by industry actors. Some form of relational contact among the market participants is usually present. Utilising long term contracts, joint ventures, minority equity investments, licensing agreements, and other alternatives to vertical integration can bring about the desired capabilities and sufficient control without carrying the investments and costs of full ownership over adjacent stages in the value system.

In such a perspective, industrial networks can serve as an adequate alternative to vertical integration, where the manufacturer obtains specialised inputs from external suppliers. "*The manufacturers maintain ongoing contacts with these suppliers; they train them, provide equipment and know-how, and otherwise invest in the relationship. Suppliers also invest in assets that allow them to produce inputs to buyers' specifications. Typically, manufacturer-supplier relationships are not exclusive; buyers have several suppliers for each input, and suppliers have several clients.*" (Kranton & Minehart, 2000:571). Networks may serve as a basis for contractual co-operation and an intermediate state

¹ "*Asset specificity refers to the existence of significant transaction-specific sunk costs, which are durable non-redeployable investments in transactions that thus have little use or economic value outside the buyer-supplier relationship*" (Whyte, 1994: 288)

between pure market transactions and vertical integration, especially favourable for the manufacturing firm when uncertainty prevails in the demand for input factors. Such networks rely heavily on *trust* in transactions between buyer and seller, which clearly affects the terms of trade between actors, (see Dulsrud (2002) for a review).

Afuah (2001) asserts that *firm boundaries are dynamic*, and that technological changes can outdate former organisational adaptations to supply (e.g. vertical integration, alliances or market transactions), as supply conditions change. The ‘in-house’ or ‘through market’ decision should also be based on the evaluation of which makes the most efficient generation and exploitation of knowledge, thus firms might end up with different conclusions depending on their evaluation of in-house resources.

In our effort to understand the ambiguous findings – and explanations regarding the VIP relationship – to our surprise – flexibility as an alternative strategy to vertical integration is seemingly missing. Important intended purposes of vertical integration are to control and reduce variations in critical supply. An alternative is flexibility, aiming at as smoothly as possible to adjust to unpredictable changes. It should be noted that the two strategies put different requirements on firms pursuing them. Flexibility comes in several forms, relevant to handle input fluctuations or to secure critical inputs, e.g. volume flexibility, financial flexibility, and input flexibility (i.e. to what extent the firm may apply multiple – and alternative types of inputs to utilise its production capacity).

Our discussion above reveals a variety of aspects that may influence what is the most effective organisation form to secure critical supply under turbulent conditions. From this also follows that we subscribe to the idea of equifinality², i.e. there is no one solution that is the best one for all, but that the derived goal may be achieved in multiple ways. Accordingly, not only industry factors, but also firms specific characteristics and resources need to be included to improve our understanding of the VIP relationship (Leiblein & Miller, 2003;). Surprisingly few contributions have focused on firm specific factors as a moderator when explaining the “make-or-buy” decision (Coles & Hesterley (1998) serving as an exception), to a large degree based on the heavy demand for data. As a point of departure, case studies like our – meeting the severe claims on data – can be a way of overcoming these major challenges.

Based on the above discussion we advance three “working hypotheses” (WH), i.e. “hunches” or ideas to guide, but not dictate our effort to gain insights into the apparent ambiguous VIP relationship.

WH₁: The same performance goal may be reached in several ways, (i.e. we subscribe to the idea of equifinality)

WH₂: Firms specific factors (resources) – almost neglected in past research – may contribute to our understanding of adequate organisation for firms to cope in turbulent environments

WH₃: Flexibility and vertical integration are alternative strategies to cope in turbulent environments

² According to Gresov & Drazin (1997:404) the concept **equifinality** means that: “...*the final state, or performance of an organization, can be achieved through multiple different organizational structures even if the contingencies the organization faces are the same. [It] thus imply that strategic choice or flexibility is available to organization designers when creating organizations to achieve high performance. (...) The possibility of multiple, equally effective designs to support a given strategy undermines the predictive value of the contingency approach.*”

3. Research methodology

In this section we report the research methodology underlying our empirical study. We first describe our research design, and then we report our choice of setting, followed by description of data.

3.1. Research design

To study our research problem we need variation in organisational forms for well performing firms operating in the same industry. Also, to capture turbulence longitudinal data are needed.

Here a longitudinal study of a population of firms, i.e. the Norwegian fish processing industry was conducted. Two firms were chosen for detailed case studies. The selected firms have proven to be among the best financial performing firms within the industry for several years. Interestingly for our aim of the study, they have chosen to organise differently in order to secure supplies. One firm (A) is vertically integrated, i.e. it owns the fishing vessels which supply the firm with most raw materials. The other firm (B) has never owned fishing vessel, and purchase all the needed raw material in an open market. Both firms are located in the same region, produce the same type of products and rely heavily on the same input factor – demersal fish. In fact, even though this is the most labour intensive branch of this industry, raw materials are the most important input and cost component, with about two thirds of total costs. Our data cover most of all purchases of fish to these firms for the years in question

The design chosen is well suited for a detailed study of the impact of the VIP relationship, and the cases studied open for measuring firm specific resources and their impact on this relationship. As both firms perform well, our design gives the opportunity for testing predicted strengths and weaknesses, as reflected in the literature, of the two organisational forms contrasted here. A major weakness facing a case study is the risk of poor external validity. Here we try to overcome this critique by comparing our findings at firm level to industry averages for all the variables applied. Additionally, the longitudinal design strengthens the external validity as far as time is concerned and opens for statistical tests of differences in factors between two firms.

3.2. Setting

The Norwegian fish processing was chosen as our research context. We did so, because this industry comprises a link in the seafood value system between the biological resource and the consumers, where several structural factors may motivate for vertical integration. As underlined by Dreyer (1998) and Ottesen & Grønhaug (2003) among others, managers of fish processing firms are exposed to an almost stochastic supply of the most important input factor; namely fish, due to the risky environment surrounding this biological resource (seasonality, quality, abundancy, meteorology). Uncertainty is also prevalent in the other end of the value system, where prices and output fluctuate heavily. It has been claimed that vertical integration can be beneficial in such situations (Carlton, 1979; Walker & Weber, 1987; Williamson, 1991; Miller & Shamsie, 1999). In a setting like ours, upstream vertical integration towards the fishing fleet, in order to achieve control over the most important input factor is claimed to be a meaningful strategy to reduce uncertainty and to secure a sufficient supply.

The Norwegian fish processing industry is a very heterogeneous industry. The number of firms is relatively high, (within NACE code 15.2 the number in 2002 was 520). Most firms are small or medium sized, and the degree of concentration is very low, the Hirshman/Herfindahl index was 0.025 in 2001, (Bendiksen 2001).

By limiting our study to one industry we control for “industry effect”, i.e. elimination of outside factors due to industry that may covary with organisational arrangement. However, variations within the same industry – especially when heterogeneity is high as here – may also be difficult to account for. Here we try to remedy this by including firm specific factors. In this way, the imperative made by Joskow (1988)³ on thorough knowledge about the industry studied, becomes crucial.

Above we have argued that the choice of appropriate degree of vertical integration is a complex decision exceeding the pure dichotomy between to ‘make or buy’ or ‘use or sell’. In Dreyer *et al.* (1998) the state of vertical integration in the Norwegian fish processing industry was examined to a greater detail, where one of the main problems encountered was how to establish the state of vertical integration in a heterogeneous industry like this. One measure is degree of self-sufficiency, i.e. how much of the main input stem from controlled affiliated businesses. This is a relative measure, ranging from 0 to 1, where non-integrated firms receive 0, and firms receiving all their inputs from controlled units are given the value 1. This corresponds with the recommendation from the theoretical literature (Mahoney, 1992; de Koning, 1994; Peterson *et al.*, 2001) and from measures used in other empirical research (MacDonald, 1985; Edwards *et al.*, 2000).

3.3. Data and measurement

Detailed data at firm level, to capture vertical integration, raw material flow and profitability, are necessary. For this purpose “Driftsundersøkelsen”, a “state of art” database, which has surveyed the profitability and structure of the Norwegian fish processing industry on an annual basis since 1977, (Bendiksen, 2001) has been used. Data for the same firms each year, give us the opportunity to construct time series as well as panel data sets. The very detailed - and annual - data allow us to capture the various variables under scrutiny in an adequate way.

In addition to this data, we have carried out semi-structured interviews with the managers of the firms focusing on how they cope in order to secure their supply of raw material. We also collected information from internal and external financial statements published by the firms. Information concerning the firms in the press and other sources was also collected. We also collected detailed information concerning raw material flow into the firms regarding; season profile, volumes and prices of different species and number of suppliers.

Based on these data we have developed various measures of relevance for the present research purpose (see section 4).

In order to capture the competitive position of the firms studied we calculated Return of Investment (ROI) for several years at firm level in the population. Both Firm A and B have been among the top 25 per cent with regard to ROI every year within a period of the last ten years, which corresponds to one of our design criteria. Table 1 shows various characteristics for the two firms – as well for the total industry in 2002.

³ “[G]ood empirical work aimed at testing theories (...) requires that we know a lot about the characteristics of the firms and products that we are relying on in the empirical work.” (Joskow, 1988:111)

Table 1: Key characteristics of the firms studied compared to population average in 2002

Variable	Firm A	Firm B	Industry average
Vertical integrated	Yes	No	-
Return on Investment (%)	1.7	6.9	-2.1
Equity (%)	37	48	27
Number of employees	146	67	64
Total revenues (mNOK)	147	123	113
Total assets (mNOK)	170	42	78
Volume raw fish (tonnes)	8,600	6,900	6,500

Inspection of Table 1 reveals that Firm A is larger than Firm B, while the size of Firm B is approximate the same as the average among the firms in the setting. Both firms performed better than the industry average. The last ten years, this relative picture, both regarding size and performance, has been very much the same as illustrated in Table 1.

4. Empirical hypotheses

To examine our tentative, working hypotheses, a set of testable empirical hypotheses (**EH**) were derived. The empirical hypotheses are derived from our working hypotheses and are also theory-based on the streams of literature briefly reviewed above.

According to the literature on the VIP-relationship, a major advantage among vertical integrated firms is that they are in a position where they are able to control the flow and price of input independent of the market situation. To study this assumption we have mapped the monthly supply of raw material during the last three years. In order to measure fluctuation in supply we have applied a random walk model where volume in period $(t-1)$ is applied to predict volume in period t . This model is tested in an ordinary linear regression analysis, where the regression coefficient (r^2) measures the fit of the model. Thus, high r^2 indicate low fluctuation. Based on our review of literature we predict to find the following relationship:

EH₁: Raw material supply fluctuations are higher in Firm B than in Firm A ($r_A^2 > r_B^2$)

Another assumed advantage for the vertical integrated firm is avoidance of the market, implying that it can secure its supply at a lower price than non-integrated firms. Additionally, the literature indicates that non-integrated firms, due to less capacity cost, are in a position where it can apply price as a tool in order to secure input. Both arguments indicate that Firm B pays more for its input than firm A. In order to test this hypothesis we have mapped the average monthly prices for cod (**P**), i.e. the most valuable species, paid by Firm A and B and tested if there are any differences in prices. According to these arguments and our literature review we predict that:

EH₂: Firm B pays a higher price for its input than Firm A ($P_A < P_B$)

Transaction costs related to the securing of critical inputs are assumed to be lower in integrated than non-integrated firms due to control of input and few suppliers. Non-integrated firms, however, must put resources in searching the market for new suppliers. In order to investigate this proposition we have measured the degree to which the firms receive supply from own vessels (**O**), i.e. a self sufficiency ratio. We have also mapped the number of suppliers (**S**) for 2002, and we predict to find:

EH₃: Firm A is to a higher degree supplied from own vessels than Firm B ($O_A > O_B$)

EH₄: Numbers of suppliers are higher for Firm B than for Firm A ($S_A < S_B$)

According to literature asset specificity motivates for vertical integration. Thus a vertical integrated organisation is predicted, in order to perform better, to be highly specialised when it comes to processing input from its own suppliers. Firms operating in the open input market, however, must to a higher degree have technology that is less vulnerable for specific suppliers or sources of supply. Additionally, the ability to process input from different sources will be an advantage for a non-integrated firm in their struggle for securing supplies. In this supply market input-specificity can be measured as the mix of different species in supplies. We have mapped the level of the most important species in the supplies (**C**), namely cod. Another dimension of specificity relates to the technology the suppliers make use of for catching fish - a dimension that both impact on quality, size of fish and mix of species. In order to measure this dimension, we have mapped the level of supplies from the most important fishing gear (**G**). According to literature on asset specificity we predict that:

EH₅: Firm A is more specialised in supplies, (i.e. fish species), than Firm B ($C_A > C_B$)

EH₆: Firm A is more specialised in supplies, (i.e. fishing gears), than Firm B ($G_A > G_B$)

Vertical integration is often associated with ownership and control. Vertically integrated firms tend – in contrast to non-integrated firms – to own vessels. It seems also reasonable to assume that firms owning vessels would buy catch mainly from their subsidiaries/ vessels. As such the share of landings to a firm stemming from so-called “loyal” recurring vessels (**L**), (i.e. fishing vessels delivering at least 15 per cent of total catch, and landing catch to the firm at least two out of the last five years) should be higher for vertically integrated firms. Thus we can hypothesise that:

EH₇: The share of total landings from recurring “loyal” vessels is higher for Firm A than Firm B ($L_A > L_B$)

It seems reasonable to assume that vertically integrated firms with their own vessels both buy the catch from these vessels and that they to the extent possible invest in vessels suitable to secure supply. For fish processing firms the number of landings ($L^{\#}$) to secure adequate supply influences costs, and the more landings the higher the costs. Because non-integrated firms don't have the “buffer” to secure supply we expect that:

EH₈: The number of landings will be higher for Firm B than for Firm A ($L_A^{\#} < L_B^{\#}$)

Further, according to **EH₄**, **EH₆** and **EH₈**, one can expect the average volume per landing of the vertically integrated firm to outweigh the average volumes per landing (L^{kg}) to the non-integrated firm. Firms studied here are highly volume dependent. Potential integration candidates typically would be vessels that could bring ashore high volumes. From the hypothesised limited number vessels supplying the integrated firm, and therefore small number of transactions, we also should expect that

EH₉: Average volume per landing for Firm A should outweigh that of Firm B ($L_A^{kg} > L_B^{kg}$)

A major disadvantage facing the vertically integrated firm is cost of capacity. In the literature this is a factor applied to explain poor performance among vertical integrated firms. In order to study this aspect we have examined the financial statements and capacity costs reported, i.e. sum of financial cost and depreciations related to total income (**CC**). Based on our discussion we predict to find:

EH₁₀: Firm A has higher capacity cost than Firm B ($CC_A > CC_B$)

Vertical integration is a strategy often proposed to reduce uncertainty. On the other hand, the problem can be turned around, how to handle uncertainty. In literature uncertainty is often related to flexibility. If Firm B is viewed upon as a firm succeeding in coping with uncertainty, the question becomes whether non-integrated firms are more flexible than vertical integrated firms. Above we have predicted that Firm B is more flexible when it comes to ability to differentiate to broader sources of supply. Flexibility, however, comes in many forms. For instance we expect Firm B to have a different portfolio of firm resources than Firm A. In order to be flexible in the supply market Firm B also needs financial flexibility to a higher degree than Firm A. To analyse this we have examined the cash-position, i.e. working capital (**WC**), and predict:

EH₁₁: Firm B has a higher proportion working capital than Firm A ($WC_A < WC_B$)

According to our arguments related to flexibility, we also expect to find that less proportion of the assets in Firm B tied up in fixed assets (**FA**):

EH₁₂: Firm A has a higher proportion of fixed assets than firm B ($FA_A > FA_B$)

In order to understand better the VIP-relationship it is also important to inspect how the chosen approach to secure supply impact over all costs and value creation. A major remaining question is thus; do successful vertical integrated firms have cost advantages? So far we have predicted that vertical integrated firms have advantages when it comes to prices paid for input, and disadvantages as far as capacity cost is concerned. But what about working force efficiency. A short glance on Table 1 indicates that Firm A has relatively more employee related to total income than Firm B. This may relate to an observation often mentioned – that vertical integration often leads to less efficient organisation. In order to test this we have developed a measure for working force efficiency, i.e. total income related to total wages (**IW**). According to the perspective that vertical integrated firms are less efficient than firms competing in an open market, we predict that:

EH₁₃: Firm A has less total income related to wages than firm B ($IW_A < IW_B$)

Another interesting question arising from the debate related to the VIP relationship is whether vertically integrated firms are in a better position, when it comes to value added activity. In the literature it is claimed that vertical integrated firms have an advantage in controlling quality resulting in a market advantage. In order to test this assumption we have measured value added in the firms, i.e. total income per kg raw material (**IKG**). Here we predict:

EH₁₄: Firm A create higher income per kg raw material than Firm B ($IKG_A > IKG_B$)

Letting **EH₁** through **EH₁₄** serve as our empirical hypotheses, utilising the variables as described above, we conduct our analysis as accounted for in section 3.1.

5. Findings

We start the presentation of our findings by quoting the answers given by two top managers when asked about the importance of ownership in fishing vessels:

Manager of a vertical integrated firm:

"Landings from own vessels are a necessity to survive. Control over landings is a 'must' to secure long-term planning and with that; profitability."

Manager of a non-integrated firm:

"We don't feel competent to invest in the fishing fleet. As auction markets steadily grow and improve we can pay a substantial 'mark-up' rather than tying capital to vessel investments."

Inspections of the reported answers show that ambiguity regarding the role of vertical integration prevails in this industry. Table 2 reports findings from the testing of our empirical hypotheses - **EH₁** to **EH₁₄**. Our findings are based on data for 2002, though similar analyses for previous years yield very much the same results. As noted above, both Firm A and Firm B are in front among the firms in this population with regard to financial performance. Here we focus on different factors that can help us to understand how Firm A and Firm B achieve their competitive position in spite of the fact that they organise their input securing activities very differently.

Table 2: Variables, empirical hypothesis and results

EH	Variable	Empirical hypothesis	Firm A	Firm B	Industry Average	Direction
EH ₁	Input control	The fluctuations in supply of raw material are higher in Firm B than in Firm A ($r_A^2 > r_B^2$)	0.31	0.23	0.35	+
EH ₂	Pricing	Firm B pays a higher price for its input than Firm A ($P_A < P_B$)	10.86	10.99	11.04	+
EH ₃	Network	Firm A is to a higher degree supplied from own vessels than Firm B ($O_A > O_B$)	80 %	0 %	n.a	+
EH ₄	Network	Numbers of suppliers are higher in Firm B than in Firm A ($S_A < S_B$)	10	170	124	+
EH ₅	Specialisation	Firm A is more specialised in supplies, i.e. fish species, than Firm B ($C_A > C_B$)	63 %	75 %	76 %	-
EH ₆	Specialisation	Firm A is more specialised in supplies, i.e. fishing gears, than Firm B ($G_A > G_B$)	100 %	36 %	55 %	+
EH ₇	Network	The share of total landings from 'loyal' vessels is higher for Firm A than Firm B ($L_A > L_B$)	93 %	76 %	68 %	+
EH ₈	Network	The number of landings will be higher for Firm B than for Firm A ($L_A^{\#} < L_B^{\#}$)	212	1,972	684	+
EH ₉	Network	Average volume per vessel is higher for Firm A than for Firm B ($L_A^{kg} > L_B^{kg}$)	40,500	3,500	n.a	+
EH ₁₀	Capacity cost	Firm A has higher capacity cost than Firm B ($CC_A > CC_B$)	2.4	2.6	6.6	-
EH ₁₁	Flexibility	Firm B has a higher proportion working capital than Firm A ($WC_A < WC_B$)	12.9	47.5	26.9	+
EH ₁₂	Flexibility	Firm A has a higher proportion of fixed assets than firm B ($FA_A > FA_B$)	69.0	44.1	54.4	+
EH ₁₃	Productivity	Firm A has less total income related to wages than firm B ($IW_A < IW_B$)	3.31	6.25	5.89	+
EH ₁₄	Productivity	Firm A creates higher income per kg raw material than Firm B ($IKG_A > IKG_B$)	17.1	17.7	17.3	-

The numbers in Table 2 are correlation coefficients (**EH₁**), averages (**EH₂**, **EH₉**, **EH₁₀**, **EH₁₁**, **EH₁₂**, **EH₁₃** and **EH₁₄**), percentages (**EH₃**, **EH₅**, **EH₆** and **EH₇**), and counts (**EH₄** and **EH₈**). We test the empirical hypothesis by comparing the scores for Firm A and B respectively, and the last column reveals whether the findings are in accordance with the hypotheses (+).

Inspection of Table 2 reveals that Firm A is confronted with less fluctuation in supply than Firm B, i.e. **EH₁**. This finding is in the predicted direction. However, for both firms the fluctuations are somewhat higher than the industry average. Though, we have to bear in mind that for the industry we have added up fluctuations for several firms illustrating the fluctuations if we only had one firm. A proper way to compare our firms to the fluctuation among the other firms would be to conduct the same analyses in every firm and then compute the average of every r^2 's. This is, however, beyond the scope of our analysis. The

results in Table 2 indicate that if it was only three firms in this population, the fluctuation in the third firm (Industry) also would be rather high. Looking at input control, our results indicate that the vertical integrated firm is able to reduce the fluctuation by controlling the activity of their own vessels.

The findings regarding hypothesis **EH₂** show that Firm B pays – as predicted – somewhat higher prices than does Firm A, and also that the prices for both firms are somewhat lower than the industry average. These results confirm the value of avoiding the market through vertical integration, and are in accordance with theoretical predictions.

Inspection of **EH₃** and **EH₄** shows overwhelming support for the stated hypotheses, as 80 per cent of supply came from own vessels, but this fraction were zero for Firm B. This as such, is almost tautological as Firm B does not own any vessel. More convincing, however is the much higher numbers of suppliers used by Firm B than Firm A. An interesting observation is also that the number of suppliers used by Firm B is substantial higher than the industry average. A potential explanation might be that Firm B has more contacts – and is more competent in using these contacts – and thus the higher performance than the industry average. This might be what Bowersox & Dröge (1989:69) refer to as: “*A strategic alliance among leading edge firms offers a substitute for vertical integration.*”

Inspection of the findings for **EH₅** shows a result contrary to what we expected. However, by extending the most valuable species to also including saithe and haddock – in addition to cod - Firm B exhibit less specialisation than Firm A, as corresponding figures are 96 and 99 per cent respectively. When also taking the findings for **EH₆** into consideration, which are in the expected direction, we can conclude that Firm A is more specialised than is Firm B. For the latter hypothesis an interesting finding is also that Firm B is substantial less specialised than the industry average. As such this may probably contribute to explaining why Firm B performs better than the industry average. This is in accordance with what leading population ecologists predicts; that in turbulent environments generalists will oust other organisational forms, whilst under more “fine-grained” conditions specialists will have their advantages, (Freeman & Hannan, 1983).

The empirical hypotheses **EH₇** - **EH₉** all deal with the landings to the firms and as can be seen from Table 2, the results are in the hypothesised direction. Firm A – the vertical integrated one – receive more from loyal vessels (**EH₇**), have fewer landings during 2002 (**EH₈**) and receive on average much more fish per landing (**EH₉**) than does Firm B. More interestingly is it, however, that Firm B has a more stable portfolio of suppliers than the industry average, even though the numbers of landings are considerably higher.

Inspection of **EH₁₀** shows that Firm A has somewhat lower capacity costs than Firm B, contrary to what expected. Even more surprising is that the both Firm A and Firm B have substantially lower capacity costs than the industry average. Low capacity costs are predicted to be advantageous when it comes to utilisation of both capacity and flexibility in a turbulent supply market. Thus, our findings support this prediction and indicate that low capacity costs are an important driver for firm performance in this setting.

Inspection of **EH₁₁**-**EH₁₃** reveal that all are in the expected direction, i.e. Firm A has a higher portion of working capital (**EH₁₁**), less portion of fixed assets (**EH₁₂**), higher income related to wages (**EH₁₃**), than do Firm A. Probably more important and equally interesting is that both firms in these respects perform better than the industry average, which contribute to explain firm’s performance.

For **EH₁₄**, on the other hand, findings reveal that earnings per kg raw material are lower for Firm A than for Firm B, as well as lower than industry average. We can at this point, not subscribe this contradictory finding to a particular phenomenon, rather than referring to the literature predicting that vertically integrated business units might suffer losses in competitiveness due to lack of market orientation. This however cannot explain away that our prediction failed to be accounted for.

A major difference between Firm A and B is revealed when looking into capital structure. In Firm A most of the capital is tied up as fixed assets. Firm B has a higher proportion of its capital as equity and working capital, indicating higher financial flexibility. Compared to the rest of the population, both Firm A and B demonstrate a history of well performing by their high equity. One major explanation for the competitive position of Firm B seems to be high flexibility, both when it comes to input sources and cash position. In this setting these firm specific resources seem valuable.

6. Discussion

The reported findings deserve some additional comments. Our outset emphasised the paradox that two firms in the same setting – each choosing opposite organisational designs in order to cope with highly turbulent input supply conditions – obtain superior performance. Based on theoretical contributions illuminating the VIP relationship we advanced three working hypothesis (**WH**), further specified into a set of 14 testable empirical hypotheses (**EH**). Support for all, but three of the empirical hypotheses was found. The probability for this result by chance is $P(B \geq 11) = .006$, ($p = .5$ and $n = 14$), indicating that the applied theory really possesses predictive validity.

To understand our puzzle, i.e. how both the integrated as well as the non-integrated firm in our study perform substantially better than the industry average we need to return to the reported findings.

Our findings reveal that both firms have advantages and disadvantages rooted in their organisational design for securing critical supply in a turbulent market. For example, it is observed that the vertically integrated firm achieved less input fluctuations and paid less for critical inputs than did the non-integrated firm – also as predicted from theory. At the same time the non-integrated firm was observed to compensate its disadvantages by higher degree of flexibility, allowing for the handling of unpredicted changes without suffering losses in productivity.

On the other hand our design and data reveal several weaknesses related to the two ways of organising – also predicted by literature. The vertical integrated firm suffer from losses in productivity and high capacity costs, while the market oriented firm suffer from high transaction costs and is exposed for huge fluctuations in volumes and market prices. However, both firms perform superior compared to the industry average, indicating that they manage to utilise advantages and avoid major disadvantages of the organisational form chosen. As illustrated in our findings, Firm A manage to avoid high capacity cost although being vertically integrated, while Firm B manage to combine high flexibility with productivity, (as underlined by the rejection of our **EH₁₄**).

A key finding from our investigation is that vertical integration and flexibility are alternative strategies to cope with turbulence. More precisely, vertical integration is applied as a means to reduce imposed fluctuations, while flexibility is applied to adjust to

fluctuations encountered. These findings are important for a better understanding of the mixed empirical findings concerning the VIP relationship in past research and illustrate the need for bringing in firm specific resources when assessing these results.

Can these contradicting findings be explained? Obviously not if we only take the theoretical contributions on the VIP-relationship into account. But by utilising the idea of “equifinality” together with the exploitation of flexibility as an alternative to controlling the environment through vertical integration, we contribute to a better understanding of the confusing findings regarding the VIP-relationship. A main conclusion from our study is the support for the idea of “equifinality”, i.e. the same performance effects can be achieved in several ways. Additionally, we conclude that success of the chosen strategy not only depends on industry specific factors, but also require that firm specific factors or resources are adequately taken into account and properly exploited.

Our research design chosen has proven to be valuable, both when it comes to enlighten further knowledge concerning pros and cons of vertically integrated firms as well as better understanding of the confusing empirical findings when it comes to the VIP relationship. The validity of our findings is improved by the way the two firms are compared to the rest of the firms within the industry and the timeframe of our study. However, our study is based on detailed information from only two firms within a specific setting. Further studies, utilising similar designs in other settings, will enhance the understanding of how firms organise and act to secure critical input in turbulent supply markets – a challenging task for both strategic and logistic research.

Both firms pursue apparently successful strategies. The strategies followed are probably formed by earlier strategic choices and resource endowments, and thus reflect that they both are taking firm specific – in addition to industry specific conditions – into account. To pursue a strategy successfully requires insights and competence. The fact that both firms apparently are successful indicates that they both are competent in pursuing – and benefiting from – their chosen strategies. Moreover, because more than one strategy proves successful, it also favours the principle of “equifinality”, i.e. more than one approach can be appropriate to become successful. This requires, however, that in addition to industry specific factors also firm specific factors must be adequately taken into account and exploited. This simple, yet complex reality, can be illustrated by the words of the top manager in Firm B, cited from a portrayal in a newspaper after his firm had – quite sensational for this part of the fish processing industry – delivered positive results for 15 consecutive years:

“Our firm is rather boring, and performs well because of conservative investments and a marvellous, stable workforce.”

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