

EXPANDING FIRM BOUNDARIES THROUGH VALUE CHAIN ORCHESTRATION – A STUDY IN THE AGRICULTURAL BIOTECHNOLOGY INDUSTRY

1. INTRODUCTION

Alliances, mergers and acquisitions, and joint ventures are playing an increasingly important role in corporate development. The growing number of publications on this subject only mirrors this trend. The present paper also examines interfirm alliances, albeit from a different angle. In an empirical study I have observed companies which make use of alliances beyond the scope examined by extant theory, i.e. risk sharing, competence enhancement or market development (Powell, 1998). Instead, they use their network of alliances, joint ventures, and acquisitions, which has been configured along an extended, cross-industry value chain, linking formerly separate industries in order to create fundamentally new markets. This activity, which I will call “virtual value chain orchestration” is studied in this paper.

The paper is organized as follows. After reviewing existing literature in this field, a framework for value chain orchestration is presented. Next, after a section dedicated to research methods, value chain orchestration is illustrated by two empirical case studies. I will attempt to shed some light on the relationship between value chain orchestration and financial results. Subsequently, we discuss the results of our empirical research. The paper concludes with directions for future research and final remarks.

2. LITERATURE REVIEW

In recent years, there has been an unprecedented growth in corporate partnering and various forms of external collaboration. Ever since the 70s and 80s, many companies gave up their long-held beliefs in the benefits of vertical integration, preferring instead to engage in a variety of contractual agreements with other companies.

Empirical research across a diverse set of industries has found that alliance formation activity has grown between 25% and 35% annually over the past years (Margulis, 2002). Revenues from alliances accounts for approx. 20% of total revenues for US firms and approx. 24% of total revenues for European firms (Margulis, 2002).

The various types of interfirm alliances take on many forms, ranging from outsourcing agreements, strategic alliances, equity joint ventures to reciprocal shareholdings and other, more complex arrangements. The advantages of risk sharing, increased organizational competencies, access to new markets and the possibility of interorganizational learning have all been cited as possible rationales for this development. After the functional, divisional and matrix structure, organizational scholars view the network organization as an alternative capable of overcoming their deficiencies. (e.g. Miles & Snow, 1994). Recent literature examined the formation of networks resulting from intense partnering such as strategic blocks or strategic supplier networks (Jarillo, 1988). On the other hand, managers, such as those within Omnicom, further developed and adapted this organizational model to industry-specific contingencies (e.g. Kelley, 2000). Recent management scholars have suggested that the *network position* of a given firm might explain intercompany profitability differences more accurately than a firm's market position, thereby implying the conceptual superiority of a relational, rather than atomistic approach in examining competitive behaviour (Gulati, Nohria, & Zaheer, 2000). In theoretical and empirical studies knowledge, then, was found to reside not within firms alone, but within networks of companies (Kogut, 2000).

The access to interorganizational networks is seen as form of social capital that increases in value with subsequent use (Coleman, 1988). Network experience intended as knowledge on how to collaborate as well as knowledge gained from collaborations was found to be positively linked to sales growth, innovation rates, or other measures of firm performance (Chung, 1996; Hagedorn, & Schakenraad, 1994; Powell, Koput, Smith-Doerr, & Owen-Smith, 1999; Stuart, 2000).

Predominant focus of the extant literature on strategic alliances and networks, however, is the relationship between the attributes of the partner firms and the resources of the partnering firm in domains of business activity that are critical for competitive success *in the current market*.

In this paper, networks will be examined under a different perspective: I will study the creation of intercompany networks purposeful configured along the extended, cross-industry value chain and managed with the aim of linking previously unrelated industries in order to create fundamentally new markets.

This paper thus takes a dynamic, cross sectional view on patterns of network formation activity. With this we answer a widely and frequently expressed need in extant literature calling for more research on “how network structure and competitive dynamics evolve” (Gnyawali & Madhavan, 2001; page 442). Similarly, Parkhe, Wasserman, and Ralston (2006) urge researchers to devote more attention to “process issues” (Parkhe, Wasserman, & Ralston, 2006; page 563) of network formation, a call which is repeated by Dhanarai

and Parkhe (2006) suggesting that in the future researchers “need to focus attention on process, as opposed to position and structure” when studying organizational networks (Dhanarai & Parkhe, 2006; p 666). Current literature sheds points out a further gap in existing research, namely a near total lack of understanding of performance implications of network formation activities: Koka, Madhavan and Prescott (2006) point out a strong “need to understand performance implications of networks” (Koka, Madhavan, & Prescott, 2006; page 734); similarly Möller and Rajala (2007) suggest that future research be dedicated to the “assessment of performance of different nets” (Möller & Rajala, 2007; page 906).

This paper further makes use of in-depth case studies of value chain orchestration in one particular industry, the global agricultural-biotech industry. We thus take up a suggestion by Anderson, Hakansson, and Johanson (1994) proposing the use of “directed case studies to guide theory development” on business networks (Anderson, Hakansson, & Johanson, 1994; p 11).

In sum, we study the process of linking a set of previously unrelated industries through what I call virtual value chain orchestration, i.e. through linking alliances partners, joint venture partners and acquired companies to in-house activities. This paper extends current research in three directions: first I study innovation resulting from linking previously separate industries (as opposed to the current focus of extant research examining innovation in firms *current industries*); I employ a cross-sectional, dynamic approach and am thus able to document the process of network formation; finally, I shed light on the performance implications of alliance activity (and am thus able to offer preliminary results on outcomes of networking activities).

The two distinct tasks of network configuration – i.e. selection of partner companies – and network management – i.e. optimal resource utilization – will be analysed separately in the following pages. Six steps can be distinguished in this process.

2. 1. Six steps of value chain orchestration

1. Analyse internal value chain: The first step in value chain orchestration is an internal perspective on costs and value added at each step. While nothing new, this exercise provides a first view of the total value added and the effectiveness of internal operations. If compared to leading competitors, conclusions can be drawn quickly. While this exercise is a standard tool in everybody’s toolbox, unfortunately most companies simply stop here.

2. Analyse flow of goods from primary sourcing to consumption and analyse total amount of value created in the extended value chain. Rarely is a company’s internal value chain the only point where value is added to a given product. Consequently, the next step involves an analysis of all upstream or downstream industries which come in contact with the product and add value or could add value to the product. Subsequently, the actual contribution of each industry to the overall value creation is determined or estimated. This step will reveal the amount of value created – measured by EVA (Economic Value Added) or approximated by EBIT (Earnings Before Interest and Taxes) – by each of the industries in the cross-industry value chain.

3. Identify ways to increase the amount of value created by the extended value chain. Once the value created presently by the extended value chain has been determined, ways to substantially increase this amount through innovation are identified. The objective is to produce radically innovative ideas on value creation. Value is created by improving the quality of products or services or by reducing costs – potentially at each step of the extended value chain.

4. Configure network around identified opportunities of value creation: Once potential growth opportunities outside a company’s internal value chain have been identified, links with other companies ensure that the potential value created is delivered to customers. The task of configuration of a network can be split in two: selection of partner companies and determination of the most effective form of the relationship with selected partner companies.

The selection process: As pointed out earlier, recent organization scholars have asserted that competences lie not only within firm boundaries, but also within networks of companies (Kogut, 2000). If we follow Andrews in his view of strategy as match between firm competencies and environmental opportunities, network members should be selected both for their capacity to add to firm specific competencies and for their capacity to broaden available market opportunities.

Form of the relationship with partner companies: The question of the appropriate ownership structure for various economic transactions has long occupied academic research.

In particular, the organizational capability perspective, which sees the firm essentially as a bundle of relatively static and transferable resources (Prahalad & Hamel: 1990; Cool & Schendel: 1988) views the firm boundary issue as a capability-related issue. Where the firm already has a strong knowledge base, acquisition provides an advantage and would be the preferred way of undertaking the activity. On the other hand, the capability constraint becomes important when the firm enters into unfamiliar areas of activity, where the technological distance of the target activity is high in relation to firm capabilities (Madhok, 1997). Empirical studies have confirmed that joint ventures, rather than acquisitions, are the preferred vehicle when acquirers do not know the value of the assets desired, i.e. when they are in different industries.

As value chain orchestration implies the coordination of a wide array of partner companies belonging to different industries, value chain orchestrators will exhibit a significantly higher strategic alliance activity along the extended value chain than other companies in the industry.

5. Identify ways to capture value created:

While strategic alliances with lower resource commitments and increased flexibility are key for expanding a network across a wide array of unrelated industries, they come with one main disadvantage: lack of control. In instances where value creation is joint but ownership is disjoint, conflicts can arise over the appropriation of resulting rents.

Transaction cost theory, in particular, under assumption of bounded rationality and opportunistic behaviour, has identified the conditions for market failure, thus highlighting circumstances under which internalisation – i.e. acquisition – is more efficient or less costly (Williamson, 1975). Difficulties in observation, measurement, and contractual specification increase the potential for opportunistic behaviour and hence raise transaction costs. Under these circumstances, transaction cost theory suggests internalisation of concerned activities.

I therefore hypothesize the following: At the point of the extended value chain where rent appropriation concerns or measurement problems regarding contributions of partner companies are greatest, acquisitions or joint ventures, rather than strategic alliances will be predominantly employed. .

6. Management (“Orchestration”) of cross-industry value chains

Once a network of network has been set-up, orchestrators need to coordinate the activities of a wide array of partner companies and effectively relate them to in-house activities. Given the diversity of partner companies, orchestrators need “value creation insights” (Campbell, Goold, & Alexander, 1995) in order to successfully manage and develop the network. In particular, as direct ties serve both as a resource and as a channel for information (Ahuja, 2000), knowledge transfer between the focal firm and its partners and between partners themselves is critical. As central firms, orchestrators develop ideas in the sense that they take ideas from network partners and add value by developing them further in their own organizations (Lorenzoni & Baden Fuller, 1995).

As a result, we expect value chain orchestrators to achieve performance levels significantly higher than those realized by their industry peers: The intense and purposeful development of a wide network of partner companies should give value chain orchestrators the potential to achieve superior operational performance compared to companies pursuing another type of strategy.

3. METHOD OVERVIEW

The setting of this study is the global agrochemical and biotech industry, a slowly growing market valued at around \$ 30 billion per year (Philips McDougall, 2001).

In the context our company’s effort to identify and implement a biotech strategy, I have been involved as a project manager in one specific area of the overall strategy. The project, which spanned several years from kick-off until implementation of the identified strategies, can be divided in three major phases. Phase one involved an extensive assessment of current and future customer needs, competitive strategies, and the company’s core competencies. Interviews with selected executives of industry associations, investment banks and consultancies complemented the first phase. In the second phase alternative strategic options were tentatively identified and evaluated based on technical and financial criteria. In an attempt to gain a deeper understanding of the viability of the selected options, structured interviews with suppliers, customers, customers of customers, competitors, regulatory agencies and again selected industrial consultants were conducted in Germany, France, and Great Britain. In total, the transcripts of 90 interviews could be usefully

analysed. A literature review of CEO interviews, newspaper articles, research reports by investment banks, Harvard Business School case studies and other background material on the biotech industry completed the second stage of the project. In the final phase of the project, about 18 months after kick-off, research findings and the preferred strategic option were summarized in a report issued to the Board of Management.

4. ORCHESTRATION IN ACTION – THE EMPIRICAL EVIDENCE

Monsanto:

Monsanto's search for growth beyond industry boundaries was triggered in 1995 when Monsanto's leadership team, under the direction of its CEO, Shapiro, drafted a new strategy for the company. The team recognized that an increasing world population, the ongoing pollution of the environment especially in developing countries, and decreasing acreages of arable land would put the world's environment under sensible pressure over the next decades. Shapiro's vision of "sustainable growth" led the company to a fundamental shift in its strategic approach: rather than producing chemicals sprayed on fields, the company would produce information – genetic information – to be incorporated in plants which would add value for the farmer and the consumer. "A closed system like the earth cannot withstand a systematic increase of material things, but it can support exponential increases in information and knowledge", Shapiro says. Biotechnology was the mean to achieve this vision (Magretta, 1997).

Arnold Donald, CEO of Monsanto Agro, expressed the incumbent paradigm shift in the following way: "Traditionally, agricultural inputs were produced, distributed, and marketed as separate products: seed was produced and distributed by seed companies, herbicides, insecticides by chemical companies, and quality improvements were done by processing companies. " Donald saw a system "where these separate channels would merge. Through biotechnology the insecticide is hosted by the plant itself. Quality can be built in directly into the genome of the plant. We will witness a paradigm shift."

Monsanto also recognized that this paradigm shift required a fundamentally different approach to the traditional food chain: rather than viewing it as a system of clearly separated steps where each company would focus on optimising its specific contribution, Monsanto recognized the opportunity of seeing it as interconnected where the potential existed for a selected number of companies to directly or indirectly influence the whole chain. For this to become true, a network of partner companies would be needed – on all levels along the extended, cross-industry value chain.

By following a strategy of value chain orchestration, Monsanto created a dense network of partner companies covering every step of the extended value chain.

Insert figure 1 & 2 about here

DuPont

In 1998, after having spun-off Conoco, DuPont's petrol subsidiary, in the largest ever IPO on Wall Street so far, Charles Holliday was considering his company's next moves. He knew the company's future lay predominantly in biotechnology.

Within DuPont, research efforts in biotech had been exploratory until the mid 1980s. In 1986, however, biotech started to receive increased management attention and financial resources. DuPont recognized that, eventually, plant could be transformed into "tiny factories", capable of enhancing the value of agricultural products in many ways.

The company recognised the potential of biotechnology to fundamentally reshape current industry value chains. Stephen Potter, DuPont vice president of strategy and business development, stated: "We are moving from an asset-based industry into a knowledge business. This will redefine and reshape our industry's value chains. The application of bioscience, genomics, and technology will dramatically alter the ability to create and capture value. " He continued: "Many of the best opportunities will arise from the convergence of two or more formerly separated fields. In short, we will have to figure out how to use the existing systems better to create more value and to cut costs."

Value capture: Holliday recognized: "To deliver output traits, one has to have a delivery mechanism, and that's seed." In 1998, DuPont acquired Pioneer, a leading US seed company; following a series of other, smaller acquisitions, the company is recognized today as the largest seed company in the world.

Michael Ricciuto, head of DuPont biotech communication, said: "The business system just does not exist for distributing and marketing branded products. So we are creating it."

In the creation of the new business system involving a broad range of partner companies DuPont relies heavily on strategic alliances. The company attempts to build partnerships without actual integration: "Virtual integration" stands for the company's commitment of long-term cooperative arrangements with independent firms (West & Kasper, 1999).

The underlying logic of identifying the most desirable partner companies was the logic of virtual value chain orchestration. The extended, cross-industry value chain and the purpose of creating fundamentally new markets became the framework for identifying, evaluating and selecting alliance partner companies. Ultimately, DuPont "covered" all steps of the extended value chain with a dense network of R&D collaborations, joint ventures, strategic alliances, and acquisitions.

Performance standards with partner companies are managed through service level agreements, i.e. predefined commitments on expected outcomes between DuPont and partner companies. Star-performers can thus earn a more central and hence more important role in the network, while underperforming companies are expelled, if they do not reach specified milestones.

Other players in the industry

Although I will not report in detail about competitive strategies of other industry participants, I made considerable efforts to gather reliable data on the alliance and acquisition activity between 1996 and 1999 in the industry. Main sources of information were industry journals *Agrow* and *Chemical Week* – where all significant alliance and acquisition activities are reported – annual reports, research reports by investment banks, and field interviews.

The table below lists the number of alliances and acquisitions/joint ventures in the industry for the period analysed, and provides specific information for the two companies discussed in detail.

Insert table 3 about here

Financial results

Alliance activity: It was suggested before that orchestrators would exhibit a significantly higher alliance activity along the extended value chain than other companies. The data above confirm that Monsanto (25 alliances) and DuPont (21 alliances) exhibit a significantly higher alliance activity than their industry peers (13 alliances on average).

Acquisition activity: We then hypothesized that acquisitions, rather than strategic alliances, would be employed at the point of the extended value chain, where uncertainties regarding rent appropriation were greatest. As already mentioned, this point is represented by the seed industry in the global agrochemical and biotech industry. The data above show the following: at the level of the seed industry Monsanto has a total of 19 acquisitions and 2 alliances, DuPont has a total of 5 acquisitions and 1 alliance, while other companies have on average 3 acquisitions and 2 alliances. The available empirical data thus support the hypothesis.

Financial results: A word of caution is necessary before interpreting financial results of orchestrators and other companies in our study. As mentioned already, investments in biotechnology are long-term investments, where, so far, costs and revenues have not materialized in the same way. Monsanto's CEO stated that, even after the significant investments of his company in biotechnology, "a commercial breakthrough [in output traits] was still a long way off" (Magretta, 1997). Tom McKillop, at that time CEO of Zeneca, echoed his words: he recognized that biotechnology would only add significant contributions to the bottom in the mid to long-term.

Thus, rather than analysing present financial results, I decided to look at expected financial results. Here, research reports by investment banks provide useful data. Research reports by Merrill Lynch, HSBC, Deutsche Bank, and Morgan Stanley were scanned for data on the global agrochemical industry, as well as on data for expected profits and sales for Monsanto and DuPont. (Investment Banks, 2001) The table below summarizes estimates by investment banks on the expected profitability and growth of Monsanto, DuPont, and their industry peers.

Insert table 4 around here

Expected sales growth for the industry (year 2000-2010) is 3.4% per year, while Monsanto and DuPont are expected to growth by 8.3% and 7.2%, respectively. The expected profitability in the industry (defined as

EBIT/sales) is 14.0%, while Monsanto and DuPont are expected to realize profitability margins of 22.0% and 20.5%, respectively.

The data from the two case studies thus seems to indicate that value chain orchestrators are expected to exhibit significantly higher sales growth and profitability ratios than their industry peers.

On a final note, I want to add that biotechnology was initially met with scepticism – especially in Europe and Japan. Today, by contrast, it seems that solid scientific research has been successful in convincing consumers worldwide about the benefits of the responsible use of agricultural biotechnology (Yan & Kerr, 2000).

In Europe, where consumers initially were most sceptical about the consumption of produce from genetically modified crops, agricultural biotechnology has recently received a strong support from the leading European regulatory body, the European Food Safety Authority (Efsa), which has declared that “healthy clones [i.e. genetically modified organisms] ... do not show any significant differences from their conventional counterparts” (Financial Times, 2008).

5. DISCUSSION AND CONCLUSIONS

In this paper I have attempted to explore the theory and practice of an emergent phenomenon of organizing and strategizing: virtual value chain orchestration has been defined as way to create and capture value by structuring, coordinating, and integrating activities of previously unrelated markets and by effectively relating these activities to in-house operations with the aim of developing a network of activities that create fundamentally new markets.

The dynamics of interorganizational relationships, and especially the challenges linked to the configuration and management of an extended network of partner companies, were illustrated by two companies operating in the highly dynamic environment of the global agrochemical and biotech industry.

I explored the relationship between strategic orientation (i.e. virtual value chain orchestration vs. “traditional” strategies) and financial results: Companies implementing a strategy of value chain orchestration were found to exhibit significantly higher sales growth and profitability rates than their industry peers.

In a review of network studies Oliver and Ebers (1998) remark that, despite the growing number of publications on inter-organizational networks, only limited attention had been given to outcome variables, such as cost/price, revenues, learning and innovation. Through the two illustrative case studies I have attempted to shed some light on the relationship between network structures and financial results of focal firms. Specifically, our analysis of the global agrochemical industry has shown that value chain orchestration and the creative management of a wide array of partner companies along the extended value chain indeed seem to translate into superior financial performance.

Our study has several limitations. First, the superior results determined for orchestrators are not actual results, but expected results: we have made an effort to use a reliable and unbiased source (investment banks), but of course there is no guarantee that these results will actually be met.

Second, the evidence presented here is anecdotal, rather than systematically scientifically grounded. More research is needed to empirically ground the concept of value chain orchestration, possibly in other industry contexts using historical financial results.

Despite these limitations, I see the model of value chain orchestration as an emerging way of organizing and strategizing, which underscores the importance of relationships, competencies, and systemic innovation. It probably represents a further step beyond the model of virtual outsourcing in the sense that a compelling and clear-cut logic underlies the evolution of a web of partners. As stated above, this model of organizing and strategizing is still emergent, in the sense that we need more empirical research to undermine its foundation. This paper should therefore be considered as a first puck on the ice at the beginning of a very long game.

TABLES AND FIGURES

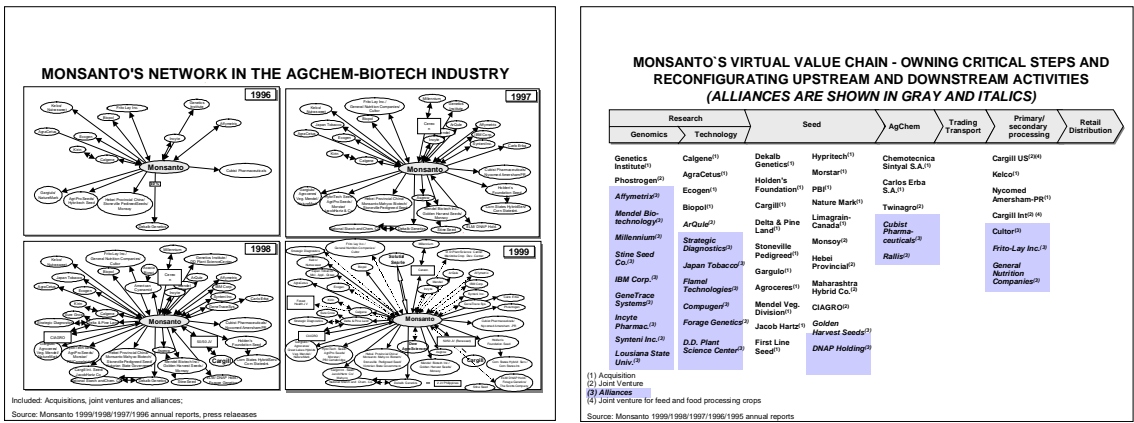


Figure 1&2: Monsanto’s network in the agchem-biotech industry

Company	Research Genomics Technology		Seed	Agchem	Trading & Transport	Processing	Retail
INDUSTRY AVERAGE							TOTAL
Alliances	5	4	2	2			13
Joint ventures		1	1	1			3
Acquisitions	1	3	3	2		1	9
Monsanto							TOTAL
Alliances	10	8	2	2		3	25
Joint ventures			4	1		2	7
Acquisitions	5	7	19	2		2	35
Du Pont							TOTAL
Alliances	6	3	1	3	2	4	21
Joint ventures	1			2			3
Acquisitions		2	5	1		2	10

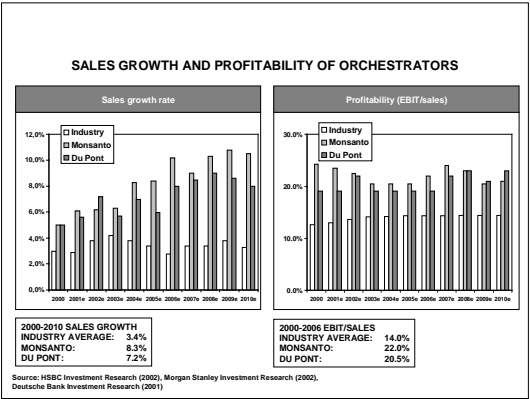


Table 3&4. Alliance and acquisition activity in the global agrochemical and biotech industry; performance implications of value chain orchestration

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