DO TOO MANY CHEFS REALLY SPOIL THE BROTH? COLLABORATIVE PRODUCT INNOVATION IN THE FOOD INDUSTRY

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ABSTRACT

Open innovation is customarily associated with fast-growing, technology-intensive industries like the Information and Communication Technology sector or the pharmaceutical industry. There is, however, increasing evidence that such practice also prevails in more traditional and mature industries, particularly when these are highly dependent on external parties - other firms, public institutions, user communities - for the supply, development and/or commercialization of new technologies and product ideas.

This paper's primary aim is to understand why and how Collaborative Product Innovation (CPI) takes place in mature industries within the framework of an open innovation corporate strategy. Additionally, the paper focuses on the role played in this context by user expert communities in the support of technological development and the creation of value networks for the commercialization of new products. To this end, we track the innovation path of sous-vide technology in the US from the 1970s until today, through the analysis of the collaborative product development initiatives of three firms manufacturing sous-vide meals for the foodservice industry. Data sources used included personal interviews, financial reports, academic and industrial publications, newspaper articles, etc.

Our analysis of new process/product development in the US foodservice industry shows that collaboration with external parties is frequent in this mature sector and encompasses both the exploration and exploitation stages of innovation. In line with earlier studies, it also indicates that despite different cooperation strategies being employed, expert user communities - accomplished, haute-cuisine chefs in European and US restaurants - constitute preferred innovation partners. Collaboration with highly innovative chefs creates value to manufacturers by aiding technical development, accelerating technology adoption and diffusion among customers (through the development of novel recipes and applications), and increasing technology acceptance and perceived product quality. In return, chefs benefit from efficiency gains, certified cooking methods, improved professional reputation and higher consumer patronage.

Please cite as: Costa, A.I.A. & Sarkar, S. (2008). Do too many chefs really spoil the broth? Collaborative product innovation in the foodservice industry. *Proceedings of the 15th International Product Development Management Conference*, June 29 – July 1, Hamburg, Germany.

INTRODUCTION

The human capital inputs of innovation processes – i.e., the individual skills and knowledge employed in Research and Development (R&D) and commercialisation activities (Romer, 1990) – can be sourced both inside and outside corporate boundaries. Innovation processes in which human capital inputs are sourced mainly within a firm's boundaries have been broadly designated as Closed Innovation, as opposed to innovation processes in which such inputs are, to a large extent, purposively sourced outside the firm - a business strategy commonly known as Open Innovation (Chesbrough, 2003). The latter is about harnessing the inbound and outbound flows of ideas, technology and skills across a firm's boundaries (which are channelled through its multiple inter-organizational links), with the intent of accelerating internal innovation processes and establishing additional, external paths for the commercialisation of their outcomes (Chesbrough, 2003; Simard and West, 2006). The establishment and management of inter-organizational relationships with customers, competitors, suppliers, public and private research institutions or even seemingly unrelated businesses, with the aim of acquiring additional knowledge and skills for innovation processes, is increasingly seen as an important way for firms to augment their innovation capability (Gatignon et al., 2002; OECD and Eurostat, 2005).

To date, open innovation has been commonly associated with fast-growing, technology-intensive industries (e.g., information and communication technology and pharmaceuticals). There is, however, increasing evidence that this concept and associated strategies may also prevail in more traditional and mature industries (Huston and Sakkab, 2006), particularly when certain sets of circumstances arise. Among such circumstances is a high dependence on other entities - other firms, public research institutions, end-user communities - for the supply, development and/or commercialization of new technologies (Chesbrough and Crowther, 2006; Maula et al., 2006; Vanhaverbeke and Cloodt, 2006). Cross-boundary product innovation management should thus be a widespread practice in food supply chains and networks, mainly due to the number of actors of different areas involved in food supply and their difficulties to single-handedly meet all the heterogeneous (and often contradictory) requirements of intermediate customers, end-users and legislators (Costa and Jongen, 2006; Grunert et al., 2005; Mikkelsen et al., 2005). Empirical evidence of food manufacturing and foodservice companies engaging in open innovation strategies (Knudsen, 2007) is, however, scarce. Most importantly, a detailed analysis of such activities, their rationale and market outcome is, with the exception of a few case studies (Huston and Sakkab, 2006; Thomke and von Hippel, 2002; Vanhaverbeke and Cloodt, 2006), equally absent from both academic and practice-oriented literature.

Consequently, the aim of this paper is:

- To understand why and how Collaborative Product Innovation (CPI) takes place in mature industries within the framework of an open innovation corporate strategy;
- To analyze the effects of CPI strategies on the innovation capabilities and market outcomes of mature firms, such as those active in the food manufacturing and foodservice areas.

The paper is structured as follows. In the next section, we present a critical review of the extant literature on the general use of open innovation strategies in the food area.

Afterwards, we present and discuss the results of a case-study research project (Yin, 2003) describing the CPI activities of three manufacturers of sous-vide meals for the US foodservice industry. Here, we analyze the impact of the open innovation strategies employed by these firms on their innovation capabilities and market outcomes. Finally, we summarize the conclusions of our analysis; derive relevant managerial implications and highlight areas where more empirical research is needed.

A REVIEW OF OPEN INNOVATION PRACTICE IN THE FOOD INDUSTRY

Conceptual framework

The food industry is typically described as a relatively mature and slow-growing area of business, which displays a relatively low level of R&D investment and is quite conservative in the type of innovations it introduces to the market (Costa & Jongen, 2006). This sector perceives its end-customers to be, to a large extent, wary of radically new products and changes in consumption patterns. Such perceived wariness, together with the necessary stringency of legal requirements related to safety, transforms food product and process innovation in a highly complex, time-consuming and risky endeavour, and hence one not to be lightly undertaken. However, recent important changes in the nature of both food demand and supply, coupled with a high level of competitiveness, have rendered innovation not only an unavoidable corporate activity, but also one that is increasingly vital for overall agri-business profitability.

Contemporary consumers demand unique flavours and singular foods, guilt-free convenience in cooking and eating, and an increasingly health-promoting diet closely tailored to their individual needs and preferences (Costa et al., 2001, 2007). Such demand requires a kind of product development that necessarily entails creating, or at the very least adopting, innovative technological solutions and new business models. On the other hand, recent general advances in areas like biotechnology, nanotechnology and preservation technology offer an unprecedented number of opportunities for added-value applications in the food industry, many of which have the potential to adequately meet modern consumer demand (Juriaanse, 2006).

Unavoidable as it may, innovation remains a highly challenging and complex process for the food processing industry to manage. The number of actors of different sectors involved in food production, together with their difficulty to single-handedly meet all the heterogeneous (and often contradictory) requirements of intermediate customers, end-users and legislators, determines that innovation activities must be carefully coordinated. This in turn compels innovation processes to be managed both within and across organizational boundaries along the value chain (Costa and Jongen, 2006; Grunert et al., 2005; Mikkelsen et al., 2005). Moreover, many of the emerging technologies that can potentially sustain (or complement) a wave of successful new food applications (e.g. nanotechnology) are being developed outside the processing industry. In order to leverage these on-going innovation processes, food industry actors must therefore enter into more or less formal arrangements with other entities in the innovation system. Formal agreements are likewise required for the adoption of externally-developed novel technologies (Maula et al., 2006). Last but not least, the establishment of close relationships with regulatory bodies, intermediate and end-users throughout the innovation process is essential to improve public acceptance of emerging food technologies and the commercial success of the products thereof (De Jong et al., 2006; Vanhaverbeke and Cloodt, 2006).

All of the above implies that innovation in the food industry is likely to increasingly rely upon the decisions and activities of other entities in the innovation system. As such, the sector should exhibit a significant number of open innovation strategies, the purpose of which could range from merely securing access to external sources of human capital to actively taking part in the creation of inter-organizational knowledge and skills.

Empirical evidence

Knudsen (2007) analyzed the results of a survey on the employment of inter-organizational relationships in product innovation by EU manufacturing and service firms active in the Food & Beverages sector. She observed that all surveyed companies (n=132) had partnered, on average, with at least one other organization for the development of their last important product innovation. Additionally, survey results indicated that these companies would rather cooperate with customers, suppliers and competitors than with private/public research organizations or consultants, and preferably at the initial research stage rather than during technical development. Finally, she was also led to conclude that food companies allied preferably with organizations in their own sector, probably due to the high degree of overlapping between their knowledge-bases. The latter was believed to facilitate inter-organizational interactions and thereby increase the chances of innovation success.

Huston and Sakkab (2006) described the successful development and launch of a new type of Pringles' potato crisps (printed with words and images), driven by the application of the open innovation concept. The authors reported on how Procter & Gamble (P&G) was able to lower product development costs and time-to-market for the new line through the in-sourcing of a technology for printing edible images on cakes and cookies. This technology had been primarily developed by a baker in Italy and was discovered through the global network of potential sources of ideas and know-how that Procter and Gamble maintained as a part of its open innovation program.

Alternatively, Thomke and von Hippel (2002) revealed how International Flavors and Fragrances (IFF), a company supplying flavors to the food industry, managed to outsource part of its new product design to customers. IFF developed a customer innovation tool-kit - consisting of an interactive, internet-based application with a large database of flavour profiles -, with which it equipped its clients in the food processing industry. This tool allowed customers to design and alter flavour samples at will, enabling IFF to bypass costly market research activities and accelerate the trial-and-error cycles that inevitably accompany product development (PD). By putting customer expertise to use, IFF was also able to expand its knowledge-base and increase the level of customization of its product offer, while lowering its share of the innovation risk.

Finally, Vanhaverbeke and Cloodt (2006) explained how Calgene, a plant biotechnology R&D firm, established a network of inter-relationships with seed companies, farmers, packers, consumers and legislators to support the launch of a new, genetically-modified tomato for the fresh market. Calgene was forced to cooperate with other firms and organizations in the innovation system in view of the uncertainties inherent to the development and commercialization of foods derived from gene technology. Such uncertainties compromised its ability to reap value from the commercial applications of the novel technologies it pioneered. The resulting value network allowed Calgene to cope better with the high levels of product innovativeness introduced by its gene-modification technology and the consequent low initial levels of public acceptance and consumer adoption (Ram, 1989).

Table 1 summarizes the main characteristics of the open innovation strategies reported to have been employed in the food industry so far, based on previously developed innovation categorization schemes (Costa and Sarkar, submitted; Garcia and Calantone, 2002; OECD and Eurostat, 2005). While IFF and Procter & Gamble's open innovation activities are clearly cases of technological process innovations, introduced to increase PD efficiency and sustain new marketing strategies for existing products, the case of Calgene is substantially different. In the latter, a new marketing strategy is implemented, involving the development of new sales channels and promotion tactics, to sustain the successful creation of an entirely new market for a radical product innovation. Although the commercialization of a tomato with enhanced flavour might have been a novel initiative to Calgene and its partners, the basic knowledge of plant biotechnology employed in the process was, nonetheless, not new to them

Table 1: Main characteristics of the open innovation strategies employed so far in the food industry.

	Open Innovation in the Food Industry		
Case study	New Pringles´ potato crisps (Huston & Sakkab,2006)	Design of new food flavours (Thomke & von Hippel,2002)	Launch of GM tomato (Vanhaverbeke & Cloodt,2006)
Innovating firm	Procter & Gamble	Int. Flavors and Fragrances	Calgene
External partner	Technology supplier	Customers in the food industry (e.g. Nestlé)	Seed firms, farmers, packers, retailers, consumers, legislators
Type of relationship	Dyad at non-arm's length	Vertically integrated dyad	Network across innovation system
Stage	Process development	Product design	Commercialization
Strategy	Technology in-sourcing	PD out-sourcing	Creation of value network to sustain market launch
Goal	Reduce PD costs and time-to-market	Reduce PD costs and time-to-market High customization	Ensure acceptance and market success of novel technology
Supporting technology	New printing technology for food	New tool kit for flavour design	Plant biotechnology
Newness to firm	Really new	Really new	Incremental
End-product	Printed potato crisps for consumer markets	Custom flavours for the food industry	New tomato for the fresh market
Newness to market	Incremental	Incremental	Radical

As can be readily concluded from the literature review performed, empirical evidence of food companies engaging in open innovation practices is scarce, particularly in what respects specific cases of CPI strategies. Most importantly, a detailed analysis of such strategies, their rationale and market outcome is, with the exception of the few case studies reviewed here, virtually absent from both academic and practice-oriented literature. This gap in academic research concerning the study of open innovation in general - and CPI in particular -, is by no means exclusive of the food area, a fact that has been often pointed out by many other innovation management scholars (Chesbrough et al., 2006; Emden et al, 2006; Littler et al., 1995). In view of this, the following section presents the outcome of an exploratory case-study research project (Yin, 2003), undertaken with the aim of better understanding why and how CPI takes place in mature sectors, namely in the food manufacturing and foodservice areas.

COLLABORATIVE PRODUCT INNOVATION AND THE DEVELOPMENT OF SOUS-VIDE TECHNOLGY IN THE US: THREE CASE-STUDIES

Research background

Collaborative Product Innovation

As we have seen in the previous section, product innovation is becoming not only more important to the organizations operating in the food area, but also more complex, often involving several actors within and outside food value chains, as well as many different areas of skill and expertise. As globalization moves forward, markets and technologies converge, product life-cycles shorten and the rate of technological innovation increases – all leading to a mounting pressure to produce more innovative products in shorter periods and to commercialize them simultaneously in a higher number of foreign markets. Consequently, open innovation, and in particular collaborative product innovation, has often been singled out as a means by which some of these problematic aspects of the product innovation process in consumer markets can be lessened (Emden et al, 2006; Costa and Jongen, 2006; Sarkar and Costa, 2008; Littler et al., 1995).

Collaborative Product Innovation (CPI) has been conceptualized in a number ways in previous academic literature (see Emden et al, 2006, for a more recent definition), but as with other open innovation approaches, there is yet little agreement how to best define and characterize it. For the purpose of this study, and based on a previously developed characterization of open innovation strategies (Costa and Sarkar, 2008), CPI will be understood *as a collaborative relationship between an innovating firm and an external partner, established with the purpose of sustaining the development and/or commercialization of an innovative product or product line*. Collaborative relationships are defined here as cross-boundary, information-exchange linkages that are characterized by high levels of relational and structural embededdness (*i.e.*, high levels of interaction, integration, transparency, mindfulness and synergy, as well as highly similar actionable knowledge bases), and in which each party contributes actively and significantly to the common goal or end solution (Emden et al, 2006; Rindfleisch and Moorman, 2001). In this setting, the innovating firm may collaborate with independent external organizations, communities or individuals located at various stages of the value chain (customers, competitors, suppliers) or even in the surrounding innovation system (user communities, private and public research organizations). The collaboration projects may take several, non-equity based forms and have a varied time span, but are likely to be relatively structured and focused (at least initially), and to involve some type of contract or written agreement (Dittrich and Duysters, 2007; Littler et al., 1995).

Sous-vide technology

Sous-vide technology is a food processing technology that is employed both by the food manufacturing and the foodservice industry in the production of meals and meal components for the HORECA (hotels, restaurants and caterers), the transport catering (airlines, cruises, trains), the institutional (schools, hospitals, jails) and the consumer (supermarkets, take away, home delivery, specialty shops) markets. It consists of a series of highly complex and sophisticated cooking methods, in which raw-or pre-cooked food is sealed under vacuum in laminated plastic pouches or containers, heat-treated by carefully controlled cooking (monitored time and temperature combinations for each type of food), rapidly cooled and reheated for service after a period of cold storage. Sous-vide cooking methods are believed to present four main advantages *vis-à-vis* traditional interrupted catering systems: (1) to reduce the degree of oxidization of food components, such as vitamins and other anti-oxidants, by packing, cooking and storing under vacuum; (2) to prevent recontamination and reduce the loss of important food components (water, vitamins, flavour and odour volatiles normally lost in open container cooking), by using laminated plastic packaging resistant to high temperatures; (3) to reduce the breakdown of vitamins and flavour and odour volatiles by cooking at low temperatures during relatively long periods of time; (4) to reduce the need of using salt, chemical and/or other artificial compounds to preserve foods for a longer time (Creed, 2001a).

The initial basis for the development of sous-vide technology in the late 1960's was the 'industrialization' of foodservice operations through the adoption of food manufacturing processes like centralized production, large-scale equipment, consistent safety and quality and sophisticated packaging systems. The viability and success of these processes depended largely on the incorporation of a "time buffer" – a stage during which food could be safely and conveniently stabilized by storage at low temperatures –, which interrupted the necessarily continuous flow of food through the traditional "cook and serve" catering system. However, the efficacy of such time buffer in terms of preserving the necessary levels of food safety was most often achieved at the expense of the sensory and nutritional quality of the reheated meal or meal component. That is, given the standing food safety requirements, the desired operational benefits came at the cost of poor perceived quality and low consumer acceptance. Consequently, the initial stages of development, commercialization and adoption of sous-vide technology in the food area were largely driven by the promise it held of providing, for the first time, a highly positive balance between safety requirements, operational benefits and end-product quality.

A second drive of the development of sous-vide technology was a growing consumer demand for convenience in meal preparation. Most of the active population increasingly felt that, at the end of the day, there was not much time left to eat, let alone to shop and cook. This translated itself into high growth rates of the ready meals and other convenience and foodservice markets in the EU and US all through the eighties and nineties, and until today (Costa et al., 2001; Datamonitor, 2006). Given the operational benefits and the superior product quality provided by the technological sophistication of sous-vide cooking, manufacturers and caterers worldwide turned to sous-vide meals as the preferred means of satisfying the growing consumer demand for convenience (Otto, 1989). However, market acceptance of sous-vide meals and the underlying technology was surprisingly low, with sales never really taking off and firms closing down its sous-vide activities only a few years, or even months, after start-up (Carlino, 1991). Both public organisms and consumer organizations, especially in the US, voiced concerns about the potential public health hazards involved in storing foods under anaerobic conditions, as well as doubts regarding the level of safety of sous-vide meals (Martin, 1990). Moreover, foodservice customers were rightfully afraid of the markets' negative perception of the nutritional and sensory quality of sous-vide meals. It was felt that, without a sufficiently intensive, informative and persuasive marketing strategy, consumers were simply not ready to come to terms with the notion of eating their dinner out of a vacuumised plastic pouch (Allen, 1991).

Last but not least, the development and wide-spread adoption of sous-vide technology was significantly fuelled by the emergence of the highly popular, new millennium "science of deliciousness" – otherwise known as 'New Cookery' (Adriá, 2006), "Molecular Gastronomy" (This, 2005) or "Hypermodern Cuisine (Pontin, 2005). Hypermodern Cuisine is aggressively technological, as it borrows the latest developments in the food science area (as well as its industrial applications), and turns them into ´haute-cuisine'. Sous-vide is considered to be its most remarkable, spectacular and well-known innovation, one which nowadays takes centre-stage in the kitchens of the best and most reputed restaurants in the world. World-renowned chefs have picked a boring and fear-inspiring industrial cooking method and taken it to all new level by adding their creativity and art, a never-ending variety of applications and recipes, and much needed flair. Thanks to this, eating dinner out of a plastic pouch is no longer sad, lonely and suspicious, but a sign of sophistication and superior culinary craftsmanship. Most importantly, sous-vide cooking currently epitomizes the "slow food" trend in high-end cookery and is gradually spilling-over the technology and equipment to ordinary kitchens, as well as boosting refrigerated, prepared meals sales in all distribution channels (Newman, 2003; Hesser, 2005).

The market size of chilled processed foods in Europe was expected to reach 15 billion Euros by 2003, while in the US the sous-vide market was expected to cross the 1 billion dollar barrier by the year 2000 (Meyer, 1997; Rodgers, 2001). The innovation path of sous-vide technology can be traced back to the late 1960's and the R&D and commercialization endeavours of several corporations, restaurant chefs, and food scientists located at the two sides of the Atlantic Ocean (France and the US). More often that not, over the last 35 years these actors have collaborated closely on cross-boundary process and product innovation projects in the sous-vide area, demonstrating the importance and usefulness of open innovation in mature sectors like the food manufacturing and foodservice areas. Throughout this section, we will describe three of instances of CPI projects in the sous-vide area in detail, as well as analyze its impacts on the innovation capabilities and market outcomes of the innovating firms.

Research Approach

Given the current gap in academic research regarding the study of CPI in mature industries, an exploratory case-study approach was employed with the aim of understanding why and how CPI takes place in the food manufacturing and foodservice areas. Exploratory case-study research is the most appropriate research strategy when “how” and “why” questions are being asked, when the researcher has little control over events, and when the focus is a contemporary phenomenon within some real-life context (Yin, 2003). A multiple, cross-sectional, retrospective case-study design was used involving 3 units of analysis – the CPI activities of three manufacturers of sous-vide meals for the US food manufacturing and foodservice industry between 1968 and 2007. The data sources for the case-study analysis included financial reports, academic and industrial publications, newspaper articles, company brochures and other types of written documentation. Personal interviews were conducted on-line with the CEO and the Chief Scientist of only one of the three manufacturers under scrutiny, since this was the only unit of analysis still active in the US marketplace today.

Case-study A

The first unit of analysis concerned a US company in the area of food-grade materials and vaccum-packaging (henceforth ‘company A’). In 1968, company A started to allocate part of its R&D resources to the aim of developing a method of sealing and pasteurising ready-to-eat foods at industrial scale for long storage times (Creed, 2001a). These R&D activities started to bear fruit in 1971, when company A filled a patent for sous-vide cooking (as well as for the accompanying laminated plastic pouch), as a new and improved method of preparing and preserving ready-to-eat foods (Ready, 1971).

By the middle of the 1970’s, company A starts to explore the possibility of diversifying its activities to include the large-scale production of sous-vide meals and meal components for the catering industry. To this end, they hire two French consultants with very different backgrounds – a scientist that worked in a food safety laboratory, and who had done research on the vacuum-packaging of meat, and a restaurant chef who had developed a method for slow-cooking foiesgras with less weight loss. The latter was hired to improve the sous-vide cooking method from the culinary viewpoint (operational costs, sensory quality, presentation and the development of new recipes), while the former was required to optimise the time-temperature cooking combinations in order to comply with the necessary food safety requirements. The two consultants worked closely together with company A’s own specialists, and with each other, for about ten years in the optimization of the sous-vide cooking method. The main goal was to achieve the right combination between plastic pouch composition, level of vacuum in the pouch, cooking and storage temperatures, and cooking and storage times which allowed for maximum sensory and nutritional quality within the food safety limits imposed by legislation (Creed, 2001a; Hessler, 2005)

By 1989, company A had opened its own sous-vide food production plant and a subsidiary company that commercialised sous-vide meals for the US market (Lingle, 1991). Both were sold out in 1996 and changed activity.

Case-study B

The second unit of analysis was a US company launched in 1986 to produce and distribute chilled sous-vide meals and meal components in California (henceforth ‘company B’). Two former executives at a foodservice company had came across the technique in France and managed to convince several venture capital firms in the US to back a business based on the industrial production and distribution of sous-vide foods. To that end, they recruited several French chefs familiar with the sous-vide cooking method as consultants, to help develop the company's product line. At the time, company B invested about 10 million dollars in research related to product innovation, resulting in the production of 65 different chilled food items and 100 000 dinners and entrees a day for the US foodservice market (Otto, 1989).

However, market diffusion of sous-vide foods in the US remained low throughout the nineties, mainly due to public concerns with food safety and poor consumer acceptance of the underlying technology and its benefits (Allen, 1991; Martin, 1990). This lead company B to switch from chilled to frozen storage and distribution of its products, to avoid food safety risks and increase customer confidence. But this switch came at a heavy cost of the end-product's overall sensory quality and convenience features, and company B would eventually cease its activities in 1992. Given the R&D effort made, such lack of success was attributed mainly to Company B's insufficient market research and to a poor marketing and distribution strategy (Carlino, 1991)

Case-study C

The third unit of analysis was a US company founded in 1987 to produce and market frozen sous-vide foods in Europe and US (henceforth 'company C'). Company C currently operates plants in the US, South-America and Europe and markets its meals and meal components through channels such as airlines, passenger trains, cruise lines, hotels, retail, military, restaurant chains, and on-line consumer markets. Figures 1a,b show the R&D effort and net sales volume of company C between 2004 and 2006 (Company C, 2007). This company is listed on the American Stock Exchange since 2005.

Company C's corporate strategy relies mainly on the development and marketing of upscale, high quality, fully cooked frozen entrees through sous-vide cooking methods. Its motto is: "exceptional food for exceptional events with ultimate convenience at a good value". This company exhibits a mainly R&D-based, technology-driven corporate innovation strategy, supported upon its manufacturing facilities in the US and what they considered to be the best and most experienced technical team in sous-vide technology (including their chief senior scientist, who also collaborated as consultant with company A on the original development of the sous-vide technology for the foodservice industry). Their unique facilities and expertises are also enhanced by frequent collaborations with the best chefs in the foodservice industry. Concerning its intellectual propriety, the company currently holds 3 trademarks in the US and in Europe, which are often used in international advertising campaigns.

Since 1997, Company C has also devoted a growing share of its resources to a more focused sales and marketing strategy. It has launched several marketing campaigns, some with the direct patronage of world-renown French, US and UK restaurant chefs, to educate the marketplace about the advantages of sous-vide processing and to increase awareness of the company and its product lines. To the same end, they also run a certification program in sous-vide technology for meal preparation for the US East Coast restaurants. This is based on consultancy and training on food safety issues, equipment handling and meal provisioning, and is an essential step for restaurants in this region to obtain a license to operate sous-vide cooking methods in their kitchens. In this area of the

Figure 1a: R&D effort of company C between 2004 and 2007

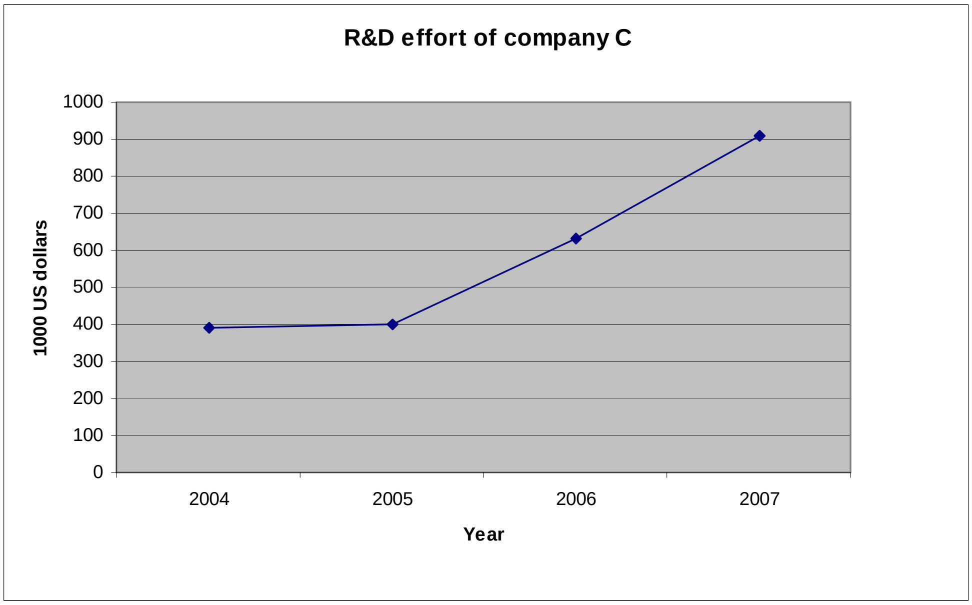
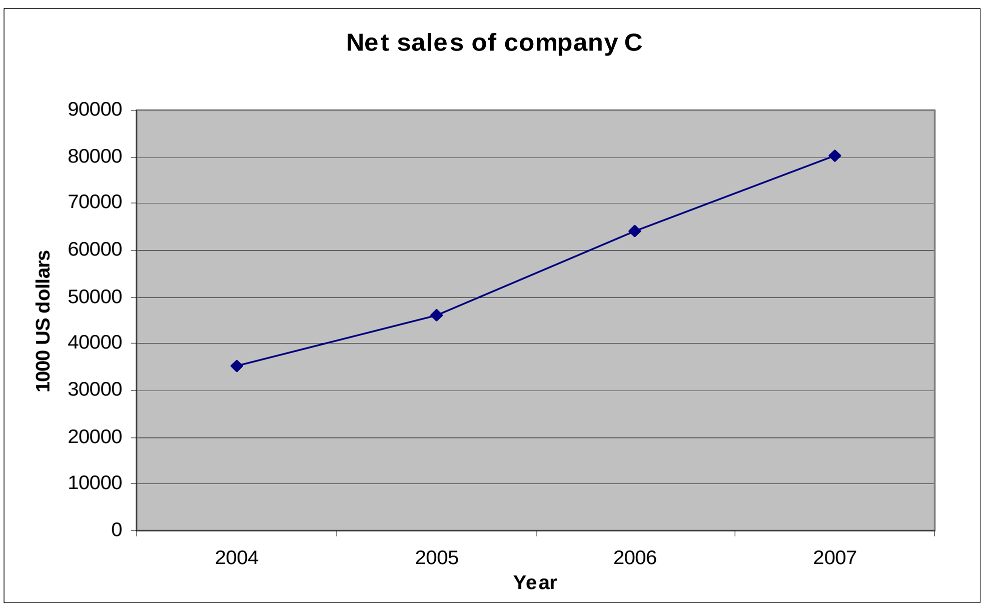


Figure 2a: Net sales volume of company C between 2004 and 2007



country, sous-vide cooking methods are allowed for industrial purposes only, unless proper certification is obtained with a partner in the food manufacturing industry.

Throughout its history, company C has based its innovation strategy on a consciously crafted combination of in-house R&D and open innovation initiatives. In 1983, while still operating in the bakery area, company C started a research collaboration with a related French company, to capitalize on their knowledge of frozen bread products and the quick-freezing process. In this way, the company came across the sous-vide technology and realised the potential of its application in Europe and US's foodservice markets, which would eventual became its sole area of business activity in 1987. Since 2002, and partly in reaction to the negative impact brought by the 9/11 events upon the world's travel and tourism industry, company C regularly establishes partnerships with high-end retailers for the development of sous-vide products for the French and US consumer markets. This gives the company the opportunity to test their products directly with the end-customer and helps increase consumer and public acceptance of the underlying sous-vide technology. In 2004, company C also firmed a strategic research alliance (Dittrich and Duysters, 2007; Yoshino and Rangan, 1995) with one of its suppliers in South America (an equity agreement where company C is a minority stockholder), with the aim of developing and producing high quality, valued priced, fish-based sous-vide products for the global retail and foodservice markets.

Concerning specific CPI projects, two of Company C's recent initiatives stand out as prime examples of partnering between the foodservice industry and the end-user community of restaurant chefs. The first is the company's on-line sales program, where changing sous-vide menus with signature, created exclusively by the world's leading restaurant chefs, are commercialized for home delivery to the gourmet customer segment. The second one is their trade-marketed, salmon product developed by a French restaurant chef while he was working as a consultant to the company. This chef used custom tools made by a manufacturer of medical equipment in Germany, as well as a high level of expertise in sous-vide cooking, to create a shank out of the tail end of the salmon (Poris, 2005).

CONCLUSION AND MANAGERIAL IMPLICATIONS

In this paper, we started by reviewing extant literature regarding the application of the open innovation concept in the food manufacturing and foodservice industry. The first conclusion to be drawn from our review is that open innovation does take place within the food sector, in spite of it being known as a relatively more traditional and mature industry. Moreover, open innovation strategies come in a variety of forms and, as such, are also met with a wide variety of outcomes. Consequently, there is a clear need for a better understanding of open innovation in the food sector that should be addressed by the performance of more and more focused case and empirical research.

Next, we analyzed the impact of the open innovation strategies employed so far on the innovation capabilities and market outcomes of food manufacturing and foodservice industries. Namely, an exploratory case-study approach was employed with the aim of understanding why and how CPI takes place these areas. Our analysis of new process/product development in the US foodservice industry shows that collaboration with external parties is frequent in this mature sector and encompasses both the exploration and exploitation stages of innovation. In line with earlier studies (Costa and Sarkar, *submitted*; Knudsen 2007), it also indicates that despite different cooperation strategies being employed, expert user communities - accomplished, haute-cuisine chefs in European and US restaurants - constitute preferred innovation partners (Adriá et al., 2006; Fauchard and von Hippel, 2006). Collaboration with highly innovative chefs creates value to manufacturers by aiding technical development, accelerating technology adoption and diffusion among customers (through the development of novel recipes and applications), and increasing technology acceptance and perceived product quality. In return, chefs benefit from efficiency gains, certified cooking methods, improved professional reputation and higher consumer patronage.

Finally, our review and analysis demonstrated that firms stand a better chance of escaping the law of diminishing returns to innovation efforts if they can improve the effectiveness of both their technological and marketing capabilities in a concerted manner. This supports the long-standing call for a higher level of integration between R&D and marketing activities within agri-business companies (Costa & Jongen, 2006). Likewise, when effects on technological capabilities and market outcomes are analysed simultaneously within an integrated framework, research into (open) innovation stands a better chance to become more meaningful to academics and practitioners alike.

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