Open innovation in the Hungarian wine sector

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1. Introduction[1]

Adopting an open innovation process is the new mantra of the Food and Beverage (F&B) sector. To illustrate, Heinz, one of the largest multinational corporations (MNC) operating in the sector, recently re-focused its R&D and innovation strategy on an open innovation platform, including all relevant phases of food production, thus from agriculture to health science[2]. Unilever, another F&B giant, re-shaped its CSR policy (Unilever Sustainable Living Plan) with a renewed innovation platform fully re-focused on an open innovation approach[3]. In 2004 Barilla group, one of the largest pasta-makers in Europe, funded a branch-company, Academia Barilla, as an open (web-based) platform to collect traditional recipes from the Italian cuisine, and to use them to produce world-class food products[4]. SMEs are also increasingly joining the club of open-innovators, especially through industrial and knowledge-based clusters[5].

This trend can be seen as a reaction of food companies to their exposure to severe (and increasing) competitive pressures worldwide. Adopting an effective innovation process to successfully introduce and develop new products to the market has become one of the most important strategies for food companies (Karantininis et al., 2010). However, whether it is more effective to speed up the innovation process by sharing ideas and resources with other companies, or to innovate in-house in a more closed system is still under debate in the academic domain (Sarkar an Costa, 2008).

Chesbrough (2003) has been the first to introduce the concept of 'open innovation'. The idea of open innovation indicates that a company is increasingly using inflows and outflows of knowledge to speed up the internal innovation process, and expand the markets for external use of innovation (Chesbrough, 2006). From a theoretical perspective, the open innovation literature has focused on different topics such as (i) the degree and type of openness (i.e. outbound or inbound), (ii) effectiveness, (iii) context and (iv) process (Huizingh, 2011). In this respect a gap in the literature is an understanding of open innovation in the different stages of the innovation process, from the idea generation to the commercialization phase.

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[2] http://www.heinz.com/our-food/innovation/research-development.aspx (last access 10-08-2012)

[3] http://www.unilever.com/innovation/collaborating-with-unilever/open-innovation/ (last access 10-08-2012)

[4] http://www.academiabarilla.it/italian-food-academy/sede/default.aspx (last access 10-08-2012)

[5] An example is FoodValley operating in the Netherlands (http://www.youtube.com/watch?v=hEg0a2xCePo)

Moreover, if we look at the empirical studies on open innovation, most of them draw on evidence from high-tech industries such as equipment, computers, ICT or pharmaceuticals (e.g. Christensen et al., 2005; Dittrich and Duysters, 2007; Fetterhoff and Voelkel, 2006) and have a prevalent focus on large companies and multinational corporations (Chesbrough, 2003, 2006). Empirical investigations on open innovation in SMEs operating in the F&B sector are relatively scarce in literature (Huston and Sakkab, 2006; Sarkar and Costa, 2008; Vanhaverbeke and Cloodt, 2006; Enzing et al., 2011). Archibugi et al. (1991) indicate that a more open system of innovation is particularly interesting for food companies, which normally rely even more on external resources than other industries (see also Enzing et al., 2011). Moreover, some specific features of the innovation pattern in food companies make that looking at only internal, closed innovation processes (i.e. the effort in R&D) is a misleading indicator of food companies' innovation capacity (Avermaete et al., 2004; Galizzi and Venturini, 2008; Capitanio et al., 2010). On the other hand, a strong R&D department and access to well-trained and expert human resources is a necessary condition to adopt a more open innovation system (Wang and Ahmed, 2007).

This paper contributes to the existing literature by addressing the issue of open innovation in the different phases of the innovation process in SMEs operating in the F&B sector. The issue is particularly controversial in the wine sector, where innovative marketing strategies have to be combined with sometimes "exclusive" and "secret" recipes, which make the quality of the products unique. The uniqueness of the empirical investigation is twofold: (i) this survey is the first one in the Hungarian agri-food sector, aiming at purely the knowledge and innovation characteristics of the enterprises and (ii) the survey is the first in Hungary concentrating on a natural resource based industry. The uniqueness is very much coupled with economic interest, because in the developing countries the innovation process in natural based sectors (especially the wine industry in the New World of Wine countries, like e.g. Chile) has generated huge economic wealth during the last 20 years (Anderson, 2005). One of the most critical questions to be answered by wine companies is how to arrange external ties with other companies and research organizations - potentially leading to a successful innovation system - without compromising unique and highly specific assets. Therefore, understanding the main factors that lead wine companies to adopt an open, rather than a closed, innovation system is the main research question of this paper. We aim at "unbundling" the open innovation process and analyse whether the degree of openness of wine companies varies in the different stages of innovation, whether patterns of openness and common factors that can predict them do exist. More specifically, we analyse the relationship between dynamic capabilities, namely the

adaptive and absorptive capabilities of the firm, and open innovation in three main stages of the innovation process: idea creation, development and commercialization. We also control for sector and regional specific conditions.

The Hungarian wine industry presents an interesting case for research on the issue of open innovation. Wine contributes significantly to the total turnover in the Hungarian F&B industry. Wine typically offers opportunities for strong value creation and can be marketed as a premium processed F&B product. However, in recent years the Hungarian wine industry has been left behind in worldwide trends on premium and super-premium wine markets (Wittwer, 2007).

The dataset allows to incorporate differences in regional conditions that can support or constrain the opportunities that companies have to participate in open innovation networks.

The literature on open innovation predicts a low degree of openness in low-tech companies (Dahlander and Gann, 2010), including SMEs operating in the F&B sector (Sarkar and Costa, 2008). However, we find that open innovation is quite extensive in the Hungarian wine industry: 25-30% of companies generate, develop and commercialise the majority of new ideas in cooperation with other partners. As a second result, we find that the degree of openness decreases as a company moves through the consecutive stages of innovation. In other words, Hungarian wine companies are significantly more likely to use outside ideas in the idea generation and development stages than in the commercialization stage. This contradicts findings in the literature (Lee et al., 2010). However, conclusions from this earlier research focused on the importance of outbound activities in the later innovation stages, while our data only allow us to look at the inbound open innovation processes (i.e. the 'buy' decision with respect to knowledge and technology transfer). This may explain our outcomes.

Finally, we use a multivariate probit model to determine the factors that drive the degree of openness at different innovation stages. The multivariate probit allows the binary dependent variables to be correlated. As dependent variable we use an indicator of the presence of openness at the three main stages in the innovation process, more specifically the share of in-house idea generation, idea development and idea commercialization. The independent variables are derived from the literature and include indicators of (1) companies' dynamic capabilities, such as absorptive and adaptive capabilities, which are hypothesised to be a precondition to benefit from open innovation; (2) control variables such as companies' age, size, legal form and the role of external networks. Since the cross-sectional nature of our data does not allow us to completely avoid issues of endogeneity, reverse causality and omitted variables problems, the results of the econometric estimations should be interpreted as

correlations and not as casual relationships.

Furthermore, results show that there is a high positive correlation between the degree of openness in different stages of the innovation process. The use of the multivariate probit model is therefore justified. This result leads us to conclude that companies are inclined to be open (or closed) throughout the whole innovation process. Drivers that stimulate openness in idea creation in a company may therefore also contribute to a positive attitude towards openness in idea development and commercialisation and vice versa. Furthermore, the estimation provides evidence that larger wine companies have more open innovation processes. Other significant results are the positive impact of access to specialised regional suppliers and the negative impact of a company's age. The former seems to indicate that supplier-buyer relationships are crucial in stimulating knowledge and technology transfer. The latter shows that older wine companies rely more on in-house innovation processes.

2. Open innovation processes, dynamic capabilities and institutions in the Food and Beverage sector

2.1. Defining open innovation in the F&B sector

What makes food companies substantially different from other manufacturing companies is their higher dependency on natural resources - not limited to e.g. fossil fuels – and their need for specific (often tacit and local) know-how in their production processes. Transforming an often heterogeneous and discontinuous flow of raw materials into standardized and marketable products is at the core of a food business. Therefore, more than being involved in ground-breaking and radically innovative projects, food companies (including multinational corporations) are more likely to be active in a very targeted process of stakeholder and technology adaptation (Rama, 2008; Enzing et al., 2011). As a result, when scholars look at R&D activities in the F&B sector they are often inclined to see food companies as conservative, slow-growing and mature businesses, where innovative activities are less likely to occur (Sakar and Costa, 2008; Capitanio et al., 2010). On top of that it is rather difficult to assess the degree of openness of the innovation system adopted by a food company. To illustrate, if a wine-maker is producing a world-class wine using and adapting a "local recipe" (which is often the case), this is not regarded as an open innovation approach, though it is fitting in the concept of "increasingly using inflows and outflows of knowledge to accelerate the internal innovation process, and expand the markets for external use of innovation" (Chesbrough, 2006).

A review of the literature on open innovation in the F&B sector performed by Sarkar and Costa (2008) clearly indicates two main shortcomings in this domain: on the one hand, few empirical evidence is available to thoroughly assess whether food companies are approaching open innovation in a different way than other manufacturing companies; on the other hand, most of the contributions in this literature use proxies to measure the presence and degree of open innovation, for example through the presence and number of external ties (see also Enzing et al., 2011). The literature also indicates potential differences of open innovation features in the different stages of innovation (i.e. idea generation, development and commercialization) (Sarkar and Costa, 2008). The question is how to measure and assess open innovation in food companies.

Van de Vrande et al. (2009) measure open innovation by identifying technology exploration and exploitation practices. As pointed out by Huizingh (2011) using external ties as a proxy of openness is potentially misleading because it only captures one of the components of the concept, such as the inbound/outbound dynamics. Thus being engaged in a partnership with someone (i.e. a research organization) does not necessarily mean that you are internally making use of your partner's knowledge (*inbound innovation*), nor that you are using internal knowledge to exploit resources provided by your partner (*outbound innovation*). In effect it merely highlights the underpinning mechanisms and trends leading to an open innovation process (Gassman et al., 2010; Huizingh, 2011). Parida et al. (2012) point out that inbound open innovation refers more to exploring and integrating external knowledge to develop and exploit technology. Outbound open innovation is the practice of exploiting technological capabilities, combining internal with also external paths of commercialization (Chesbrough 2003; Chesbrough and Crowther 2006).

In line with this literature review, we conceptualize the measurement of open innovation as "the proportion of innovations entirely generated within the company as opposed to the ones generated in co-operation/collaboration with universities, research organizations, regional customers and/or suppliers, other F&B companies, venture capitalists and industry/cluster associations or business assistance centres". We apply this definition to the different stages of innovation, namely the *idea generation* phase (discovering market opportunities or problems to be solved, envisioning areas for technical breakthrough, developing initial insights, basic and applied research), *idea development* phase (developing a deeper conception of products or services, building a model of a product or service, product or process testing) and *commercialization* phase (production, promotion, distribution, and sales of a product/service/technique). In line with Parida et al. (2012) this conceptualization emphasizes

more an inbound than an outbound open innovation process. Inbound open innovation is prevailing in low-tech industries (Chesbrough and Crowther, 2006), where the exploration and exploitation of external knowledge through networks of collaboration is more likely to occur than new venture spin-offs for technology development and / or licensing-out technologies to other organizations (Parida et al., 2012). It is more difficult to understand whether significant differences occur in the different stages of innovation. Lee et al. (2010) argue that high tech companies can be more prone to use an open innovation process in the commercialization phase. While high-tech companies show superior capabilities in the phases of creation and development of new technologies, they might suffer from a lack of marketing capabilities when it comes to the phase of commercialisation (Lee et al., 2010). Enzing et al. (2011) show that F&B companies need to implement open innovation processes from idea creation to commercialization. In fact, while they are more likely to engage in large networks of collaboration with upstream partners to use and adapt technologies to innovate their processes, they engage with downstream partners (i.e. retailers) to overcome challenges in introducing new products to the market (Enzing et al., 2011). Based on this literature we formulate the following hypothesis:

H1: *The degree of openness in the innovation process does not differ between the three different stages of the innovation process.*

2.2. The role of company dynamic capabilities

Factors that contribute to a company's openness, such as dynamic capabilities, must be seen as the main explanatory variables when analysing open innovation (Dahlander and Gann, 2010; Huizingh, 2011). As mentioned earlier, the role of openness and connected capabilities is even more important in F&B companies because they have even more intense interactions with both upstream and downstream partners than other types of companies (Enzing et al., 2011). F&B companies may develop some specific capabilities due to the peculiarities characterizing their innovation pattern. On the one hand, F&B companies are mainly "market-pulled" businesses, therefore involved in incremental rather than radical food product innovations (Grunert et al., 1997; Galizzi and Venturini, 2008; Elzing et al., 2011). In this respect, they benefit the most from the interaction with downstream partners, such as retailers and distributors, in order to make the introduction onto the market of new products successful. On the other hand, F&B companies are "technology-pushed" (Capitanio et al., 2010). Therefore, they are mainly process-innovation oriented through adaptation of equipment and

the use of new technologies developed by upstream (high-tech) industries to create new food products (Archibugi et al., 1991; Garcia Martinez and Burns, 1999; Capitanio et al., 2010). In line with these statements, we use dynamic capabilities to explain differences in degree and patterns of open innovation in F&B companies. Teece et al. (1997) extensively discusses the relationship between dynamic capabilities and innovation-based competition in different industries. In this framework dynamic capabilities are seen as a subset of competences and resources which allow the firm to create new products and processes, and respond to market changes (Teece at al., 1997). Wang and Ahmed (2007) highlight the presence of two main types of dynamic capabilities, namely the *absorptive capabilities*, as a way in which companies create and absorb, integrate and re-configure external knowledge from other organizations (Cohen and Levinthal, 1990); and *adaptive capabilities*, as a way in which companies are able to explore and exploit external opportunities in the market (or the geographical context) (Staber and Sydow, 2002). Based on these concepts we develop the following research hypotheses:

H2: *Open innovation in the idea creation and development phase is more likely to occur in the presence of dynamic capabilities developed with upstream partners*

H3: *Open innovation in the commercialization phase is more likely to occur in the presence of dynamic capabilities developed with downstream partners*

3. Data and empirical strategy

First we describe the data. The survey was carried out in 2006 in the 22 Hungarian wine regions, as part of the T 046882 OTKA (Tóth, 2009) research with the assistance of the National Council of Wine Regions. Altogether 115 questionnaires were completed representing an average of 5 questionnaires for each wine region. As the statistical representativeness could not be achieved, the research results are relevant on country level.

The examined time period (2004-2006) is the same when the EU had to face with the aggressive market penetration of new wine producing countries (Australia, Chile and South Africa), taking wine reforms in force. The new EU framework is more market oriented and competitive, therefore for the Hungarian wine sector – with almost only SME companies – fostering, adapting and spreading the innovation is more crucial than ever. Table 1 reports our main variables.

Tab 1. – Descriptive statistics

Variables			Obs.	Mean	S.D.	Min.	Max
Panel A: Open innovation variables							
Presence of open innovation at idea generation phase (>25% ideas created with outsiders)		OIgeneration	115	0.635	0.484	0	1
Presence of open innovation at idea development phase (>25% ideas developed with outsiders)		OIdevelopmt	115	0.548	0.500	0	1
Presence of open innovation at commercialization phase (>25% ideas coming from outside)		OIcommerce	115	0.426	0.497	0	1
Panel B: Dynamic capabilities variables							
Absorptive capabilities	Presence of high-skilled workers	educ_skill	92	0.304	0.280	0	1
	Percentage of English-speaking workers	eng_skill	115	20.643	25.380	0	100
	Percentage of workers familiar with ICT	ICT_skill	115	44.757	37.235	0	100
	The firm is dependent on specific knowledge	spec_know_depend	114	5.518	1.465	1	7
	The firm owns specific know-how	own_spec_know	114	5.105	1.319	2	7
Adaptive capabilities	The firm has intensive info exchanges with buyers	buy_info	114	5.193	1.211	1	7
	The firm has intensive info exchanges with suppliers	supl_info	114	4.307	1.446	1	7
	Reciprocity in sharing know-how with competitors	rec_info	114	3.500	1.581	1	7
Panel C: Control variables							
	Number of workers	size	115	11.296	19.916	0	130
	Age of the firm	age	105	11.095	6.631	1	47
	Legal status (1 if private partnership)	legalform	115	0.574	0.497	0	1

Panel A in table 1 describes the open innovation variables. We identify open innovation in the Hungarian wine companies when at least 25% of the new ideas have been created / developed / commercialised together with partners outside the boundaries of the firm. All three measures

are based on self-assessment of top-managers. Panel B refers to variables related to dynamic capabilities. We proxy absorptive capacities through the presence of highly-educated workers, the percentage of workers who are able to use English for business relations and the percentage of workers that have a familiarity with ICT. Furthermore, we include variables that are based on the assessment of top-managers about the firm's dependence on specific knowledge and the level of know-how specificity that is present in the company. To proxy adaptive capabilities we use the intensity of information exchanges the company has with both upstream (suppliers) and downstream parties (sellers) and the reciprocity in sharing know-how with competitors. As controls we use firm size, age and legal status (whether a wine company is a private partnership instead of a cooperative or other legal forms).

We now describe our empirical strategy. We consider correlations between our measures of open innovation and dynamic capabilities of F&B companies:

$$(1)\ O_j = \alpha + \beta_1 D_j + \beta_2 C_{j+} \varepsilon_{j,}$$

where O_j refers to our open innovation variables, such as the proportion of ideas entirely generated, developed or commercialized in collaboration with other partners of company j, where j=1,....115. D_j refers to a vector of company dynamic capabilities, I_j to a vector of institutional variables, and C_j refers to a vector of company control variables.

4. Results

As a first result we can see from table 1 that the degree of openness decreases as we move through the different stages of the innovation process. While open innovation occurs in 63% of the surveyed companies in the idea generation phase, this share has decreased to 55% and 43% in the development and commercialisation phase respectively. To test hypothesis 1 we perform pearson's chi-squared test to determine independence of the variables OIgeneration, OIdevelopment and OIcommerce. The test strongly rejects independence and hence confirms that the degree of openness is strongly correlated in the three different stages of the innovation process in Hungarian wine companies. In other words, we accept hypothesis 1. Moreover, the positive correlation between the degree of openness in different stages of the innovation process also justifies the use of the multivariate probit model. We can conclude that companies are inclined to be open (or closed) throughout the whole innovation process. Drivers that stimulate openness in idea creation in a company may therefore also contribute to a positive attitude towards openness in idea development and commercialisation and vice

versa.

In table 2 we present our results on correlations between open innovation variables and dynamic capabilities in Hungarian wine companies.

Tab. 2 – Multivariate probit results

	OIgeneration		OIdevelopment		OIcommerce	
Variable	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Presence of high-skilled workers	0.1596	0.6401	0.0430	0.5624	0.7054	0.60613
Percentage of English-speaking workers	0.0189 *	0.0099	0.0029	0.0071	0.0068	0.00802
Prercentage of workers familiar with ICT	0.0015	0.0065	0.0040	0.0052	-0.0059	0.00525
The firm is dependent on specifci knowledge	-0.1465	0.1301	-0.1208	0.1104	-0.0673	0.10143
The firm owns specific know-how	-0.2466 *	0.1432	-0.0224	0.1245	-0.1256	0.12784
The firm has intense info exchanges with buyers	0.0322	0.1506	-0.0536	0.1279	0.24994 *	0.14356
The firm has intense info exchanges with suppliers	0.3106 **	0.1231	0.0868	0.1055	0.10555	0.11103
Reciprocity in sharing know-how with competitors	-0.1224	0.1429	-0.1077	0.1141	-0.1741 *	0.10474
size	0.0184	0.0151	0.0211 *	0.0124	0.0103	0.008
age	-0.0494 *	0.0287	-0.0181	0.0236	-0.0519 **	0.02536
legal form	-0.2764	0.3579	-0.5377 *	0.3030	-0.4972	0.31389
constant	1.3445	1.0627	1.0813	0.8964	0.205	0.94027
Corr_gener_dev	0.83902 ***	0.08653				
Corr_com_gener	0.66411 ***	0.12792				
Corr_dev_com	0.84704 ***	0.07919				

The results in table 2 confirm hypothesis 2: open innovation in the idea generation phase is

more likely to occur in the presence of intensive information exchanges with suppliers. Furthermore, we find evidence in line with hypothesis 3, namely that open innovation in the commercialisation phase is stimulated by information flows between the wine companies and downstream buyers. This points to the relevance of other value chain actors in the innovation process in the wine industry but with an important distinction between the players that affect the first stages of the innovation process (idea generation) as compared to the later stages (commercialisation).

Other dynamic capabilities that play a role in explaining the degree of openness include the skill level of the labour force and the degree of in-house specific knowledge. In line with the the literature, companies that adopt an open innovation process have access to a well-educated workforce. Furthermore, access to own specific know-how in the company is negatively correlated with the openness of the innovation process. This may point to a trade-off between openness and own innovation capacity. Reciprocity in information exchange with competitors, on the other hand, is negatively correlated with open innovation.

Finally, the control variables show a significant effect of firm size (positive), firm age (negative) and legal form. The former indicate that larger and younger firms are more likely to have an open innovation process. Companies established as private partnerships, on the other hand, are less likely to engage in open innovation.

5. Discussion and conclusions

In general we conclude that both the regional (access to suppliers) and the company-specific (age and size) context affect the openness of innovation processes in the Hungarian wine industry. It remains to be investigated to what extent this is related to the actual costs of openness or to the limitations in accessing its potential benefits for individual companies. A better understanding of the process of innovation is therefore crucial to improve the competitive position of the Hungarian wine sector. From a rural development perspective, this may provide valuable information for policymakers that are interested in creating an innovation-friendly environment.

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