

Exploring the Networking Characteristics of New Venture Founding Teams

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ABSTRACT. This paper deals with newly established ventures and their relations with external agents. The *founding teams' intention to set up relations with external agents* and their *frequency of interaction with external agents* are addressed as two features that are likely to lead to the success of academic spin-off companies. Empirical analysis is based on a data set of 40 Italian academic spin-offs. The external agents who are most likely to have interactions with academic spin-off companies are first identified. Two research hypotheses are then put forward: (a) that the intention of the founding teams to set up relations with external agents is influenced by the degree of articulation of roles and the completeness of the founding teams; (b) that the founding teams' frequency of interaction with external agents is influenced by the frequency of interaction with external agents of the research groups of origin and by their scientific and technological excellence. Some remarks are then made on the role that universities play in helping new ventures to set up relations with external agents.

1. Introduction

Over the last twenty years increasing attention has been paid to the contribution of universities and other public research institutions to new venture creation. The main initiatives to transfer scientific and technological knowledge from universities to the market place include academic spin-off companies (Chiesa and Piccaluga, 2000; Evans and Klofsten, 1998; Roberts, 1991a), i.e. new entrepreneurial activities generated within academic environments by individual faculty members, staff or students¹ (Stankiewicz, 1995; Smilor et al., 1990; Caryannis et al., 1998).

Literature on academic spin-offs has so far mainly focused on the characteristics of the entrepreneurs and of the organisations for which they have been working (Roberts, 1991a; Rogers, 1986; Steffensen et al., 1999; Smilor et al., 1990), and on a complex of external influences, including the availability of venture capital and supporting services, the economic climate, market and technology opportunities, industrial relationships, and complementary assets (Chiesa and Piccaluga, 2000; Segal, 1986).

Little attention has been paid to the relational structure of academic spin-offs at the time of founding, though networking is a key feature in explaining the nature of newly established companies and in predicting their future success (Rothwell, 1992; Hansen, 1995; Larson and Starr, 1993). The establishment of effective internal and external communication links to sources of scientific and technological knowledge and to industry is identified as a key factor for success in the innovation process (Allen, 1977; Jarillo, 1989; Tidd et al., 1997).

In this paper we shed some light on the actors involved in new venture networks and on the reasons why entrepreneurs rely on external resources. We identify two factors that are likely to lead to the success of new ventures. These are the founding teams' *intention to set up relations with external agents* and their *frequency of interaction with external agents*. Two research hypotheses are put forward on the way that these two factors, in the specific case of academic spin-offs, are affected by certain characteristics of the founding teams and of the research groups from which academic spin-offs originate.

Empirical analyses are carried out on a database of 40 Italian academic spin-off companies. In the light of regression results, and with the support of evidence that emerged during the interviews,

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we make some remarks both on the role that universities ought to and in fact do play in helping new ventures to set up relations with external agents, and on the need for universities to be more proactive in encouraging academics to engage in entrepreneurial initiatives.

2. External agents involved in business idea generation

Although networking has not received much attention in the literature on academic spin-off companies, there seems to be a consensus that it is extremely important for newly established ventures to be part of an extended network of relations. Interactions with external agents are essential in order to gather relevant information about the new business, to find external support and services, to access external resources not available in-house, to advertise the new company, and to look for business advice (Birley, 1985). The choice of external relations is the key to understanding the future development of newly established companies; during the process of new venture generation, the foundations of the new firm are laid and the main decisions are taken on the kinds of resources required to run the business and on how these are to be sourced (Larson and Starr, 1993).

The assessment and acquisition of resources for new ventures leads entrepreneurs to develop the exchange relationships that shape the new organisation. The search for resources and the process of communicating with a diverse set of resource partners give rise to new connections that the entrepreneur evaluates and eventually brings into his network. Through a process of expanding and fine-tuning the network, the entrepreneur identifies a set of relationships that merit further development and future investment by the new venture (Larson and Starr, 1993).

The literature tends to distinguish between two types of networks on which the entrepreneur can draw (Birley, 1985): formal and informal. Formal networks include banks, accountants, lawyers, the chamber of commerce, small business administrators, etc. Some of these relations (contacts with research institutes, universities, companies, institutional agencies supporting new firm creation, public institutions) may be inherited directly from

the "parent organisation". Informal networks include family, friends, previous colleagues or previous employers. In order to translate the business concept into a business reality, the entrepreneurs turn first – mainly for information and for the validation of their entrepreneurial ideas – to informal contacts, and then to physical and capital resources and to more formalised kinds of linkages. Birley (1985) observes the extensive use of informal networks in the early stages of a new venture generation process. Starr and MacMillan (1990) document the use of social and socio-economic exchange mechanisms to acquire resources and to gain legitimacy during the early stages of ventures. Informal friendship and family linkages exist first as emotional ties and social relations; then, as the business concept and strategy for implementation become more refined, the entrepreneurs reduce the initial set of relations to a limited number supplying sufficient resources to launch the venture. According to Larson and Starr (1993), at the first stage, certain relationships are selected, others are dropped, others continue to evolve, and new ones are added. The set of linkages is ultimately narrowed to a specific arrangement – a network of essential ties – providing the mechanism for mobilising the resources required. By "network of essential ties" we refer to a limited number of relations with those external agents who are most likely to interact with the new venture. "... As the business concept and strategy for implementation become more refined, the entrepreneur reduces the wide range of possible resource sources to a critical mass, the essential ties, which will supply sufficient resources to launch the venture. . . ." (Larson and Starr, 1993). These relationships represent a set of core activities that establish the initial operations of the new companies.

3. "Networking" characteristics of the founding team associated with success: Two research hypotheses

The literature on networking and new venture success suggests that the attitude of the founding team towards interacting, communicating and exchanging knowledge with the outside is positively related to success (Van de Ven, 1986; Brush, 1992; Birley, 1985). Both Johannisson (1986)

and Van de Ven et al. (1984) describe a positive relationship between entrepreneurs' interactive personal styles and new venture success. Johannisson (1986) finds that successful entrepreneurs have large local as well as global networks, which they exploit in the process of starting their new ventures. Van de Ven et al. (1984) demonstrate that the more successful entrepreneurs generally draw on a broad network in the process of developing their specific product concepts. Stuart and Abetti (1987) show that the possession of good networking and communicating skills by the founding team are characteristics associated with success. Tidd et al. (1997) also stress that the attitude towards communication and the creation of effective exchange mechanisms with the outside is a characteristic of successful innovating organisations. They argue that developing a sense of external orientation and the tendency to interact with the market place are key characteristics for entrepreneurial teams, enabling them to build and maintain a successful innovative organisation. Aldrich, Rosen and Woodward (1987) report a positive relationship between network size and the likelihood that new ventures more than three years old would earn a profit.

All these contributions seem to suggest that one of the factors leading to the success of new ventures is access to networks of external relations. Moreover, contributions reporting a positive relation between the intention of an individual towards interaction with the outside and the success of new ventures support the idea that what is ultimately important for success of new ventures is the establishment of relations with external agents. This is corroborated by a specific current in organisational behaviour literature, dealing with the causal relationships between behaviours and personal attitudes. According to Fishbein and Stasson (1990) the behaviour to perform a given action (in our case setting up relations with external agents) is driven by the *intention to engage* in that behaviour, which in turn is driven – among other factors – by a personal attitude towards that behaviour. On the basis of these contributions we assume that the action of setting up relations with external agents is a predictor of success (see also Jarillo, 1989). The empirical literature (Steel and Ovalle, 1984) also suggests

that an individual's *intention* to engage in a given action/behaviour is the best predictor of that action/behaviour. We accordingly take the *intention of the founding team to set up relations with external agents* as a "predictor of success".

The use of "predictors of success" is quite common in the literature dealing with the evaluation of newly established companies. For newly established companies or for those that are likely to start up it is not possible to use the indicators, which are traditionally used to measure the success of already existing companies, as there is no data or information to work out such indicators. It is therefore common in the literature on the criteria used by venture capitalists in their investment decisions in new ventures to examine characteristics of the market, the external environment, the technology, the business, and the founding team as "*predictors of success*" (Stuart and Abetti, 1987; Duchesneau and Gartner, 1990; Roure and Keeley, 1990; Roure and Maidique, 1986; MacMillan et al., 1986; Meseri and Maital, 2001).

We argue that the intention of the founding team to set up relations with external agents is positively influenced by the presence of key individuals within the organisation's informal structure, which we refer to as the articulation of roles. The literature has stressed the importance of organisational structures based on differentiated roles for successful innovation to occur (Allen, 1977; Rothwell, 1992; Roberts and Fusfeld, 1981; Tidd et al., 1997; Galbraith, 1982). We refer to Roberts and Fusfeld's (1981) structure of roles. They identify five key roles, corresponding to the functions of the informal organisation: idea generator, internal entrepreneur, project leader, technological gatekeeper and project sponsor. Each role deals with activities or phases within the innovation process that are specific and differentiated in terms of the competencies and personal characteristics required. The heterogeneity of personal characteristics, which is at the basis of role articulation, makes it easier to cope with the difficulties that typify a new venture generation process. It also prompts the team members to develop a positive attitude toward interaction among themselves, given the natural need to complement one another. This positive attitude toward interaction (exchange of knowledge-based

experiences, expertise, etc.) becomes a peculiarity of the founding team members, reflected in their attitude toward the integration of their competencies with those of other individuals, both internal and external to the organisation. We argue that the positive attitude toward interacting and communicating within the founding team is reflected in a more general positive inclination toward communicating with external agents. Katz and Tushman (1981) suggest that the existence of clear mechanisms for the communication, codification and integration of knowledge within the organisation increases the likelihood of successful interactions between the team and external agents.

Among the five key roles identified by Roberts and Fusfeld (1981), the technological gatekeeper, in particular, is in charge of interfacing his team with the external environment, channelling information within his team, and sharing information with the outside (Tidd et al., 1997; Allen, 1977; Katz and Tushman, 1981). Allen (1977) in his study highlights the importance of informal communication in successful innovation and draws particular attention to gatekeepers, who are always well connected with the informal social structure of the organisation, as key players in the process. We expect that teams presenting a certain degree of articulation of roles are likely to have individuals acting as gatekeepers and that these individuals will tend to boost interaction levels with the outside.

Yet the intention of the founding team to interact with external resources is negatively influenced by the team's degree of completeness, i.e. by the extent to which the team possesses the competencies and knowledge bases that it requires to run the business (Roure and Keeley, 1990). If companies at the initial stage do not have all the resources they need in-house, they will look for them outside and hence will be more likely to set up relations with external agents (Jarillo, 1989; Teece, 1986; Rothwell, 1992).

These considerations lead to our first research hypothesis:

Hypothesis 1: The intention of the founding teams to set up relations with external agents is positively affected by their articulation of roles and negatively affected by their degree of completeness.

The literature supports the idea that what matters in the process of founding a new organisation is the size of the subset of people who are in some way involved with the entrepreneurs in founding it (Aldrich et al., 1987; Van de Ven et al., 1984; Nohria, 1992). Yet an extended network must still process a great number of transactions in order to start up a new high-growth organisation (Aldrich and Zimmer, 1986). Aldrich, Rosen and Woodward (1987) report a positive relationship between the average number of times per week that entrepreneurs contact their network members and the creation of a new venture. In a subsequent study, Hansen (1995) argues, on the basis of the existing literature, that the frequency of communication linkage use is expected to be positively related to new-venture initial growth. In a closely related field, the literature on innovation processes finds that the clarity and intensity of interactions is critical to innovation success (Tidd et al., 1997; Allen, 1977).

These contributions suggest that the "frequency of interaction" between the founding team and external agents is a factor related to new-venture success. On this ground we shall take the "frequency of interaction with external agents" as a predictor of new-venture success. From the theoretical point of view, the "intention to set up relations with external agents" and the "frequency of interaction with external agents" are two different, though related concepts. The former refers to the action of setting up relations with external agents and hence, has to do with the *size* of the network. The latter refers to the *frequency* by which new ventures interact with the agents of their networks (Hansen, 1985).

To understand the nature of some of the factors affecting the frequency of interaction between the founding team and its external agents at the time of founding, we need to look back at the process through which the new venture is generated and at the actors involved in the said process, who are assumed to be responsible for setting up relations with external agents. Kamm and Nurick's model (1993) emphasizes the involvement of a range of different actors in new venture creation. They argue that the process through which the initial business concept is transformed into a product/service ready for commercialisation turns an initial "informal social group" into an "entrepreneurial

team". According to this model, in the specific case of a new venture generated by academics, it is possible to distinguish between the actors involved in the process thereby differentiating a "research group of origin" and a "founding team". The first set of actors comprises that set of individuals who are mainly involved in the generation of technological knowledge with the potential for exploitation. The second set of actors is what Kamm and Nurick define as the "entrepreneurial team" in charge of exploiting the technological knowledge and of marketing it through the new company. This does not imply that all members of the research group will leave it to set up the new venture. Only some of them (at the very least a single individual) will get involved in the commercialisation of the technology. The "entrepreneurial team" emerges as those members of the research group who decide to become involved in the entrepreneurial initiative are joined by other non-university partners.

In terms of relations with external agents, this model shows that throughout the new-venture generation process the actors involved bring in their own "ties" so that, when the new venture starts up, its set of external relations (network of essential ties) reflects to some extent the set of external relations of the actors involved in the process. More generally, the same model suggests that some characteristics of newly established academic spin-offs may be influenced by the characteristics of the research groups from which the companies have spun off.

Drawing on this model, we argue that academic spin-off companies inherit part of their contacts and linkages from their research groups of origin (contacts that research groups had established in the past), either because the academic founders bring into the new venture all the ties with external agents that they have developed while still working at the university (continuing to interact with these actors afterwards) or because, after the creation of the new company, academic research groups tend to outsource to university spin-offs all the work that they cannot do by themselves (Grimaldi and Grandi, 2001). This occurs when the business activity of the newly established company is very similar to what the academic members of the founding team used to do when still working at the university of origin (Stankiewicz, 1995).

Moreover, academic spin-off companies benefit from their affiliation with the parent organisation in terms of reputation, image and other positive externalities (Chiesa and Piccaluga, 1998; Roberts, 1991b). For academic spin-offs, the affiliation with a technologically advanced university or, more specifically, with a research group that has a reputation for scientific and technological excellence, makes it easier to set up relations with clients, suppliers and other external actors since, in the eyes of external agents, it ensures that advanced scientific and technological knowledge bases will be available to the new-established companies. The character and the quality of academic spin-offs can be largely explained by the technological and R&D strength that the research groups of origin have built up in the past (Zucker et al., 1998). The reputation of excellence guarantees, in the eyes of external agents, the rigour of the academic way of carrying out research activities (Roberts, 1991b; Grimaldi and Grandi, 2001). These considerations lead to our second research hypothesis:

Hypothesis 2: The frequency of interaction of new ventures' founding teams (with external agents) at the time of founding is positively affected by the frequency of interaction (with external agents) of the research groups of origin as well as by their scientific and technological excellence.

The model in Figure 1 illustrates the research hypotheses and, more generally, the remarks that we have made so far.

4. Empirical analysis

4.1. *The sample of companies*

We studied a non-random sample of 40 Italian academic spin-off companies. The selection of companies was not based on particular criteria (e.g. industrial sectors or activity types), but was conducted in a quite unstructured and informal way, asking experienced and eminent academic professors, researchers, scientists and work colleagues to identify spin-off companies of which they are aware. The majority of the companies were founded over the last two years as a result, on the one hand, of increasing institutional inter-

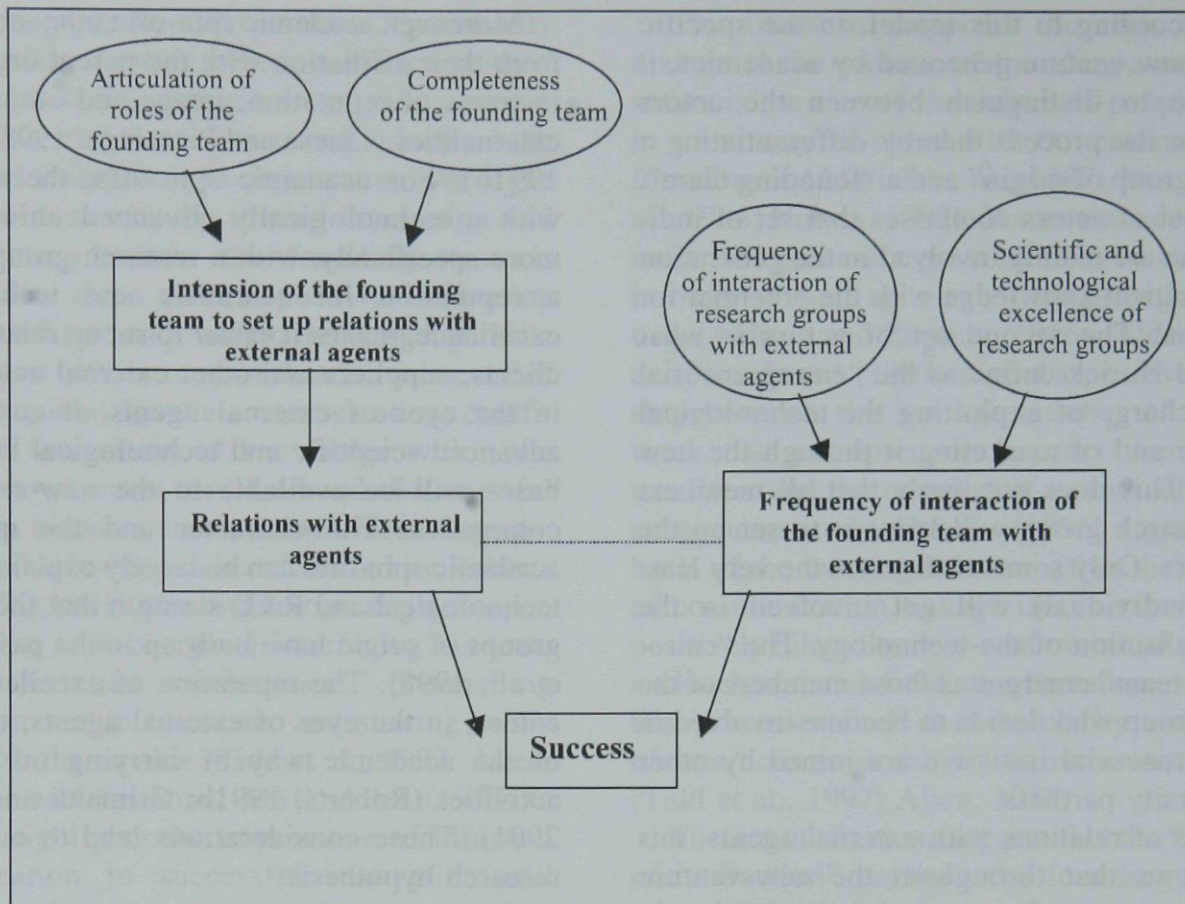


Figure 1. The model.

vention in Italy to support the commercialisation of research results, which has succeeded in prompting academics to exploit research results and, on the other hand, of the difficulties in identifying more aged companies, spontaneously originated, without and before any form of institutional intervention and originally founded as academic spin-offs. The average company size is rather small; we in fact have no significant data on turnover (since some companies have just been founded and most of them were founded in the last two years), but we have been able to infer the companies' small size from the employee numbers, given that 84% of the companies in the sample have no employees at all, and the only people working for them are their owners. The main industries represented are: electronics (30%), mechanics (7%), software (11%) and Internet (18.7%). 23% of companies sell products, 43% sell services and 34% are involved in both products and services. The majority of companies are located in the north of Italy (87%), with few companies in the south (10%) and even fewer in

the centre (3%). This geographic distribution, which reflects the actual population of Italian spin-offs, is due to: (a) the presence of excellent universities in the north part of the country, which have started their support to entrepreneurial initiatives earlier than other Italian universities; (b) greater opportunities (from the industry side) for new start-ups in the north and more industrialised part of the country. Almost one third of companies were spun off from the University of Bologna. Other main "source organisations" include the Polytechnic of Milan and the Polytechnic of Turin, both in the north of the country.

4.2. Methodology

We carried out face-to-face structured interviews with – on average – two academic founders from each spin-off company in the sample. Interviews lasted about 80 minutes on average and in some cases were supplemented by written materials provided by the companies. We used a question-

naire as a grid to interview academic spin-off founders. The questionnaire was developed in two main phases: first we drafted the survey on the basis of the existing literature; then we tested the questionnaire with a few spin-offs, in order to verify the respondents' ability to answer our questions. The final version of the questionnaire comprised four sections: section one aimed to gather basic information about the new ventures; section two aimed to gather information about the research group of origin; section three aimed to gather information about the team of founders; and section four aimed to identify the entrepreneurs' perceptions about some characteristics of their business ideas (data concerning this last section has not been used in this paper). Due to the mainly qualitative nature of the information that we were asking for, we found it necessary to gather data from direct interviews, so as to minimise any kind of misunderstanding and to provide support in giving answers. We first asked entrepreneurs to identify the "network of essential ties" that had contributed to the founding of their new organisation and with which they interacted at the time of founding. Entrepreneurs were also asked about the frequency of interactions with those external agents. We also asked them about the external agents with which their research group of origin interacted and about the frequency of interactions with these agents.

In the questionnaire, we distinguish between technological and scientific excellence, drawing on the common distinction between basic and applied research activities. We made clear to academic entrepreneurs the differences between scientific and technological activities: during the interviews, they displayed no difficulty in answering, and were perfectly able to distinguish between the two variables. Data about the research groups of origin referred to a period of time previous to the spin-offs (three years before).

As for the "degree of role articulation" variable, we referred to Roberts and Fusfeld's (1981) five key roles and asked entrepreneurs to indicate the extent to which their team members fit in those five informal organisational functions. The "degree of completeness" variable has been adopted from Roure and Maidique (1986) and refers to the in-house availability of the competencies needed to run the business. According to

Roure and Maidique (1986), a complete team is to be understood as a group including all the competencies necessary to run the business. These may vary from company to company, on the basis of their specific requirements.

It is important to note that entrepreneurs were asked to recall events that took place during the last year that they spent within their universities of origin. During the interviews, the entrepreneurs felt at ease in answering and in recalling such events. They answered without hesitation, which suggests that their knowledge was complete enough to respond accurately.

The variables that we account for in our empirical analysis refer to characteristics of the research groups of origin and of the founding teams. Characteristics of the research group of origin relate to the three years previous to the spin-off establishment; characteristics of the founding team relate to the time of founding.

Table I provides information about the items that we took into account for multi-item variables. Items were reduced to single variables through Factor Analysis. For the variables "frequency of interaction with external agents" of both the research groups and the founding teams items have been collapsed into a single variable through the arithmetic averaging of answers, since we were interested in the additive effect of the items representing frequencies of interaction with different external agents, rather than in correlations among them.

The "Technological Excellence" (TE) variable relates to the "quality" of applied research activities carried out by the research group at the university of origin. The "Scientific Excellence" (SE) variable relates to the "quality" of scientific research carried out by the research group at the university of origin. The TE and SE variables have been collapsed, through arithmetic averaging, into a single variable (scientific and technological excellence of the research groups), representing the excellence of research groups from both the scientific and technological point of view. Items used to compute the "Frequency of Interaction" variables (FINTFG and FINTRG) represent the intensity of relations respectively of the founding teams and the research groups with different types of external agents. The "Founding Team intention to set up relations with external agents" variable

TABLE I
Multi-items variables used in the study

Variables	Items used to compute variables
Technological Excellence (TE)	(1) Reputation of the research group in relation to the quality of applied research; (2) Number of patents produced by the research group during the last three years; (3) Degree of participation in collaborative applied research projects with international partners; (4) Number of publications of the research group on technology-related themes (applied research); (5) Degree of participation in technologically relevant events (conferences, meetings, workshops).
Scientific Excellence (SE)	(1) Reputation of the research group in relation to the quality of basic research; (2) Degree of participation in collaborative scientific research projects with international partners; (3) Number of publications of the research group on science-related themes (basic research); (4) Degree of participation in scientifically relevant events (conferences, meetings, workshops).
Frequency of interaction of the research group with external agents (FINTRG)	Frequency of interaction with: (1) Firms; (2) Research institutes; (3) Institutions for technological transfer of research results; (4) Public organisations; (5) EU.
Frequency of interaction of the founding teams with external agents (FINTFG)	Frequency of interaction with: (1) Firms; (2) Research institutes; (3) Incubating organisations; (4) Public organisations; (5) EU; (6) Universities of origin.
Founding Teams' intention to set up relations with external agents (EXRL)	Intention to: (1) Collaborate with external agents; (2) Negotiate with external agents; (3) Communicate with external agents; (4) Exchange/transfer knowledge with external agents.

(EXRL) relates to the tendency of the founding team to interact with external agents. The "Degree of Role Articulation" is a single-item variable and relates to the extent to which team founders' roles structure fits the five key informal roles described by Roberts and Fusfeld (the variable being equal to 1 when only one key role was envisaged within the founding team and 5 when the five roles could be identified). The "Degree of completeness" is a single-item variable and relates to the availability in-house of different knowledge bases and competencies needed to run the business.

The majority of variables used in our empirical analysis are composite measurements, combining multiple items; answers for most of the items have been given on a Likert scale (1 = low;

5 = high). Likert scales are widely used – not only in the social sciences – to measure attitudes, opinions, personalities, and descriptions of people's lives, intentions and behaviour (Spector, 1992). We found such scales suitable for measuring characteristics of both the founding team and the research groups of origin.

The existing theoretical and empirical literature on entrepreneurship and new venture creation has provided useful indications on how to transform our theoretical constructs into measurable variables. Previous studies have made extensive usage of self-reported data, relying on respondents' perceptions to describe individuals' characteristics (Watson et al., 1995; Duchesneau and Gartner, 1990; Stuart and Abetti, 1987). Chandler and

Jansen (1992) correlate new-venture success with self-assessed founding team characteristics. Rea (1989) measures on a Likert scale the importance of characteristics of the market, the team, the product and other factors for venture capitalists having to make investment decisions in new ventures. Watson et al. (1995) use a Likert scale to measure the efficacy of interpersonal processes within entrepreneurial teams. Duchesneau and Gartner (1990) use a Likert scale to measure some characteristics of success (relating to aspects of entrepreneurs, processes, strategies) of 26 newly established companies.

The validation of hypotheses has been done through regression analysis. Ordinary Least Squares has been used to estimate the parameters of the equations. Before running regression analyses, we computed the Cronbach alpha for multiple item scale constructions, as a measure of internal consistency of variables (correlation among items). For a statistical testing of our hypothesised factor structure, to verify that items were measuring the same construct, we ran a Confirmatory Factor Analysis.

4.3. Results

Results relating to the reliability analysis (*Cronbach alpha*) proved to be amply acceptable [$\alpha > 0.7$ for all variable groupings, as shown in the table below].² Confirmatory Factor Analysis provided confirmation of all the variable groupings (results in Table II). For the two variables "frequency of interaction with external agents" of both the research groups of origin and the founding teams, we computed variances relating to the arithmetic averages of the items representing frequencies of interaction with different

external agents. These variances proved to be rather low, confirming the existence of similar trends for each company in interacting with different external agents.

We run bivariate correlation analysis to detect the interrelationships among the independent and dependent variables (Table III). Correlation matrix shows that the two dependent variables "Founding teams" intention to set up relations with external agents' and "Frequency of interaction of the founding teams with external agents" are unrelated to one another. It also shows that the independent variables of Hypothesis 1 are not correlated, whereas between the two independent variables of Hypothesis 2 there is a correlation of 0.50. It makes sense to think that the excellence of the research activities carried out by research groups has an impact (or vice versa) on their frequencies of interaction with external agents. Yet, the correlation between these two variables is below the threshold commonly used to detect multicollinearity problems (Berry and Feldman, 1985).

The regression results shown in Table IV are significant. We have good values of adjusted R^2 for both regressions.⁵ Results relating to Hypothesis 1 prove the positive effect of the articulation of roles on the intention to interact with external agents. The degree of completeness of the founding team negatively affects the dependent variable, thus confirming that one of the main drivers behind the intention to set up external linkages is represented by the search for resources not available in-house. As for Hypothesis 2, the positive coefficients of both the independent variables show that the source organisation affects the frequency of interactions with external agents of spin-off companies both through a direct effect (frequency of interaction at the parent organisa-

TABLE II
Characteristics measurements

Variables	Number of items	Reliability (Cronbach α)	Barlett test ¹³	KMO ¹⁴
Scientific excellence	4	0.95	113 ^a	0.84
Technological excellence	5	0.86	109.5 ^a	0.78
Founding teams' intention to set up relations with external agents	4	0.77	74.46 ^a	0.71

^a Significance < 0.001 level.

TABLE III
Correlation matrix for dependent and independent variables

		1	2	3	4	5
Founding teams' intention to set up relations with external agents	1					
Frequency of interaction of the founding teams with external agents	2	0.20				
Degree of completeness	3	-0.38 ^b	-0.27 ^c			
Degree of role articulation	4	0.64 ^a	0.19	-0.24		
Frequency of interaction of the research groups with external agents	5	0.14	0.56 ^a	-0.18	0.22	
Scientific and technological excellence of research groups	6	0.00	0.50 ^a	-0.11	0.13	0.50 ^b

^a $p < 0.01$; ^b $p < 0.05$; ^c $p < 0.10$.

TABLE IV
Regression results

Independent variables	Dependent variables	
	Regression I Founding teams' intention to set up relations with external agents	Regression II Frequency of interaction of the founding teams with external agents
Degree of role articulation	+0.505 ^a	—
Degree of completeness	-0.290 ^b	—
Frequency of interaction of the research groups with external agents	—	+0.316 ^a
Scientific and technological excellence of the research groups	—	+0.164 ^c
β_0	-0.62	+2.44
Adjusted R^2	0.45	0.36
F-test	16.707 ^a	11.325 ^a

^a Significant < 0.01 level; ^b Significant < 0.05 level; ^c Significant at the 0.06 level.

tion) and also through a more indirect effect, mainly related to reputation externalities (scientific and technological excellence).

5. Conclusions

In this concluding section, we comment on the regression results with the support of evidence that emerged during the interviews, and we present some final remarks.

In relation to Hypothesis 1, our results show that the articulation of roles positively affects the intention to set up relations with external agents. What emerges from our interviews is that, though there is no clear "division of labour" among founders, when a certain articulation of roles emerges, there is good communication within the team, and the willingness to share knowledge and experiences is reflected in the group's tendency to interact with external agents as well. Moreover,

in almost all cases involving role articulation, it was possible to identify individuals (generally the most experienced ones) who acted as gatekeepers. Respondents stated that these individuals play a key role in that they are the interface between the team and the outside world and that they channel knowledge, expertise, information from the team to the outside, and vice versa. These points suggest that great attention should be paid to the way that teams are composed and how they are developed in order to enhance the founders' willingness to interact and communicate among themselves and with external agents. Team composition should be considered a criterion that institutional entities should look at, before deciding whether to invest/support a new venture.

Still in relation to Hypothesis 1, the degree of completeness appears to be quite a controversial issue. On the one hand, teams want to have all the resources they need in-house; on the other

emerged during the interviews, and we present some final remarks.

In relation to Hypothesis 1, our results show that the articulation of roles positively affects the

hand, the easy availability of all resources reduces the team's need to look outside and hence to interact with the external environment, which is, incidentally, important for company growth. In this respect, we believe that if, as our findings suggest, a high degree of completeness undermines the intention to set up relations with external agents, complete teams should be aware of the risk they run in the absence of pressure to seek external interactions. This may be dangerous, above all in the start-up phases, since it may: (a) prevent spin-offs from becoming known on the market, and hence from promoting their businesses and attracting new clients; and (b) prevent companies from accessing potential external agents who could provide resources which, while they may not be fundamental in the start-up phase itself or in the short term, may turn out to be important for future growth.

In relation to Hypothesis 2, academic entrepreneurs bring into the new ventures their own "ties" and their interaction modalities with external agents, so that, if they were used to interacting frequently with specific external agents before the spin-off, they are likely to keep interacting with the same frequency (or even more, given the different nature of the new business) with external agents after the establishment of the new company. Our empirical results also show that a reputation effect is operating. What emerged during the interviews was that several companies had benefited from their affiliation to a university, especially in the start-up phase, when they had no previous history and the market had no evidence with which to evaluate them. The fact of being spun off from a credible university (and this explains the emphasis on scientific and technological excellence) represents, in the eyes of external agents, a guarantee for the quality of the knowledge-based companies.

It might be argued that "affiliation" with universities may not always be a good "visiting card" for newly established companies, since affiliation with a university may be associated with a theoretical orientation and hence with a lack of practical experience. Moreover, academics are suspected of lacking managerial skills when it comes to running a business. Yet this problem can be overcome by drawing on the interdisciplinary character of the founding team. The majority of

founding teams in our sample were very mixed in their composition: they include both academics and people from industry, with different background and experiences. The entrepreneurs interviewed feel confident about themselves because of their ability to complement one another and to rely on different skills, knowledge bases and experiences.

More generally, we realised during our field-work that it is extremely difficult for newly established companies to make themselves known on the market and to create their first contacts with clients. In the majority of cases, their first contacts are inherited from their university of origin. This happens mainly for two reasons: (a) because academic entrepreneurs keep on networking with external companies or public institutions that they had met when they were still working at the university; (b) because the universities from which new companies have spun off provide academic entrepreneurs with some work (applied research or development), that they could not take on by themselves, either because they had no time, or because they are concerned that developmental activities might reduce their commitment towards more fundamental types of research.

In situations like this, companies may benefit from the already-existing university network that can be used to create new relations or to enlarge their own network. Respondents state that the set of relations that they inherit from their source organisations represent the initial base of contacts that is then complemented by ties brought in by other non-academic members of the team.

It might be reasonable, at this point, to wonder to what extent universities should get involved in relations with external agents. Here we are providing some evidence of the need for more "outside-oriented" universities, willing to interact with industry, public institutions, research centres, etc. The improvement of linkages between these external agents and universities may create fertile ground for research spin-offs, by generating a network of key relations, from which entrepreneurial initiatives can benefit.

To conclude, we should like to comment on the types of data elaborated and on future research directions. Our data were gathered through face-to-face interviews and, as such, are supposed to be more reliable than data collected by a mailed

questionnaire, since the possibility of misunderstanding the questions is minimized. Yet the study suffers from all the shortcomings of analyses based on self-reported qualitative data. We aim to gather for our sample of companies more objective data, and to improve the qualitative information we possess, perhaps by interviewing all the founders of each company. The collection of further data will make it possible to carry out longitudinal analysis and to account for the real success of companies and hence to overcome the shortcomings entailed in using, as dependent variables, factors "predicting" success.

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Notes

¹ We define academic spin-offs as companies with the following two characteristics: (a) the technological knowledge on which the new venture is based originates within academia; (b) technological knowledge is transferred into the new venture by a university-affiliated person (formal employees, such as professors, researchers or technicians, students, other individuals involved in academic research projects). According to this definition the academic entrepreneur is the founder of the spin-off company (Carayannis et al., 1998; Smilor et al., 1990; Stankiewicz, 1995); though extensive, such a definition disregards situations in which the technology source elects to provide the rights to the technology to an external, independent entrepreneur, who initiates a new company. The distinction between the two modalities of academic spin-offs has been outlined by Radosevich (1995), who distinguishes between the inventor/academic entrepreneur approach and the surrogate entrepreneur approach (Franklin et al., 2001).

² Cronbach alpha was computed only for items that we collapsed into single variables through Factor analysis and that were meant to measure the same theoretical constructs (therefore we expected them to be correlated).

³ The Barlett test of sphericity is used to test the hypothesis that the correlation matrix is an identity matrix. Since one of the goals of the factor analysis is to obtain factors that help explain these correlations, the items must be related to each other for the factor model to be appropriate. The Barlett test index of our multi-item variables confirms the adequacy of the model (the hypothesis that the population correlation matrix is an identity can be rejected).

⁴ The highest value of the Kaiser-Meyer-Olkin index is 1. Small values of KMO indicate that a factor analysis of the items may not be a good idea, since correlations between pairs of items cannot be explained by other items. The KMO values for our composite measures confirm the adequacy of the

groupings

⁵ For typical multivariate models in the social sciences, adjusted R^2 values between 0.35 and 0.50 are considered good values for model fit (Bagozzi, R., 1994).

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