

43rd European Regional Science Association Congress
“Peripheries, Centres, and Spatial Development in the New Europe”
University of Jyväskylä, Finland, August 27th –30th 2003

Business Networks and Performance: A Spatial Approach

by

Efthalia Dimara, Alexandra Goudis, Dimitris Skuras and Kyriaki Tsegenidi

Department of Economics, University of Patras

University Campus – Rio, P.O. BOX 1391

Patras 26500, Greece

Fax: + 30610996161, Email: skuras@econ.upatras.gr

Abstract

Business networks are associated to increased business performance and are regarded as a major factor influencing the development of rural and lagging areas. It is assumed that businesses access many networks in order to pursue their short and long term entrepreneurial objectives. The most important spatial features of this business-network relationship are firstly the spatial coverage of the network and secondly the location of the business in relation to its markets. As concerns the spatial coverage of the networks we distinguish between vertical and horizontal business networks. Vertical networks allow local enterprises to forge alliances with externally located consumers, suppliers, distributors, retailers and institutions, while horizontal networks provide relationships with locally based producers, institutions, and consumers. As concerns the location of the business in relation to its markets we distinguish between firms located in accessible locations and firms located in less accessible and peripheral locations in relation to their output markets.

A survey of 100 businesses in the manufacturing and services sectors in two areas of Greece (one remote and one more accessible) is used to test empirically the effects of the spatial features of the business-network relationship on firm performance. Business performance is approximated through a series of measures capturing conventional firm growth and other less conventional managerial objectives. The analysis demonstrates

that a significantly high proportion of successful businesses located in the remote area simultaneously access vertical and horizontal networks while in the less remote area successful businesses access mainly vertical networks. It is argued that policy initiatives towards the support of business networks as a tool of regional development policies should have a strong territorial and spatial perspective.

1. Introduction

A network is a structure in which a number of nodes are related to each other by specific threads (Håkansson and Ford, 2002). Both threads and nodes are rich in resources, knowledge and understanding as a result of complex interactions, adaptations and investments within and among firms over time. Business networking is also a social structure that exists only so far as the individual understands and uses a network (Johannisson, 1995; Monsted, 1995; Chell and Baines, 1998). Other definitions of business networks and networking tend to focus on the issue of relationships created among businesses. In that sense, business networks are defined as ‘an integrated and co-ordinated set of ongoing economic and non-economic relations embedded within, among and outside business firms’ (Yeung, 1994). Several researchers (Aldrich et al., 1987; 1989; Sanders and Nee, 1996) argue that networks and their surroundings (resources, actions, support) are useful when it comes to starting new firms, and thus, social networks motivate entrepreneurship.

It is acknowledged that especially for SMEs, which are the dominant form of enterprise in rural lagging and peripheral areas, firms can overcome some of the assumed disadvantages of limited size through accessing and utilizing external resources in the network (Havnes and Senneseth, 2001). A number of studies indicate that highly networked small businesses outperform other small businesses (Ostgaard and Birley, 1996; Barkham et al., 1996), and facilitate foreign market development (Johnsen and Johnsen, 1999) and innovation (Dickson and Hadjimanolis, 1998; Freel, 2000). Littunen (2000) found that networks internal to a firm create competitive advantages, innovation and efficiency, and networking contributes to the firm’s survival. Thus, networking serves or sustains long-term business objectives. Contrary to this position, other studies have failed to reveal any relationship between networking characteristics and business performance (Johannisson, 1995). Havnes and Senneseth (2001) suggest that

networking is not associated to high growth in employment or total sales but there is evidence implying that networking affects the rate at which the geographic extension of the firm's markets occurs.

Section 2 provides a review of the business networking literature. An attempt is made to provide a typology of business networks based on all different classifications of business networks found in the international literature. Furthermore, the possible effects of business networking on business performance are reviewed. Section 3 attempts to provide a theoretical framework for researching the effect of business networks on business performance and, as a result, on regional development. The terminal question and hypothesis that will be indirectly researched concerns with the role of business networks as an important 'aspatial' factor of regional development. The following section 4 presents the results of a survey of 100 businesses in the manufacturing and services sectors in two areas of Greece (one remote and one more accessible). It is used to test empirically the effects of the spatial features of the business-network relationship on firm performance.

2. A typology of Business Networks

Business networks can be classified into several types each containing certain categories according and resulting from the point of view networks are researched and seen. Various types of networks arise when researchers study the nature of flows, the network's strength (centrality), its spatial and distant coverage (reachability/length of network) and the type of relationships on which the network is based.

2.1 Network Nature

This is actually a classification of the kind and nature of what it flows through the network and the scope of maintaining or accessing a network. Recently, research effort has been directed in the study of information flow and knowledge transfer through networks and the operation of the network as a resource for the promotion of innovation (Grabher, cited in Murdoch 2000, p.414). A very rough classification of what it flows through the network may be the following:

➤ Products or services. The scope is trade: Upstream (inputs) or downstream (output) exchange of products-services

- Capital. The scope is finance: Upstream (from suppliers) or downstream (from customers)
- Information and Knowledge. The scope is capacity building: Upstream(from suppliers) or downstream (from customers)
- Employment. The scope is productivity and capacity building: According to sources of employment and the qualitative characteristics of employment.

2.2 Spatial Characterization/ Location

Another important feature of peripheral and rural business networks concerns with their spatial expansion. The terminology of vertical and horizontal networks is used in business economics to indicate networks linking businesses at different stages of the production chain (vertical linkages) and at the same stage of production (horizontal linkages). The first attempt to define the same terms under a spatial perspective first appears in Murdoch (2000) with the term ‘vertical networks’ referring to those networks linking rural spaces into the agro-food sector and the term ‘horizontal networks’ referring to those networks that link rural spaces into more general and non-agricultural processes of economic change. This is a clear spatial-sectoral view of network operation with an obvious focus on the agro-food sector. Building on Murdoch’s (2000) suggestion that the concept of network can provide a new paradigm of rural development, Kneafsey et al (2001), have, in a sense, redefined the concept provided by Murdoch and adapted it to a culture economy framework giving it a more spatial focus. The specific hypothesis will be to test whether businesses having strong access to vertical and horizontal networks are performing better and thus combat peripherality. We should also attempt to disentangle the major flows and external to the business factors influencing formation and access to networks. In the framework of our empirical work to come in this project many other hypothesis concerning the relation between business performance and the operation of business networks will be formulated and tested.

A classification according to the spatial location of the involved parties (nodes) may be characterized as having:

- Vertical networks : The thread is with businesses (business) outside the location where the business under consideration is established. Kneafsey et al. (2001), argue that strong vertical networks allow local enterprises to be characterized by external market

outlets, relationships with external buyers, processors, institutions, etc. and are fundamental to the long term success of a marginal (peripheral) region.

On the other hand, horizontal networks provide relationships with locally based producers, institutions, and consumers.

➤ Horizontal: The thread (contact) is with businesses (business) in the same location as the business under consideration. Kneafsey et al (2001) argue that strong horizontal networks may be characterized by local market outlets, trust-based relationships between local producers, consumers and institutions, knowledge flows and use of place-based promotional schemes.

➤ Mixed or Commodity networks: The threads include both of the previous types, i.e., horizontal and vertical.

According to O'Neil and Whatmore(2000), commodity networks are a special variant of networks putting the focus on webs of interdependence that exist among different actors in the rural economy. Commodity networks integrate vertical and horizontal dimensions of commodity movement overcoming problems associated with supply chains and circuits (Whatmore &Thorne,1997, Murdoch,2000) and therefore can be seen as a fusion of ideas from commodity chains and geographies of consumption (Hughes,2000, Stathopoulou, Psaltopoulos, Skuras 2002).

2.3 Type of Contact/ Intensity – (How are relations maintained?)

This is the main focus of network study within the discipline of industrial economics.

There are two main sources of information gathering:

➤ Formal contacts

➤ Informal contacts (friends, family, personal relationships e.t.c.)

Formal networks ('organizational network perspective') are composed of business entrepreneurs, banks, accountants, creditors, legal representatives and trade associations (Littunen, 2000a). Business interaction based on previous agreement or contracts (written or verbal) with another business (businesses) which, originally, when the contact started, were not either friends or family members (Jenssen, Koeing,2002). A network consisting of formal relationships gives the mental and social support that is necessary to promote entrepreneurial action (Johannisson,1988; Jenssen and Koeing, 2002) A network consisting of formal networks will usually be conformed and information usually flow through informal networks.

Informal Networks ('personal network perspective') They are comprised of business interactions based on trust, friendship or family relations and focus on entrepreneurship as embedded in a social context, channelled and facilitated or constrained and inhibited by people's positions in social networks (Aldrich and Zimmer, 1986). Individual contacts of the entrepreneur explain the entrepreneur's behavior in improving his/hers business skills. They shape an autonomous field of information, which adds to the entrepreneur's training, and work experience. Personal networks are considered as central canals for accessing information. Information that is often useful, exclusive and valuable as they might come from distant and different parts of the social system (Granovetter, 1974,1985).

What is more, both customers and supplier can get involved in the social networks. Friends and acquaintances, 'used' as customers, can spread information on the firm via their own networks and thus help to the success and growth of the enterprise. As a final point, there is a possibility that network contacts expand the financial basis of a firm. In particular informal credits obtained from family or friends are helpful in the starting stage of the enterprise. The family network is a special social network type that is of great importance for the periphery. It admits employees recruited from the family and gives emotional support (Bruderl & Preisendorfer, 1998). In addition, when family is employed, the entrepreneur doesn't have to make a big effort to control workers. Finally, emotional support given by the spouse could be very supportive to maintain emotional strength (Jenssen, Koeing,2002). Moreover, although several researchers stress that informal (weak ties) networks are important for receiving the necessary information, many have also pointed to the significance of other network features for access to resources other than information (Dubini&Aldrich, 1991; Johannisson, 1988). Entrepreneurs have been found to use the help available within their local networks during the period prior to start up and approach formal sources when the elements of the firm are set (Birley,1985).

2.4 Other Network Characteristics (Network Length and Strength)

The strength of network use may determine the business's performance. A wide range of studies, that are reviewed below, argue that there are certain effects from the strong or weak use of networks by businesses. At this point we should avoid, yet another,

confusion in the business networks terminology as certain literature (Aldrich&Zimmer,1986, Granovetter,1974, Jenssen &Koeing,2002) uses the term weak and strong ties to describe informal networks in which there are relationships based on trust. Usually, trust is involved in strong relationships such as ties with family, friends and relatives (Chell and Baines,2000).

The Length of a network measures the scope of the network by counting how many intermediaries are contacted to indirectly link the entrepreneur to someone else. (Aldrich&Zimmer,1986, Amit,Gloster,Muller,1993). Short: One or two contacts before the product is sold to the consumer (and not to the final customer). Long: More than two contacts before the product is sold to the consumer (and not to the final customer).

➤ Strong: A significant and vital part of the business's exchange (in trade, capital, information) is carried out through the contact. People expecting to deal with each other frequently, over an extended period, develop trust predictability and voice rather than exit.

➤ Weak: A not very important part of the business's exchange (in trade, capital, information) is carried out through the contact. Strong ties can, however, offset risks including untrustworthy partners or employees and limit the circulation of information, leading to the reproduction and distribution of the same information while reducing their internal capacities to innovate and develop competitive advantage. Weak ties or even more distant ties in the socio-economic hierarchy may be of short duration and frequency but they enable the individual to access networks with new information, advice, assistance or other resources.

3. Business Economic Activity and Local Development

3.1 A Simple Multiplier Framework

In the framework of a simple regional multiplier model, the operation of a new enterprise creates additional regional income due to its regional exporting activity (ΔX_r), which may be considered as the first round of impacts. In a second round, the additional expenditures of the firm in the local economy will create $\Delta X_r(c_F - m_F)(1 - t_F)$ where c_F is the firm's marginal propensity to 'consume' i.e., to use inputs, m_F is the firm's marginal propensity to 'consume' imported inputs and t_F is the firm's tax rate. This

second round of input to the local economy triggers the regional multiplier assumed to be:

$$k_r = \frac{1}{1 - [(c - m) + (i - g)](1 - t)} \quad (1)$$

where c is the marginal propensity to consume, m is the marginal propensity to consume imported products, i is the marginal propensity to invest in the local economy, g is the marginal propensity of reducing government spending as local income increases and t is the tax rate. Taking into account the multiplier in equation (1) and the third and subsequent rounds of impacts of a new enterprise, the impacts of all aforementioned rounds on regional income will be:

$$\Delta Y_r = \Delta X_r + \frac{\Delta X_r (c_F - m_F)(1 - t_F)}{1 - [(c - m) + (i + g)](1 - t)} \quad (2)$$

An examination of equation (2) shows the numerical importance of ΔX_r , i.e., the additional regional income due to the firm's exporting activities and of $c_F - m_F$, i.e., the firm's marginal propensity to consume locally produced products.

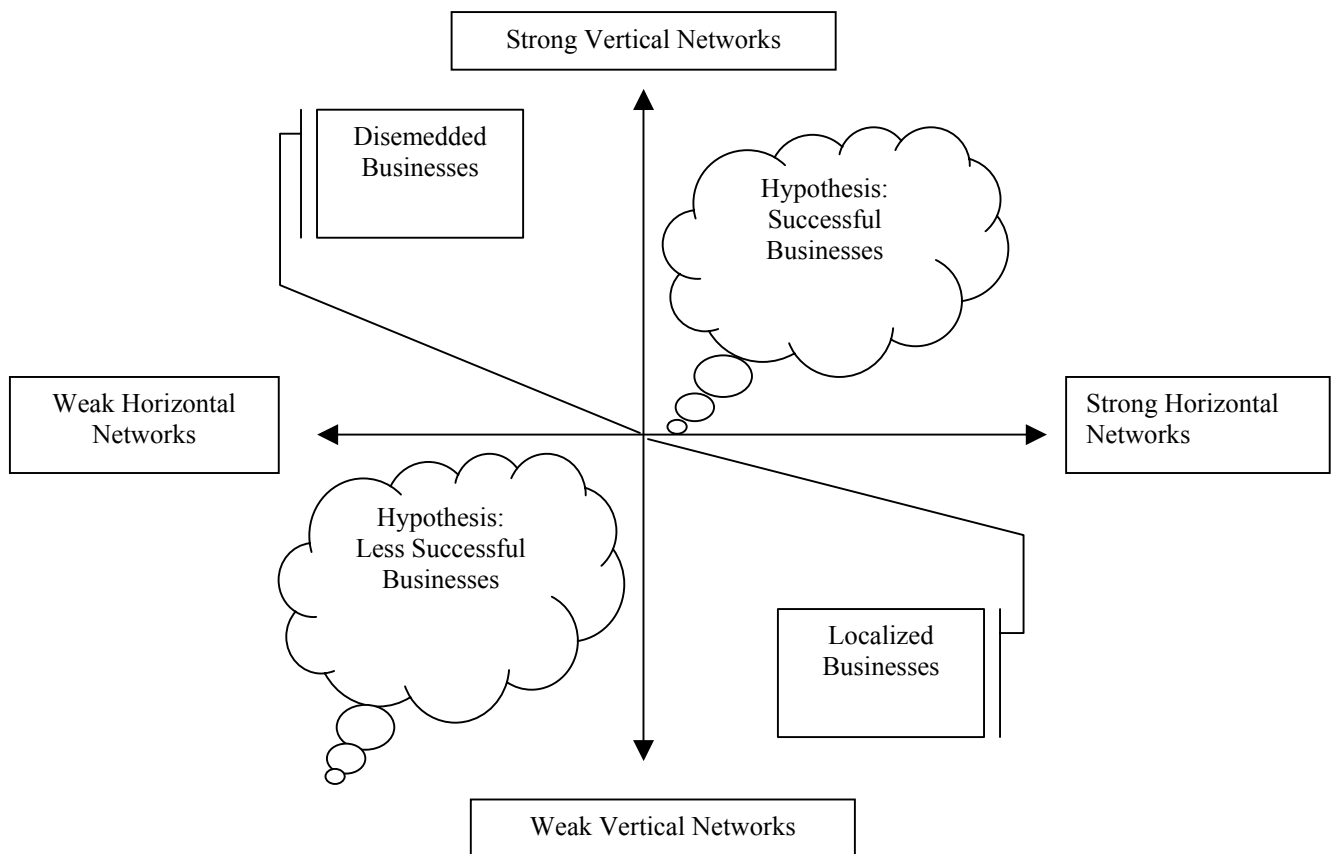
We may assume that firms accessing various types of networks as these were defined above may show higher levels of exports and/or higher levels of a marginal propensity to use locally produced inputs. Firms accessing vertical (in spatial terms) networks of customers may show higher levels of exports or indeed export a higher percentage of its production. On the other hand, firms accessing horizontal (in spatial terms) networks of suppliers may show a higher propensity to use locally produced inputs. Horizontal networks of suppliers may provide an advantage to their members in terms either of a steady flow of inputs and/or of lower and pre-determined prices. Furthermore, the type of network agreements (formal vs informal) and other types of networks such as financial networks may also play an important role in facilitating or inhibiting increased regional exports and increased use of locally produced materials.

Figure 1 presents the graphical representation of this hypothesis by adapting a previously formulated hypothesis of Kneafsey et al (2001). In this hypothesis we assume the operation of two spatial types of networks in the economy and society of the case study regions:

- Vertical networks linking the case study area with the region, the nation and the EU
- Horizontal networks linking businesses in the case study region

We also assume the existence of an intensity (some kind of scale) linking businesses in a network from strong to weak links. We expect vertical networks to be more formal while horizontal networks to be more informal (partnerships or occasional synergistic approaches to economic and social issues).

Figure 1. The Operation of Vertical and Horizontal Networks
(adapted by Kneafsey et al., 2001)



3.2 Business Performance

The definition of successful business performance is a controversial issue in business economics, largely due to the multidimensional meanings and goals that have been assigned to entrepreneurship. Research on performance measurement generates from organization theory and strategic management. Murphy's et al. (1996) work has provided the most complete account of the changing meaning and measurement of

performance in entrepreneurship research up to the mid 90's. Financial performance is at the core of the organizational effectiveness domain (Chakravarthy, 1986) while operational performance measures concepts such as product quality and market share and defines a broader conceptualization of organizational performance by focusing on factors that ultimately lead to financial performance (Hofer, 1987; Kaplan, 1983).

Measuring performance in SMEs in lagging and peripheral regions presents some very acute difficulties in practical terms. Basic performance may be measured by physical quantities (employment, quantities of inputs or outputs, etc.) or by basic financial measures of performance (e.g. Returns on Assets), profitability (e.g. profit margins, etc.), growth (of sales, assets, etc.) or of leverage (liquidity measures etc.). Data may be derived either from published data that are drawn from a firm's book values or directly from questionnaires conducted with businesses. Both sources involve serious concerns about data validity, referring either to the firm's disclosure policy or to intentionally misleading answers in questionnaires. Another problem related to data derived from book values is that only data related to the firms' financial performance may be derived while all other dimensions of performance such as strategic and/or organizational may not be approximated. Especially when SMEs are considered, financial performance data are not easily derived from book values because most firms are not legally obliged to publish book value data or make them available to interested parties. It is not thus surprising why in most studies examining dimensions of performance of SMEs in rural and peripheral areas data are derived from questionnaires.

4. Case Study, Data and Methods

4.1 Case Study Areas

The area of Kalavryta is a mountainous region in the prefecture of Achaia, just one and a half hours driving from Athens. Kalavryta is assumed to be a peripheral area but situated relatively closer to major markets than other disadvantaged areas of the country. The economic activity in this study area is based on the operation of a ski resort that is the second largest of the country and religious and cultural tourism. Alongside tourism, certain food processing businesses produce local quality food, with feta cheese being the most famous product of the region. On the other hand, the prefecture of Evrytania, the second study area of the project is located in Central Greece

about 4 hours driving from Athens and Thessaloniki. Evrytania is by far less accessible than Kalavryta and day trips to the area from major urban centers are not possible. The economic activity in Evrytania is more diversified than the one in Kalavryta and, despite the existence of a ski resort, tourism is mostly scattered over a large number of villages (more than 80) and a large number of activities and is not dominated by skiing as is the case in Kalavryta. Thus, the economic base of the area is more diversified and the development of tourism is softer. In Evrytania, manufacturing industry is mostly concentrated on food processing activities and more specifically meat processing, while remoteness has developed a sustainable trade sector (wholesale and retail) and many support services.

In both areas there is a degree of economic growth, which, if measured in terms of per capita income is higher in Evrytania, despite remoteness. Other indicators of economic development are also showing that Evrytania achieves a more sustainable growth due to the diversification of economic activities and the participation of a large part of the population in the development process while in Kalavryta, growth is concentrated in the town of the area and around the ski resort and benefits a limited number of the population.

4.2 Data

It was decided (due to cost limitations) to sample 50 businesses from each of the two case study areas. A two-stage, (quota, then representative stratified) sampling procedure has been devised. The total of 50 businesses is first divided into two sub-samples (25 each), to be drawn from the manufacturing and service sectors (as defined by the NACE Divisions). Each sub-sample, is to be proportionately stratified so that it is representative of the distribution of micro, small, medium and large firms in the two case study area. An exhaustive list of enterprises in the two case study areas was drawn up and, due to the fairly limited number of businesses in the manufacturing sector, all businesses in manufacturing were included in the sample. After conducting a pilot survey, certain minor adjustments were made to the questionnaire, and personal interviews conducted by trained personnel started in the second half of April 2002 and ended in mid August of the same year. The survey yielded 100 fully completed and usable questionnaires. These enterprises dealt with food processing operations (olive oil refineries, cheese making, etc.), other manufacturing activities, wholesale and retail,

transportation, rural tourism activities, mostly room-letting, combined or not with restaurants and/or other services, such as financial services or tourism and property agents.

The questionnaire recorded in detail each firm's networking and innovative activities and attempted to capture several dimensions of business performance. More specifically we tried to capture the level of the firm's material input produced (not traded) by local firms and the level of the firm's output directed to customers outside the region or to trading companies that export it outside the region, in terms of percentages of total inputs or total outputs. Thus we avoided to record actual numbers (quantities or values) of inputs or outputs in order to get more accurate responses away from intentionally misleading figures. Moreover, we attempted to examine whether each firm was a part of suppliers or customers network or exercised spot trade for inputs and outputs. We considered that a firm is part of a network of businesses if the firm carries out transactions (for inputs or outputs) that are long established and repeated with a predetermined frequency, and exercises spot trade if its business partners change over time and its business relationships are spurious. These networks may be horizontal in spatial terms, if most of the businesses involved in the network are local or vertical if most of the businesses involved in the network are located outside the area. Thus, we could characterize a business as belonging to a horizontal or vertical, suppliers or customers network or as exercising spot trade. All variants of business network were in operation in the two case study areas as we actually met businesses belonging to a horizontal or vertical suppliers network and exercising spot trade for customers or vice versa or belonging to a horizontal network for suppliers and a vertical for customers or vice versa. Furthermore, we asked whether firms were trading with the same sources for finance, advice and consultancy services. For finance there was a considerable variation among firms attending repeatedly the same sources and firms spotting the best chances each time. For advisory and consultancy services there was not any great variability as most firms seek local consultants, especially accountants and have with them established relationships. Finally we recorded, for all firms irrespective of whether they are part of a network or not, whether business agreements are formal, i.e., governed by written legal documents and/or contracts and are subject of legal dispute, or are informal, i.e., are based on trust and on verbal agreements.

In this work we assume that the firm's marginal propensity to use locally produced products ($c_F - m_F$ in equation 2 above) may be proxied by the percentage of material inputs used by the firm and produced by local firms. Furthermore, we use the percentage of exported product as a proxy of the firm's exporting activity. Of course, this percentage does not render a direct approximation of ΔX_r in equation 2 above but is an indication of the firm's impact to the local economy that is attributed to its exporting activity. As concerns performance we tried to avoid questions related to financial measures and attempted to examine whether certain indicators of performance had improved over the last five years or not. In that sense we recorded for each firm whether employment, total sales, profit margins and investments had evolved favourably for the firm or not. Our intention was to increase the validity of the responses on the expense of more information that could, however, be wrong or misleading. Again, we assume that responses to these questions may be used as proxies to the firm's conventional performance (employment, profit margins, investment) or even to reveal growth trends and strategy (total sales). Furthermore we assume that the firm's performance may be proxied by a series of dummy variables revealing whether certain dimensions of performance have shown a positive or no-change (more infrequently a negative change), in the past five years. Again we assume that either the firm's percentage of product that is exported or the firm's percentage of material inputs produced by local firms may determine a firm's performance. Table 1 shows definitions and descriptive statistics of all dependent and independent variables collected through the questionnaires.

4.3 Econometric Methods

We assume that the percentage of material inputs used by a firm and produced by local firms (PMIR) is affected by the firm's relation to suppliers networks and the type of these networks as well as a range of other factors that reveal the firm's size, sector of economic activity, location in a remote or a more accessible area, etc. In the same way we assume that the percentage of a firm's product that is exported outside the area (PSE) is affected by the firm's relation to customers networks and a range of enterprise and entrepreneurial characteristics. In other words we assume that the percentage of material inputs used by a firm and produced locally (PMIR) or the percentage of

exported product (PSE) are functions of some observable characteristics of the firm and of the entrepreneur as:

$$y_i = f(\mathbf{x}_i) \quad (3)$$

Both these percentages are bounded from below by 0 and above by 100. The most appropriate econometric formulation of the relationship in equation (3) is a tobit model as:

$$y_i = \begin{cases} 0 & \text{if } 0 \geq \mathbf{x}_i\boldsymbol{\beta} + \varepsilon_i \\ \mathbf{x}_i\boldsymbol{\beta} + \varepsilon_i & \text{if } 0 < \mathbf{x}_i\boldsymbol{\beta} + \varepsilon_i < 1 \\ 100 & \text{if } 1 \leq \mathbf{x}_i\boldsymbol{\beta} + \varepsilon_i \end{cases} \quad (4)$$

where the y_i is either the variable PMIR or the variable PSE in turn, while the vector \mathbf{x}_i includes network characteristics, and enterprise and entrepreneurial characteristics of the firm. The marginal effects of the tobit model presented in equation (4), given censoring from below at 0 and from above by 100 is given by:

$$\frac{\partial E[y_i | \mathbf{x}_i]}{\partial \mathbf{x}_i} = \boldsymbol{\beta} [\Phi(z_{100}) - \Phi(z_0)]$$

$$z_0 = -\mathbf{x}_i\boldsymbol{\beta} / \sigma$$

$$z_{100} = (100 - \mathbf{x}_i\boldsymbol{\beta}) / \sigma \quad (5)$$

where $\Phi(\cdot)$ denotes the cumulative normal distribution function and σ the variance, while $\Phi(z_{100}) - \Phi(z_0)$ represents the probability of observing a noncensored observation.

Furthermore, we assume that the percentage of material inputs used by a firm and produced by local firms affects various dimensions of performance. Due to the dummy nature of the variables showing performance, an appropriate econometric formulation is a logit model as:

$$\text{Prob}(Y = 1, \text{Positive Change of Performance Indicator}) = \frac{e^{\beta' \mathbf{x}_i}}{1 + e^{\beta' \mathbf{x}_i}} = \Lambda(\beta' \mathbf{x}_i) \quad (6)$$

where Y can be in turn the variables indicating performance (PEREMP, PERPM, PERTS, PERINV), \mathbf{x}_i is a vector of factors influencing performance and including, among others, the percentage of material inputs produced by local firms or the percentage of exported product, β is a vector of parameters to be estimated by the model and $\Lambda(\cdot)$ indicates the logistic cumulative distribution function. The log-likelihood function for the logit model in equation (6) is estimated as:

$$\ln L = \sum_j \left[Y_j \ln \Lambda(\beta' \mathbf{x}_i) + (1 - Y_j) \ln(1 - \Lambda(\beta' \mathbf{x}_i)) \right] \quad (7)$$

By differentiating equation (7), we find the marginal effects at the sample mean of the regressors on the probabilities as (Greene, 1997):

$$\frac{\partial P_{Y=1}}{\partial \mathbf{x}_i} = P_{Y=1} \left[\beta - \sum_{Y=0}^{Y=1} P_Y \beta \right] = \Lambda(\beta' \mathbf{x}_i) - [1 - \Lambda(\beta' \mathbf{x}_i)] \quad (8)$$

A goodness of fit measure based on the likelihood ratio test statistic, usually reported as McFadden's ρ^2 measure (Maddala, 1983), is:

$$\rho^2 = 1 - \frac{\log L_\Omega}{\log L_\omega} \quad (9)$$

where L_Ω is the maximum of the likelihood function when maximised with respect to all parameters and L_ω is the maximum when the likelihood function is maximised with respect to the constant term only, i.e. setting all the β s equal to zero. The marginal effects show how much the probability to report positive change in an indicator of performance, expressed in percentages, will change if the independent (explanatory) variable changes by a marginal amount from its sample mean. The marginal effects for dummy independent variables are estimated as a difference between the variable's two values, i.e. 0 and 1 (Greene, 1997).

Our econometric approach suffers from two major drawbacks. Firstly, we assume that the two tobit models for the percentage of material inputs and for the percentage of exported product (presented in equation 4 above) are independent and thus are not jointly estimated. Despite the fact that there is no economic underlying theory pointing out to the joint estimation of these equations, one could attempt a joint estimation and compare it with the independent estimations. Secondly, we assume that the effects of either the percentage of material inputs or the percentage of exported product are exogenous to the firm's performance indicators. In other words we do not test for possible endogeneity of the tobit estimates in equation 3 to the logit model in equation 6. This would require a rather complicated econometric application which will not add much to our understanding of the real processes at work. Furthermore, in the case where the two tobit models had been jointly estimated there is not a known test for endogeneity of simultaneously estimated tobit models in a logit (or probit) model.

Table 1. Definitions and descriptive statistics of dependent and independent variables.

Variable Name	Definition	Mean (S.D)
<i>Dependent Variables</i>		
PMIR	Percentage of material inputs produced from local firms	47.65 (41.87)
PSE	Percentage of production exported	25.61 (32.03)
PEREMP	Dummy variable, 0= Firm reports negative or no change in employment, 1=Firm reports positive change	0.29 (0.45)
PERPM	Dummy variable, 0= Firm reports negative or no change in profit margins, 1=Firm reports positive change	0.52 (0.50)
PERTS	Dummy variable, 0= Firm reports negative or no change in total sales, 1=Firm reports positive change	0.53 (0.50)
PERINV	Dummy variable, 0= Firm reports negative or no change in investments, 1=Firm reports positive change	0.36 (0.48)
<i>Independent Variables</i>		
NETINPUT	Dummy variable, 1=Firm accesses horizontal networks for inputs, 0=Firm does not have access to horizontal networks, i.e, it accesses vertical networks or exercises spot trade for inputs	0.43 (0.50)
NETSALES	Dummy variable, 1= Firm does not have access to vertical networks for output, i.e, it accesses horizontal networks or exercises spot trade for output, 0=Firm accesses vertical networks for output,	0.59 (0.49)
NETFINAN	Dummy variable, 1=Firm accesses horizontal networks for finance, 0=Firm accesses vertical networks or exercises spot agreements for finance	0.49 (0.51)

... table 1 continued on next page

... table 1 continued

CONTINF	Dummy variable, 1=Major value of transactions done informally, 0=Major value of transactions done formally	0.88 (0.33)
REGION	Dummy variable, 1= Firm is located in Kalavryta (less remote), 0=Firm is located in Evrytania (remote)	0.50 (0.50)
SECTOR	Dummy Variable, 1=Firm is active in the trade sector, 0=Firm is active in manufacturing or tourism (export base)	0.44 (0.50)
LABSIZE	The firm's size in Annual Full-Time Equivalent (AFEs)	2.55 (3.27)
FIRMAGE	Firm's age in years	12.13 (11.52)

5. Results

Table 2 shows the coefficients of estimating the tobit models for PMIR and PSE. It is important to note that the two variables indicating networking activities for suppliers and customers are highly significant. It is also evident that networking for finance does not affect the firm's use of locally produced material and/or its exporting activities. Furthermore, the type of formal or informal agreements again does not have an impact on the firm's use of locally produced inputs and of its exporting activity. Surprisingly enough the sector of economic activity does not exert a statistically significant impact. Comparing the means of PMIR and PSE for the two values of the sectoral dummy variable (SECTOR) does not reveal statistically significant differences in either the mean (a non-parametric Mann-Whitney test) or the median (a non-parametric Kruskal-Wallis test). Furthermore, the location of the business in the remote or the less remote area is not statistically significant. Finally, the size of the business again is not statistically significant. Other variables concerning entrepreneurial and enterprise characteristics were also entered in the tobit model but did not significantly improve the fit of the models.

Table 3 shows the estimated marginal effects of the independent variables on the PMIR and PSE. Between two firms with all their characteristics equal at sample's means, the

firm that accesses a horizontal network for inputs has 50.69% more use of locally produced inputs from a firm that accesses either vertical networks or exercises spot trade for inputs. Between two firms with all their characteristics equal at sample's means, the firm that accesses vertical networks for customers has 44.44% more exported output from a firm that accesses either horizontal networks or exercises spot trade for customers. Table 4 shows the estimated coefficients and asymptotic t-values for the four logit models of business performance. The percentage of material input from local firms exerts a statistically significant and positive effect on employment change and a statistically significant but negative effect on investment change. The percentage of exported product affects significantly and negatively the performance in terms of profit margins. The location of the firm affects all dimensions of performance with firms located in Evrytania having higher probabilities of performing better than firms located in Kalavryta. Firms in the manufacturing and tourism sector are less probable to have increased total sales while firms in the trade sector are less probable to have increased investments. Table 5 shows the marginal effects of independent variables on the probability of having a positive change in each one of the four dimensions of performance.

Table 2. Coefficient estimates of tobit models for PMIR and PSE.

Independent Variables	PMIR		PSE	
	Coefficient	t-value	Coefficient	t-value
Constant	46.73	2.74**	75.69	2.85**
NETINPUT	51.37	4.92**	----	----
NETSALES	----	----	-90.69	-2.93**
NETFINAN	-9.81	-1.20	-2.84	-0.25
CONTINF	8.75	0.73	9.33	0.62
REGION	5.00	0.58	-16.99	-1.33
SECTOR	-14.29	-1.50	-10.00	-0.77
LABSIZE	-0.89	-0.68	1.02	0.305
σ	20.13	3.45	27.59	4.38**
Log-L	-178.87		-239.25	

Note: Two asterisks indicate significance at the 5%.

Table 3. Marginal effects of independent variables on PMIR and PSE.

Independent Variables	PMIR		PSE	
	Marginal effect	t-value	Marginal effect	t-value
NETINPUT	50.69	5.14**	---	---
NETSALES	---	---	-44.44	-4.39**
NETFINAN	-9.68	-1.21	-1.40	-0.25
CONTINF	8.63	0.73	4.57	0.61
REGION	4.93	0.59	-8.33	-1.34
SECTOR	-14.10	-1.51	-4.90	-0.77

Note: Two asterisks indicate significance at the 5%.

A one percent increase in the use of locally produced inputs increases the probability that the firm experienced increased employment by 1% and decreases the probability that the firm experienced increased investments by 2%. Similarly, a one percent increase in exported product, decreases the probability that the firm experienced increased sales and/or increase in profit margins by 1%.

Table 4. Coefficient estimates of the logit models for PEREMP, PERTS, PERPM and PERINV

Independent Variables	PEREMP	PERTS	PERPM	PEINV
Constant	-2.25 (-3.06)**	0.55 (0.99)	0.66 (1.18)	3.69 (3.23)**
PMIR	0.01 (1.65)*	---	---	-0.02 (-2.19)**
PSE	---	-0.01 (-1.10)	-0.02 (-1.64)*	---
REGION	-1.46 (-2.58)**	-1.95 (-4.08)**	-1.55 (-3.46)**	-3.69 (-4.79)**

... table 4 continued on next page

... table 4 continued

SECTOR	0.46 (0.81)	0.78 (1.69)*	0.22 (0.46)	-2.53 (-2.97)**
LABSIZE	0.30 (1.99)**	0.11 (0.98)	0.17 (1.31)	-0.17 (-1.67)*
FIRMAGE	0.04 (1.85)*	0.02 (0.79)	0.01 (0.25)	0.01 (0.08)
$\log L_{\Omega}$	-50.22	-56.64	-60.02	-36.39
$\log L_{\omega}$	-58.97	-68.37	-68.49	-64.89
$-2[\log L_{\omega} - \log L_{\Omega}]$	17.48**	23.48**	16.94**	57.00**
McFadden's ρ^2	0.15	0.17	0.13	0.44
% correct predictions	77.77	71.71	67.67	82.82

Note: Two and one asterisks indicate significance at the 5% and 10% respectively.

Table 5. Marginal effects of the logit models for PEREMP, PERTS, PERPM, PERINV

Independent Variables	PEREMP	PERTS	PERPM	PEINV
PMIR	0.01 (1.65)*	---	---	-0.01 (-2.21)**
PSE	---	-0.01 (-1.10)	-0.01 (-1.68)*	---
REGION	-0.28 (-2.74)**	-0.45 (-4.76)**	-0.37 (-3.81)**	-0.61 (-6.94)**
SECTOR	0.09 (0.80)	0.19 (1.65)*	0.05 (0.46)	-0.41 (-3.32)
LABSIZE	0.06 (1.85)*	0.03 (0.98)	0.04 (1.32)	-0.03 (-1.63)*
FIRMAGE	0.01 (1.87)*	0.01 (0.79)	0.01 (0.25)	0.00 (0.08)

Note: Two and one asterisks indicate significance at the 5% and 10% respectively.

6. Conclusions

This paper aims to contribute to the effect of business networks on business performance and, as a result, on regional development. We recorded in detail each firm's networking and innovative activities and attempted to capture several dimensions of business performance. More specific, the level of material inputs produced locally and the firms production exported (to customers or trading companies) was captured in terms of total inputs and total outputs. We avoided to record actual numbers (quantities or values) of inputs or outputs in order to get more accurate responses away from intentionally misleading figures. Furthermore, it is examined whether each firm was a part of suppliers or customers network or exercised spot trade for inputs and outputs, whether they were trading with the same sources for finance, advice and consultancy services and if their business agreements are formal or informal.

After using a simple Keynesian regional multiplier model (input-output), our conclusions are that, surprisingly enough the sector of economic activity does not exert a statistically significant impact. Furthermore, the type of formal or informal agreement doesn't yield any important results. And financial and consultancy networking again doesn't have any impact on the firms' use of locally produced inputs and of its exporting activity. However, the location of the firm affects all dimensions of performance with firms located in Evrytania having higher probabilities of performing better than firms located in Kalavryta.

We have evidence that businesses accessing a horizontal network (for inputs) has more use of locally produced inputs from businesses that access either vertical networks or exercises spot trade (for inputs). Moreover, businesses that access vertical networks for customers have more exported output from businesses accessing either horizontal networks or exercise spot trade for customers. Last but not least, capital is maintained in the area, increasing regional growth.

Acknowledgment

This publication arises out of 'Aspatial Peripherality, Innovation, and the Rural Economy', EU Fifth Programme, (AsPIRE – QLK-2000-00783) coordinated by Dr. Andrew Copus of the Scottish Agricultural College, Aberdeen, (Scotland) and in

participation with TEAGASG (Ireland), the National University of Ireland in Galway (Ireland), the Institute of Spatial Planning, University of Dortmund (Germany), Spiekermann and Wegener, Urban and Regional Research (Germany), the Department of Geography of the University of Valencia (Spain), the Seinajoki Institute for Rural Research and Training of the University of Helsinki (Finland) and the Department of Economics of the University of Patras (Greece).

References

Aldrich, H. and Zimmer, C. (1986), 'Entrepreneurship through social networks', in Sexton, D.L. and Smilor, R.W (Eds), *The Art and Science of Entrepreneurship*, Ballinger, Cambridge, MA.

Aldrich, H. E., Rosen, B. and Woodward, W. (1987), 'The impact of social networks on business foundings and profit: a longitudinal study', in Churchill, N., Hornaday, J., Krasner, O. and Vesper, K. (Eds), *Frontiers of Entrepreneurship Research*, Babson College, Wellesley, MA. Pp. 154-168.

Aldrich, H. E., Reese, P. R. and Dubini, P. (1989), 'Women on the verge of a breakthrough? Networking among entrepreneurs in the United States and Italy', *Entrepreneurship and Regional Development*, Vol. 1, 339-356.

Amit R., Glosten L., Muller E. (1993), Challenges to the theory development in Entrepreneurship Research, *Journal of Management Studies*, vol.30(5).

Barkham, R., Gudgin, G., Hart, M. and Havney, E. (1996) *The Determinants of Small Firm Growth: An Inter-regional Study in the U.K., 1986-90*, Jessic Kingsley, London.

Birley S. (1985), the Role of Networks in the entrepreneurial process, *Journal of Business Venturing*, vol.1(1), pp.107-117

Brüderl, J. and Preisendörfer, P. (1998), 'Network support and the success of newly founded businesses', *Small Business Economics*, Vol. 10, pp. 213-225.

Chakravarthy, B. S. (1986) "Measuring strategic performance", *Strategic Management Journal*, Vol 7, pp. 437-458.

Chell E., Baines S. (2000), Networking, Entrepreneurship and Microbusiness Behaviour, *Entrepreneurship and Regional Development*, vol.12, pp.195-215

Dickson, K.E. and Hadjimanolis, A. (1998), 'Innovation and networking amongst small manufacturing firms in Cyprus', *International Journal of Entrepreneurial Behaviour and Research*, Vol. 4 No. 1, pp. 5-17.

Dubini P., Aldrich H. (1991), Personal and extended Networks are central to the entrepreneurial process, *Journal of Business Venturing*, vol.6, pp.305-313

Freel, M. (2000), 'External linkages and product innovation in small manufacturing firms', *Entrepreneurship and Regional Development*, Vol. 12, pp. 245-266.

Granovetter, M.S. (1974), *Getting a Job*. Harvard University Press, Cambridge, MA.

Granovetter, M.S. (1985), 'Economic action and social structure: the problem of embeddedness', *American Journal of Sociology*, Vol. 91, pp. 481-510.

Greene, W. (1997) *Econometric Analysis*, Upper Saddle River, NJ: Prentice-Hall.

Hakansson, H. and Ford, D. (2000), 'How should companies interact in business networks?', *Journal of Business Research*, Vol. 55, pp. 133-139.

Havnes P.A., Senneseth K. (2001), A Panel Study of Firm Growth among SMEs in Networks, *Small Business Economics*, vol.16, pp.293-302

Hoffer, C. W., Sandberg, W. R. (1987) "Improving new venture performance: some guidelines for success", *American Journal of Small Business*, Vol 12, pp. 11-25.

Hughes, D. (2000), 'Retailers, knowledges and changing commodity networks: the case of the cut flower trade"', *Geoforum*, Vol 31, pp. 175-190.

Jenssen J.I., Koeing H.F. (2002), The effect of social networks on resource access and business start-ups, *European Planning Studies*, vol.10(8)

Johannisson, B. (1988), Business Formation-a Network Approach, *Scandinavian Journal of Management*, vol.4 (3-4)

Johannisson, B. (1995), 'Paradigms and entrepreneurial networks – some methodological challenges', *Entrepreneurship and Regional Development*, Vol. 7, pp. 215-231.

Johnsen, R. and Johnsen, T. (1999), 'International market development through networks', *International Journal of Entrepreneurial Behaviour and Research*, Vol. 5 No. 6, pp. 297-312

Kalantaridis, C. (1996), 'Local production networks in the global marketplace', *International Journal of Entrepreneurial Behaviour and Research*, Vol. 2(3), pp. 12-28.

Kaplan, R. S. 1983. "Measuring manufacturing performance: A new challenge for managerial accounting research", *The Accounting Review*, Vol 58, pp. 686-705.

Kneafsey, M., Ilbery B. and Jenkins, T. (2001) 'Exploring the Dimensions of Culture Economies in Rural West Wales', *Sociologia Ruralis*, 41 (3): 298-310.

Littunen H. (2000a), Networks and local Environmental Characteristics in the Survival of New firms, *Small Business Economics*, vol.15, pp.59-71.

Littunen H. (2000b), Entrepreneurship and the characteristics of the entrepreneurial personality, *International Journal of Entrepreneurial Behaviour and Research*, vol.6(6), pp.295-309.

Monsted, M. (1995), 'Processes and structures: reflections on methodology', *Entrepreneurship and Regional Development*, Vol. 7, pp. 193-213.

Murdoch J.(2000), Networks-A new paradigm of Rural Development?, *Journal of Rural Studies*, vol.16, pp.407-419

Murphy G.B., Trailer J.W., Hill R.C. (1996), Measuring Performance in Entrepreneurship Research, *Journal of Business Research*, vol.36, pp.15-23

O'Neill, P. and Whatmore, S. (2000), 'The business of place networks of property, partnership and produce', *Geoforum*, Vol. 31, pp. 121-136

Ostgaard T.A., Birley S. (1996), New Venture Growth and Personal Networks, *Journal of Business Research*, vol.36, pp.37-50

Sanders, J. and Nee, V. (1996), 'Immigrant self-employment: The family as social capital and the value of human capital', *American Sociological Review*, 61, 231-249.

Stathopoulou S., Psaltopoulos D., Skuras D. (2002), Rural Entrepreneurship in Europe : A research Framework and Agenda, Working Paper, Department of Economics, University of Patras, Greece

Yeung, H. W. (1994), Critical reviews of geographical perspectives on business organizations and the organization of production: towards a network approach, *Progress in Human Geography*, Vol. 18 No. 4, pp. 460-490.

Vatne E., Taylor M. (2000), *The Networked Firm in a Global World-Small Firms in New Environments*, Ashgate

Whatmore, S. and Thorne, L. (1997), 'Nourishing networks: alternative geographies of food', in Goodman, D. and Watts, M. (Eds), *Globalising Food: Agrarian Questions and Global Restructuring*, Routledge, London.