

**Title: Academic Entrepreneurship in a Resource Constrained Environment:
Diversification and Synergistic Effects**

Abstract

This paper investigates the nature of academic entrepreneurial engagement in a resource constrained environment. In addition to context-specific contributions, the paper adds originality to the academic entrepreneurship literature by discussing diversification strategies adopted by academic entrepreneurs, and synergies among academic entrepreneurial activities. Mixed methods are used in a sequential manner; 1. Initial context specific data gathering stage 2. On-line survey 3. In-depth face to face interview phase. The survey response rate is 30% (358 academics), and the sample size of in-depth interviews is 78. Findings reveal that resource barriers do not suppress academic engagement in entrepreneurial endeavour. Instead, academics consider being entrepreneurial as a means to be resource-rich. It is also revealed that academics gradually diversify their engagements, and due to limited opportunities, they tend to engage in unrelated diversification. In resource constrained environments unrelated diversification is found to generate more synergistic effects than related diversification. Policy implications and future research avenues are highlighted.

Key words – Academic entrepreneurship; Resource constraints; Developing country; Social network; Diversification; Synergistic effects

1. Introduction

Expectations regarding the contributions of academics to entrepreneurial engagement, besides their primary role of carrying out teaching and research (Laukkanen, 2003), have increased in recent years (Venkataraman et al 1992). At a government policy level, the commercialization of university-generated knowledge is considered to be a way of achieving national competitiveness (McMullan and Vesper 1987; Henderson et al 1998; Mowery et al 2002) and innovation (Lam 2005). This has increased pressure on universities to generate additional economic returns (Storey and Tether 1998; Shane and Stuart 2002) through bridging the gap between industry and universities (Mowery and Shane 2002).

However, most of the research on academic entrepreneurship has been carried out in a developed country context, and it is questionable to what extent the findings of these studies could be generalized to developing countries (Eun et al 2006; Adesola 1991). On the other hand, developing countries are also heterogeneous in nature. For instance, the national innovation systems of low income (developing) countries has been found to face relatively high funding constraints in comparison to high income (developing) countries (Nelson 1992). Since interactions between government, industry, and universities in a national innovation system determine the socio-economic success of a country (Lundvall 1992; Nelson 1993; Balzat and Hanusch 2004), funding constraints could lead to relatively high resource scarcity in the whole system. For example, a lack of funding injected by the governments of low income (developing) countries to the system, could lead to a lack of research capacity and resources in universities (e.g. limited financial resources, and inadequate research equipment and facilities etc), underdeveloped infrastructure and institutional supporting mechanisms, and the limited absorptive capacity of both universities and industry (Eun et al. 2006, Adesola 1991, Bowonder 2001, Monck and Segal 1983; Ynalvez and Shrum 2011). Accordingly, it could be stated that resources that are required for academic entrepreneurs operating in low income countries to capitalise on opportunities are relatively low. Therefore, it could be argued that academic entrepreneurial engagement in relatively resource constrained environments could be different from that in relatively resource-rich environments, and thus, the main objective of this paper is to investigate the nature of academic entrepreneurial engagement in a resource constrained environment.

2. Theory and Hypotheses

In the literature the term academic entrepreneurship has mostly been used in a focused manner to illustrate academic engagements in the formation of spin-off companies (Radosevich 1995, Samson and Gurdon 1993, Daniels and Hofer 1993). However, the term has also been used to represent a much broader spectrum of knowledge-transfer activities (Jones-Evans and Klofsten 2000; D'Este and Perkmann 2011). It seems that different definitions had served the purpose of answering specific research questions, and thus, the selection of a definition has been dependent upon the objectives of research. This is a strategy often adopted and recommended in the entrepreneurship literature (Hebert and Link 1989; Gartner 1990). Since the objective of this research is to investigate the nature of academic entrepreneurial engagement in a context that has received inadequate attention in prior research, it was required to investigate the whole subject of academic entrepreneurship. Hence, it was decided to use the broad view of academic entrepreneurship. Since the broad view hasn't defined the term theoretically (Mars and Rios-Aguilar 2010), in this study, by considering the definitions of entrepreneurship (Shane and Venkataraman 2000), academic entrepreneurship is defined as academics capitalising on perceived opportunities, by matching these with resources, in order to accumulate wealth, which could be monetary and/or social.

Individual academics are considered as the major driving forces of academic entrepreneurship (D'Este and Patel 2007; Ambos et al 2008). Entrepreneurs are shaped by the environmental context in which they operate since it determines the availability of data and exploitable resources (Ucbasaran et al 2000), which influence entrepreneurs' ability to identify and capitalize on opportunities (Scott et al 2000). The total environment of an academic entrepreneur consists of university, which is considered as the internal environment (Eun et al. 2006), and government and industry, which are considered as the major components of the external environment of academics (Etzkowitz and Leydesdorff 2000; Siegel et al 2004).

Based on the Resource Based View of firms, Eun et al (2006) argued that the stronger the universities in terms of resources, the higher the tendency for academics to engage in entrepreneurial endeavour. Similarly, it is stated in the literature that there is a higher propensity for academics to engage in entrepreneurial endeavour when their macro environment is rich in terms of resources (Etzkowitz and Leydesdorff 2000; Siegel et al

2004). These research findings led to believe that resources may be a means to be entrepreneurial in resource-rich environments.

This argument is further supported by studies that had found resource limitations as a barrier for academic entrepreneurial engagement (Monck and Segal 1983; Adesola 1991). It is also stated in the literature that when limited facilities available in universities are used for a number of activities, it could result in resource conflicts, and thus, poor quality performance (Van Dierdonck and Debackere 1988). Therefore, it could be assumed that resource constrained environments inhibit academic entrepreneurship.

However, some studies in the entrepreneurship literature argued that, in extremely unpromising and constrained environments, entrepreneurial skills are very important for spotting opportunities, and matching these with available resources, and thus, more entrepreneurial behaviour is observed in such environments (Kodithuwakku and Rosa 2002). Furthermore, Hart et al (1995) argued that ownership to resources is not mandatory, and entrepreneurs creatively overcome resource barriers. On the other hand, resources being constrained have been identified in the literature as a push factor, which motivates academics to be entrepreneurial in order to overcome resource barriers (Adesola 1991; Gilad and Levine 1986). These findings led to counter argue that, resource constrained environments may not necessarily inhibit academic entrepreneurship, and being entrepreneurial may be a means to be resource-rich in resource constrained environments (as opposed to resources as a means to be entrepreneurial in resource-rich environments). This led to the first hypothesis of this section, which claims:

H 1: Being entrepreneurial is a means to be resource-rich in a resource constrained environment

In order to shed further light on the nature of academic entrepreneurial engagement in a resource constrained environment, it was decided to investigate the entrepreneurial engagement of individual academics in-depth since they are the core of academic entrepreneurship (D'Este and Patel 2007; Ambos et al 2008). It has been found in the literature that, entrepreneurs operating in resource constrained environments try to capitalise on every minute opportunities, which result in them engaging in multiple income generation activities (Kodithuwakku and Rosa 2002). Therefore, it could be argued that, academic

entrepreneurs operating in resource constrained environments may have engaged in a number of academic entrepreneurial activities. This was further supported by the literature about the motives of academic entrepreneurs, which has identified the engagement in multiple academic entrepreneurial activities as a way to satisfy the diverse motives of academic entrepreneurs (D'Este and Patel 2007). Carrying out multiple income generation activities by entrepreneurs is defined as diversification in the management literature (Alsos et al 2003). Hence, it is possible to argue that carrying out a number of academic entrepreneurial activities by academic entrepreneurs resembles diversification.

Two types of diversification strategies are identified in the corporate diversification literature, namely, related diversification and unrelated diversification. Related diversification is a phenomenon in which firms diversify into a number of business units that are related in some ways (e.g. market, industry, or products etc) or related to their core business/competency. In contrast, unrelated diversification is a phenomenon in which firms diversify into substantially different areas (Rumelt 1982). The same argument is put forward when explaining diversification strategies adopted by individuals, particularly with respect to farming entrepreneurs, in which related diversification means diversifying into farming activities, and unrelated diversification means carrying out farming in conjunction with off-farming activities (Shucksmith and Smith 2008; Damianos and Skuras, 1996; Ilbery et al., 1998). Even though the term 'relatedness' is inconclusive (Chatterjee et al. 1992, Grant et al. 1988), the above stated literature led to conclude that related diversification, in a broader sense, means carrying out activities that are related to the core task of a business or an individual.

The core task of academics is engaging in teaching and research activities (Etzkowitz et al 2000). Therefore, related diversification, in the context of academic entrepreneurship could be considered as carrying out academic entrepreneurial activities, which are related to teaching or research. In order to understand this further, it was required to investigate whether it is possible to differentiate academic entrepreneurial activities in terms of their relatedness to teaching and research.

Schartinger et al (2001), in a research conducted in Austria, stated that company creation by academics is substantially different from normal academic duties, while other forms of knowledge transfer activities are related to normal academic duties (i.e., teaching and research). This could be further supported by the focused definition of academic

entrepreneurship which states that company creation by academics is a role that is distinctively different from the traditional job role of academics (Radosevich 1995, Samson and Gurdon 1993, Daniels and Hofer 1993). Additional evidence to this distinction is provided by Jones-Evans (1997), who stated that the formation of companies by academics is motivated by a set of motives that are totally different from motives to engage in normal knowledge transfer activities.

Therefore, it could be argued that, the formation of companies (e.g. spin-off companies, joint-ventures, and academic owned companies etc) is substantially different from normal academic duties of academics, and thus, could be considered as one distinct category, while their engagement in knowledge transfer activities are related to teaching or research. It should be noted that, to some degree, teaching and research are independent of each other. For example, Marsh and Hattie (2002) stated that teaching effectiveness and research productivity are mutually exclusive, and thus, concluded that these two activities are independent. Hence, academic entrepreneurial activities could be categorised into three types, namely, teaching related academic entrepreneurial activities, research related academic entrepreneurial activities, and company creation. It should be noted that, categorizing activities into these three groups doesn't delineate the fact that there aren't interactions between groups. The rationale for this categorization is that activities categorised under one group are more similar in terms of their relatedness to normal academic duties, than activities between groups. In line with these arguments, seventeen academic entrepreneurial activities identified in the literature are categorised into above stated three groups, based on the nature of these activities (Table 1). Grouping academic entrepreneurial activities into similar groups according to the nature of these activities is a strategy adopted in the academic entrepreneurship literature (D'Esta and Patel 2007).

INSERT TABLE 1 HERE

As discussed above, academics may have engaged in a combination of academic entrepreneurial activities. The three types of academic entrepreneurial activities could result in 8 possible combinations (i.e., 2^3), and when the combination that hasn't engaged any type of activities is excluded, seven combinations could be derived (Table 2). These combinations

could be considered as resembling different diversification strategies adopted by academic entrepreneurs.

INSERT TABLE 2 HERE

Taking the above stated arguments and the seven diversification strategies into account, ‘related diversification’ in the context of academic entrepreneurship could be defined as academic engagement in either teaching related academic entrepreneurial activities, or research related academic entrepreneurial activities (i.e., type 1 and 2 in the Table 2). This kind of engagement is considered as ‘related’ due to two reasons. First, these activities are related to their normal academic duties, and second, they engage in only one type of activities (i.e., teaching related academic entrepreneurial activities or research related academic entrepreneurial activities). Unrelated diversification could be defined as their engagement in company creation and/or engagement in more than one type of academic entrepreneurial activities (i.e., type 3 to 7 in the Table 2). The engagement in company creation is considered as unrelated since it is substantially different from normal academic duties, and the engagement in more than one type of activities is considered as unrelated since the three types of academic entrepreneurial activities are different from each other.

It will be interesting to investigate to what extent academic entrepreneurs in a resource constrained environment adopt the above stated seven ‘related’ and ‘unrelated’ diversification strategies. On the one hand, it could be argued that, the majority of academics may engage in related diversification, since related diversification provides more opportunities to share common resources (Markides and Williamson 1996), which will be of paramount importance in a resource constrained environment. On the other hand, it could be argued that, since opportunities and resources are limited, academics may attempt to capitalise on every minute opportunity (Kodithuwakku and Rosa 2002), which may result in them engaging in diverse academic entrepreneurial activities, and thus, unrelated diversification. This led to the second hypothesis of this section, which claims:

H 2: Academic entrepreneurs in a resource constrained environment are more likely to engage in unrelated diversification than related diversification

Engagement in a combination of academic entrepreneurial activities could provide academics with additional advantages. For example, Alsos et al (2003) argued that engagement in more than one income generation activity enhances entrepreneurs' ability to identify opportunities, which has positive impacts towards their engagement. Similarly, the portfolio entrepreneurship literature argued that diverse experience possessed by portfolio entrepreneurs provides them with an edge over novice entrepreneurs when identifying and capitalising on opportunities (Westhead et al 2005). Furthermore, Shane (2000) had also stated that past experience is advantageous when identifying entrepreneurial opportunities.

These additional benefits have been found to arise due to their ability to use social network (Westhead et al 2005; Krabel and Mueller 2009), knowledge and skills (Shane 2000; Westhead et al 2005; Alsos et al 2003), output (Eun et al 2006), and resources (Westhead et al 2005; Alsos et al 2003) obtained by engaging in one activity when engaging in other activities. Therefore, these additional benefits that arise as a result of interactions among activities (Roberts 2004, Buchanan and Huczynski 1997), could be named as synergistic effects, which have been defined in the literature on systems theory, as '*the whole is better than the sum of its parts*' (Von Bertalanffy (1972), pp 407). Hence, it could be stated that, carrying out a combination of academic entrepreneurial activities could deliver additional benefits, owing to synergies among activities, which wouldn't have been possible by carrying out these activities independently. It is also stated in the literature that, related diversification results in more synergistic effects than unrelated diversification since related activities could share capabilities and resources to a greater extent than unrelated activities (Markides and Williamson 1996). This led to the third hypothesis of this section, which claims:

H3: Related diversification by academic entrepreneurs generates more synergistic effects than unrelated diversification

3. Methodology

This research used Sri Lanka as the study context to represent a resource constrained environment. The use of a single case study is recommended in the literature when it is deployed to represent a particular context (Yin 2003), and/or to begin the process of theory development in an area that has received inadequate focus in prior research (Ryan et al 2002). The per capita GDP of Sri Lanka in 2010 was only \$5000 (Central Intelligence Agency 2011). Government expenditure on universities as a percentage of GDP in Sri Lanka was

only 0.27%, which represented 1.21% of total government expenditure (University grant commission 2011). Undergraduate education is provided to students free, and only postgraduate education (which is by independent institutes attached to universities) charges a fee. As a result, universities generate a relatively low income. It has also been revealed, in a study conducted in Sri Lanka, that there is a lack of supportive mechanisms and institutional framework for university industry interactions. The same study revealed that the research and development spending of Sri Lankan industry is very low (Esham 2008). These facts clearly illustrate the resource constrained environment in which Sri Lankan academics operate.

The academics in 13¹ universities in Sri Lanka (total of 4215 as at 01.01.2009) (University Grant Commission 2010) were considered as the population of this study. Mixed methods were used in this research in a sequential manner, which is referred in the literature as ‘sequential triangulation’ (Morse 2003); 1. Initial context specific data gathering stage 2. On-line survey 3. In-depth face to face interviews. The following sections intend to elaborate and justify the use of mixed methods in this study.

Since most of the literature was from western developed nations, initial data gathering phase was conducted to improve construct validity of the study (Tashakkori and Teddlie 1998). Telephone interviews were conducted with the registrars of 8 universities² in order to obtain general information about context specific entrepreneurial engagements by academics. The designing of the on-line survey was shaped by the findings of these initial discussions, which is a strategy adopted in studies in academic entrepreneurship (Menzies 2000, Yang et al. 2006). Furthermore, the findings of the initial data gathering stage were used to assess the appropriateness of categorizing academic entrepreneurial activities into three groups. The on-line survey was piloted with 16 academics to further improve the construct validity (Bisbe et al. 2007).

The on-line survey was used to investigate academic engagement in 17 academic entrepreneurial activities during last 5 years, and the purpose of the timeline was to obtain

¹ Sri Lanka had 15 public universities. There weren't any private universities other than some private institutions mainly focused on teaching. Out of the 15 universities, the University of Jaffna was excluded due to the issues related to accessibility. The University of Visual & Performing Arts was considered as a part of the University of Kalaniya since the two bodies were separated recently.

² Sri Lanka did not have Technology Transfer Offices, and thus, registrars were contacted to gather initial information.

comparable data. The unavailability of a list of elements in the population, as well as being unable to cover all the universities during in-depth interview phase led to decide to use cluster sampling technique. The use of cluster sampling technique was further supported by the ability to consider universities as natural clusters. According to Arber (2001) selecting a representative sample of clusters reduces the sampling error associated with this technique, and thus, the age (Franklin et al. 2001), location and size of universities (Friedman and Silberman 2003, Agrawal and Henderson 2002) were used as criteria for selecting universities. Accordingly, academics in 6 out of 13 universities were selected as the sample. The rate of response of the online survey was 30% (358 responses in total), and the proportion of the sample and respondents were almost similar with respect to university, and the gender, and position of academics.

The on-line survey was followed by face to face in-depth interviews in order to gather qualitative data required (i.e., how and why they have engaged in each academic entrepreneurial activity, and benefits derived by their engagement) to test stipulated hypothesis, and to improve internal validity through triangulation (Outhwaite 1998; Modell 2009). A sample of 78 academic entrepreneurs, which is a representative of the types of diversification strategies adopted by them (which is identified from data gathered through the online survey) was selected for in-depth interviews. Using the findings of an initial phase to derive a sample for a subsequent phase is a technique successfully used in a number of studies in social and behavioural sciences, which is found to generate data with both breadth and depth (Teddlie and Yu 2007).

Data gathered through the on-line survey was analysed quantitatively (using SPSS) to investigate diversification strategies adopted by academic entrepreneurs, and to test the relationship between diversification strategies and some synergistic effects such as the business management and entrepreneurial knowledge and skills, and strength of social network of academics. Data gathered through in-depth interviews was analysed qualitatively (using NVivo) to obtain an in-depth understanding about what made academics adopt particular diversification strategies, and synergistic effects among academic entrepreneurial activities.

4. Results and Discussion

4.1. Academic Engagement in Entrepreneurial Endeavour

Data collected via on-line survey was analysed to identify the diversification strategies adopted by academic entrepreneurs. If they have engaged in at least one activity grouped under each type of activities (i.e., teaching related academic entrepreneurial activities, research related academic entrepreneurial activities, and company creation) they were considered as engaged in the particular type of academic entrepreneurial activities. As illustrated in table 3, 43 academics have not engaged in any academic entrepreneurial activity, and except for 13, the rest of them (302) have adopted type 1, type 4, or type 7 diversification strategies.

INSERT TABLE 3 HERE

It was revealed during in-depth interviews that academic entrepreneurship is a process, in which academics gradually diversify their engagement. They have started their academic entrepreneurial careers by engaging in teaching related academic entrepreneurial activities, and then added research related academic entrepreneurial activities, and company creation. Following quotation from one of the respondents, who has adopted the type 7 diversification strategy, illustrates the sequence of engagement:

'Soon after my PhD I started engaging in external teaching at postgraduate institutes. Most of the students were from industry and this opportunity allowed me to develop contacts, and later these students invited me to conduct some training and seminar sessions for industry. These enabled me to develop reputation in industry, which paved the path for me to secure opportunities to engage in joint research. Constant engagement in joint research with industry resulted in we deciding to open a joint research lab in the university.'

However, diversifying into company creation has not stopped them engaging in other teaching and research related academic entrepreneurial activities. One academic stated:

'.....after creating the company we got more opportunities to engage in consultancy, joint-research projects, and external teaching. Moreover, we were able to use resources in our company to engage in these activities'

Follow-up email contacts with those who have adopted type 2, 3, and 6 diversification strategies revealed that they have also followed the same sequence, but due to some personal circumstances they could not engage in certain academic entrepreneurial activities during last 5 years (but previously they had engaged in these combinations, and they will resume them in future). Otherwise, they would have been categorised into one of the three prominent diversification strategies. As a result, it was decided that type 1, type 4, and type 7 diversification strategies illustrate academic entrepreneurial engagement in the given context. Based on the sequence in which academics diversify their engagement, it is possible to assume that some academics who have adopted type 1 and 4 may be still in the process of adding activities (mainly with respect to young academic entrepreneurs). However, it was revealed that academics who have adopted type 1, 4, and 7 diversification strategies did not differ significantly with respect to their age $F(2, 295) = 0.831, p=0.437$ (Type1 $M = 42$ $SD=9$, Type 2 $M= 44$ $SD=10$, Type 3 $M= 45$ $SD=10$). Therefore, it could be stated that, in this sample, most of the academic entrepreneurs who have adopted type 1 and 4 are those who have decided not to add other activities into the combination at some point. It was revealed during in-depth interviews that academics decide not to engage in research related academic entrepreneurial activities and/or company creation due to a lack of interest, and/or some barriers for engagement (e.g. lack of time, entrepreneurial skills, and opportunities etc). Since diversification strategies represent the nature of academic entrepreneurial engagement by academics, it was considered that the three prominent types of diversification strategies resemble the typologies of academic entrepreneurs, and they were named as follows:

1. Those who have engaged in only teaching related academic entrepreneurial activities were named as single role academic entrepreneurs since they have engaged in only one type of academic entrepreneurial activity.
2. Those who have engaged in both teaching and research related academic entrepreneurial activities were named as double role academic entrepreneurs since they have engaged in two types of academic entrepreneurial activities.
3. Those who have engaged in teaching and research related academic entrepreneurial activities as well as company creation were named as triple role academic entrepreneurs since they have engaged in all three types of academic entrepreneurial activities.

The above stated findings have revealed that despite resources being constrained, academics have engaged in entrepreneurial activities to a greater extent. It was revealed during in-depth

interviews that academics use entrepreneurial engagement as a vehicle to overcome resource barriers. For example, one academic said:

'We didn't receive enough funding from the government. Therefore, we have to find out alternative ways to improve resources. World is moving, we have to go with the flow.....Engagement in these activities allowed tapping funds and resources in local industry and other international bodies.A portion of income generated from consultancy was used to buy expensive equipments. When preparing budgets, we always try to improve university resources.....We also got a joint research lab, as a result, we get more opportunities to engage in consultancy'

As discussed, the findings in relation to academic engagement in entrepreneurial endeavour revealed that resource constraints motivate academics to engage in entrepreneurial endeavour. This led to accept the first hypothesis, which states that being entrepreneurial is a means to be resource-rich in a resource constrained environment.

4.2. Related and Unrelated Diversification

Based on the theoretical foundation developed in the section 2 of this paper (pp.-5-8), it could be stated that, single role academic entrepreneurs ($N= 30$) have engaged in related diversification, double role academic entrepreneurs ($N=150$) have engaged in unrelated diversification to some extent, and triple role academic entrepreneurs ($N=122$) have engaged in unrelated diversification to the highest extent. This provides evidence to support the second hypothesis, which states that academics in resource constrained environments are more likely to engage in unrelated diversification. During in-depth interviews, it was revealed that this was mainly due to academics attempting to capitalise on every minute opportunity due to the lack of opportunities in a resource constrained environment. For example, one triple role academic entrepreneur said:

'the opportunities for extensive engagement in teaching related academic entrepreneurial activities was rare. Furthermore, we do not have a continuous flow of consultancy projects.....Therefore, it was required to engage in different activities'

However, this questioned how academics managed to overcome resource conflicts, when engaging in a number of academic entrepreneurial activities. During in-depth interviews it was revealed that, in comparison to engaging in one type of activity, engaging in all three types of activities allowed them to create new resources. On the other hand, to some degree,

resource requirements for unrelated diversification were different, which had reduced potential resource conflicts.

A lack of opportunities and resources to engage in one type of activity was further supported by the findings with respect to extent to which they have diversified each type of academic entrepreneurial activity, which are discussed in following sections.

4.2.1. Teaching related academic entrepreneurial activities

A chi-square test revealed that there was a significant difference among the three types of academic entrepreneurs with respect to the number of teaching related academic entrepreneurial activities they have engaged in $X^2(6, N=302) = 48.350, p = 0.000$. The majority of 'single role academic entrepreneurs' (i.e., 43.3%) had engaged in only one teaching related academic entrepreneurial activity. In contrast, the majority of triple role academic entrepreneurs (43.4%) have engaged in all four teaching related academic entrepreneurial activities.

It was evident that a higher percentage of single role academic entrepreneurs had engaged in external teaching (60%) and designing degree programmes (53%), which do not require extensive interactions with industry, while their engagement in other two activities (47% and 33%) which involve relatively high interactions with industry was low (Table 4). In contrast, a higher percentage of triple role academic entrepreneurs have engaged in all four teaching related activities, and particularly, their engagement in finding industrial placements to students and conducting training and seminars was higher than the other two groups.

INSERT TABLE 4 HERE

4.2.2. Research related academic entrepreneurial activities

A chi-square test revealed that there was a significant difference between double role and triple role academic entrepreneurs in relation to the number of research related academic entrepreneurial activities they have engaged in $X^2(7, N= 272) = 56.404, p = 0.000$. The majority of 'triple role academic entrepreneurs' had engaged in a significantly higher number of research related academic entrepreneurial activities (5-7 activities – 54.2%) in comparison to double role academic entrepreneurs (1-3 activities – 56%). As illustrated in table 5, it was clear that a relatively high percentage of 'triple role' academic entrepreneurs' had engaged in all the activities of concern in comparison to 'double role academic entrepreneurs'.

INSERT TABLE 5 HERE

The findings revealed that triple role academic entrepreneurs have engaged in a significantly higher number of teaching and research related academic entrepreneurial activities, in comparison to other two types of entrepreneurs. During in-depth interviews it was found that, this was due to synergistic effects, and the following sections intend to discuss synergies among academic entrepreneurial activities.

4.3.1. Synergistic Effect - Social Network

The analysis of data gathered through in-depth interviews revealed that during the early stages of academic career, engaging in teaching related academic entrepreneurial activities enabled them to develop network of contacts, which had been subsequently capitalised on to engage in research related academic entrepreneurial activities. Diversifying their engagement into research related activities had resulted in widening and strengthening the social network further, which had assisted them immensely in company creation. The following quotation from one academic entrepreneur explains how the social network developed by engaging in external teaching was helpful when engaging in other types of academic entrepreneurial activities:

'The majority of students in external teaching were the employees of industry and such contacts had provided us with opportunities to engage in consultancy projects, conduct training and seminars, place students as trainees in industry, and gain access to industrial resources etc.'

In a similar vein, the contacts developed by academics as a result on engaging in research related academic entrepreneurial activities had resulted in them securing opportunities for long-term involvements such as forming joint research labs. One academic said:

'We were constantly engaging in providing consultancy services to the company X. They have the highest market share in the industry. The company was extremely happy with our delivery, and regular contacts

with them enabled us to build up trust and reputation. This resulted in them deciding to establish a joint research lab in our university'

Diversifying their engagement into company creation had resulted in them having constant interactions with industry, and the social network developed through such interactions had in turn resulted in them securing more opportunities to engage in other teaching and research related academic entrepreneurial activities.

The gradual development of social networks from teaching related academic entrepreneurial activities to the formation of companies was further illustrated by the findings of the on-line survey, which revealed that there is a significant difference among the three types of entrepreneurs in relation to the strength of their social network. In the on-line survey, academics were asked to state to what extent they agree with two statements (i.e., 'I have very strong personal contacts with industrial partners' and 'I'm a member of a team(s) that has (have) very good contacts with industry') in a likert scale of 1 to 4 (i.e., 1= strongly disagree, 2= disagree, 3=agree, 4 Strongly agree). It was revealed that a significant majority of triple role academic entrepreneurs, in comparison to double role and single role academic entrepreneurs, have very strong personal contacts with industrial partners $X^2(6, N=296) = 54.447, p = 0.000$. Similarly, it was revealed that a significant majority of triple role academic entrepreneurs, in comparison to double role and single role academic entrepreneurs, are members of a team(s) that has (have) very good contacts with industry' $X^2(6, N=276) = 43.917, p = 0.000$. Triple role academic entrepreneurs have engaged in unrelated diversification to the highest extent, and thus, it could be stated that unrelated diversification generates more synergistic effects with respect to social network. Since academics generally do not have strong contacts with industry, the development of networks of contacts was very important, and the engagement in unrelated diversification allowed academics to develop and maintain diverse contacts with industry, which in turn, paved the path for them to diversify their engagement further.

4.3.2. Synergistic Effect - Knowledge and Skills

According to academics, engaging in teaching related academic entrepreneurial activities had assisted them in understanding the needs of industry. Engagement in research related academic entrepreneurial activities and company creation had enabled them to develop business management, entrepreneurial, and applied oriented knowledge and skills.

Furthermore, engaging in joint research projects and forming joint ventures with industry had facilitated the exchange of tacit knowledge, which had been immensely helpful when engaging in other academic entrepreneurial activities.

One academic stated:

'I was working in industry on a secondment, and that had resulted in me understanding industrial culture and developing business and management skills. After the secondment I realised the potential for collaborating with industry and started a number of collaborative projects which were completed with a great success. I believe that my experience in working in industry immensely helped me in identifying and engaging in these activities'.

The gradual development of relevant knowledge and skills was further confirmed by the findings of the online survey. It was revealed that triple role academic entrepreneurs believe that they have significantly higher levels of business management skills $X^2(6, N=278) = 10.718, p = 0.097 < 0.1$, personal entrepreneurial skills $X^2(6, N=276) = 34.426, p = 0.000$ and the ability to entrepreneurially apply technological knowledge $X^2(6, N=277) = 15.065, p = 0.020$ in comparison to single role and double role academic entrepreneurs. These findings are in line with Westhead et al (2005) who has stated that portfolio entrepreneurs have the advantage of knowledge and skills acquired through diverse engagement. Hence, it could be concluded that unrelated diversification by academic entrepreneurs enables them to develop relevant knowledge and skills to a greater level, which in turn, is useful when diversifying their engagement further.

4.3.3. Synergistic Effect - Input-output flow

It was also evident that the ability of using the outputs of one academic entrepreneurial activity as inputs for another was also a synergistic effect of diversifying engagement. For example, the outputs of carrying out applied research and assisting small business owners were used as inputs for company creation. The respondents stated that inability to find out appropriate industrial partners, the lack of opportunities to sell intellectual property rights, and issues associated with intellectual property right laws made academics decide to create companies. A similar flow was also observed among different consultancy projects where output of one consultancy was resulted in bringing other related consultancy in which the

output of the previous one is used as input to the later ones. Similarly, outputs of short-term joint research projects with industry, has been used as inputs for longer-term projects. Therefore, it could be stated that both related and unrelated diversification attempts had resulted in the synergistic effect of using outputs of one activity as inputs for others. Sufficient evidence was not available to gauge whether it is related or unrelated diversification which results in greater input-output flow.

4.3.4. Synergistic Effect - Resource

Academics were with the view point that government funding is insufficient at least to carry out their normal academic duties. Therefore, engaging in research related academic entrepreneurial activities and company creation has been used by academics as a mechanism to improve resource status, which in turn, improves opportunities to engage in more teaching and research related academic entrepreneurial activities.

One double role academic entrepreneur stated:

'The funding we acquired from industry and international bodies for carrying out consultancy and other research projects had resulted in improving infrastructure/ resource status of the university by way of receiving lab equipment, chemicals, stationary, computers, printers, photocopy machines, and buildings etc. When we prepare budgets we always try to include elements to improve resource status of the university which in turn facilitates us when engaging in other academic entrepreneurial activities'.

Similarly, the formation of joint ventures by way of joint research labs had enabled academics to make use of lab facilities for other academic entrepreneurial activities. Furthermore, it was reported that some of the spin-off companies had contributed to 'departmental funds' which had been used to improve resource status of the department, and in turn, had positive effects on engagement in other teaching and research related academic entrepreneurial activities.

The above discussion led to conclude that academic engagement in unrelated diversification results in generating more synergistic effects in terms of social network, knowledge and skills, and resources. Even though it has been stated in the literature that related

diversification generates more synergistic effects since it allows sharing common resources and competencies (Markides and Williamson 1996), in a resource constrained environment it is required to create resource in order to share, which was allowed by unrelated diversification. Hence, the third hypothesis, which asserts that related diversification generates more synergistic effects, is not accepted.

Based on findings with respect to the typologies of academic entrepreneurs (which resemble diversification strategies adopted by them) and synergistic effects (which were emanated as a result of diversifying their engagement) a theoretical framework was developed to illustrate the nature of academic entrepreneurial engagement in a resource constrained environment (Figure 1).

INSERT FIGURE 1 HERE

5. Conclusions

Findings revealed that academic entrepreneurship is a process, in which academics start their entrepreneurial engagement by engaging in teaching related academic entrepreneurial activities, and then diversify into research related academic entrepreneurial activities and company creation. However, diversifying into company creation does not stop them engaging in teaching and research related academic entrepreneurial activities. As a result, academics tend to engage in a combination of academic entrepreneurial activities, which resembles diversification. These findings are in line with Tijssen (2006) who, in a research carried out in OED countries, revealed that academic entrepreneurship as a process that starts from less entrepreneurial activities, and then, extends to more entrepreneurial activities. He also found that carrying out more entrepreneurial activities does not prevent academics engaging in less entrepreneurial activities.

Academics in the given resource constrained environment have adopted three types of diversification strategies, which resemble three typologies of academic entrepreneurs:

1. Single role academic entrepreneurs had engaged in only teaching related academic entrepreneurial activities, and thus, they were considered as engaging in related

diversification 2. Double role academic entrepreneurs had engaged in both teaching and research related academic entrepreneurial activities, and thus, they were considered as engaging in unrelated diversification to a certain extent

3. Triple role academic entrepreneurs had engaged in company creation besides engaging in both teaching and research related academic entrepreneurial activities, and thus, they were considered as engaging in unrelated diversification to the highest extent.

The existence of these typologies led to conclude that resource barriers do not suppress academic engagement in entrepreneurial endeavour. Instead, being entrepreneurial is used by academics as a vehicle to overcome resource limitations. This is in line with the literature which has argued that resource constrained environments motivate entrepreneurial engagement (Adesola 1991; Gilad and Levine 1986). Hence, the first hypothesis of the study, which asserts that being entrepreneurial is a means to be resource-rich in a resource constrained environment, is accepted.

It was also found that the majority of academic entrepreneurs have engaged in unrelated diversification. Engagement in unrelated diversification is mainly driven by their need to capitalise on every minute opportunity available in the resource constrained environment. Therefore, the second hypothesis of this study, which states that academics operating in resource constrained environments tend to engage in unrelated diversification, is accepted. This finding is consistent with Kodithuwakku and Rosa (2002) who have found that limited opportunities induce portfolio entrepreneurship.

It was further revealed that triple role academic entrepreneurs engage in significantly higher number of teaching and research related academic entrepreneurial activities in comparison to single role and double role academic entrepreneurs. This was due to synergies among three types of activities, which in turn provided them with more opportunities and resources to engage in teaching and research related academic entrepreneurial activities. Even though it has been stated in the literature that related diversification, which allows sharing common resources and competencies, generates more synergistic effects (Markides and Williamson 1996), this research revealed that in a resource constrained environment unrelated diversification generates more synergistic effects. This was on the one hand, due to the need to create resources before sharing, which was made possible by unrelated diversification. On the other hand, enough opportunities and resources were not available in this resource

constrained environment to engage in one type of activity (i.e., related diversification) extensively, which reduced the synergies among related activities. Furthermore, unrelated diversification reduced possible resource conflicts since unrelated activities demand relatively different resources. Accordingly, the third hypothesis, which claims that related diversification generates more synergistic effects, is not accepted.

The findings of this research highlighted a number of implications for policy makers and academic entrepreneurs. In a resource constrained environment, engaging in academic entrepreneurship could be used as a strategy to overcome resources barriers. Academic entrepreneurs could make use of unrelated diversification strategically to create higher levels of synergistic effects. The findings related to the sequence in which academics diversify their engagements highlighted the importance of considering academic entrepreneurship as a process, and nurturing the process, rather than merely pressurising academics to create business ventures. The existence of three typologies of academic entrepreneurs highlighted the importance of acknowledging different role identities (Jain et al 2009) in a university setting.

Even though synergistic effects explained the extent of diversification, and the ways of overcoming resource barriers, the paper didn't address extensively why some academics decide to be single or double role academic entrepreneurs. Accordingly, it could be assumed that there may be several other micro, macro, and meso level factors that will explain the existence of different academic entrepreneurs, which will be a future research interest. There are also future research avenues to investigate the impact of the existence of different typologies in a university. It may be the case that, optimal benefits as a university could be derived by having different typologies. This research is carried out in one context, and replicating this study in other contexts will allow theory development via empirical generalization.

List of References

- Adesola, A. O. 1991. The Nigerian university system: meeting the challenges of growth in a depressed economy. *Higher Education* 21, 121-133.
- Agrawal, A., Henderson, R .2002. Putting Patents in Context: Exploring Knowledge Transfer from MIT. *Management Science* 48, 44-60

- Alsos, G. A., Ljunggren, E., Pettersen, L. T. 2003. Farm-based Entrepreneurs: what triggers the start-up of new business activities? *Journal of Small Business and Enterprise Development* 10, 435-443.
- Ambos, T. C., Makela, K., Birkinshaw, J., D'Este, P. 2008. When Does University Research Get Commercialized? Creating Ambidexterity in Research Institutions. *Journal of Management Studies* 45, 1424- 1447.
- Arber, S. (2001). Designing Samples. In: Gilbert, N. (ed.) *Researching Social life* (2nd ed.) Sage Publications Ltd, London, pp. 58-82
- Baldini, N., Grimaldi, R., Sobrero, M. 2006. Institutional changes and the commercialization of academic knowledge: A study of Italian universities patenting activities between 1965 and 2002. *Research Policy* 35, 518–532.
- Balzat, M. and Hanusch, H. 2004. Recent trends in the research on national innovation systems, *Journal of Evolutionary Economics* 14,197 – 210.
- Benneworth, P., Hospers, G.-J., Timmerman, P. (2009). Who Builds ‘Science Cities’ and ‘Knowledge Parks’? In: Oakey, R., Groen, A., van der Sijde, P. & Cook, G. (eds.) *New Technology-Based Firms in the New Millennium*. Bingley: Emerald Group Publishing Limited, pp. 147-164.
- Bisbe, J., Batista-Foguet, J. M., Chenhall, R. 2007. Defining management accounting constructs: a methodological note on the risks of conceptual misspecification. *Accounting, Organizations and Society* 32, 789-820.
- Bowonder, B. 2001. Globalisation of R&D: the Indian experience and implications for developing countries. *Interdisciplinary Science Reviews* 26, 191-203.
- Buchanan, D., Huczynski, A. 1997. *Organizational behaviour, introductory text* (3 ed.): Prentice Hall. Harlow
- Central Intelligence Agency (2011) <https://www.cia.gov/>
- Calvert, J., Patel, P. (2003). University–industry research collaborations in the UK: bibliometric trends. *Science and Public Policy* 30, 85–96.
- Clarysse, B., Wright, M., Lockett, A., Van de Velde, E., Vohora, A. 2005. Spinning out new ventures: a typology of incubation strategies from European research institutions. *Journal of Business Venturing* 20, 183–216.
- Chatterjee, S., Lubatkin, M. H., Schweiger, D. M., Weber, Y. 1992. Cultural differences and shareholder value in related mergers: linking equity and human capital. *Strategic Management Journal* 13, 319–334.
- Damianos, D., Skuras, D. 1996. Farm business and the development of alternative farm enterprises: an empirical analysis in Greece. *Journal of rural studies*, 12, 273-283.
- Daniels, G., Hofer, C. (1993). Characteristics of Successful and Unsuccessful Entrepreneurial Faculty and Their Innovative Research Teams. In: Churchill, N., Birley, S., Bygrave, W., Doutriaux, J., Gatewood, E., Hoy, F., Wetzal, W. (eds.) *Frontiers of Entrepreneurship Research*. Babson College, Wellesley pp. 598-60p.
- Di Gregorio, D., Shane, S. (2003). Why do some universities generate more start-ups than others? *Research Policy* 32, 209–227.
- D'Este, P., Patel, P. 2007. University–industry linkages in the UK: what are the factors underlying the variety of interactions with industry? *Research Policy* 36, 1295–1313.
- D'Este, P., Perkmann, M. 2011. Why do academics engage with industry? The entrepreneurial university and individual motivations, *Journal of Technology Transfer* 36, 316-339
- Etzkowitz, H. 1998. The norms of entrepreneurial science: Cognitive effects of the new university–industry linkages. *Research Policy*, 27, 823-833.
- Etzkowitz, H., Leydesdorff, L. 2000. The dynamics of innovation: from National Systems and Mode 2 to a Triple Helix of university–industry–government relations. *Research Policy* 29, 109–123.
- Etzkowitz, H., Webster, A., Gebhardt, C., Cantisano Terra, B. R. 2000. The future of university and the university of the future: evolution of ivory tower to entrepreneurial paradigm. *Research Policy* 29, 313–320.
- Eun, J.-H., Lee, K., Wu, G. 2006. Explaining the “University-run enterprises” in China: A theoretical framework for university–industry relationship in developing countries and its application to China. *Research Policy*, 35, 1329-1346.

- Franklin, S. J., Wright, M., Lockett, A. (2001). Academic and Surrogate Entrepreneurs in University Spin-out Companies. *Journal of Technology Transfer* 26, 127-141.
- Friedman, J., Silberman, J. 2003. University technology transfer: do incentives, management, and location matter? *Journal of Technology Transfer* 28,17–30.
- Gartner, W.B. 1990. “What are We Talking about when We Talk about Entrepreneurship?,” *Journal of Business Venturing* 5, 15–28.
- Gilad, B., Levine, P. 1986. A behaviour model of entrepreneurial supply. *Journal of Small Business Management* 24, 45-54.
- Glassman, A. M., Moore, R. W., Rossy, G. L. 2003. Academic Entrepreneurship: Views on Balancing the Acropolis and the Agora. *Journal of Management Inquiry*, 12, 353 – 374.
- Goldfarb, B., Henrekson, M. 2003. Bottom-up versus top-down policies towards the commercialization of university intellectual property. *Research Policy* 32, 639– 658.
- Grant, R., Jammine, A., Thomas, H. 1988. Diversity, diversification, and profitability among British manufacturing companies 1972–1984. *Academy of Management Journal* 31, 771-801.
- Hall, B. H., Link, A. N., Scott, J. T. 2001. Barriers inhibiting industry from partnering with universities: evidence from the advanced technology program. *Journal of Technology Transfer* 26, 87–98.
- Hart, M.M.,Stevensen, H.H., Dial, J. 1995. Entrepreneurship: a definition revisited, *Frontiers of Entrepreneurship Research*, 75-89
- Henderson, R., Jaffe, A., Trajtenberg, M. 1998. Universities as a source of commercial technology: a detailed analysis of university patenting, 1965–1988. *Review of Economics and Statistics* 80, 119–127.
- Hebert, R.F., A.N. Link.1989. In Search of the Meaning of Entrepreneurship. *Small Business Economics*, 1, 39-49
- Ilbery, B., Bowler, I., Clark, G., Crockett, A., Shaw, A. 1998. Farm-based tourism as an alternative farm enterprise: a case study form the Northern Pennines, England. *Regional studies*, 32, 355-364
- Jain, S., Georgeb, G., Maltarichc, M. 2009. Academics or entrepreneurs? Investigating role identity modification of university scientists involved in commercialization activity. *Research Policy* 38, 922–935.
- Jones-Evans, D. 1997. Universities, Technology Transfer and Spin-off Activities: Academic Entrepreneurship in Different European Regions. Targeted Socio-Economic Research Project No 1042. University of Glamorgan. <http://www.hm-treasury.gov.uk/d/utheschoolforbusinregiondeveljdjones-evans130203.pdf>
- Jones-Evans, D. (2000). Entrepreneurial universities: Policies, Strategies and Practice. In: Pedro, C., Gibson, D. V., Heitor, M. V., Shariq, S. (eds.) *Science, technology and innovation policy*. Quorum Books, Westport, Connecticut, London, 119-128.
- Jones-Evans, J., Klofsten, M. 2000. Comparing Academic Entrepreneurship in Europe – The Case of Sweden and Ireland. *Small Business Economics*14, 299–309.
- Kodithuwakku, S. S., Rosa, P. 2002. The Entrepreneurial Process and Economic Success in a Constrained Environment. *Journal of Business Venturing* 17, 431-465.
- Krabel, S., Mueller, P. 2009. What drives scientists to start their own company?: An empirical investigation of Max Planck Society scientists. *Research Policy* 38, 947-956.
- Lam, A. Work roles and careers of R&D scientists in network organizations. *Industrial Relations* 44,42–75.
- Laukkanen, M. 2003. Exploring academic entrepreneurship: drivers and tensions of university based business. *Journal of Small Business and Enterprise Development* 10, 372-382
- Louis, K. S., Blumenthal, D., Gluck, M. E., Stoto, M. A. 1989. Entrepreneurs in academe: An exploration of behaviours among life scientists. *Administrative Science Quarterly* 34, 110–131.
- Lundvall, B.A., (ed.) 1992. *National systems of innovation: Towards a theory of innovation and interactive learning*. Pinter, London
- Mars, M., Rios-Aguilar, C. 2010. Academic entrepreneurship (re)defined: significance and implications for the scholarship of higher education. *Higher Education* 59, 441-460.

- Marsh, H. W., Hattie, J. 2002. The Relation Between Research Productivity and Teaching Effectiveness: Complementary, Antagonistic, or Independent Constructs? *The Journal of Higher Education* 73, 603-641.
- Markides, J. G., Williamson, P. 1996. Corporate diversification and organizational structure: a resource-based view. *Academy of Management Journal* 39, 340-367.
- McMullan, W. E., Vesper, K. H. 1987. Universities and community venture development: the spin-off phenomenon: *The Spirit of Entrepreneurship*. 32nd Annual World Conference International Council for Small Businesses. Simon Fraser University (Burnaby), Vancouver British Columbia. pp 350-370.
- Menzies, T. V. 2000. An exploratory study of university entrepreneurship centres in Canada: A first step in model building. *Journal of Small Business and Entrepreneurship* 15, 15-38.
- Modell, S. 2009. In defence of triangulation: A critical realist approach to mixed methods research in management accounting *Management Accounting Research* 20, 208-221.
- Monck, C., and Segal, N. 1983. University science parks and small firms. National Small Business Conference. Durham University, September 1983
- Mowery, D. C., Sampat, B. N., Ziedonis, A. A. 2002. Learning to patent: Institutional experience, learning, and the characteristics of U.S. university patents after the Bayh-Dole Act, 1981-1992. *Management Science* 48, 73-89.
- Mowery, D. C., Shane, S. 2002. Introduction to the special issue on university entrepreneurship and technology transfer. *Management Science* 48, 5-9
- Nelson, R. R., (ed.). 1993. National innovation systems: A comparative analysis. Oxford University Press, Oxford
- Nelson, R.R. 1992. National innovation systems: a retrospective on a study. *Industrial and Corporate Change* 1, 347-374 .
- Outhwaite, W. 1998. Realism and Social Sciences. In: Archer, M., Bhaskar, R., Collier, A., Lawson, T. & Norrie, A. (eds.) *Critical realism: Essential readings*. Routledge, London. Pp. 282-296.
- Phan, P. H., Siegel, D. S. 2006. The effectiveness of university technology transfer. *Foundations and Trends in Entrepreneurship* 2, 77-144.
- Radosevich, R. 1995. A Model for Entrepreneurial Spin-Offs from Public Technology Sources. *International Journal of Technology Management* 10, 879-893.
- Roberts, J. 2004. *The Modern Firm: Organizational Design for Performance and Growth*. Oxford University Press, New York
- Rumelt, R. P. 1982. Diversification strategy and profitability. *Strategic Management Journal* 3, 359-69.
- Ryan, R.J., Scapens, R.W., Theobald, M. 2002. *Research Methods and Methodology in Accounting and Finance*, (2nd ed.) Thomson Learning, London
- Samson, K. J., Gurdon, M. A. 1993. University Scientists as Entrepreneurs: A Special Case of Technology Transfer and High Technology Venturing. *Technovation* 13, 63-71.
- Schartinger, D., Schibany, A., Gassler, H. 2001. Interactive relations between university and firms: empirical evidence for Austria. *Journal of Technology Transfer* 26, 255-268.
- Schmoch, U. 1997. Indicators and the relations between science and technology. *Scientometrics* 38, 103-116.
- Scott, M., Fadahunsi, A., and Kodithuwakku, S. (2000). *Tackling Adversity with Diversity*. (ed.) S. Birley, D. Muzyka, Financial Times: Mastering entrepreneurship. The Complete MBA Companion in Entrepreneurship, Pearson Education Ltd, Harlow
- Shane, S. 2000. Prior Knowledge and the Discovery of Entrepreneurial Opportunities. *Organization Science* 11, 448-470.
- Shane, S., Stuart, T. 2002. Organizational Endowments and the Performance of University Start-Ups. *Management Science* 48, 154-170.
- Shane, S., Venkataraman, S. 2000. The Promise of Entrepreneurship as a Field of Research. *The Academy of Management Review* 25, 217-226.
- Shucksmith, D. M. & Smith, R. 2008. Farm household strategies and pluriactivity in upland Scotland. *Journal of Agricultural Economics*, 42(3), 340-353
- Siegel, D. S., Waldman, D., Atwater, L., Link, A. 2004. Toward a model of the effective transfer of scientific knowledge from academicians to practitioners: Qualitative evidence from the

- commercialization of university technologies. *Journal of Engineering and Technology Management* 21, 115–142.
- Storey, D.J. and Tether, B.S. 1998. Public policy measures to support new technology-based firms in the European Union, *Research Policy* 26, 1037-57.
- Tashakkori, A., Teddlie, C. 1998. *Mixed methodology: combining qualitative and quantitative approaches*. Sage Publications, Thousand Oaks
- Teddlie, C., Yu, F. 2007. Mixed Methods Sampling: A Typology with Examples. *Journal of Mixed Methods Research* 1, 77-100.
- Ucbasaran, D., Howorth, C., Westhead, P. 2000. Habitual entrepreneurs: Human capital, opportunity search and learning. Paper presented at the Babson-Kauffman conference, 2000, Babson College, Wellesley
- University Grant Commission, Sri Lanka .2010, <http://www.ugc.ac.lk/>
- Van Dierdonck, R., Debackere, K.1988. Academic entrepreneurship at Belgian Universities. *R&D Management* 18, 341-353.
- Venkataraman, S., I. MacMillan, and McGrath,R. 1992. Progress in Research on Corporate Venturing, in D.L. Sexton and J. Kasarda (eds) *The State of the Art of Entrepreneurship*, PWS-Kent, Boston 487-519
- Von Bertalanffy, L. 1972. The History and Status of General Systems Theory. *The Academy of Management Journal* 15, 407-426.
- Westhead, P., Ucbasaran, D., Wright, M. 2005. Decisions, actions and performance: Do novice, serial and portfolio entrepreneurs differ? *International Small Business Journal* 43, 393–418.
- Yang, P. Y., Chang, Y., Chen, M. 2006. Factors nurturing academic entrepreneurship in Taiwan. *Journal of Enterprising Culture* 14, 267-290.
- Yin, R. K. 2003. *Case study research, design and methods*.(3rd ed). Sage Publications, Thousand Oaks
- Ynalvez, M. A., Shrum, W. M. 2011. Professional networks, scientific collaboration, and publication productivity in resource-constrained research institutions in a developing country. *Research Policy* 40, 204-216.

Table 1 : Types of Academic Entrepreneurial Activities

| Teaching related academic entrepreneurial activities | Research related academic entrepreneurial activities | Company creation |
|---|--|---|
| <p>(1) External teaching (2) Initiating the development of new degree programmes (3) Placing students as trainees in industry (4) Conducting seminars and training sessions for industry</p> <p>(Jones-Evans 1997; Jones-Evans and Klofsten 2000; Schmoch 1997; D’Este and Patel 2007)</p> | <p>(1) Working in the industry (research based) (2) Research based consultancy for industry through the university (3) Research based consultancy privately (but without forming a company) (4) Developing products or services with potential for commercialization. (5) Acquiring research funding from government, non-governmental or international bodies (those without collaborations with industry) (6) Collaborating with industry through joint research projects (7) Research related assistance to small business owners. (Glassman et al 2003; Jones-Evans 1997; Louis et al 1989; Goldfarb and Henrekson 2003; Siegel et al 2004; Calvert and Patel 2003)</p> | <p>(1) Contributing to the formation of joint ventures in which university and industry are the joint partners (2) The formation of joint venture(s) privately through collaborating with industry (3) Contributing to the formation of one or more new spin-off companies (4) Contributing to the establishment of university incubators and/or science parks (5) Contributing to the formation of university centres designed to carry out commercialization activities (6) The formation of your own company/(s) (Radosevich 1995; Samson and Gurdon 1993; Daniels and Hofer 1993; Jones-Evans 1997; Louis et al 1989; Goldfarb and Henrekson 2003; Clarysse et al., 2005; Di Gregorio and Shane, 2003; Hall et al., 2001)</p> |

Table 2: Diversification Strategies adopted by Academics

| Diversification Strategies | Teaching Related^a | Research Related^a | Company Creation^a | Type of diversification |
|---|-------------------------------------|-------------------------------------|-------------------------------------|--------------------------------|
| Type 1 (<i>Diversify into only teaching related academic entrepreneurial activities</i>) | √ | | | Related diversification |
| Type 2 (<i>Diversify into only research related academic entrepreneurial activities</i>) | | √ | | |
| Type 3 (<i>Diversify into only company</i>) | | | √ | Unrelated diversification |
| Type 4 (<i>Diversify into teaching related and research related academic entrepreneurial activities</i>) | √ | √ | | |
| Type 5 (<i>Diversify into teaching related academic entrepreneurial activities and company creation</i>) | √ | | √ | |
| Type 6 (<i>Diversify into research related academic entrepreneurial activities and company creation</i>) | | √ | √ | |
| Type 7 (<i>Diversify into company creation, teaching related academic entrepreneurial activities and research related academic entrepreneurial activities</i>) | √ | √ | √ | |

^a √ indicate that academics have engaged in at least one activity in the given group of activities

Table 3: Diversification Strategies adopted by Academic Entrepreneurs – Results

| Diversification Strategies | Teaching Related | Research Related | Company Creation | Frequency | Type of diversification |
|-----------------------------------|-------------------------|-------------------------|-------------------------|------------------|--------------------------------|
| Type 1 | √ | | | 30 | Related diversification |
| Type 2 | | √ | | 8 | |
| Type 3 | | | √ | 1 | Unrelated diversification |
| Type 4 | √ | √ | | 150 | |
| Type 5 | √ | | √ | 0 | |
| Type 6 | | √ | √ | 4 | |
| Type 7 | √ | √ | √ | 122 | |
| Type 8 | | | | 43 | N/A |

Table 4: Extent of engagement- Teaching related academic entrepreneurial activities

| Activity | Single role^b | Double role^b | Triple role^b |
|--|------------------------------------|------------------------------------|------------------------------------|
| External teaching | 60% | 64.7% | 73.8% |
| Introducing new degree programmes | 53.3% | 73.3% | 71.3% |
| Finding industrial placements for students | 46.7% | 68% | 90.2% |
| Training and seminars for industry | 33.3% | 62.7% | 83.6% |

^b values indicate the number of academics who have engaged in each activity as a percent of the total number of academics in respective typologies

Table 5: Extent of engagement- research related academic entrepreneurial activities

| Activity | Double role^c | Triple role^c |
|--|------------------------------------|------------------------------------|
| Working in the industry on secondments | 24% | 55.7% |
| Research based consultancy for industry through the university | 51.3% | 77% |
| Research based consultancy privately | 34% | 54.9% |
| Developing products with the potential for securing patents | 16.7% | 37.7% |
| Acquiring funding from government, non-governmental or international bodies (those without collaborations with industry) | 54% | 63.1% |
| Collaborating with industry through joint research projects ³ | 70% | 82.8% |
| Assisting small business owners to commercialize their innovations | 18% | 46.7% |

^c values indicate the number of academics who have engaged in each activity as a percent of the total number of academics in respective typologies

³ Comparatively high percentage of academics engaging in joint research projects with industry was due to considering student supervision in collaboration with industry under this category (revealed during in-depth interviews).

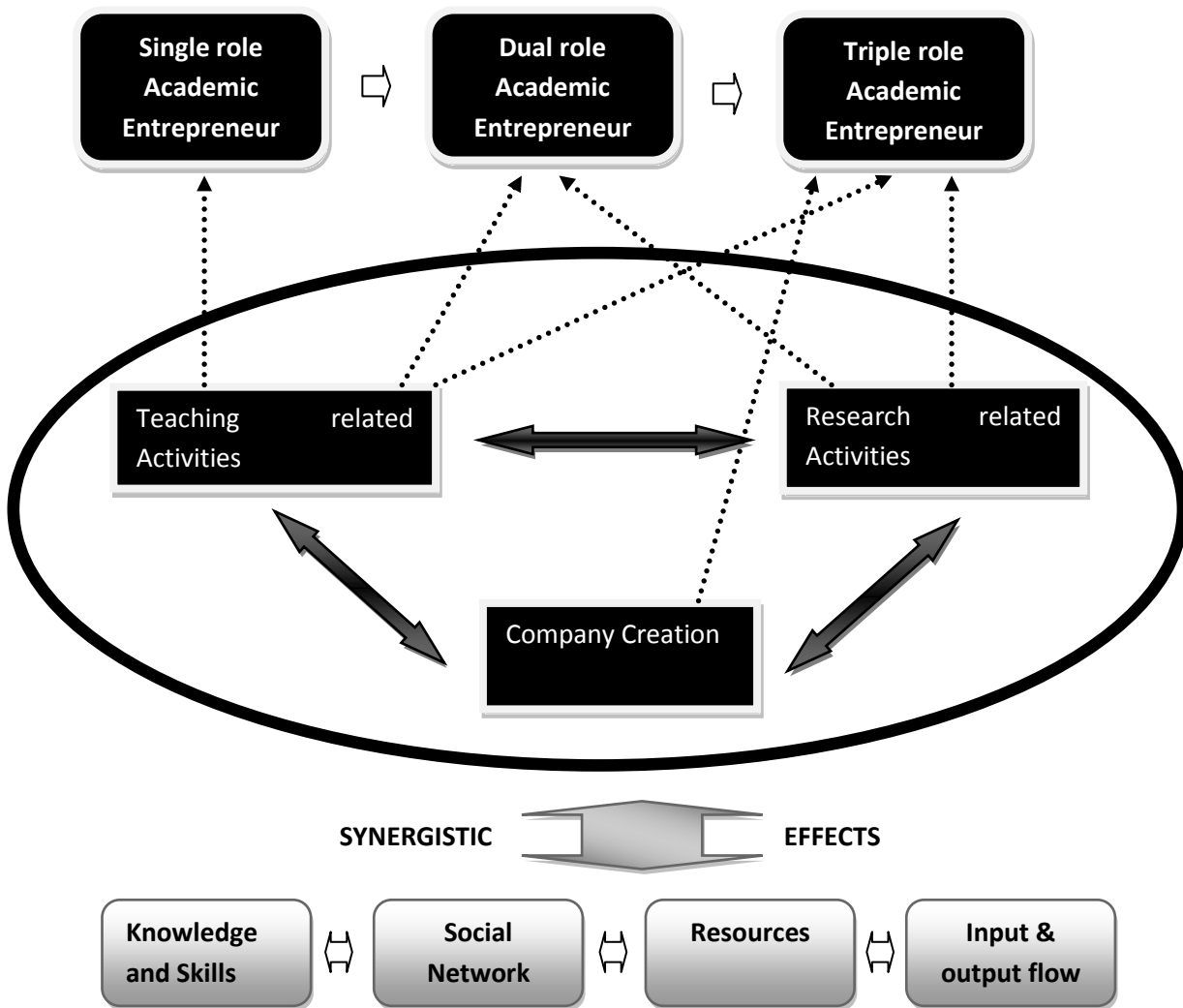


Figure 1: The Nature of Academic Entrepreneurial engagement in a Resource Constrained Environment