

## Technology Based Entrepreneurship Financing. Lessons for Nigeria

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### Abstract

Technology entrepreneurship is a form of business leadership based on the process of recognizing high-potential, technology-intensive business opportunities, gathering resources such as talent and cash, and managing rapid growth using principled, real-time decision making skills. Technology based entrepreneurial firms account for a substantial number of essential inventions and innovations in successful countries. Such firms have become an integral part of the development of the global and regional economy. However, they are often characterized by the paradigms liability of newness and resource poverty, coupled with suffering from inadequate technical and marketing know-how, inexperience management, inability to discover initial financing and huge overheads. In view of this, startups in the technology sector encounter the problem of sourcing technical and financial resources and commercialization capabilities required to take their products to market. This study adopts a secondary approach to research methodology through the review of existing articles in this domain of investigation. Articles are sourced from conference and journal papers from reputable database, internet sources, brochures and newspapers. This study concludes that investment and financial decisions play an increasing vital role in economic growth and entrepreneurial new venture creation. Hence, investment and financial policies are part of the main operational resolutions in emerging nations to support investment by domestic firms, particularly technology entrepreneurial firms. Hence, policy makers in Nigeria and other developing countries could evolve ambitious policy framework aimed at developing the equity financing sector through venture capital, particularly for technology entrepreneurs. Also they could build substantial amount of skilled and experienced venture capitalists to identify high potential investments opportunities and be able to nurture and support them to an exit.

### Key words

Venture capital firms, technology entrepreneurship, financing, Nigeria

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### 1. Introduction

Policy makers in developed and new industrializing nations have made available substantial support to Technology Based Entrepreneurial Firms (TBEFs) to cover certain areas of their operations. Gomez (2009) argues that concerned ministries and public agencies should provide support in technical expertise, training, disseminating information and financing. Massa and Testa (2008) posits that TBEFs are viewed as major influences in the economic growth, wealth creation, job provision and creation of new innovations or inventions. Some economists have also argued that notwithstanding the huge dominance of Research and Development (R&D) funding in large corporations, Technology Based Entrepreneurial Firms account for a substantial number of essential inventions and innovations in the economy (Khin *et al.*, 2010; Bloch, 2007; Ferrary and Granovetter, 2009). Technology Based Entrepreneurial Firms (TBEFs) have become an integral part of the development of the global and regional economy (Somsuk *et al.*, 2012; Ajagbe *et al.*, 2012a). These firms are often characterized by the paradigms liability of newness and resource poverty (Lendner, 2007; Mason and Brown, 2010). In addition, they suffer from inadequate technical and marketing know-

how, inexperience management, inability to discover initial financing and huge overheads (Hackett and Dilts, 2004).

In view of this, startups in the technology sector encounter the problem of sourcing technical and financial resources and commercialization capabilities required to take their products to market (Lin *et al.*, 2011; Somsuk *et al.*, 2012; Ajagbe and Ismail, 2014). Aside the aforementioned, one of the main constraints encountered by TBEFs is their inability to have access to adequate funding. It is however very important to highlight that investment and financial decisions play an increasing vital role in economic growth and entrepreneurial new venture creation (Kortum and Lerner, 2000). These investment and financial policies are part of the main operational resolutions in emerging nations to support investment by domestic firms, particularly technology entrepreneurial firms, and multinational companies investing in these countries (Wonglimpiyarat, 2011; Ajagbe, 2014). Whilst arguing that technology entrepreneurial small firms play important roles in innovation, Thiruchelvan *et al.* (2010) point out the challenges of access to finance, inability to cope with government regulations and non-availability of adequate professional management expertise as a few of the challenges these technology small firms face globally.

Figure 1 below shows the conceptual framework of this research including the relationship amongst the variables, for example, venture capital firms; technology based entrepreneurial firms and government intervention strategies.

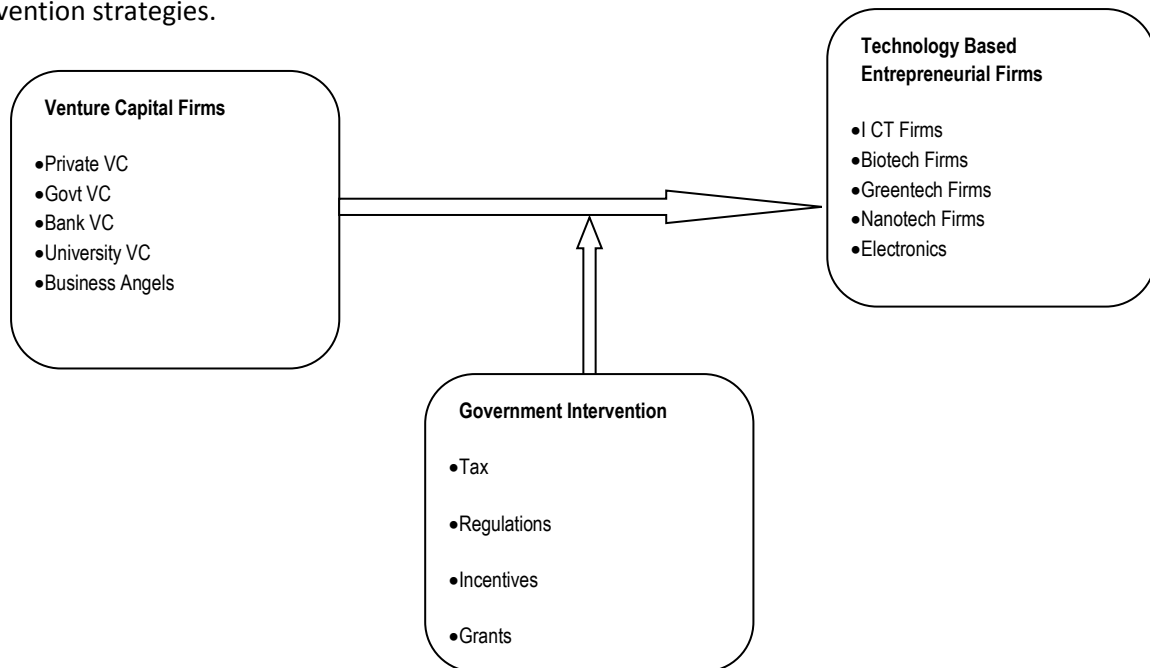


Figure 1. Research Conceptual Framework

## 2. Literature review

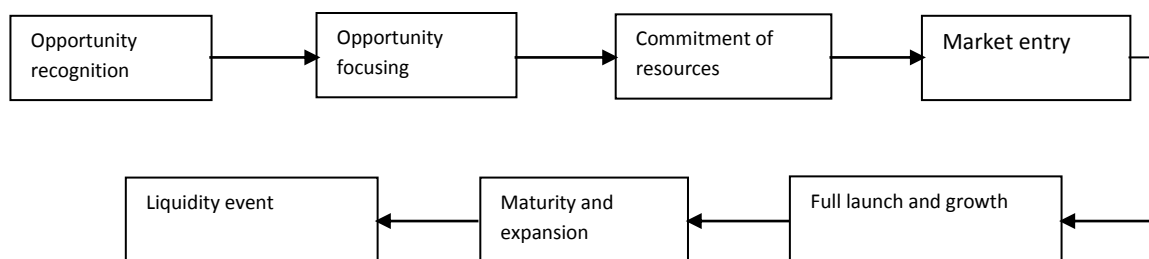
### 2.1. Technology Entrepreneurship

Dollinger (2003) posits that technology is a branch of knowledge that deals with industrial arts, applied science, and engineering. It can be seen as a process, an invention, or a method. Technological change can take place either through pure invention or process innovation, and includes devices such as artefacts, processes, tools, methods and materials that can be applied to industrial and commercial purposes. Dorf and Byers (2008) emphasizes that, technology entrepreneurship is a form of business leadership based on the process of recognizing high-potential, technology-intensive business opportunities, gathering resources such as talent and cash, and managing rapid growth using principled, real-time decision making skills. Dollinger (2003) opine that an attractive business opportunity is said to consist of a great value proposition, technically feasible products, protectable intellectual property (IP), a sustainable competitive advantage, a large potential market, and a proven business model. This can be based on either a revolutionary breakthrough in technology or evolutionary advancement which can target an existing market or create an entirely new one. This entrepreneurial process is applicable to both independent startups and established corporations (Buenstorf and Geissler, 2012; Elenurm, 2012).

Technology entrepreneurs use technology as their driving factor in transforming resources into goods and services, creating an environment conducive for industrial growth. There are two different kinds of technology entrepreneurs depending on their characteristics: these are technology developers (inventors) who are those who develop a unique technology capable of driving new businesses (Dollinger, 2003). The other group is the technology users or innovators who are those who see a new technology development and understand how it can be applied to meet market needs (Gercia-villaverde, 2012 and Barreto, 2010). Nicholas and Armstrong (2003), provide another definition of technology entrepreneur as someone who organizes, manages and assumes the risk of an engineering business enterprise. Technology entrepreneurship was recognized by the Malaysian government as a force that can create huge impact on growth, recovery and societal progress by fueling innovation, social empowerment, economic empowerment, employment generation and productivity. This assertion led the Malaysian government to set up agencies to assist technopreneurs in obtaining the relevant standards and systems that are pertinent for them to enter desired market both locally and internationally (Mosti, 2012; Janssen and Moors, 2013). Technology Entrepreneurial Firms produce high value-added products that have rippling effect or spill-over effects on other firms (Groh *et al.*, 2010; Ajagbe *et al.*, 2012b). For example, employment creation, the generation of wealth and R&D spill-over benefits has been identified as the three major contributions of technology entrepreneurship.

## 2.2. Technology Entrepreneurial Process

Price (2004) and Ajagbe and Ismail (2014) emphasize that in trying to understand the differences and similarities between a conventional and technology entrepreneur, it would be useful to understand the entrepreneurial process both have to undergo. They enumerated however that technology entrepreneurial process involves seven stages of the entrepreneurial life cycle. Figure 2 below shows the technopreneurial process model as studied by Price and supported by Ajagbe and Ismail.



**Source:** Price (2004) and Ajagbe and Ismail (2014)

Figure 2. Technopreneurs Process Model

## 2.3. Characteristics of Technology Entrepreneurs

Bulsara *et al.* (2010) elucidates on two options open to technology entrepreneurs to commercialize their patented technology, and suggests that an innovator who does not possess an enterprising tendency or entrepreneurial characteristics should opt for technology transfer (licensing). These authors add that someone who has a strong entrepreneurial characteristics and enterprising tendency would also be most suited for techno-entrepreneurship. In addition to this, they explained that the basic characteristics that would be expected of a technology entrepreneur to be successful include: need for achievement, need for autonomy and independence, creative tendency, moderate and calculated risk taking, drive and determination.

## 2.4. Definitions of Technology Entrepreneurial Firms (TBEFs)

Ajagbe (2014), describes TBEFs as those ventures in which the sales revenue is generated through the implementation of about 51 percent or more of technology based operations, for example, the internet, electronics, mechanical, automobile, clean energy, bio-medical, communications, telephone, fax companies and so on. The main trust of these ventures depends heavily on the use of high technology.

TBEFs have a high standard of business internalization (Mason and Brown, 2011) and are more likely to engage in global markets than other non-high growth small and medium sized firms (BIS 2010).

TBEFs have been suggested to have above-average levels of productivity growth (Mason *et al.*, 2009), strong levels of innovation (Coad, 2009; Mason *et al.*, 2009), and strong levels of export-orientation (Parsley and Halabisky, 2008). The classic expressions of TBEFs are that of young entrepreneurial companies, inventive designs which have been nurtured into high growth technology organizations. The most successful of these young technology firms of the last ten or more years are the popular and talked about giants of today. These are Microsoft, Netscape, Facebook, Amazon.com, Jumia, Konga, and Alibaba to mention a few. Nelson *et al.* (2009) on the one hand, identifies high growth firms as those young firms that have the potential to produce spectacular results, facilitate development of leading edge technology and, perhaps, move on to initial public offering (IPO) in order to take their place in “the fortune 500” of tomorrow. On the other hand, Smith (2010) groups high-technology entrepreneurial firms on the definition of the National Science Foundation (NSF) as technology generating and technology employing firms. He emphasizes on the profound nature of the economic and social impact of these category of firms (NSF, 2009). Whilst Fuller (2010), carried out an empirical observation of 400 ethnic Chinese firms and categorized TBEFs based on this group of firms into technology-intensive start-ups. That is, those that aims to create tangible or intangible products requiring a significant amount of technology knowledge or skills. The firms were reported to depend on their technical skills to differentiate their products in order to ensure firm survival and success.

### **2.5. Problems in Funding Technology Based Entrepreneurial Firms**

Most TBEFs during their early growth phase are said to be faced with funding problems (Murray, 2007; Ismail *et al.*, 2011a). These problems are believed to be mainly as a result of the cyclical nature of both product sales, and R&D expenditure associated with their type of products. Further evidence shows that the fast growth nature and subsequent diminishing of sales over time from an initial new product indicate that the returns on investment (ROI) from these firms may not be sustainable (Mason, 2010; Mason and Brown, 2011; Mason and Pierrakis, 2011). The nature of returns from TBEFs’ products and the manner of scrutiny they go through coupled with the credibility of lenders limit their ability to pay back their debt. Banks are therefore typically cautious or at times reluctant to lend to these firms especially to the ones in the early growth phase. Mason and Harrison (2008) and Moore (1994) identify the reluctance of traditional lending institutions to invest in these firms as a reflection of the problems of distinguishing between good and bad technology businesses, and also, the lack of expertise of banks in this sector of the economy, coupled with the limited collateral that entrepreneurial managers have.

### **2.6. Financing Sources for Technology Based Entrepreneurial Firms**

Ajagbe and Ismail (2014) however, posit that different financing possibilities are available to technology based entrepreneurial firms. These can be family funding, loan from friends, overdrafts or personal loan from banks. This is popularly known as financial bootstrapping. Financial bootstrapping involves adopting strategies that reduce cash requirement by securing resources at little or no cost. Managers may for example rely on their personal relationships to secure free access to certain resources. They may also adopt a strategy to secure resources without making use of commercial bank funding or external equity funding. They may obtain capital through subsidy financing or personal sources of finance (Helleboogh *et al.*, 2010; Ismail *et al.*, 2011b). For other projects with high growth potentials, a TBEF owner can access funds from private investors known as venture capitalist (VCs) and or business angels (BA). Lam (2010) in his research on financial bootstrapping discussed that despite unequivocal evidence, more than 90% of new ventures are financed through informal means, and more than 60% of the start-up capital is financed by business founders. He found that vast majority of research emphasize on the supply of formal sources of finance, mainly in the area of equity as corroborated by McNally (1995) and in debt financing as studied by Fabowale *et al.* (1995). These two common avenues used to finance technology based entrepreneurial firms are discussed further in the next section.

#### **2.6.1. Debt Financing**

Hisrich *et al.* (2008) identify debt financing as a financing method that involves an interest-bearing instrument, usually a loan, the repayment of which is only indirectly related to the sales and profits of the entrepreneurial firm. In most cases, debt financing requires that some asset of the borrower be used as collateral security. Ismail *et al.* (2011a) suggest that debt funds have a lower capital cost to the company than company shares and they increase the financial risk attached to the shareholders investment. This is because shareholders' investment ranks last for payment in the event of liquidation, hence, are at greater risk. They added that, there are different sources of debt financing, for example, debentures and unsecured notes. These funds can be sourced from the public, and requires the preparation of a prospectus. Ajagbe *et al.* (2012a) found that other sources of debt financing such as term credit and bank overdrafts are short-term in nature and require the company to approach individual lending institutions to obtain the funds.

### 2.6.2. Equity Financing

Ismail *et al.* (2011b) identifies that in for example, Malaysia, raising capital through company share issues is a significant source of finance for potentially strong technology entrepreneurial firms. Most firms are incorporated with authorized share capital stated in the memorandum of understanding (MOU). The value of authorized capital is the maximum that can be offered to individuals or firms to raise funds for the company. Hisrich *et al.* (2008) argues that equity financing is an alternative method of financing growth in firms without the use of collateral security and it offers the investor some form of ownership position in the TBEF. In this type of financing, the investor shares in the profits of the TBEF, as well as in any disposition of assets on a pro-rata basis based on the percentage of ownership of the venture. The suitability of a particular funding source is however dependent on the availability of adequate funds, the assets of the venture, and the prevailing interest rates at the time (Bathelt *et al.*, 2010; Boehm and Hogan, 2012; Janssen and Moors, 2013). Majority of technology entrepreneurs are found to adopt a combination of debt and equity sources of financing. Figure 3 below shows the different types of financing sources available to technology based entrepreneurial firms in different parts of the world.

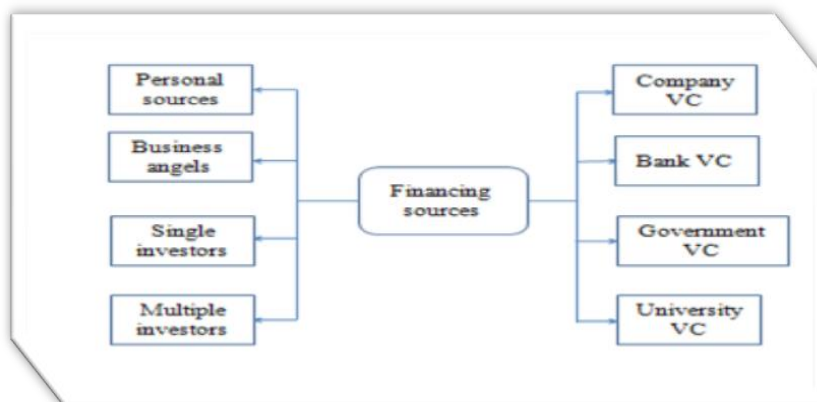


Figure 3. Technology Business Financing Sources

### 2.7. Venture Capital and Private Equity

Venture Capitalists are specialized mediators that direct capital to firms and professional services to companies that might otherwise be excluded from the corporate debt market and other sources of private finance (Mason and Brown, 2011; Mason and Pierrakis, 2011; EVCA 2011). On the evaluation of Venture Capitals (VC) in Japan, Kirihata (2008) refers to venture capitalists as individuals directly involved in the VC investment process from scouting and screening activities to post-investment and exit, and excluding employees of the Venture Capital Firms who are engaged in general duties that are unrelated to investment process, for example, general personnel affairs. Venture Capital financing is used to invest mainly in technology small firms with good growth and exit potentials (Groh *et al.*, 2010; Wonglimpiyarat, 2011), while private equity finance is used for the change of ownership in established businesses, often supported by debt capital. Ahlstrom *et al.* (2007) views VC as early stages of equity investments including

later stage mezzanine, turnaround and buyout investments typically associated with private equity investments in the West. Cumming & Dai (2010) posits that VC operates across countries and time zones, providing capital and skills to entrepreneurial firms competing in global markets. This is especially true in the early stages of the firm when technology transcends geographic boundaries (Groh *et al.*, 2010; Ajagbe *et al.*, 2015).

Typically, VC concentrates on industries with a great deal of uncertainty, where information asymmetry (gaps) among entrepreneurs and investors are commonplace. These ventures are identified as financially constrained. The Technology Ventures rely on VC as one of their main sources of funding. Recent empirical research found that the effects of VC on the success of these ventures are considerable. The value of venture capital investment is borne out by figures which show that VC backed firms grow on average twice as fast as those not backed by VC (EVCA, 2011). This category of equity investors focuses on particular regions, or single countries when searching for corporations that deserve financial backing. This means that one of the main criteria for selecting potential investments is the proximity to source of funding to facilitate the transaction processes of monitoring and oversight (Wonglimpiyarat, 2011; Groh *et al.*, 2010). Venture Capital is equity financing available to select new TEFs and growth businesses that demonstrate the ability to produce extraordinary returns for investors within a 5-7 year time frame (Nelson *et al.*, 2009). Classic Venture Capitals invest pools of funds in portfolio of industries on behalf of limited partners. Majority of Venture Capitals manage more than one portfolio simultaneously, and they are typically small firms with flat partnership style organizations; investment decisions are made jointly by the partners and the firms tend to specialize by industry and or by stage of development, with a concentration in science and technology innovation.

Investors in venture capital funds are known as Limited Partners. These are either wealthy individuals or institutions with available capital. Similar types of investors are “Business Angels”, who are affluent individuals that provide capital for business start-ups (Olsson *et al.*, 2010). Venture Capital (VC) investors study general factors related to their potential investments, such as market size and growth, competitive advantage, entry barriers, patents, legal issues and contractual restrictions and also evaluate the management teams of the firms they wish to invest in. De Carvalho *et al.* (2012) in their study of private equity (PE) and its evolution in Brazil in the last five years, found that the participation of investors in the investment process, absence of leveraged buyouts, shared control and use of special rights to compensate for the absence of a controlling stake were very important. They found an increase in the use of PE investments and VCs, and of the efficiency of managers in the selection process. The use of special rights to compensate for the lack of control in the portfolio companies such as veto power, the use of arbitration panels for the resolution of conflicts, and the participation of limited partners in the investment process were also found to be important. These PE investors seek investments that have a potential for high return on investment. The investors must see potentials for realistic exit options so that profit from the investment can be realized either via initial offerings or acquisitions. These are the most common or preferable exit options to VCs (Olsson *et al.*, 2010).

Different Venture Capitalists specialize in different areas and types of investments. Certain VCs establish themselves as leaders in their respective niches, for example, Kleiner Perkins, by developing expertise in linking up its portfolio companies with more established companies in the industry (Kenny and Patton, 2011). The VCs are known to achieve high rates of returns by gaining access to proprietary deal flow and providing value added services to their portfolio companies. From a Limited Partner’s perspective, Venture Capitals are expensive because the venture capital partners receive not only hefty management fees, (typically 2% of funds committed) but also a profit share (called carry) of 20%. The unique expertise and value added contribution however, of the general partners are responsible for this expensive arrangement (Hellmann and Puri, 2002; Kenny and Patton, 2011). The current nature of public intervention to encourage the growth of the informal VC market beginning from the early 1990s in the UK and in the late 1990s, in other parts of Western Europe were identified by Mason (2009), whilst in Eastern Europe such interventions are found to still be in their infancy. Mason (2010) and Cumming and Dai (2010) identified six forms of interventions that have evolved overtime; with new approaches supplementing, rather than replacing earlier approaches; fiscal incentives for investors; Business Angel Networks (BANs) to enable investors and entrepreneurs find one another earlier. Changes to Securities Legislation to remove constraints on the advertisement of investment opportunities; capacity building initiatives to raise the

competence of investors to make investments and to improve investment readiness of businesses seeking finance; and co-investment schemes that leverage public money with angel money. Mason (2009) also found that the informal VC market has been a focus of public sector intervention to improve access to finance for the young TBEFs for less than two decades in Europe, and in most other countries for less than a decade. The form of intervention has evolved from a supply-side approach using tax incentives targeted at high net worth individuals, through an intermediation approach aimed at improving the availability of information using capacity building and only currently, back to supply-side approach with the use of government funding to leverage private investment (Mason, 2010).

### 2.7.1. Venture Capital in Asia

Zhang *et al.* (2011) investigated and found that in Asia there are more Venture Capital investments in the early stage firms than found in Europe where it is more predominant in the later stages of a firm's life. Europe although, boasts of more investments in medical and biotechnology firms than found in Asia, there are now more tremendous efforts in Asia towards this end too (Wonglimpiyarat, 2011; Ismail *et al.*, 2011b). Studies on health biotech innovation in China recognize the fact that the Venture Capital industry in Asia is less developed than in North America and Europe. Consequently, TBEFs in the region especially in the biotechnology sector depend more on funds from outside Asia than within Asia (Ajagbe, 2014; Zhang *et al.*, 2011). Hence, 37% of new capital in Asia comes from outside investors, whilst in Europe the figure is 29% and in the Americas less than 10% (White *et al.*, 2005; Wonglimpiyarat, 2011). In this view, public policy makers are advised to evolve an ambitious intervention policy in developing the biotechnology sector. In addition, they should enhance the venture capital contribution to innovation and clearly demarcate the role of government in the management of uncertainties.

Even though, Japan has been the focal point of Venture Capital (VC) activity in Asia for most of the last three decades (Kiriata, 2008; Hasegawa, 2004; Ajagbe and Ismail, 2014), China has suddenly been observed to have received increased attention in recent years. This is likely because it has developed majority of the needed components required for a vibrant VC industry, including robust economic growth, a growing commitment to IP rights, and a strong entrepreneurial culture (Ahlstrom *et al.*, 2007; Zhang *et al.*, 2011). China, not only drives much of the economic development in the home country, but also in many other Asian countries such as Taiwan, Indonesia, Singapore, Hong Kong, Malaysia and South Korea. Zutshi *et al.* (1999) reports in their study of VCs in Singapore the tremendous growth of the industry during the last decades of the last century. They argued that the steps taken by the Singaporean government in encouraging VC development by making selective VC investments through the Economic Development Board (EDB) in 1991 was highly commendable. The aim of setting up the agencies was in promoting high-tech ventures in Singapore. The South Korean government also created the Korean Development and Investment Corporation (KDIC) and Korean Technology Finance Corporation (KTFC) to invest in cutting edge technology firms. Similarly, the government of Taiwan and India created venture funds, primarily, to invest in technology ventures. In Japan, Hasegawa (2004) and Kiriata (2010) found that Venture Capital Firms were established by banks, securities companies, trading companies, and large industrial groups to pursue high-tech start-ups (Ray and Turpin, 1993).

In Malaysia, the Government noted that the best way to move the country out of the "middle income" trap is to pursue economic policies that will succeed in the knowledge industries of the future, encourage technological innovation to grow and build more technology based entrepreneurial firms, supporting these firms to grow to a global scale, thereby attracting foreign direct investment (FDI) and inform of VC from within and abroad (Najib, 2010). Government Transformation Programme (GTP) and Economic Transformation Plan (ETP) that are built into the National Key Economic Areas (NKEAs) will be instrumental to achieving such dreams. This is with a view to deliver the New Economic Model (NEM), and makes government achieve its aspiration of becoming the manufacturing and financial hub of South East Asia. This could be achieved through the 7th-11th Malaysia Plan which is aimed towards developing a Knowledge Based Economy. It will also help to attract Foreign Direct Investment (FDI) of about 92 percent in the years ahead. In order words, both the traditional or conventional lending institutions and equity financial market are expected to play significant roles (Gomez, 2009).

### 2.7.2. Categories of Venture Capital Firms

*Independent Venture Capital:* Muala *et al.* (2005) recognizes the unique form of risk capital provided by VCFs to young high potential businesses has been viewed as crucial in supporting a vibrant modern 'information economy'. Further consideration of the scale of sophistication of the America's VC industry was also accepted as one of the strong point for America's exceptional ability to turn innovative ideas from institutions of higher learning and research organizations into world-class firms. Examples are; Sun Microsystems, Oracle, Amazon.com, Microsoft, Cisco Systems, Genentech, Federal Express, Intel Corporation and Yahoo to mention a few (European Commission, 1998; Mason and Pierrakis, 2011). These new firms are mostly established by technically skilled entrepreneurs with little managerial expertise. Such companies can only reach their maximum potential when assisted by VCFs who are able to provide active coaching support cum financing (Hellmann and Puri, 2002; Kim, 2012). Classic VCs specializing in the earliest stages of investment (seed, start-up and early growth finance) are commonly mandated to deal with talented but inexperienced entrepreneurial teams. The VCs ability to impart needed knowledge and experience in addition to capital may be instrumental in the portfolio firm's subsequent success or even survival.

*Government Supported Venture Capital:* A modest amount of Government Venture Capital (GVC) finance was reported by Ajagbe and Ismail (2014) to improve the performance of entrepreneurial firms relative to ventures supported purely by Private Venture Capitalists (PVCs). They emphasize that high levels of support from GVCs are usually associated with weaker performance. In their empirical study they find that at low levels of GVC finance, success is increasing in the GVC share (Ajagbe, 2014). At high levels of GVC support, additional government support reduces success. Thus, a little bit of government support appears to be a good thing but too much government support has an opposite effect. Full GVCs are fully owned and operated by governments. Partial GVCs receive investment from governments but also receive private investment and are independently managed. Indirect GVCs are not based on investment by government but receive subsidies and/or preferential tax treatment.

*Bank Supported Venture Capital:* The banks in China were very active and played prominent role during the development of new ventures in the early years (White *et al.*, 2005). Whereas in Japan the background of VCFs were set up as affiliates of financial institutions such as insurance companies, securities companies and commercial banks (Kiriata, 2008; 2010). They were the primary source of financing to high tech start-ups. They, rather than the government bureaus directly, provided the majority of the investment in spin-off projects under the Torch Program. Gu (1999) estimates that initially banks contribution stood at only 10% of investment in 1988 when the program began but steadily rose to 50% by 1990 and 70% by 1991. The banks themselves did not have the capabilities or access to critical information to assess risk at the initial start-up stage. Instead, they relied on a project's designation as a recipient of Torch Program support as policy guidance. The majority of banks financing, however, was available only at the expansion and later stages of a venture's development (Kiriata, 2008; 2010), with local governments acting as guarantors.

*University Supported Venture Capital:* White *et al.* (2005) and Kiriata (2008) identifies that during the developmental phase of VC in China in the 1980's, research institutions and universities played the most important role at the start-up stage, providing both the original technology and seed capital for TEFs. Kiriata (2008) posits that substantial numbers of VC funds for university spin-offs which are critical sources of financing for nascent technologies, was set up by Hokkaido University's "Hokudai Ambitious Fund" established in 1997 and until today has shown a continuous increase (Kiriata, 2010). It was emphasized that majority of the technologies financed during that era emanated from the universities and research institutions. White *et al.* (2005) highlight that universities in China utilized their new authorities to allocate resources and provide financial support to university spin-off companies. Ajagbe and Ismail (2014) reports that though Malaysian Universities have not been generally seen to set up VCFs with the sole aim of taking up equity and occupying board positions directly with technology start-up firms. The authors concluded that they play significant roles very similar to that of equity financiers. Ajagbe (2014) argues that in Malaysia, some Universities have established what they call Innovation and Commercialization Centre (ICC) in other climes referred to as University Technology Transfer Office (UTTO). Such Universities award financial support in form of research grant schemes to academics (students, lecturers and staffs) to pursue research that would lead to major innovation capable to be patented and commercialized as spin-off



companies or through licensing to large companies. This they do in collaboration with Malaysia Technology Development Corporation with the aim to spin out university ventures.

*Business Angels:* The venture capital market consist more than just the institutional VC industry, however, there is an informal venture capital market, an invincible market place comprising wealthy personalities referred to as “Business Angels” who provide risk capital directly to new and growing businesses in which they have no family connections (Mason, 2010; Cumming and Dai, 2010). There has been an astonishing swing away from investing in early staged firms in support of sectors in growth mode which have bigger capital requirements (Mason, 2010; Mason and Harrison, 2010). This exposed the need for BA to have become an important source of new capital for new and young technology based firms. The most fascinating thing to note about this class of investors is that; their market is considerably larger than the institutional VC market; they fill the so-called equity gap by making investment exactly in those areas in which institutional VC providers are very reluctant to invest. Hence, and most significantly they finance TEFs in terms of more dollars and number of ventures the fund especially in the USA (Wetzel and Freear, 1996). Several researchers reported that business angels are also regarded as individual investors (Wong *et al.*, 2009; Wiltbank *et al.*, 2009). They can also be regarded as informal investors.

### **2.8. Roles of VCFs on TBEFs**

Venture Capitalists help technology entrepreneurial firms by emphasizing on value creation. Ajagbe & Ismail (2014) argues that value creation is realized through a concerted effort that leads to accelerated growth of innovative product and services either with technology or greater market penetration ability. Ajagbe (2014) added that VCs also share their wealth of expertise & knowledge and provide advice on vital issues in order to advance the firm’s performance. They are able to harness the inherent strengths of TBEFs because VCs are people who are determined to empower entrepreneurs to create new wealth. The next section discusses the two most important roles VCs play in helping to nurture technology entrepreneurial firms apart from financing support.

*Resource Based Theory:* Following from the resource based theory, Muala *et al.* (2005) and Barney (1991) argues that physical, social and knowledge resources of particular investor categories influence the nature and worth of the value-added that VCs are able to provide to investee firms. Defining the term ‘resource’ in the concept of the “resource based-view”, Barney (1991) refers to resource as ‘all assets, capabilities, organizational processes, firm attributes, information, knowledge controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness’. Prior research on the value-added of both independent VCs (Macmillan *et al.*, 1989) and corporate venture capitalists (CVCs) (Muala, 2001; Muala *et al.*, 2005) indicate that the majority of the value-added of independent and CVCs is linked to their membership of valuable networks (social capital) or their ownership of private and not easily imitable knowledge and experience (knowledge-based view). But, for the value-added provided by investors on the basis of their knowledge resources (Eisenhardt and Santos, 2001; Elenurm, 2012; Kenny and Patton, 2011). The knowledge-based literature considers knowledge as the strategically most significant asset of the firm. Proponents of the knowledge-based view have argued that heterogeneous knowledge bases, such as; knowledge of markets, knowledge on competition, knowledge of technology and knowledge of organizing which both contribute to and are sustained by unique capabilities among firms, are the main determinants of sustained competitive advantage and superior corporate performance.

*Value-Added Role:* Chemmanur (2010) declares that a very significant contribution of VCs that has been talked about by practitioners is the roles they play in helping TEFs create value in the product market. This is done by helping them develop high quality management teams, contacts and credibility with suppliers and customers, and in improving their deficiency overall. The perspective of the author is consistent with that of Chemmanur *et al.* (2010a) who also adds that significant evidence have been developed recently indicating that VCs indeed help to strengthen firm’s management teams, and to improve on their operating efficiency, as measured by their total factor productivity overall. Chemmanur *et al.* (2010b) opines that once an investment has been made, it is in the interests of the investors to do everything they can to ensure that their investee firms succeed in order to maximize their financial returns. Various forms of managerial activity on the part of the equity investor can help to add value to a firm. This

is particularly important in the case of TBEFs where the entrepreneur's technical competence rarely matched with business skills (Murray, 2007).

### 3. Conclusions

This research finds that the main roles VCFs play in helping to nurture technology based entrepreneurial firms (TBEFs) are: to source additional capital, they bring to the board of TBEFs a wide range of industry experience and boost the image of the company, they help to build track records, to develop a credible financial capability, help improve profit generation, sometimes they help in commercialization support, they help to recruit qualified manpower, provide mentorship and training to team members, introduce TBEFs to existing contacts and source technology from overseas. The outcome of this study it is believed, will contribute immensely to existing body of literature on venture capital financing. This research is one of the few studies that have reviewed the relationship of the characteristics of the elements in the conceptual framework and how they impact on funding of technology based entrepreneurial firms. In explaining the importance of social and human environment as elements that attract international venture capital investment, the study finds that in order to foster a growing risk capital industry, research culture plays an important role, especially in universities or national laboratories. Policy makers in Nigeria could build substantial amount of skilled and experienced venture capitalists to identify high potential investments opportunities and be able to nurture and support them to an exit. Furthermore, majority of Chief Executive Officers (CEOs) of startups in developing nations have been found to be non-university graduates and do not hold MBAs, hence they may lack the requisite management capabilities and skills required to propel the TBEFs to success. Another issue is that the money raised by VCs may be poorly managed due to lack of experience of personnel, this may result in poor quality investment decisions and provide inadequate support for their portfolio companies and more so, some countries cannot also boast of a talent pool of professional VC experts. The major problems facing TBEFs therefore are their inability to secure adequate financing because of lack of collateral, inadequate VC professionals and inexperience in choosing good equipment and transfer of technology; these have hindered the growth of the industry in many countries. The Nigerian government can help TBEFs in the country by developing a policy framework for the equity investment sector particularly for those aimed at financing in the technology sector.

### References

1. Ajagbe, A.M., Isiyawwe, T.D. and Ogbari, M.I.E. (2015). Financing Early Staged Technology Based Firms in Malaysia. *Research Journal of Finance and Accounting*, 6(4), 210-221.
2. Ajagbe, A.M. and Ismail, K. (2014). Factors Influencing Venture Capital Assessment of High Growth Companies in Malaysia. *International Journal of Entrepreneurship and Small Business*, 21(4): 457-494.
3. Ajagbe, A.M. (2014). Funding Criteria in Technology Based Firms in Malaysia. An Unpublished PhD Thesis Submitted to the Graduate School, Universiti Teknologi Malaysia.
4. Ahlstrom, D., Bruton, G.D. and Yeh, K.S. (2007). "Venture Capital in China: Past, Present and Future." *Asia Pacific Journal of Management* 24: 247-268.
5. Ajagbe, A.M., Ismail, K., Aslan, A.S. and Choi, S.L. (2012a). "Investment in Technology Based Small and Medium Sized Firms in Malaysia: Roles for Commercial Banks." *International Journal of Research in Management and Technology* 2(2): 147-153.
6. Ajagbe, A.M., Ismail, K., Aslan, A.S., Thwala, D.W. and Choi, S.L. (2012b). "Technology Based Firms Financing: An Operational Model for Malaysia" *South East Asia Journal of Contemporary Business, Economics and Law* 1: 108-114.
7. Barney, J.B. (1991). "Firms Resources and Sustained Competitive Advantage." *Journal of Management* 17(1): 99-120.
8. Barreto, I. (2010). "Dynamic capabilities: A review of past research and an agenda for the future." *Journal of Management* 36: 256-280.
9. Bathelt, H., Kogler, D.F. and Munro, A.K. (2010). "A knowledge-based typology of university spin-offs in the context of regional economic development." *Technovation*, 30(9-10): 519-532.

10. BIS (2010). "Internalisation of Innovative and High Growth SMEs. London: Department for Business, Innovation and Skills." *Bicore economics and statistics paper*: 39.
11. Bloch, C. (2007). "Assessing Recent Developments in Innovation Measurement." *The Third Edition of the Oslo Manual* Science and Public Policy 34: 23-34.
12. Boehm, D.N. and Hogan, T. (2012). "Science-to-Business collaborations: A science to-business marketing perspective on scientific knowledge commercialization." *Industrial Marketing Management* 67: 34-45.
13. Buenstorf, G. and Geissler, M. (2012). "Not invented here: technology licensing, knowledge transfer and innovation based on public research." *Journal of Evolutionary Economics* 22: 481-511.
14. Bulsara, H.P., Gandhi, S. and Porey, P.D. (2010). "Commercialization of Technology Innovations and Patents; Issues and Challenges." *Journal of Technology Monitor* 47(6): 12-18.
15. Chemmanur, T.J. (2010). "Venture Capital, Private Equity, IPOs, and Banking: An Introduction and Agenda for Future Research." *Journal of Economics and Business* 62(7): 471-476.
16. Chemmanur, T.J., Krishnan, K. and Nandy, D. (2010a). "How Does Venture Capital Financing Improve Efficiency in Private Firms? A Look beneath the Surface." Working Paper, Boston College, New York University, and Northeastern University.: 87.
17. Chemmanur, T.J., Simonyan, K. and Tehranian, H. (2010b). "Management Quality and Initial Public Offerings: The Role of Venture Capital " Working Paper. Boston College: 140.
18. Coad, A. (2009). "The Growth of Firms: A Survey of Theories and Empirical Evidence." Cheltenham: Edward Elgar 15: 79.
19. European Commission (1998). "Risk Capital Action Plan" The Commission of the European Communities, Brussels.
20. Cumming, D. and Dai, N. (2010). "Local Bias in Venture Capital Investments." *Journal of Empirical Finance* 17(2): 362-380.
21. DeCarvalho, A.G., Gallucci, N.H. and Sampaio, J.O. (2012). "Private Equity and Venture Capital in Brazil: an Analysis of its Recent Evolution." Abstracts Collections available at SSRN:<http://ssrn.com/abstract=1996729>: 237.
22. Dollinger, M. (2003). "Entrepreneurship; Strategies and Resources" 3rd. ed. Prentice hall: 45.
23. [24] Dorf, R. C. and Byers, H. T. (2008). "Technology Ventures; From Ideas to Enterprise." 2nd ed., McGraw Hill: 176.
24. Eisenhardt, K.M. and Santos, M.F. (2001). "Knowledge Based View; a New Theory of Strategy?" *Handbook of Strategy and Management*, Thousand Oaks; Sage Publications: 3-30.
25. Elenurm, T. (2012). "Entrepreneurial orientations of business students and Entrepreneurs." *Baltic Journal of Management*, Emerald Group Publishing Limited. 7(2): 217-231.
26. EVCA (2011). "European Private Equity and Venture Capital Association." 2011 Year Book. Bruges: 128.
27. Fabowale, L., Orser, B. and Riding, A. (1995). "Gender, Structural Factors, and Credit Terms between Canadian Small Business and Financial Institutions." *Entrepreneurship Theory and Practice* 19(4): 41-65.
28. Ferrary, M. and Granovetter, M. (2009). "The Role of Venture Capital Firms in Silicon Valley's Complex Innovation Network." *Economy and Society* 38(2): 326-359.
29. Fuller, D.B. (2010). "How Law, Politics and Transnational Networks Affect Technology Entrepreneurship: Explaining Divergent Venture Capital Investing Strategies in China." *Asia Pacific Journal of Management* 27: 445-459.
30. García-Villaverde, P.M. (2012). "Entrepreneurial orientation and the threat of imitation: The influence of upstream and downstream capabilities." *European Management Journal* 34(3): 234-244.
31. Gomez, E.T. (2009). "The Rise and Fall of Capital: Corporate Malaysia in Historical Perspective." *Journal of Contemporary Asia* 39(3): 345-381.
32. Groh, A.P., Liechtenstein, H. and Lieser, K. (2010). "The European Venture Capital and Private Equity Country Attractiveness Indices." *Journal of Corporate Finance* 16: 205-224.
33. Gu, S. (1999). "China's Industrial Technology: Market Reform and Organizational Change." Routledge, London.

34. Hackett, S.M. and Dilts, M.D. (2004). "A Systematic Review of Business Incubation Research." *Journal of Technology Transfer* 29: 55-82.
35. Hasegawa, H. (2004). "Bencha Kyapitaru Bencha Kigyo no Baryueshon (Venture Capitalist's Valuation of Ventures)." *Business Insight*: 8-25.
36. Helleboogh, D., Laveren, E. and Lybaert, N. (2010). "Financial Bootstrapping Use in New Family Ventures and the Impact on Ventures Growth-in: Long Term Perspectives on Family Business: Theory, Practice, Policy." 10th Annual IFERA World Family Business Research Conference, Lancaster, UK. (6-9 July 2010): 112-113.
37. Hellmann, T. and Puri, M. (2002). "Venture Capital and Professionalization of Start Up Firms; Empirical Evidence." *Journal of Finance* 57: 169-197.
38. Hisrich, R.D., Peters, M.P. and Shepherd, D.A. (2008). "Entrepreneurship (7th ed)." McGraw Hill International Asia 7edition: Chapter 1-3, 7-21.
39. Ismail, K., Aslan, A.S. and Ajagbe, A.M. (2011a). "An Investment Framework to Help Equity Financiers Select Tech SMEs in Malaysia." *Interdisciplinary Journal of Contemporary Research in Business* 3(5): 966-983.
40. Ismail, K., Aslan, A.S. and Ajagbe, A.M. (2011b). "A Conceptualized Approach towards Building a Growth Model for Venture Capitalists Finance of TBFs." *International Journal of Innovation, Management and Technology* 2(4): 315-320.
41. Janssen, M. and Moors, E.H.M. (2013). "Caring for healthcare entrepreneurs — Towards successful entrepreneurial strategies for sustainable." *Technological Forecasting & Social Change* 23(4): 231-239.
42. Kenney, M. and Patton, D. (2011). "Does inventor ownership encourage university research-derived entrepreneurship? A six university comparison" *Research Policy* 40: 1100-1112.
43. Khin, S., Ahmad, N.H. and Ramayah, T. (2010). "Product Innovation among ICT Technopreneurs in Malaysia." *Journal of Business Venturing* 11(6): 397-406.
44. Kim, J. (2012). "Study of the Performance and Characteristics of U.S. Academic Research Institution Technology Commercialization (ARITC)." Portland State University.
45. Kirihata, T. (2008). "Venture Capitalist's Investment Decision Making in The New Technology Based Firms (NTBFs) in Japan." Kurenai, Kyoto University Research Information Repository. Working Paper 93: 2-11.
46. Kirihata, T. (2010). "The Formation Process and Characteristics of the Japanese Venture Capital Industry." KURENAI: Kyoto University Research Information Repository. Working Paper 113: 2-13.
47. Kortum, S. and J. Lerner (2000). "Assessing the Contribution of Venture Capital to Innovation." *Rand Journal of Economics* 31(4): 674-692.
48. Lam, W. (2010). "Funding Gap, What is Funding Gap? Financial Bootstrapping; Supply, Demand and Creation of Entrepreneurial Finance." *International Journal of Entrepreneurial Behaviour and Research* 16(4): 268-295.
49. Lendner, C. (2007). "University Technology Transfer through University Business Incubators and how they help Start-Ups." in Therin, F. (Ed.), *Handbook of Research on Techno-Entrepreneurship*, Edward Elgar, Cheltenham, UK: 163-169.
50. Lin, C., Jiang, J.L., Wu, Y.J. and Chang, C.C. (2011). "Assessment of Commercialization Strategy using R&D Capability." *Industrial Management & Data Systems* 111(3): 341-369.
51. MacMillan, I.C., Kulow, D.M. and Khoylian, L. (1989). "Venture Capitalists Involvement in their Investments; Extent and Performance." *Journal of Business Venturing* 4: 27-47.
52. Mason, C. (2010). "Entrepreneurial Finance in a Regional Economy, Venture Capital." *An Internationaal Journal of Entrepreneurial Finance* 12(3): 167-172.
53. Mason, C. and R. Brown (2010). "High Growth Firms in Scotland." Final Report for Scottish Enterprise. Glasgow.
54. Mason, C. and R. Brown (2011). "Creating Good Public Policy to Support High-Growth Firms." *Small Business Economics* 15(3): 114-121.
55. Mason, C. and Y. Pierrakis (2011). "Venture Capital, the Regions and Public Policy: The United Kingdom since the Post-2000 Technology Crash." *Regional Studies*: 1-16.

56. Mason, C.M. (2009). "Public Policy Support for the Informal Venture Capital Market in Europe: A Critical Review." *International Small Business Journal* 27(5): 536-556.
57. Mason, C.M. and R.T. Harrison (2008). "Measuring Business Angel Investment Activity in the United Kingdom: A Review of Potential Data Sources." *Venture Capital* 10(4): 309-330.
58. Mason, C.M. and R.T. Harrison (2010). "Annual Reports on the Business Angel Market in the United Kingdom 2008/2009. Department for Business, Innovation and Skills (BIS), London." Department for Business, Innovation and Skills (BIS), London.
59. Massa, S. and S. Testa (2008). "Innovation and SMEs: Misaligned Perspectives and Goals Among Entrepreneurs, Academics and Policy Makers" *Technovation* 28(7): 393-407.
60. Maula, M., Autio, E. and Murray, G. (2005). "Corporate Venture Capitalists and Independent Venture Capitalists: What do they know, who do they know and Should Entrepreneurs Care?" *Venture Capital Journal* 7(1): 3-21.
61. Maula, M.V.J. (2001). "Corporate Venture Capital and the Value-Added for Technology-Based New Firms" Doctoral Dissertation, Helsinki University of Technology, Institute of Strategy and International Business.
62. McNally, K. (1995). "Corporate Venture Capital: Financing of Technology Businesses." *International Journal of Entrepreneurship Behaviour and Research* 1(3): 9-43.
63. Moore, B. (1994). "Financial Constraints to the Growth and Development of Small High Technology Firms; in Hughes, A. and Storey, D. J. (eds)." *Finance and the Small Firm*, Routledge, London, 112-144.
64. Mosti (2012). "Industrial Technology Development: A National Plan of Action." Kuala Lumpur, Malaysia; Ministry of Science, Technology and Innovation.
65. Murray, G.C. (2007). "Venture Capital and Government Policy, in Landstrom (eds). *Handbook of Research on Venture Capital*." Cheltenham; Edward Elgar: 113-151.
66. Najib, R. (2010). "Invest in Malaysia 2010 "The Prime Minister of Malaysia, Inaugural Speech, Kuala Lumpur(20th June).
67. Nelson, T., Maxfield, S. and Kolb, D. (2009). "Women Entrepreneurs and Venture Capital: Managing the Shadow Negotiation." *International Journal of Gender and Entrepreneurship* 1(1): 57-76.
68. Nicholas, S.P. and N.E. Armstrong (2003). "Engineering Entrepreneurship: Does Entrepreneurship Have a Role in Engineering Education" *IEEE Antennas and Propagation Magazine* 45(1): 23-27.
69. NSF (2009). "Survey of Research and Development Expenditures at Universities and Colleges." National Science Foundation (14 February).
70. Olsson, N.O.E., Frydenberg, S., Jakobsen, E.W. and Jessen, S.A. (2010). "In Search of Project Substance: How Do Private Investors Evaluate Projects?" *International Journal of Managing Projects in Business* 3(2): 257-274.
71. Price, R.W. (2004). "Roadmap to Entrepreneurial Success; Powerful Strategies for Building a High-Profit Business" (1st. ed), AMACOM.
72. Ray, D.M. and D.V. Turpin (1993). "Venture Capital in Japan." *International Journal of Small Business* 11(4): 39-56.
73. Smith, S.W. (2010). "Beg, Borrow, And Deal? Entrepreneurship and Financing in New Firm Innovation." Federal Reserve Bank of Cleveland-Kauffman Foundation Conference on Entrepreneurial Finance (12-14th March): 1-34.
74. Somsuk, N., Wonglimpiyarat, J. and Laosirihongthong, T. (2012). "Technology Business Incubators and Industrial Development: Resource-Based View." *Industrial Management and Data Systems* 112(2): 23-32.
75. Thiruchelvam, K., Chandran, V.G.R., Kwee, N.B., Yaun, W.C. and Sam, C.K. (2010). "Towards Effective Policies for Innovation Financing in Asia-Financing Innovation, the Experience of Malaysia." Working Paper Report Submitted to the IDRC Project.
76. Wetzel, W.E. and J. Freear (1996). "Promoting Informal Venture Capital in the United States; Reflections on the History of the Venture Capital Network, in Harrison, R. T. and Mason, C. M. (eds). *Informal Venture Capital; Evaluating the Impact of Business Introduction Services*." Woodhead-Faulkner, Hemel Hempstead: 61-74.

77. White, S., Gao, J. and Zhang, W. (2005). "Financing New Ventures in China: System Antecedents and Institutionalization." *Research Policy* 34: 894-913.
78. Wiltbank, R., Read, S., Dew, N. and Sarasvathy, S.D. (2009). "Prediction and Control under Uncertainty; Outcomes in Angel Investing." *Journal of Business Venturing* 24: 116-133.
79. Wong, A., Bhatia, M. and Freeman, Z. (2009). "Angel Finance; the other Venture Capital" *Strategic Change*, 18: 221-230.
80. Wonglimpiyarat, J. (2011). "Government Programmes in Financing Innovations: Comparative Innovation System Cases of Malaysia and Thailand." *Technology and Society*, 33: 156-164.
81. Zhang, Y., Yang, J., Au, K. and Reynolds, P.D. (2011). "Anatomy of Business Creation in China: Initial Assessment of the Chinese Panel Study of Entrepreneurial Dynamics. New Business Creation" *International Studies in Entrepreneurship*, 27: 95-121.
82. Zutshi, R.K., Tan, W.L., Allampalli, D. G. and Gibbons, P. G. (1999). "Singapore Venture Capitalists (VCs) Investment Evaluation Criteria; a Re-Examination." *Small Business Economics*, 13: 9-26.