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Informal Construction Practices as Knowledge Incubators: A Conceptual Framework

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Abstract

Informal learning in construction projects offers opportunities for learning in a manner that could be likened to conventional incubation. However, whether the two concepts are similar or closely related in terms of their intended/unintended outcome is not well investigated. A guided literature review based on 20 pre-specified incubation issues has revealed that conventional incubators and informal learning-by-doing practices in construction projects in developing countries are likely to be similar on three issues; "rationale for their existence", "their employment prospect" and their respective characteristics of "graduates and graduation qualifications". As learning mechanism the two, differ substantially in the remaining 17 issues specifically on those relating to support services that accompany learning. Conventional incubators provide services and functions that facilitate the growth of firms and entrepreneurs while actors involved explicitly understands the learning objectives while informal learning-by-doing practices do not require the double-coincidence of learning intentions between the mentor and the mentee. Furthermore, unlike conventional incubators which are physical or virtue spaces, informal learning-by-doing, utilises physical spaces (informal construction sites) only as tools in the knowledge transfer process and skilled craftsmen, social networks and knowledge development are integrated as incubators. It is

therefore, imperative for governments in developing countries to nurture informal construction practices so as to incubate innovative skills thus creating an incubator-like environment within the informal setting.

Keywords: Construction, Knowledge transfer, Incubators, Informal learning, Tanzania

1. Introduction

There is no direct and acceptable definition of the term "incubator" across professions where it is being used. As an English terminology, "incubator" refers to an instrument or machines that provide a certain artificial environment for the growth and development of something immature towards maturity i.e. an environment favourable for hatching or developing enterprises (Branstad, 2010; Winger, 2000). To incubate a fledgling company or individual therefore, implies prescribing and controlling the conditions favourable to the development of a successful new organization or well knowledgeable individual capable of addressing challenges in a particular field (Karapetyan & Otieno, 2011; Winger, 2000). In terms of knowledge, the term incubator is used in reference to two main perspectives. Technologically, incubator covers physical or virtue spaces upon which newly discovered technology is nurtured before being transferred to industries for commercial application and in terms of entrepreneurship, the term business incubator is generally used in relation to nurturing entrepreneurial skills whether in physical or virtue spaces or otherwise. Business incubators therefore, describe a wide range of ubiquitous and heterogeneous institutions that operate in different contexts and with diverse objectives (Scillitoe & Chakrabarti, 2010; Bergek & Norrman, 2008; Schwartz, 2013).

This paper provides fits the characteristic of conventional incubators into informal construction practices in terms of "informal construction knowledge incubators" (ICKI) a phenomenon presumably prevalent in developing countries. The rationale for this analysis is grounded on inability of many developing countries to finance through public resources, formal training in construction craft skills (Muya, Price, & Edum-Fotwe, 2006; Roy & Koehn, 2006), thus the evaluation and recognition of informal learning practice could offer a leeway out of this hurdle. Although the two concepts are different, recent studies have shifted away from focusing on conventional incubators towards recognition of entrepreneurs as incubators. This shift is compatible with the conception of ICKI where the incubator is actually the skilled craftsmen and artisans who undertake construction work in both formal and informal construction projects. Under ICKI conceptualisation, the physical spaces are tools in the knowledge transfer process while skilled craftsmen, social networks and knowledge development are an integral component of the incubation process. It is therefore argued that, learning through informal construction practices has some of the basic attributes of a "conventional incubator" but lacks support services which are fundamental for their recognition as incubators.

2. The Nature of Conventional Incubators

In a conventional understanding of the term, incubation is a pro-active support programmes whether virtue or physical initiated for the purpose of fast-tracking the growth of start-ups

business or technology and/or conduct public-private projects (Millier Dickinson Blais, 2012). In the case of start-up business, the term "business incubators" is often used to describe an entity composed of start-up projects that give forth new ventures by providing physical resources and support (Allen & McCluskey, 1990; Branstad, 2010). An important aspect of the definition of "business incubators" is the view that the incubators take care of new/small entrepreneurs through "business assistance services" (Majbritt Chambers and Knud Erik Serup Vejle, 2011). The term business incubator is also linked to a set of other terminologies which include terminologies such as "business acceleration" which encompasses proactive support programs delivered from a physical or virtual space (or both) designed to fast-track growth and development of existing small firms with significant market potential, often in a specific economic sector and "business generation" which refers to a series of proactive support programs delivered from either a physical or virtual space designed to kick-start both businesses and joint public-private projects as part of a larger effort to grow a specific economic sector or anchor the development of an economic cluster (Millier Dickinson Blais, 2012). These incubation programmes are often organized in the form of "incubator organizations" which describes a company into which an entrepreneur gains professional knowledge prior to becoming self-standing entrepreneur (Jøgenson, 2014).

Figure 1 shows a simple conceptualization of conventional incubators based on (Rothschild & Darr, 2005). A more improved schematic presentation of incubators can be found in Wonglimpiyarat, (2016). In either case the centrality of the learning platform (physical or virtue) in conventional perspectives is evident. The conventional view is that the link between incubators, universities and research institutions and the industry is what necessitate technology and business incubation.

2.1 Classification of Conventional Incubators

When one looks into their physical space requirements, incubators could be physical or virtual or a combination of the two (Durão, Sarmento, Varela, & Maltez, 2005; Majbritt Chambers and Knud Erik Serup Vejle, 2011). Virtual incubators extend incubation services to those outside the physical incubator through electronic networks (European Court of Auditors, 2014). Physical incubators have however, been observed to be more successful than virtual incubators (Millier Dickinson Blais, 2012). This strength of physical incubators lies on their spatial proximity to universities and research institutions (Cormier, 2003; Rubin & Stead, 2011; Vyakarnam & Myint, 2011). Traditionally, knowledge was created in universities and then incubated before being transferred to industries (Rothschild & Darr, 2005; Bröchner & Lagerqvist, 2016). Proximity therefore, facilitates the flow of tacit knowledge from the university or research institute into the incubator firms (Vyakarnam & Myint, 2011). Figure 2 summarises the different ways of classifying conventional incubators across the globe. Because incubators' taxonomy is diverse, one can find it difficult to generalize the incubators phenomenon across industry or even countries (Rubin & Stead, 2011).

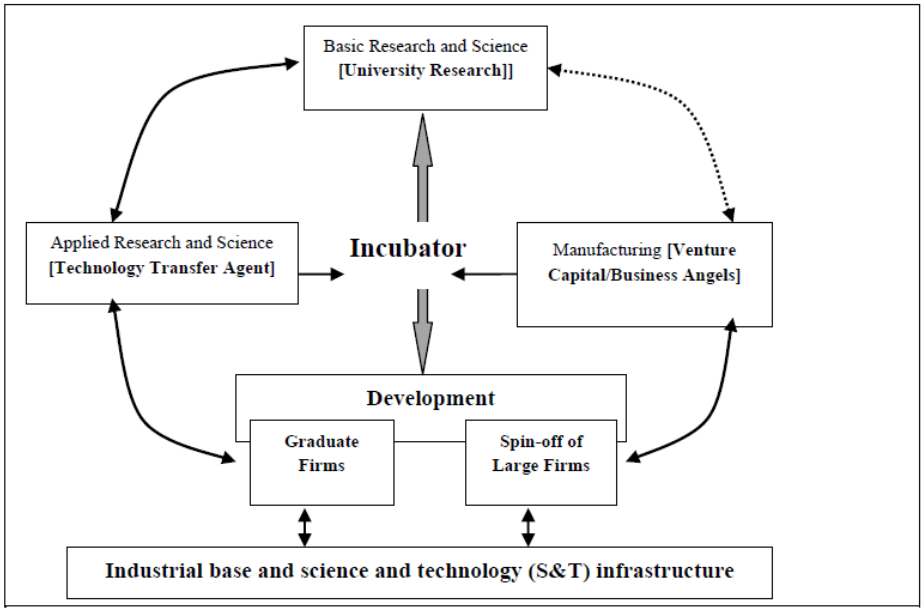

Figure 1. A conceptualization of conventional incubators as modified from Rothschild &Darr, (2005) and Wonglimpiyarat, (2016)

2.2 The Purpose and Function of Conventional Incubators

In Belgium and Spain, the incubators' objective was initially to attract branches of multinational firms, in Germany the incubators were targeted to establish innovative start-ups and in France and the Netherlands the university incubators model were promoted to commercialize research knowledge (Aernoudt, 2004). In the case of innovation market failure, the main purpose of incubators is to take innovation risks especially on behalf of society (Vyakarnam & Myint, 2011). Business incubators also provide entrepreneurs with a range of business resources and services (Rubin & Stead, 2011).The following subsections provide a summary of the literature on the main functions of conventional incubators.

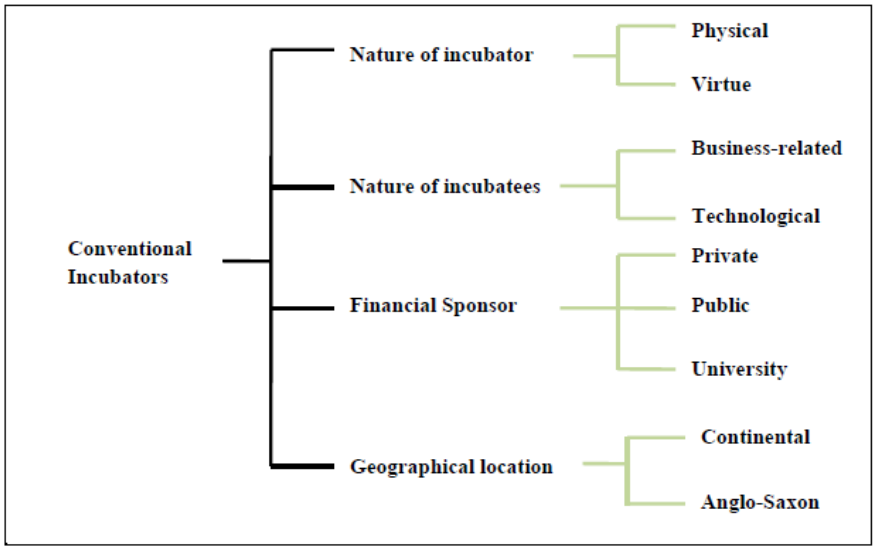

Figure 2: Classification of conventional incubators

2.2.1 Employment and Wealth Creation

Publicly sponsored incubators are intended for creating jobs by creating employers, contributing to the community or using unoccupied buildings (Jøgenson, 2014, p. 8).Privately sponsored incubators, generate profits while University-related incubators assist in the commercialization of science and technology produced by university research (Campbell & Temali, 1984; Jøgenson, 2014). There are also some indirect benefits accruing through conventional incubation mechanism such as job and wealth creation (Millier Dickinson Blais, 2012). Apart from hiring trainers, incubators do cut down labour costs, by utilising the inexpensive work force in the form of graduate and undergraduate students (Winger, 2000).

2.2.2 Provision of Physical Infrastructure

As its traditional function, incubators provide space for incubatee tenants at affordable prices (Vyakarnam & Myint, 2011; Roseira, Ramos, Maia, & Henneberg, 2014; Cormier, 2003; Smilor & Gill, 1986; Jøgenson, 2014; Benjamins, 2009; Winger, 2000).Other physical resources offered in line with space include shared computing facilities, technological facilities (e.g. laboratories), amongst others (Karapetyan & Otieno, 2011; European Court of Auditors, 2014; Carayannis & Von Zedtwitz, 2005; Bøllingtoft & Ulhoi, 2005; Hansen, Chesbrough, Nohria, & Sull, 2000; Soetanto & Jack, 2013; Roseira, Ramos, Maia, & Henneberg, 2014; Winger, 2000).

2.2.3 Provision of Networking Services

In additional to space, incubators also offer a geographical focal point for networking, collegiate nearness and specific area coverage (Majbritt Chambers and Knud Erik Serup Vejle, 2011) and access to entrepreneurial network (Jøgenson, 2014; European Court of Auditors, 2014; Carayannis & Von Zedtwitz, 2005). Networking, provide to new incubatee tenants, special contacts such as of bankers, venture capitalists, technologists, and government officials or universities" (Allen D. R., 1985; Smilor R. , 1987; Udell, 1990; Roseira, Ramos, Maia, & Henneberg, 2014; Winger, 2000). In addition, networking gives legitimacy of new entrants to external partners (such as leading universities) that can be used and leveraged by the start-up incubate tenants to enhance their visibility, credibility and legitimacy (Bergek & Norrman, 2008; Roseira, Ramos, Maia, & Henneberg, 2014; Grimaldi & Grandi, 2005; Salvador, 2011; Smilor & Gill, 1986; Bøllingtoft & Ulhoi, 2005; Salvador, 2011).

2.2.4 Provision of Administrative and Support Services

Incubators do provide administrative and support services that foster entrepreneurial growth and survival of newly established firms (Jøgenson, 2014; Bergek & Norrman, 2008; Vyakarnam & Myint, 2011). Such administrative and support services include reception, clerical services, meeting rooms, conference rooms, car parking (McAdam & McAdam, 2008) or energy, water, telecommunications, accounting services, technical editing help, computer equipment, and cleaning (Roseira, Ramos, Maia, & Henneberg, 2014; Bruneel, Ratinho, Clarysse, & Groen, 2012; Winger, 2000). Incubators have also been on the forefront in providing financial resources and individually tailored business support services (European Court of Auditors, 2014; Benjamins, 2009; Carayannis & Von Zedtwitz, 2005; Schwartz

&Hornych, 2010; Sofouli & Vonortas, 2007; Winger, 2000).Some organizations consider themselves as business incubation centres simply because they offer counselling or pooled purchasing for newly established companies/entrepreneurs despite offering no physical office space (Jøgenson, 2014; Roseira, Ramos, Maia, & Henneberg, 2014).

2.2.5 Incubators Graduates and Graduation Qualifications

Empirical studies have established that incubation time is significantly but negatively related to business knowledge acquisition (Benjamins, 2009). This suggests that the business knowledge acquisition of an incubatee is negatively influenced by the time it spends in the incubator. Furthermore, it has been noted that Incubated firms continue to be involved in the affairs of the incubator even after graduation because of its shares and networks in the firm, thus the alumni still benefit from the incubator's financial networks for its further development beyond incubation duration (Rubin & Stead, 2011).

3. Research Approach

This paper is based on literature probing based on a set of questions that were defined during the same process. The probes were intrinsically developed within the literature search and review process and as such they are an integral component of both the methodology and results parts of this paper. This section is therefore, mainly devoted to explaining the various probes which were developed and utilised in the process and the sources of the materials reviewed.

3.1 Literature Search and Review Strategy

The literature search strategy involved at least two stages; first some key concepts and terminologies which are commonly used in the technology and business incubation literature such as knowledge incubators/incubation, business incubators/incubation, informal learning/construction and technological incubators/incubation were utilised in searching in the Google search platform. Several filtering strategies were applied including quotation marks and specification of document types i.e. if pdf documents are desired then ".pdf" is included in the search string. If the results yielded published research papers, these were followed up by extending the search to listed references on those papers in the second stage. Similarly, a further search was conducted in Scopus indexed journals using the basic concepts in this paper. The result of the search strategy was 144 literatures. The classification of the reviewed materials over time is summarised in Figure 3. The results in Figure 3 suggest that publication trend in relation to incubators and knowledge transfer in construction is relatively a new phenomenon. A larger proportion of the reviewed materials are dated 2006 or later with a peak in 2012. Literatures written earlier than 1999 are relatively scanty although the search strategy did not limit the publication date of the materials needed.

The classification of the papers by regions as well as by publication sources is summarised in Figure 4. Panel (a) of Figure 4 indicates that 18.75% of the reviewed materials were retrieved from scientific conference proceeding and 11.81% are unpublished materials (mostly periodicals and institutional research paper series). The largest share of reviewed materials was however retrieved from scientific journals as follows; Construction and engineering

journals 13.19%; Multidisciplinary and management journals 9.72% in each case; Psychology journals 7.64% and economics journals 5.56%. Panel (b) indicates that most of the reviewed materials originates from Africa (34.08%) followed by cross-country studies (24.31). These cross-country studies are mainly those making cross-country comparison or explaining generic knowledge transfer in the construction industry of a particular region such as developing countries. For the phenomenon at hand the lowest number of materials were obtain in South America and the Oceania region making the conclusion of this paper more focused in developing country of Africa region rather than those of Latin America or Asia.

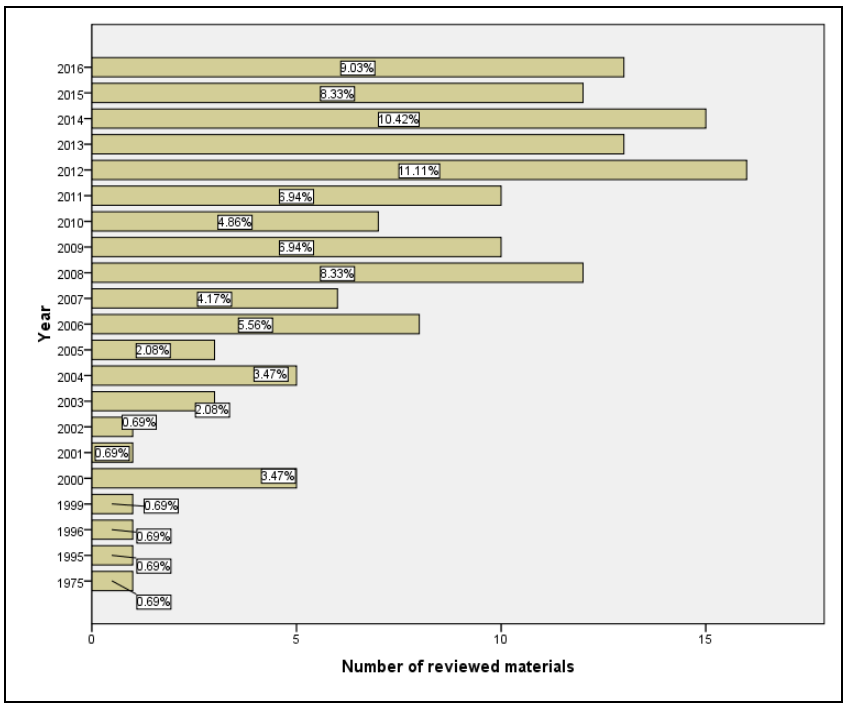

Figure 3. Reviewed materials by date of publication

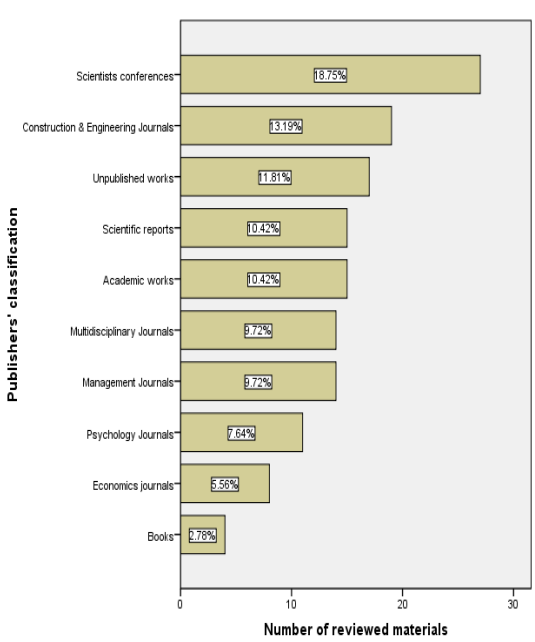

Figure 4. (a) Number of reviewed materials by publication sources

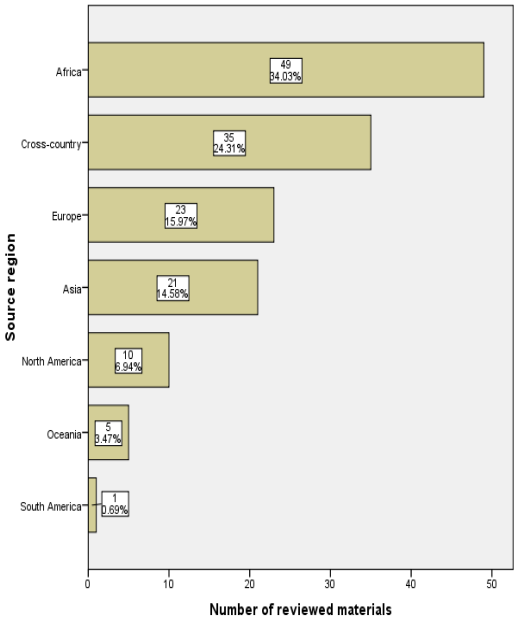

Figure 4. (b) Number of reviewed materials by source region

3.2 Comparison Criteria

Following a comprehensive literature review six comparison criteria were developed as summarised in Table 1. Depending on the number of issues identified in each criteria, a set of questions were designed to allow further probing of the literature for a more comprehensive understanding of differences and similarities of the two learning platforms.

Table 1.Probe questions and potential responses in both conventional incubators and learning in informal construction

Code	Comparison criteria	Comparison items	
		Conventional incubation	**Incubation under learning in informal construction**
1	**The nature of conventional incubators**	**Where does learning take place?**	
		Permanent physical or virtue spaces	Temporary physical spaces (project)
		What organisational framework supports learning?	
		Formally recognised technology parks, universities or research centres	Formal and informal construction projects/sites
		What is the expected learning duration?	
		Contractual short and long term	Informal and temporary terms
		What is the nature of learning?	
		incubation is a pro-active support programmes	Informal learning is not necessarily pro-active, it may be incidental
		Why incubators/learning exist?	

Code	Comparison criteria	Comparison items	
		Conventional incubation	**Incubation under learning in informal construction**
		Established to fast-track the growth of start-ups business or technology and Income and employment creation	Exists to nurture skill competency among informal workers, Income and employment creation and enhance social relations
		What is the nature of support services	
		Intended "business assistance services"	Intended and unintended informal assistance
		How is the incubation process linked to macro-economic policies?	
		Cater for a specific economic sector or anchor the development of an economic cluster	Widespread/diversified but may differ across sectors
		What is the achieved level of knowledge upon graduation?	
		An entrepreneur gains professional knowledge prior to becoming self-standing entrepreneurs	Individuals gain skills before becoming skilled craftsmen
2	**Incubation Stages**	**What steps are utilised in knowledge transfer within incubators?**	
		Innovation assessment; business plan preparation, training, monitoring and assistance and infusion of resources	Skill acquisition is haphazard rather than systematic
3	**Physical infrastructure**	**Who is the provider of physical facilities that facilitate learning?**	
		Sponsor or incubator	Incubatee, client or mentor
		Who provide the working spaces that facilitate learning?	
		Sponsor or incubator	Incubatee, client or mentor
		Who pay for utilities that facilitate learning?	
		Sponsor/government	Incubatee, client or mentor
4	**Network infrastructure**	**How social capital is utilised?**	
		The incubators brand name can be used by the incubatees to market themselves and certification/licensing through the incubator facilitate incubatees operations	Reputation of the skilled craftsman matters or master craftsman's name can be used as an indicator of Incubatees quality
		What role do social network play?	
		Financial support, professional advice, free advice, entry support and management support	Financial, free advice, moral support and entry support
		What prospects for R & D exists within an incubator?	
		Conduct research and disseminate results; develop research proposals and experimentation	Experimentation through learning by doing
		What special assistance is offered during incubation?	

Code	Comparison criteria	Comparison items	
		Conventional incubation	**Incubation under learning in informal construction**
		Business, technology, service and counselling	Informal counselling
5	**Employment and wealth creation**	**What employment prospect exists for incubator graduates?**	
		Self-employed skilled i.e. trainers; Self-employed semi- & unskilled; employed skilled and Employed semi- & unskilled; graduates and university students	Self-employed skilled i.e. trainers; Self-employed semi- & unskilled; and Employed semi- & unskilled workers
		What are the sources of incubator's funds	
		Government; University or research institutions and Formal private sector.	Individual incubatee; Family & Friends and Society or local community
6	**Incubators graduates and graduation qualifications**	**How long an incubatee should stay in the incubator?**	
		Residency in the incubator is always not predetermined and graduation subject to comprehensive assessment	Incubation duration not predetermined but graduation is natural
		How are graduates differentiated from active incubators?	
		Physically detached from the incubator; have a different name and maintain contacts with the incubator	Physically detached from the incubator; work independently; have a different name and maintain contacts with the incubator
NB: The underlined items indicate potential mismatch between conventional and ICKI learning modalities			

The number of comparison items were identified and coded as "1" if associated with practices in either conventional or learning in informal construction projects and "0" if not. A "1" in both cases suggests that the practices are "similar" and in any other case a value of "0" suggests that they are "different". The entry of whether certain practices are similar or not was interpretative based on literal interpretation of issues observed in the literature on the specific question being addressed. Based on these entries a "similarity index" for each probe/question was computed based in items summarised on Table 1 as follows:

$$\text{Item Similarity Index (ISI)} = \frac{\text{Percentage of similar items}}{\text{Percentage of dissimilar items}} = \frac{\text{NS}}{\text{ND}} \quad (1)$$

Then an overall similarity index for each of the six criteria was then computed as:

$$\text{Similarity Index (SI)} = \sum_{1=1}^{P} \frac{\text{NS}_i}{\text{ND}_i} \quad (2)$$

Where 'p' stands for the number of questions in each comparison criteria and i represents an item or a question of interest. The simple interpretation of the SI is that, it measures how

large the probability of being similar is from the probability of being different for a particular criterion. In other words it is a measure of the likelihood that conventional incubation and informal learning practices in construction sites are likely to be similar rather than being different when compare along a particular criteria 'i'. The natural log transformation works to transform the computed index into a presentable indicator that takes values as: below zero (0) suggesting limited likelihood for similarity; above zero suggesting higher similarity likelihood or zero for equality in the likelihood of being similar or the likelihood of being different (neither different nor similar).

3.3 Limitations of the Study

Despite a thorough literature review carried out in this study, the conclusion is neither generic nor unbeatable. Given the limited access to international publications for which the authors' University has subscribed to, a number of highly relevant and up-to date references along the lines of this paper might have been skipped and a s a result some conclusion reached in this paper may not be generalisable across the developing world. The adoption of all the recommendation put forth in this paper would require re-working through the steps of this paper with a full access to more repositories of published works. The results however pave ways for testing the developed conceptual framework within Sub Saharan Africa (SSA).

4. Findings and Discussion

This section describes informal construction practices as knowledge incubators where human beings as skilled craftsmen take the roles of incubators to nurture semiskilled and unskilled labourers into maturity and independence.

4.1 The Nature of Informal Construction Practices in Developing Countries

Informality refers to "shadow" economic activity or activities not measured and registered in official market statistics or labour market (Heartz, 2012). Informality is sometimes associated with illegal activities such as those of tax aversion or violation of labour standards and laws (Heartz, 2012; Sivam, 2002). De Soto (1989) describes an informal economy as "untapped reservoir" in the economy held back by regulations. Informality exists at low levels of organisations where division of labour and capital hardly exists and labour relations are based on casual employment, kinship or personal and social relations rather than contractual arrangements with formal guarantees (Naik, 2009). Since the 1980s, informal construction activities in developing countries have attracted a global attention (Wells. , 1998; Wells & Wall, 2001). In the context of construction activities in developing countries informality comprises activities which have some or all of the characteristics of informal sector under international laws such as unregistered, unprotected and unregulated (Naik, 2009; Roy & Koehn, 2006). Although there are no contractual relationship under informal construction practices, those within it both mentor and mentee perceive that permanent, temporary and casual contracts do exist (Odediran & Babalola, 2013). The World Bank (1984) associates informal construction with low-income countries having severe housing shortage where by informal construction takes a form of self-help program to construct low cost housing (Mitullah & Wachira, 2003; Mlinga & Lema, 2000; Nguluma, 2003).

4.1.1 Informal Learning as Incubation: The ICKI Model

To achieve the objectives of informal projects semi-skilled and unskilled personnel are hired and as a result of their interaction, off-springs of skilled craftsmen, emerge and continue to grow under the same practices (Kvarnström, 2014). Over time, the once informal unskilled workers become skilled craftsmen ready to undertake work on their own and hire other unskilled workers for subsequent mentorship (Wachira, Root, Bowen, & Olima, 2008). The informal construction craftsmen therefore, emerge from informal construction practices where knowledge is mainly acquired though learning-by-doing or by long terms observation and practicing in what may be considered as informal "mentorship" or "apprenticeship" (Mitullah & Wachira, 2003; Ogbeifun, 2011; Owusuaa, 2012). This learning modality is theoretically within learning-through-practice paradigms though the platform is "informal" a terminology that wipes away many of the potentials of such a learning approach (Billett S. , 2013). The construction sites as workplaces may be legally informal but since learning in such platforms is an outcome of well organised activities intended to achieve a certain objectives, such platform can be considered neither ad hoc, unstructured nor informal (Billett , 2004). The only problem with construction sites as workplaces is that they are temporary hence cannot be supplied with permanent infrastructure that facilitate learning as it is with conventional incubators.

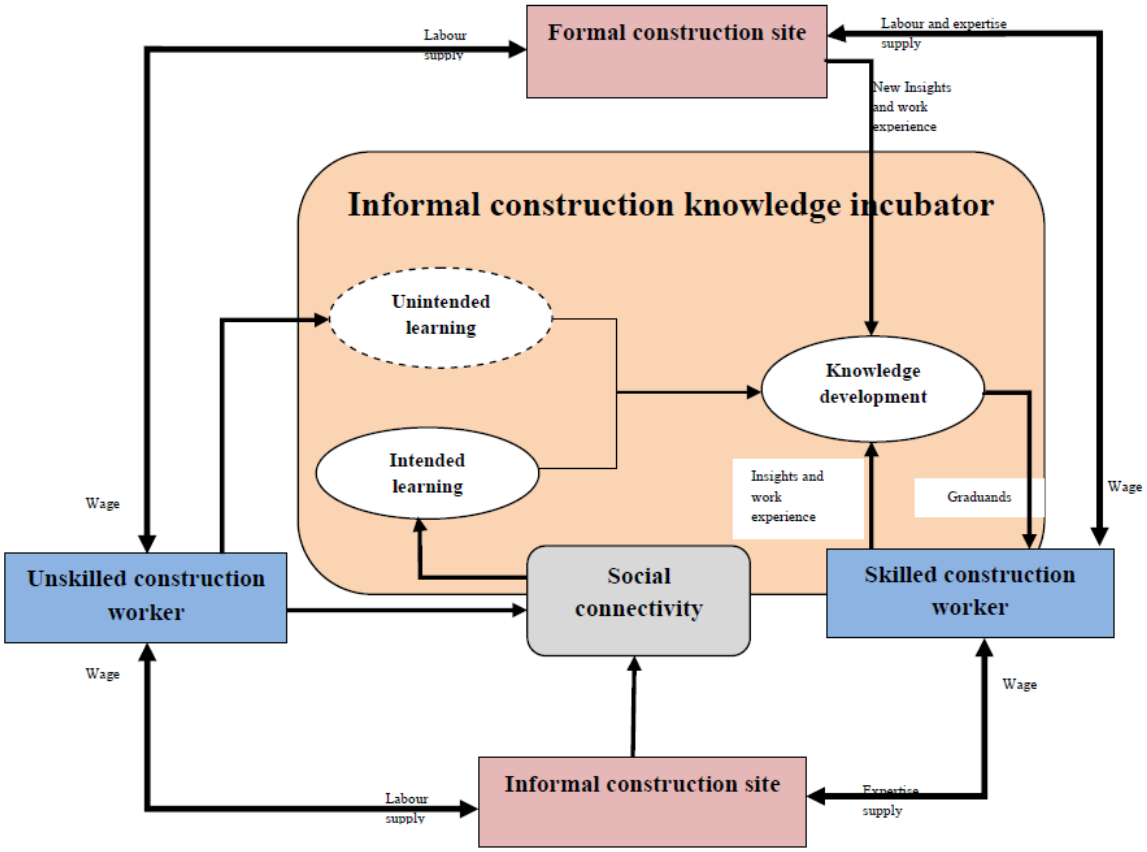

Figure 5. A conceptual model of informal construction knowledge incubators (ICKI)

The Informal Construction Knowledge Incubation (ICKI) model is depicted in Figure 5

where it is envisaged that skilled and unskilled construction workers interact in both formal and informal projects. Basically this informal "incubation process" represents the relationship between people whereas the learning platform/construction sites provides an external assistance (tool) which under conventional incubation is the incubator itself. These learning platforms lack two aspects of a conventional physical incubator (i) They are temporary in nature hence can neither facilitate repetitive learning of new unskilled workers nor can they be furnished with learning facilities or services (ii) they also exist for a purpose completely different from learning craft skills and in most cases is used for learning without the knowledge of the "legal" owner (client) or even the skilled craftsman. The formal representation of ICKI model of "informal learning as incubators" therefore, suggests that incubation can exist unintentionally i.e. learning intentions are only required from one party i.e. the mentee while in the conventional incubator learning "intentions" are mandatory on both sides i.e. the incubator and the incubatee. Under ICKI the skilled craftsman is the real incubator while the unskilled worker working within his social or physical proximity and having interest in knowledge acquisitions are the incubatee. This is because his networks of subcontractors, clients and suppliers of construction equipment can repetitively be utilised across generation of new entrants. The term "incubator" when used along these lines is no longer an adjective to refer to "incubator firms" rather a noun as proclaimed by Vyakarnam & Myint, (2011).

Informal construction activities are a good vehicle for knowledge transfer (Teerajetgul & Charoenngan, 2006; Kvarnström, 2014; Nguluma, 2003; Mlinga & Wells, 2002). A study by Dubickisa & Gaile-Sarkanea, (2015) established that innovation as an outcome includes technology transfer as a tool. The nature of a project and project team which normally comprise of people with diverse background and experience provide a good knowledge "incubation" environment (Devaport & Prusak, 1998). Incubatees can identify knowledge and skills used in one project, informally "classify" out of the bulk information, the most relevant skills to be used in the next project (Owusuaa, 2012). The resulting new ideas can be developed directly within informal learning through adaptation and innovations or/and enriched by formal practices to generate new knowledge (Makalle, Mesaki, & Victor, 2011). The new insights and experience from the formal sector can be developed through informal knowledge transfer and sharing to generate new knowledge (Wachira, Root, Bowen, & Olima, 2008). Nguluma (2003) and Mlinga & Wells (2002) insisted that informal craftsmen acquire skills through experience while working as helpers of their masters and through observation and learning by doing. The unskilled craftsmen have access to newly developed knowledge through both intended and unintended learning where partly social connectivity plays a role. Knowledge development in informal context refers mainly to either tacit knowledge transfer or sharing or more explicitly "knowledge drains" which are the key parameters in knowledge generation. Of interest to note in Figure 3 is that not all social networks and skilled workers are elements in the incubator since being an incubator is solely determined by the skilled craftsman's willingness to do so.

4.1.2 Classification of Informal Construction Knowledge Incubators

The pool of labour from which the construction sector in developing country depends has

largely remained informal unskilled and semiskilled labourers (Lukiyanto, Setiawan, Troena, & Noermijati, 2015). Similarly, formal contractors increasingly use informally trained craftsmen in many of their projects (Mlinga & Wells, 2002; Odediran & Babalola, 2013), something which suggests that informal knowledge transfer mechanisms potentially breeds "acceptable quality" craftsmen, though findings on this issue are not conclusive (Windapo, 2016; Fagbenle & Oluwunmi, 2010). Figure 6 provide a simplified classification of informal knowledge incubators based on the ICKI model. The classification is not from any empirical observation as ICKI is still conceptual rather from an aggregation of characteristics pertinent in informal construction sites.

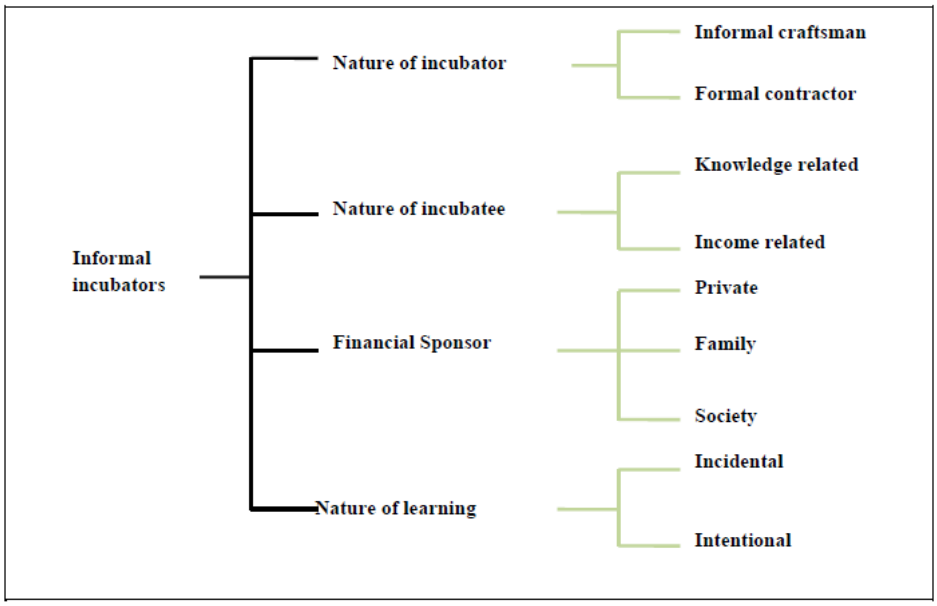

Figure 6. Classification of informal construction knowledge incubators

Generally, the way conventional incubator is defined in the literature does not however, seems to be compatible with informal construction learning practices. The summary of literature on definitional issues is presented in Table 3, criteria number 1 where the two concepts are regarded as different. The only definitional item that seems to suggest some similarities between the two is the rationale for their existence as shown in Table 2, item number 1. That is it is incontestable that both informal learning under ICKI and conventional incubators nurture people whether organised in firms or as individual entrepreneurs.

Table 2. Similarity index between conventional and incubation under ICKI model

Code	Probe questions	Similar items	Different items	Total	% Similar	% different	Similarity Index	Decision
1	Why incubators exist?	2.00	1.00	3.00	0.67	0.33	0.69	**More likely to be similar**
5	What employment prospect exists?	3.00	1.00	4.00	0.75	0.25	1.10	
6	How are graduates differentiated from active incubators?	3.00	1.00	4.00	0.75	0.25	1.10	
1	What is the nature of learning?	1.00	1.00	2.00	0.50	0.50	0.00	**Equally likely to be different/similar**
1	How is the incubation process linked to macro-economic policies?	1.00	1.00	2.00	0.50	0.50	0.00	
1	What is the achieved level of knowledge upon graduation	1.00	1.00	2.00	0.50	0.50	0.00	
1	What organisational framework supports learning?	1.00	3.00	4.00	0.25	0.75	-1.10	**More likely to be different**
1	Where does learning take place?	1.00	2.00	3.00	0.33	0.67	-0.69	
1	What is the expected learning duration?	1.00	2.00	3.00	0.33	0.67	-0.69	
1	What is the nature of support services	1.00	2.00	3.00	0.33	0.67	-0.69	
2	What steps are utilised in knowledge transfer?	2.00	4.00	6.00	0.33	0.67	-0.69	
3	Who is the provider of physical facilities that facilitate learning?	1.00	3.00	4.00	0.25	0.75	-1.10	
3	Who provide the working space that facilitates learning?	1.00	3.00	4.00	0.25	0.75	-1.10	
3	Who pay for utilities that facilitate learning?	1.00	3.00	4.00	0.25	0.75	-1.10	
4	What special assistance is offered during incubation?	1.00	3.00	4.00	0.25	0.75	-1.10	
4	How social capital is utilised?	1.00	2.00	3.00	0.33	0.67	-0.69	
4	What role do social network play?	2.00	4.00	6.00	0.33	0.67	-0.69	
4	What prospects for R & D exists within an incubator?	1.00	2.00	3.00	0.33	0.67	-0.69	
5	What are the sources of incubator's funds?	1.00	6.00	7.00	0.14	0.86	-1.79	
6	How long an incubatee should stay in the incubator?	1.00	2.00	3.00	0.33	0.67	-0.69	

4.2 The Purpose and Functions of Learning under ICKI Mechanisms

The following subsections provide a discussion on the differences between conventional incubators and in terms of performed functions.

4.2.1 Employment and Wealth Creation under ICKI Model

Many researchers agree that informal construction has no formal employment (Wells. , 2007; Mitullah & Wachira, 2003; Owusuaa, 2012; Lukiyanto, Setiawan, Troena, & Noermijati, 2015) and thus not protected by labour laws (Jason, 2008). In this regard informal workers provide for a pool of semi-skilled and unskilled labours to informal construction projects (Mitullah & Wachira, 2003; Rai & Sarkar, 2012). Informal construction enterprises play significant role in formal construction sector as well as material supply, labour and working as subcontractor (Wells , 1998; Odediran & Babalola, 2013). Based on thedata presented in Table 3, for criteria number 5 on the issue of wealth and employment creation, it is evident that the lowest level of dissimilarity is expected suggesting some prospects for employment and wealth creation to be similar under the two learning approaches.

In terms of sponsorship, conventional incubators are supported by either the private or government as they cannot exist in their own. The informal learning of the informal construction industry requires no formal sponsorship. The mentee must find his/her own means of survival by either working for a pay under his master or as part of the master's family (Rai & Sarkar, 2012). Based on the results presented in Table 2 for item number 5 on sources of incubation funds, the similarity index is higher on the negative side suggesting that 6 out of 7 assessed issues under this question are different. This dissimilarity effect is moderated by the effect of similarity in employment objectives represented under item 5 in Table 2 where, employment prospects under the two approaches are more likely to be similar. However since the impact of funding is substantially larger the end results is that employment and wealth creation when considered together under Table 3 criteria 5, turns out to be less likely to be similar under the two learning approaches.

4.2.2 Provision of Networking Infrastructure Services under ICKI

Just as the conventional serial entrepreneurs who might be well connected to sources of knowledge such as universities and research centres and financial intermediaries (Vyakarnam & Myint, 2011), the qualified informal craftsmen is well networked with information about the kind and quality of other craftsmen whose assistance may be required during project execution. These informal craftsmen are well connected to sources of knowledge and owners of technological equipment which they themselves do not own given the fact that most of them lack capital to purchase construction equipments (Wells & Wall, 2001; Makalle, Mesaki, & Victor, 2011; Aikaeli & Mkenda). Although subcontracting is rare under ICKI (Wells J. , 2006), there are indications that information about potential subcontractors may well be vested upon the mentor since personal searchers are most unlikely under ICKI (Odediran & Babalola, 2013). The services offered in the physical incubators could be likened to the moral and spiritual willingness of the skilled craftsmen to work with unskilled and semi skilled craftsmen though the unskilled craftsman may not necessarily be interested in acquiring knowledge. Assessment of the literature however, suggest that support services provided in incubators are more likely to be different as shown in Table 3 for the third criteria where it is negative suggesting that support services are less likely to be similar under the two learning approaches. These results emanate from the fact that provisional of support services in

conventional incubators is mandatory while under ICKI all that is required is learning intentions on the part of incubatee. There are no explicit provisions of any support services though any of the players including the client, mentor and mentee may facilitate the learning process.

Social networks tend to be stronger in conventional incubators than other forms of networking and have been observed to be the only level where networking could be considered of some relevance (Roseira, Ramos, Maia, & Henneberg, 2014). This observation suggest that most of what can be considered as learning in conventional incubators takes place informally because social networks are difficult to formalized and any attempt to formalize them must come at a cost of loss of either information or knowledge. Informal learning in conventional incubators can be likened to social networks determining engagement under ICKI. Under ICKI engagement is more likely for those connected to their previous employee, friends, relatives and other closely related operative (Odediran & Babalola, 2013). This argument suggests that the role of social network could be the same regardless of whether one considers learning under ICKI model or conventional incubators. The results obtained in this study however, suggest that social networking, criteria number 4 in Table 3, is more likely to be different under the two approaches. A closer examination of Table 2 for the sources of differences suggests that the main dissimilarity arises from lack of guaranteed assistance for learning in construction practices falling under ICKI. The literature suggest that the construction industry harbours a relatively younger workforce something which suggest inevitable social ties though direct evidence for that is limited (Odediran & Babalola, 2013; Mitullah & Wachira, 2003).

Table 3. Similarities between conventional and incubation under ICKI model across comparison criteria

Code	Comparison criterion	Similar items	Different items	Total	% Similar	% different	Similarity Index
1	**Defining incubators/informal construction learning**	9	13	22	0.41	0.59	**-0.37**
2	**Incubation/informal learning steps**	2	4	6	0.33	0.67	**-0.69**
3	**Provider of incubation/informal learning support services**	3	9	12	0.75	2.25	**-1.10**
4	**The role of social networking in incubation/informal learning**	5	11	16	1.25	2.75	**-0.79**
5	**Employment and wealth creation through incubation/informal learning**	4	7	11	0.89	1.11	**-0.22**
6	**Graduation and graduates of the incubation/informal learning**	4	3	7	1.08	0.92	**0.17**

4.2.3 Graduates and Graduation Qualifications under ICKI Model

Table 3 further suggests that in six comparison criteria that were probed, only in one criterion was there a greater likelihood for the two learning approaches to be similar. Learning under informal construction practices and learning under conventional incubators can be justified along similar lines in terms of "graduates and graduation" criterion since in both approaches graduation is not predetermined though incubation under ICKI, graduation is more natural. Since learning under ICKI is continuous, informality makes learning a lifelong process as artisans diversify their learning experiences for survival within the industry (Owusuaa, 2012; Wachira, Root, Bowen, & Olima, 2008). There could be some differences in terms of entry criteria since under ICKI there are no predetermined entry qualifications (Odediran & Babalola, 2013; Mitullah & Wachira, 2003), though under conventional incubators the fact that the knowledge being nurtured originates from universities and research centers may dictate predetermined entry qualifications. Similarly, in both cases graduates tend to maintain contact with their formal incubators or mentor in the case of ICKI model (Odediran & Babalola, 2013), though under ICKI the independence of the mentee seem to be more pronounced. Although graduates under conventional incubators are often firms, knowledge does not reside in firms rather in peoples' mind. Therefore, the knowledgeable person that emerges from conventional incubators can be likened to the informal learning mentee emerging under ICKI even if the later are not organized in institutional structures. A notable bias under ICKI is that entry and hence graduation is predominated by males the lowest education categories (Odediran & Babalola, 2013; Offei–Nyako, Osei–Tutu, Fugar, & Adinyira, 2014; Aikaeli & Mkenda; Owusuaa, 2012), something which is less obvious in conventional incubators.

4. Conclusion

Based on the results of this paper, the traditional view of an incubator or science park as "places" where incubation occurs does not reflect the entire context within which knowledge incubation takes place and may need revisiting (Vyakarnam & Myint, 2011). Defining incubators based on their physical or even functions are not particularly useful for understanding the learning process as it happens in different context (Benjamins, 2009; Campbell, Kendrik, & Samuelson, 1985; Smilor. , 1987), specifically the informal construction industry subsector in developing countries. A contemporary view propounded in this study suggests that knowledge incubators are no longer physical places. Knowledge resides in the mind of people and these people are not stationed at any one particular place, they are mobile and as such knowledge is also mobile. It is therefore appropriate to incorporate this knowledge mobility into the definition of incubators. As far as the existing literature considers informal learning on narrow perspective and as long as government support in informal construction is marginal, the conception of conventional incubators and informal learning are likely to diverge.

There are important observable differences between informal learning under the proposed ICKI model and the conventional incubators. First and most notably is the fact that informal incubators under ICKI require neither a permanent physical nor a permanent virtue space

rather a "spiritual space" in the heart of the skilled craftsman, to accept and allow his skills to spill-over to those within his proximity at the time of project execution; informal incubators are basically not formally organized and instituted and learning does not require double coincidence of learning intentions. In a conventional incubators' environment both the trainer and the trainee intentionally interacts in the incubator in order to either transfer or acquire knowledge which is to be commercially used upon graduation. Informal learning under ICKI model requires only learning intentions on the part of the unskilled personnel. In fact, the ICKI model knowledge transfer mechanisms are more likely to be "knowledge drain" rather than knowledge transfer since willingness to transfer on the part of the skilled craftsmen is not necessarily solicited. Furthermore, the nature of services offered in informal learning under ICKI is quite distinct from those in their conventional counterparts. Apart from offering physical spaces, conventional incubators facilitate knowledge transfer through cheaper and easy to access administrative and technical assistance within physical or virtue proximity. The informal learning under ICKI principally provides moral support and rarely any material support. Growth in these informal incubators is dependent on individual efforts and graduation is natural.

These important differences do not however, culminate into considerations that totally exclude learning in informal construction practices from incubators' conception. As long as learning takes place and as far as graduation is possible, informal construction processes nurtures and transfers knowledge in a similar manner as conventional incubators. The only problem is that informal practices are not well documented to identify innovative experiences that grow through practices and ultimately end-up being common practice or common pool knowledge in both formal and informal construction projects. As it is documented and published contemporarily, learning in informal construction projects can authoritatively be declared as resembling conventional incubation in only three items; the rationale for their existence, their employment prospects and their graduates and graduation qualifications. These similarities when compared to notable differences, it is obvious that the two concepts are substantially different. The only hope for the two to be similar lies on policy, since conventional incubation is a policy tool to nurture technology and business. If governments in developing countries designs and implements policies that recognise and support informal learning employment prospects will increase (Kanaganayagam & Ogunlana, 2008), making such learning practices marginally different from conventional incubators' conception.

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