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Contextualizing the Triple Helix framework for emerging economies: An investigation of the role of university identities[1]

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ABSTRACT

University research under the Triple Helix framework predicts a dynamic of university-industry interactions aimed at the commercial exploitation of basic research. As various mechanisms exert isomorphic pressures on universities to confirm to this framrwork, the social relevance and implications for long-term technological competitiveness from university research are pertinent questions raised in the context of emerging economies. This research examines these issues by studying how organization identity of universities impact their research output. Based on a case study of a leading medical research university in India, the paper argues that organizational identity of universities appears to influence their research output in three distinct ways – whether research is an important part of their activities, the constituencies towards which such research is directed, and the organization of research activities. Implications for future studies to understand how universities policies and practices might impact such organizational identities are discussed.

Keywords: Triple helix; organization identity; emerging economies; university entrepreneurship

Introduction

The growth of knowledge clusters and the increasing importance of basic science in technological innovations has highlighted the entrepreneurial role of universities over their teaching and research.

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Commercializing research, entrepreneurship by faculty members, and collaborations with industry are activities that have become increasingly important (Miller, Richards & Arora, 2011; Hendry & Brown, 2005). The “research university” has emerged as a key institution in this context (Altbach, 2009). Etzkowitz and others (Etzkowitz et al, 2000; Etzkowitz & Leylesdorff, 2000) have proposed the “Triple Helix” framework to explain these developments.

However, even in advanced economies that have a long tradition of university research, the entrepreneurial role seems far from institutionalized. Thus, the role of university research in the development of hi-tech knowledge clusters has been debated, with one researcher commenting, "...the jury is still out on the role research universities may play as 'drivers' of local high-tech development" (Doutriaux, 2003: 64). While a significant role of universities has been noted in some instances (for example, Bramwell & Wolfe's (2008) study of the role of Waterloo University in Canada), other studies suggest different levels of contribution on the part of universities. For example, Huggins' (2008) comparative study of the Silicon Valley, Cambridge, Ottawa and Helsinki knowledge clusters suggested varying levels of university involvement. In Cambridge and Helsinki, for example, universities had played a more influential role than in the Silicon Valley and Ottawa, where other players such as government/corporate R&D laboratories had also contributed significantly.

Nevertheless, there is considerable interest in several emerging economies to transform and encourage universities to take up entrepreneurial roles actively. These isomorphic pressures raise two questions for these economies. Firstly, the role of universities in these nations may be different from those in advanced economies in ways not adequately captured under the Triple Helix framework. Universities in these countries may be required to play specific roles that are relevant to these economies, such as “state-building” roles (Ordonika & Prusser, 2007: 189). Secondly, the question of whether university research aimed at commercial gains complements or substitutes for

basic scientific research is open. Basic scientific research is important for furthering technologies and products, especially when they approach theoretical limits (Fleming & Sorensen, 2004). Hence, this question is has an important implication for the long term technological competitiveness of emerging economies.

The first question is under-researched but important. As Shenhav & Kamens (1991) suggested, pursuing research agendas of advanced economies confers greater legitimacy on universities than researching on local issues. Yet, it is precisely the isomorphic pressures of adopting a Triple Helix paradigm that may constrain university research in these countries to focus on economically useful innovations at the cost of "socially relevant science" (Drori et al., 2003: 227).

The second question, in contrast, has seen considerable research in recent years. The basic issue that seems to be addressed is whether university entrepreneurship and commercializtuion of research substitutes for or complements more traditional, academic oriented basic scientific research. Most of this research seems to have concertated on various policy related aspects such as source of research funding (e.g. Bolli & Somogyi, 2011; Just & Huffman, 2009; Thursby & Thursby, 2011), university ownership structure (Just & Huffman, 2009), university-industry collaboration (Ponomariov & Boardman, 2010), internal policies and structures of universities (Chang, Yang and Chen, 2009; Caldera & Debande, 2010), the impact of patent assignee (Czarnitzki, Glanzel and Hussinger, 2009), and mix of faculty activities (Landry, Saïhi, Amara & Ouimet, 2010). But these variables aside, a more basic issue is suggested by some researchers when they point to the fundamental shift that seems to be occuring in the motivation and identities of researchers as they shift to commercializing their research. Thus, Duberley, Cohen, & Leeson (2007) suggest that the motivation for scientific research has shifted from curiosity of individual scientists to extend the frontiers of science to the application of science into technology through inter-disciplinary and collaborative research. One reason for this might be the way researchers and scientists define

themselves. Jain, George & Maltarich (2009: 924) differentiated the role identities of academic and entrepreneurial science on their norms, processes and outputs. University scientists make a distinction between their identities as pure science researchers, and more applied entrepreneurial science researchers, with a hybrid identity as a possible outcome for many scientists (e.g. Jain, George & Maltarich, 2009; Lam, 2010).

Therefore, given that there are isomorphic pressures on universities to change in line with the Triple Helix framework, and also that universities in emerging economies face contexts that are different from the one in which this framework was proposed, the question is to understand how universities might engage in research that confirms to such pressures but also deliver contextually relevant products and technologies. We take this argument forward by suggesting that the answer might lie in the way universities and researchers define themselves, that is, their organization identities.

The concept of organizational identity was proposed in the context of universities (Albert & Whetten, 1985). While several studies have highlighted how organizational identity might affect universities in important ways and in taking crucial decisions, the question of how it might influence the research agenda of universities is yet to receive sufficient attention from researchers. However, it is possible that the way universities define themselves might have an important bearing on what they research on, the manner of such research and its outcome. Crucial choices that universities make regarding linkages with governments and industry within the Triple Helix framework, including research funding, the organization of research and so on, might be influenced by their organization identities. Thus, we addresses the question: *How does the organization identity of universities in emerging economies affect their research output within a Triple Helix framework?* An answer to this question might throw additional light on the role of universities within the Triple Helix framework within specific country contexts. It might also add to the growing literature on the variables that explain university research propensity.

In the following sections, we shall first outline recent work on organizational identity that forms the conceptual background for this discussion. Following this, I shall report the findings of a case study on an institution of higher learning and research in the health sector in India. Based on this case study, I shall discuss some implications of university entrepreneurship, with suggestions for future research in this area. While much of this discussion will be in the Indian context, it is possible that the arguments shall apply to other emerging economies as well.

CONCEPTUAL BACKGROUND

Organization identities and hybrid organizations

Organizational identity can be understood broadly as those features of an organization that are relatively stable, enduring and central to organizations (Albert & Whetten, 1985). It has important strategic consequences for universities, including their survival (Czarnikwaska & Wolf, 1998). Organizations with different identities may interpret issues and strategize in different ways. Several schemas have been proposed to differentiate organizations on the basis of their identities. Albert & Whetten (1985) suggested that some organizations might have a utilitarian identity, which they maintain through appropriate remunerations, while others might be best described as having a normative identity which they maintain through appropriate norms. Brickson (2005, 2007) introduced the construct of organizational identity orientation and distinguished between individualistic, relational and collectivist orientations. She suggested that these orientations might explain the nature of “social value” creation by organizations, which she defined as "...that which enhances the well-being for the earth and its living organisms" (Brickson, 2007: 866).

A second important implication of organization identity is that organizations often have multiple identities (Albert & Whetten, 1985; Pratt & Rafaeli, 1997). This might lead to problems of incompatibility and conflict. Such identities may be triggered as organizations evolve and change,

and as members question how the proposed changes fit into the way they see themselves and their organization (Dutton & Dukerich, 1991; Glynn, 2000). Hence, organizations need to actively resolve these identity issues.

A specific form of multi-identity organizations is the hybrid. Albert & Whetten (1985: 270) defined an organization as a hybrid when its "... identity is composed of two or more types that would not normally be expected to go together." Such organizations may face conflicts because of the inherent tension that exists between the two largely incompatible identities. Examples of such organizations have been discussed in a variety of contexts such as the modern university (Albert & Whetten, 1985), musical orchestras (Glynn, 2000), health care (Golden-Biddle & Rao, 1997), rural cooperatives (Foreman & Whetten, 2002) and micro-finance (Battialana & Dorado, 2010).

This suggests two important implications for university research, entrepreneurship and industry linkages. It might be possible that the way universities define themselves has an important role on the quantum and subject of their research, as well as the mode and extent of monetizing this research. Whether they will forge linkages with industry or not, and the nature of those linkages, might be informed by how they define themselves. Therefore, university identities may define the nature of the roles that they take up, an aspect that we touch upon in the next section.

University roles

Etzkowitz et al. (2000: 313 pp) summarised the roles of universities in terms of three "missions" - the first being that of teaching, the second related to research, and the third being entrepreneurship. This "third mission" (Etzkowitiz et al, 2000) demands entrepreneurial activities such as spin-offs and technology licensing. On similar lines, Basant & Chandra (2007) suggest four types of linkages. Universities contribute to the labour market through training, and education. They affect the demand and supply of goods and services in the local economy through their students and faculty.

Finally, they also serve the economy through testing services, creating new enterprises, and by providing knowledge through joint projects, consortia, and lectures. Vang et al., (2007) categorise these linkages into generative roles (teaching and research) and development roles (commercializing research, linking with industry, entrepreneurial actions etc.).

A convenient way to reconceptualise these roles is by looking at the knowledge processes underlying these activities. An extensive literature on knowledge search - the process of problem-solving by locating and combining relevant technological knowledge (Katila & Ahuja, 2002: 1184; Katila, 2002: 996) by organizations - suggests that organizations undertake two broad types of activities. Drawing on the seminal work of March (1991), this body of work suggests that some organizations are relatively better at exploring new knowledge, while others are relatively better at exploiting knowledge. In the context of university research, knowledge exploration would be akin to activities such as basic research designed to discover new knowledge. Knowledge exploitation, on the other hand, would primarily involve using an existing knowledge base for various applications such as teaching, consulting and innovating.

For universities then, their three missions require different levels of these knowledge processes. Their original mission involves dissemination of existing knowledge through teaching and training. Later, knowledge discovery through research became accepted as a legitimate mission. In recent years, the stress on university entrepreneurship is about the application of an existing body of knowledge to design new products or technologies.

The knowledge search literature also suggests that knowledge exploration and exploitation are intimately connected. Thus, organizations that rely exclusively on exploiting an existing knowledge base over a period of time may end up adversely affecting the quality of innovations (e.g. Katila & Ahuja, 2002; Katila, 2002). Therefore, the three roles of universities are also connected.

Universities that underplay knowledge exploration through research are unlikely to be effective in their teaching and entrepreneurial activities in the long run. Conversely, too much focus on research without adequate teaching or entrepreneurship is unlikely to be helpful to the economy.

It is possible that how a university defines itself - its identity - might have an important bearing on its roles. Several strategic decisions, such as structures, policies to incentivize faculty, source of funding, nature of university entrepreneurship, and so on are likely to be based on what the university sees as its main identity. For example, with appropriate incentive structures, university researchers may be motivated to take up activities aimed at enhancing public goods such as low-cost health care devices or may become interested to enhance private goods such high-cost devices and technologies. Similarly, policies may favour basic research or applied research. It is possible that these roles, and the corresponding policies, structures, practices etc. could be derived from the university identities. Put another way, university identity may be an important variable that influences the roles it takes up.

Whether this actually holds out in practice or not, and to what extent, is not adequately investigated. In the next section, I report on a case study of a medical research institution to investigate how dual organizational identities affect the research orientation of universities.

The case

The case of Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTI henceforth) at Trivandrum, India provides a useful ground for study. Not only is this institute a “deemed” university, meaning that it is empowered by an act of the Indian parliament to conduct post-graduate and doctoral courses and grant degrees, but it is also a research hospital, with a dedicated R&D wing to carry out advanced research in medical sciences and develop bio-medical devices. As a research hospital catering to tertiary health care in cardiology, cardiac surgery, neurology and

neurological surgery, it runs a speciality hospital for medicine and surgery. At the same time, it is also mandated to carry out state-of-art research in medical sciences and develop bio-medical devices for mass manufacture. It has had some remarkable achievements in both medical treatment and bio-medical engineering, with its “Sree Chitra heart valve” being extensively covered by the popular media. For example, one of the leading dailies in India ran an article on how the low cost of this device has given thousands of Indians access to an otherwise very costly surgery (Gopal Raj, 2009). Its third ma date, which is of public health, is less consequential to the present discussion.

Several reasons account for the attractiveness of this organization as the research setting for this study. Being a university that caters exclusively to medical research and also running a post-graduate teaching hospital, it provides a natural setting to isolate the effect of different identities. Secondly, as a relatively young organization, with many of its first members still on rolls, it was possible to understand its development and the evolution of its identity over time with relative ease. Finally, the stature of the institute, and also its documented success in a critical area such as bio-medical innovations made it interesting, with a potential for significant practical application of this study's findings. In the following sections, we shall first provide a brief description of the institute, followed by an analysis and a discussion of theoretical implications and avenues for further research.

Data for this study was collected primarily through interviews with it’s top management, middle management and other members directly involved in operations. A semi-structured interview format was followed. Questions touched upon the history and development of the institute, its mission and objectives, its organization identity, the specific role that the respondent performed (in case of those who were in operational roles), institute policies that impacted research, changes in the institutional environment, challenges that respondents and the institute faced, relationship between the two main wings of the institute (the roles of the wings are detailed in the case description below). Each

interview lasted between 30 minutes to more than an hour for the top management representatives. Besides two members of the top management, 9 other respondents were covered. They included four clinicians, four scientists and engineers, and one respondent in administration. These interviews were transcribed and analysed. This was triangulated through annual reports since inception, data on publications, patents, manpower etc.

SCTI – its birth, growth and issues

SCTI started off almost fortuitously when its founder director Dr. M S Valiathan, an accomplished surgeon, decided to settle down in Chennai, India after an active though arduous professional career that had taken him to three continents over fifteen years. He had been invited to join the faculty of the bio-medical engineering at the Indian Institute of Technology at Chennai with a concurrent role as a consultant in cardiac surgery at another hospital in the same city. Dr. T J Cherian, who had played an active role in promoting this hospital, was invited by the government of Kerala to head SCTI and requested Dr. Valiathan to join him. However Dr. Cherian backed out later, leaving Dr. Valiathan to take over the mantle of heading the fledging organization. His resolve to join was strengthened when he met the Sri Achutha Menon, then chief minister of Kerala, who assured him of his government's full support. The Chief Minister had taken the initiative to bring the centre under the Department of Science and Technology (rather than the Department of Health) of the government of India. This was quite unexpected and underlined his intention of seeing the centre evolve into a top class institution for research besides multi-speciality treatment for the poor. With Dr. Valiathan's joining the centre on 1st October 1974, construction and administrative activities such as recruitment of medical practitioners took off rapidly. Despite several obstacles, including a protest by some members of the faculty of the government medical college in whose premises the centre was established, and some occasional adverse publicity and hiccups, the centre was formally inaugurated on February 28th 1976 and the first patients started receiving treatment. In recognition

of its work in health care, the centre was granted the status of an autonomous "Institute of National Importance" with degree granting powers under an act of the Indian parliament in 1980 and came to be known by its present name.[2]

Over the years, SCTI has churned out a good number of medical products, some of which have been licensed out for production, and some that are yet to find interested parties. A list of these products and their status may be seen in Table I below:

Insert Table I about here

However, of all these products, three have become really well known. These are the heart valve, the oxygenator, and the blood bag. Of these, the heart valve has become synonymous with the institute due to the amount of media attention it has generated and was really instrumental in putting SCTI on the national radar.

Issues with research at SCTI

The interviews highlighted concerns that were internal to SCTI affecting its ability to churn out bio-medical technology and products. There appeared to be a concern that the research and products coming out of BMT were not as impactful as the earlier products. The clinicians were certainly less charitable in their comments on this. One of them, for example, said "[we] are not able to sustain the quality [of research]…we came out with the valve in the 80s, but then beyond that for 25 years...no value addition, nothing has happened." Interestingly, a similar comment was made by one of the scientists when he said no big things were coming out of BMT. While others may or may not agree with these observations given the number of products that have come out (Table I), the perception seemed to be that with the exception of the heart valve, blood-bag and oxygenator, other products had not quite seized the imagination of the institute or the general public. Perhaps the

2 This paragraph is a summary of an account prepared by Valiathan (2004)

reason for the emotive appeal of these three products lies in the fact that the common man and the media can easily identify with them.

One pointer to this state of affairs is the change in the mode of product development at SCTI over the years. Clinicians informed that "goals [for research] are very diffused" and that projects are taken up "out of our personal interest". A researcher based out of the hospital wing similarly said, "…we are not monitored as such…output [of research] will be PhD students plus research publications." A scientist at BMT wing explicated this point:

"I am told that during the time that the heart valve was being developed, there was a lot of institute level attention… [now there are less] institute programs… very few initiatives that are institute driven, may be 10% while 90% projects are individual driven. Ideally, this ratio should be 50-50… May be the institute should identity two or three thrust areas."

Thus, although clinicians recognised that "concepts just come from experience by brainstorming", the problem was in systematically taking them forward to develop products. In this regard, one of the important challenges related to the relationship between the hospital wing and BMT wing. The director highlighted this issue:

> "[idea of product development comes from] close interaction between the user and the product development...infrastructure to develop it...under the same roof...accumulated experience...what kind of technology...can be transferred...[and a] good mechanism for this technology transfer…[but] we have not done enough...medical personnel will have to tell the bio-medical engineers regarding these equipment [that need to be developed]...what kind of modifications or improvement we should have so the hospital also has to play a large part in order to develop this..."

This issue in fact was not new, for even as far back as 1993-94, SCTI's annual report (p. 7) on its activities noted:

> "Over the years, the gap between the medical, engineering and social sciences has grown to such proportions that interdisciplinary communication has become increasingly difficult".

Scientists at BMT acknowledged the need for closer interaction between the two wings while admitting that on the ground this was wanting. Thus, one of the senior scientists commented, "interactions do take place informally [but] interdisciplinary work is not happening...BMT wing has its own drivers in terms of interests...hospital should be driving the BMT", while a clinician admitted that interactions were "not up to the expected level." This was concurred by another clinician: "I have a concern... [collaboration among medical wing and BMT] in a small way is still going on. But [it] could happen in a bigger way if there are specific programs."

In a sense, the clinicians saw their role as limited to giving ideas and spelling out requirements that BMT could then work on. Consider the following statements made by two clinicians:

> "I don't think there is any great disharmony between [the wings, but] all I think are independent…we have been giving them a lot of ideas...probably the ideas are not actually being put into production. We can only...say our requirement…"
>
> "…clinicians find it difficult to work here as well as to [carry out research]...many of our patients [give us] ideas, but to bring that idea to fruition is difficult…we can't be interacting regularly [with BMT wing]"

For one BMT scientist, the gap stemmed from the difference in approaches and research focus

between clinicians and BMT, and this needed to be addressed. Another senior scientist at BMT appeared to concur with this:

> "multidisciplinary work is still difficult because of the culture...they are overloaded with patients...rather than finding time for research…as a culture in hospital still not evolved culture for research…the culture is still not very strong...in terms of patients driving so that I think needs to be strengthened"

The head of BMT highlighted the key issue in his observation:

> "Dr Valiathan used to say what's the purpose of having research if we can't have a valve...we felt that what he said was very true… challenge is converting that research into a manufacturing technology… [while research/publications require less money, but from there to proof of concept to commercial level involves a] lot of dirty work with very little publishing… big challenge of converting research into technology continues...in India its still a bigger challenge...we have still not learnt that well unlike the west where they started with the industrial evolution and eventually they were doing research for making money or for better technology... balance required between academic component/ research component and transfer – this challenge is true internationally"

The physical distance between the two wings was itself a problem that affected the closeness of interaction between clinicians and scientists at BMT. It was apparent that the two wings differed in their approach to research and goals. But apart from these, and at a more fundamental level, the issue appeared to be that the way the two wings construed the identity of the institute seemed to diverge. It was pointed out that SCTI represented a mix of three identities – high quality health care, research and development of medical devices and materials, and public health. The director referred

to the first two in his interview when he said that the institute represented patient care, bio-medical technology development, human resource development (training programs), but pointed out that the mission of the instituted placed bio-medical technology research as number one and high quality patient care as number two. For him, the institute stood for developing products that are affordable in countries like India. On similar lines, one of the respondents said that the institute was a "model" that emphasized the "amalgamation of health scientists...clinical scientists...the public health, and the bio-medical technology development...improve patient care." However, as will be apparent from the statements in Table II below, which one took precedence was contested by different constituents. It was possible to discern two distinct groups of statements from respondents in each wing. One set of statements seemed to indicate the central role that SCTI was playing. The second set of statements suggested the identity orientation (Brickson, 2005; 2007) of SCTI - the clientele or higher purpose that its central role served.

Insert Table II about here

The statements in the table suggest that that the gap between the hospital and BMT wings is at the fundamental level of how they construed their identities. Further probing indicated that these identities were reflected in, and indeed reinforced, by the policies of the institute. On this, one of the clinicians said:

> "…every section has become more individualized over the years...roles have become more individualized for each of the departments, even each of the faculty members have own interests... [therefore, faculty evaluation should be customized] don't evaluate them blindly…each faculty member may have different goals."

Further:

> "… Nobody is asking you to do it [carry out research]...But it kind of rubs off on you. When you have the top [the director] doing it, the others also tend to do something new"

And:

> "[research for clinicians] is not compulsory, you are not forced to do any research, but if you are interested… the administrators have been good; they have not kind of said that you must do, as a clinician, so many papers." Concurring with this, another clinician said that there was probably no formal policy requiring clinicians to do research, "they are supposed to have some research programs… [and that there] could be individual motivator to so some [research] work."

Again, reflecting their identities, a particularly challenging aspect of the work schedule of clinicians was getting adequate time to do meaningful research. Although the director thought that the idea behind the super-specialty status of the hospital and its policy of admitting only referred patients was that clinicians were "not overburdened...we can at least get time think", the clinicians interviewed revealed this was still not enough for serious research. Thus, "clinicians are too tied up with patients to devote time for research", and "many clinical departments have little time for research" were some of the comments made by them. The growth in the quantum of patient care over the years would also seem to bear this out.

In comparison, a senior respondent from BMT observed, "Compared with Silicon valley – medical technologies coming out of Stanford, MIT & Boston area – many technologies – small and medium technologies promoted by professors with venture capital availability – system [institutionalized mechanisms] exists." For these researchers at BMT, the head of the wing said that the system linking equivalent publications to various stages leading up to clinical trials was available as policy now, and that for promotions, technology transfer is given equal or more weight than just research. However, he was concerned about sustaining this in the long term:

> "…whether it will get sustained is my worry...maybe [with] this explicit performance

> appraisal it may be easier to sustain many aspects of policies [that] are implicit [but] that need to be made into explicit policies…I have been keen on implementing a balanced scorecard ...because performance evaluation as I said has been more implicit than explicit so one of my primary things is to make it more explicit."

Nevertheless, there is a growing recognition that the two wings needed to integrate better. Thus, one of the researchers posted at the hospital said that while earlier programs used to be isolated, now there was greater integration, emphasizing that "programs used to be isolated [earlier]. Now there is integration", while a clinician noted, "…nowadays they [clinicians] also realize that it [interactions with BMT] is also important."

The director referred to the similarity in culture in medical & engineering wings, "I started learning about these things after I took over as director, before that I was only a neurologist. But when I enquired, I started interacting with them [the BMT wing], then I know that there is very little difference…interaction between clinicians and engineering taking place although there is a distance – people go over to the other campus every day or every other day. [I have] accomplished good amount of understanding and exchange of information between the medical and engineering."

Other respondents concurred with this. Thus, one of the researchers at the hospital said, "…now with the present director, I think there is a lot change. He is forcing us to interact….because of this [silver jubilee of SCTI] celebration, people got to know each other, otherwise there was little bit of isolation… we have committees, grouping of people from both wings". While a clinician also noted that the director was trying to increase collaboration, another said, "Co-ordination happens at [director's] level... [also] technology side there are some parallel relations. Research side there are some project which are multidisciplinary."

On the part of the BMT, its head was similarly alive to the possibilities of increasing interactions with the clinicians. He was suggesting having research professors who can spend 30% time for research, and that BMT wing could give them room so that they could spend some quality there.

The issues confronting SCTI may be interpreted as an inter-play of organizational identities at two levels. Firstly, the *absence* of pecuniary considerations in its clinical care and technology commercialization is significant. Statements such as "very clear [that]...product should be for public welfare, to reach the market, in a cost effective [way]" by one BMT scientist, or "private practice – I am against that because it will change the spirit of the [hospital]" by a clinician highlight this aspect. The collectivist identity orientation (Brickson, 2007) of SCTI is essential for research programs to be socially relevant. The social relevance of research becomes especially important in the context of developing economies, where it is important that products are relevant to the particular contexts of these economies, including low cost.

Within this collectivist identity orientation (Brickson, 2007), however, there is a difference in the way clinicians and scientists thought the institute stood for. Statements such as "basically this is a research institution" by a scientist and "…basically this is a hospital. Everything else is being added on to that" by a clinician suggests this divide. The institute's policies on staff selection, career progression, and remuneration, and its practices (such as use of canteen space) appear to support the identities at these two levels. Additionally, demands on clinician time from ever increasing number of referrals appears to accentuate the clinical care identity, while some of the policies at BMT (such as those that link appraisals to technology commercialization) appear to privilege applied research and engineering. This difference is likely to impact the orientation of SCTI to carry out basic research.

Carrying out basic research has an important implication for the development of future technologies

in the field. Basic research in science becomes important when a particular technology reaches its theoretical limit of development (Fleming & Sorensen, 2004). For example, clinical research into human physiology is likely to yield ideas regarding newer forms of treatment. Furthermore, clinicians ultimately take on the role of users of the innovations developed at BMT. Recognition of this particular role is evident from statements such as "...we have been giving them a lot of ideas...We can only...say our requirement" by one of the clinicians , and "[idea of product development comes from] close interaction between the user and the product development..." from the head of BMT.

Hence, SCTI's long term ability to develop fundamentally new technologies and treatments might be compromised without clinicians' active participation in research programs. Without an identity that fosters clinical research on the part of the clinicians and deeper inter-linkages BMT, it is possible that the long term ability of SCTI to develop fundamentally new forms of technology might be compromised, although it might still be very effective in reengineering established technologies to suit the contexts of emerging economies.

IMPLICATIONS FOR UNIVERSITY RESEARCH IN EMERGING ECONOMIES

Emerging economies face two challenges in terms of the direction of their science and technology programs. They need to compete technologically with advanced economies by carrying out advanced basic research and converting this into commercial technologies and products. Simultaneously however, they also need to be aware that many of their problems are of a different nature than those obtained in advanced economies. Thus, they also need to develop solutions for the social sector - health, education, etc. – that are affordable and contextually relevant. These present competing demands on universities. In his interview, the director of SCTI pointed to this when he asked, "Why is it that medical device development, in spite of a large market which everyone knew,

is not being [developed in India]?" This study suggests that at its core, this may have to do with the issue of how universities in emerging economies define themselves. Specifically, organizational identity informs university research through three key decisions – the extent they stress on research as an important contribution to the local economy, their role in the type of products and technologies they develop, and finally, in the way decisions regarding their organization structures affect their research output.

The impact of organization identity descriptions incorporating research as a defining characteristic of the university

This study suggests that organizational identity plays a significant role in the research output of universities by informing key stakeholders on whether they should play active roles as researchers. Taking up such roles is an important first stage before universities can become active in the knowledge economy. However, many universities in emerging economies, India in particular, are still in the process of undergoing the first academic revolution. Several recent studies attest to this. Datta & Saad (2011) analysed the historical development of universities in modern India and suggested that the nature of linkages with industry has been largely through teaching and providing human resources. The research intensity of Indian universities – the number of universities that have a reasonable publication record – is quite narrow, with just about a fifth of the universities being research active (Krishna, 2012). The chief contribution of Indian universities appears to be to the labour market, though there are concerns even here with regard to the quality of graduates trained by them (Basant & Mukhopadhyay, 2009). Making this transition between the first two missions is imperative before the "second academic revolution" towards academic entrepreneurship (Etzkowitz et al., 2000: 313 pp).

Universities are quite conservative when it comes to innovation and commercialization of research.

Indian universities still consider teaching to be their main role, with their contribution to national gross expenditure on R&D hovering around 7%, as compared to figures such as 20% in OECD countries and 15% in Japan (Krishna, 2012). Indian universities play a limited role in knowledge clusters in India, in contrast to the role of universities in the development of knowledge clusters in some developed economies. For example, commentators on the growth of the Bangalore knowledge cluster have noted that universities have played a relatively minor role in the growth of these clusters (e.g. D'Costa, 2006; Vang, Chaminade & Coenen, 2007; Basant & Chandra, 2007).

The case of SCTI suggests that one explanation for this might be the way universities define their key activities – accentuating those that are related to their first mission (clinical care and training in the case of SCTI, but more generally teaching) at the cost of basic research. The fact that several of the clinicians at SCTI did not see the institute in terms of its research output informed their decisions regarding the roles that they thought were important. An important consequence of this is the lack of emphasis on basic research. The direct implication is that without an identity that supports investment in basic research, it is difficult for universities to continue their "third mission" roles effectively in the long run.

Additionally, the same identity informs whether researchers will link with structures that interface with industry. Several such interfacing structures have been identified and reported – science and technology parks, industry research centres, and so on. These arrangements are effective only to the extent to which academics interact with them. In the case study, this interfacing role is played by BMT. While the different bases of identities of individual researchers focussed on academics and entrepreneurship has been commented on in earlier studies (Jain, George & Maltarich, 2009; Lam, 2010), the case study suggests the effect of dual identities at the organizational level. The dual nature of organizational identity at SCTI implies that the clinical wing had little to do with the activities of BMT. In the absence of this interaction, it is likely that universities will be limited in

their ability to commercialize research.

Organization identity orientation and the type of products and technologies developed by universities

Global trends in university administration increasingly require them to be self-sufficient. While education is seen as a private rather than a public good under the "neo-liberal consensus" (Altbach, 2009: 19), the rubric of the new public management framework requires universities to raise revenue from sources other the government or compete for government funding (Bolli & Somogyi, 2011). These trends increasingly require universities to depend less on public funding. One way for universities to address these challenges is through their entrepreneurial activities. Spin-offs, joint ventures, technology licensing and similar activities are likely to yield significant revenue for them.

A question that has been raised is the effect of these entrepreneurial activities on the type of university research. For instance, Just & Huffman (2009) developed a theoretical model of university behaviour in the face of increased return to privately funded research. They suggest that in a context of decreased federal funding, universities are incentivized to decrease public goods oriented basic research and instruction when they depend on external funds requiring applied private goods research. They present some empirical evidence from universities in the US to show that this effect is more pronounced in the case of private universities, followed by public universities, and then by land grant public universities.

Research is equivocal regarding how faculty roles in basic and applied research interact. Some recent studies highlight the complexities of this issue. Crespi and others (2011: 65) examined whether commercial activities of academics affected non-commercial academic activities. Their survey of academics in the United Kingdom suggested that patenting and publishing had a quadratic

(inverted U-shape) relationship, where patenting tended to crowd out publishing beyond a limit. This crowding out effect seemed to be more in basic sciences such as physics and chemistry, while a complementary crowding-in effect appeared to be the case in computer science and engineering. Almost similar relationships were observed with the effect of patenting on other forms of university knowledge transfer activities (joint research with industry, contract research agreements, consulting work, joint supervision of PhD programs, equity interests in new companies through spin-offs).

Czarnitzki, Glanzel & Hussinger (2009) examined the effect of patent assignee on publication quantity and quality. They found that when patents were assigned to non-profit entities (e.g. universities, non-profit research institutes or the professors themselves) they tended to positively correlate with publication quantity and citation quality. Conversely, when patents were assigned to for-profit entities, a weak negative correlation between patenting and publication quality and quantity was observed. In another study, Thursby & Thursby (2011) examined the effect of faculty disclosing their inventions on their ability to attract government and private funding. Government funding was taken to represent an orientation towards basic research, while industry funding represented a more applied focus. The results suggested that disclosure had an inverted U-shaped effect on government research funding while it generally had a positive effect on industry funding. The effect of a disclosure in a particular year tended to have a substantially larger effect on industry funding than on government funding. Landry and colleagues (2010) investigated whether six knowledge transfer activities (three forms of non-commercial activities consisting of publications, teaching and informal knowledge transfer; three forms of commercial knowledge transfer activities consisting of patenting, spin-off formation and consulting) were complementary or substituted for each other. Their results suggested support for the argument for complementarities for some of the activities only. While patenting, spin-off creation and consulting complemented each other as did spin-off creation and consulting, publications and teaching appeared to be substitutes of each other. The relationship between publications and patenting/spin-off creation, and between teaching and

patenting/spin-off creation/consulting/informal knowledge transfer were statistically insignificant. These results are summarized succinctly in a statement in one of the cited studies: "...academic scientists who become too involved in patenting activity may become distracted from (or devote less time to) other activities..." (Crespi et al., 2011: 65). One of the likely effects might be a shift in attention from basic research.

Apart from this, it is also relevant to examine the implications of a high level of entrepreneurially oriented research on the role of universities in the social sector. Much of the literature on academic entrepreneurship – such as its role in the development of knowledge clusters - has focussed on its role in contributing to technologies that are commercially viable. It is relatively silent on their contribution towards technologies that are relevant to the social sector in emerging economies. Just as the limited review above suggests that academic entrepreneurship may adversely affect basic research that is not immediately commercially relevant, it is also possible that research aimed at the social sector in emerging economies – such as health solutions at price-points affordable at the bottom-of-pyramid – might be adversely affected when universities focus exclusively on research programs aimed at developing commercially viable products.

In this context, the study suggests that organizational identity may balance these adverse effects. An important aspect of the organizational identity at SCTI was oriented towards producing social goods. This identity was shared by clinicians at the hospital and researchers at BMT. In a sense, it serves to put a check on developing an overtly commercial orientation to the research activities of the institute and highlights the importance of balancing collectivist and individualistic identities (Brickson, 2007). A collectivist identity orientation may be able to foster social entrepreneurship through research and engineering that is “socially relevant” (Drori et al., 2003: 227). This implies not only that the subject of research is attuned to this end (for example, research on solutions to malnutrition rather than on medicines that address life-style diseases afflicting the affluent), but also

the manner of technology transfer agreements (for example, agreements that make technologies accessible to multiple parties rather than being tied to only one).

Organization identity and the organization of research

Recent studies indicate that certatin types of organization structural configurations such as science parks, technology transfer offices, and university research centres involving faculty from various universities as well as researchers from industry are likely to facilitate university-industry linkages and academic entrepreneurship (for example, Caldera & Debande, 2010; Ponomariov & Boardman, 2010). These arrangements facilitate the exploitation of research by university faculty.

However, studies on the management of innovations suggest innovative organizations are ambidextrous – they are able to balance both knowledge exploration and exploitation. They balance knowledge exploitation and exploration, incremental and radical innovations, continuity and change, exploit existing competencies and develop new ones, and balance mechanistic structures oriented towards efficiency with organic structures offering flexibility (Raisch & Birkinshaw, 2008). Some researchers have highlighted the role of senior management decisions with regard to their decision-making processes, organisational structure and processes in fostering ambidexterity (O'Reilly, & Tushman, 2007). Other researchers have differentiated between structural ambidexterity and contextual ambidexterity. The former refers to dual structures with different foci, while the latter refers to the "…behavioural capacity to simultaneously demonstrate alignment and adaptability across a business unit" (Gibson, & Birkinshaw, 2004: 209). Research on how universities may be able to balance knowledge exploration and exploitation is still quite sparse. As an example, Chang, Yang & Chen (2009) found that institutional and organisational support, such as policies related to reimbursing patenting costs, technology transfer mechanisms, venture capital fund availability and so on (structural ambidexterity) and individual initiatives such as forging

research collaboration linkages and undergoing training on intellectual property management (contextual ambidexterity) were associated with greater academic patenting, licensing and spin-off activities.

For universities, organizational ambidexterity may also be connected to their identities. Pure research for academic purposes differs from applied research meant for commercial purposes at the level of researcher identities (Jain, George & Maltarich, 2009; Lam, 2010). Therefore, the question of reconciling conflicting identities arising from pursuing different research agendas becomes important. In other words, universities may be required to resolve this conflict not only through ambidexterity at the structural and contextual levels, but also by reconciling identity conflicts. The debate regarding whether universities should pursue entrepreneurial research agendas becomes ideological to an extent that doesn't apply to the discussion on business corporations exhibiting ambidexterity.

Some guidance on this is available from the literature on organizations with hybrid identities. Considerable scholarly work has been devoted in recent years to study how hybrid organizations cope with identity conflicts. Certain policies pursued by organizations may facilitate handling of identity conflicts. Thus, Pratt & Rafaeli (1997) found that an identity conflict that was precipitated from a decision regarding a dress code for nurses in a hospital was resolved when the nurses decided to give the choice of wearing either street dress or scrubs to the individuals concerned. Hybrids may also adopt certain hiring and socialization practices that take into account identity conflicts. Thus, Battialana & Dorado (2010) examined how hiring practices of hybrid organizations affect their ability to negotiate conflicts. Their study of two micro-finance NGOs in Bolivia suggested that one of these organization's approach was to hire fresh apprentices and socialize them into a culture of operational excellence. The second organization they studied hired experienced personnel and socialized them into the super-ordinate goals of the hybrid organization. Other

researchers have investigated how organizations may align their structures to concentrate on their primary identities. For example, Pratt & Foreman (2000) suggested a conceptual model in which multiple organizational identities may be managed by addressing how many identities need to be retained and their inter-relationships. Possible actions might include deleting a less important identity, aggregating the conflicting identities under a priority scheme, or integrating them to form a composite identity. Chatterjee (2010) documented the case of a non-profit hospital that ran a part of its operations on a commercial basis. The preferred solution in this case was to form what Chatterjee (2010) termed as a "dual-core organization", with the altruistic and non-altruistic operations separated into two distinct parts that were linked at the level of the senior management level.

This study suggested that the clinical and research wings of SCTI were quite independent to live with what they perceived to be the core identity of the institute. Administrative coordination was achieved at the senior managerial level. In parallel to the discussion on organizational ambidexterity, this meant they each wing could specialize and excel in its own tasks. However, when seen from the prespective of organization identities, each of the wings found it difficult to interact with the other because their self-definitions were incompatible with each other. This lack of interactions raise important issues regarding the quality of innovations.

In a more general sense, the question of organization identity is likely to become promiment as universities restructure themselves along ambidextrous designs. Rather than require the same faculty to undertake basic and entrepreneurial oriented research, search for potential avenues for commercialization, potential industry collaborators, universities have the option to locate their pure academic and more commercially oriented applied research in physically distinct locations, recruiting personnel with specific agendas and with distinct identities supporting these activities. In fact, several such arrangements already exist – research parks, industry research centres, technology

transfer offices and so on. However, these arrangements also entail distinct orgnizational identities for their effectiveness. Unless universitities put in place policies to encourage rich interactions between these two parts, their long term effectiveness is likely to be hampered.

IMPLICATIONS FOR FURTHER RESEARCH

The Triple Helix framework suggests that universities are likely to enter into rich and dynamically changing relationships with industry, and this is likely to affect their research in certain directions. While the framework captures trends in developed economies, the question that can be raised is whether the same might hold in other contexts as well. This study addressed the research question set out at the beginning of this paper by suggesting that organization identity appears to influence the research output of universities within the Triple Helix framework in three specific ways. The concept that researchers have regarding what a university stands for might seems to be intricately linked to the kind of activities that they carry out.

Therefore, it is necessary to extend this study by investigating the precise linkage between university identity and their research performance through cross-sectional and longitudinal research designs. This might help to throw light on why within the same institutional framework – say within a knowledge cluster - different universities have different foci of research.

Further, the study also pointed to the important role that organizational identity plays in the way key stakeholders within universities view the broader role of their organization. Policies of universities that facilitate entrepreneurial activities bring to the fore ethical issues of the role of universities in society. These ethical issues of university entrepreneurship were highlighted above in the context of possible decrease in public goods research at the cost of private goods research (Drori et al., 2003; Just & Huffman, 2009). The issue of ethics becomes particularly important for organizations

dealing with public goods such as health and education. This question has been indirectly addressed in the literature through the debate on whether academic entrepreneurship complements or substitutes for public goods oriented basic scientific research. Somewhat similar would be the debate on whether academic entrepreneurship contributes to developing solutions for public goods in emerging economies.

A pertinent question that arose from this study is the contribution of organizational identity to this debate. The extent to which policy measures such as the ones mentioned in the context of academic entrepreneurship foster an individualistic identity orientation at the cost of a collective one (Brickson, 2007), and the implications of these orientations for emerging economies, is a subject for further research. In particular, it is necessary to extend this to examine the linkages between policy paradigms such as new public management, organizational identities, and the nature of research output of universities.

CONCLUSION

The case study and the questions raised have some important practical implications for universities. There are strong pressures from a variety of sources on universities across the world to confirm to a Triple Helix model. Apart from the changing expectations of governments, there is considerable media attention to the success of some of the leading universities in developing cutting-edge technologies. Often, this finds its way into university rankings, which in turn feeds back to governments' and the public's perception of the performance of universities.

In several emerging economies such as India, such pressures are likely to be especially stronger given their desire to catch up with universities in more developed economies. However, universities in emerging economies might face greater challenges than those in developed economies. For

example, while the triple helix model assumes that universities would have already incorporated research as an academic mission (Etzkowitz et al, 2000: 315), there is today a wide spread concern about the research intensity in a vast majority of universities in these countries. A vast majority of universities in these countries see teaching as their primary role. Investigation into identity transformation of universities and its impact in channelling their research output is likely to answer some pressing policy level issues. Therefore, the findings from the study suggests important avenues for further research regarding the relationship between organizational identity and university research, with important implications for theory, university administrators and policy makers.

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Table I: Technologies developed at SCTI

(Source: Annual reports of SCTI)

Year	Technologies
1990-1991	Blood bags,chirta valves,technology of hydrocephalus shunt,oxygenator and cardiotomy reservoir)
1991-1992	Blood bags, Chitra valves, technology of hydrocephalus shunt,oxygenator and cardiotomy reservoir)
1992-1993	Blood bags,chirta valves,a dental composite and vascular graft
1994-1995	Vascular graft awaits clinical trial
1995-1996	To develop membrane oxygenator
1996-1997	Ophthalmic sponge and concentric needle electrodes
1997-1998	Hydroxyapatite porous granules as bone graft material,chitra prosthtic valve
1998-1999	Technology of fibrin glue
1999-2000	Four technologies for commercial production
2000-2001	Seven technologies transferred, while two other entered final stage of clinical evaluation
2001-2002	1. Large diameter vascular valve(clinical trials) 2. Heparin coating of intra-ocular lens(under design and development)
2002-2003	Large size porous hydroxypatite granules for orthopaedic application, technology of membrane oxygenator and vascular graft
2003-2004	Commercial production of memabrane oxygenator
2004-2005	Three technologies transferred for commercial production
2005-2006	1. Five technologies comprising of dental composites,bonding agents and glass filler . 2. Field kit for testing antibiotic sensitivity of bovine mastitis milk-under technology transfer agreements. 3. Clinical trials for hydroxyapatite bioglass ceramic composites for orthopaedic applications and bilayer HAP burr hole buttons for crainoplasty were progressing satisfactorily.
2006-2007	Single solution dental bonding agent and five bioceramic products
2007-2008	Bio ceramic bone graft products and bioactive ceramic composites for dental applications and a field kit for testing antibiotic sensitivity of bovine mastitis milk
2008-2009	1. Caries removal agent technology transfer. 2. to transfer the technology of glass ionomer cement 3. Disposable ECG electrodes. 4.Hemoconcentrator and nanohybrid radiopaque composite
2009-2010	1. A field kit for testing antibiotic sensitivity in farm animals. 2.fluoropassivated and hydrogel sealed vascular graft 3. Also the development of nano particle technology for chromatin removal.

Table II: Statements related to identity of SCTI

Statements made by scientists at BMT:

Organizational identity description:

- Sree Chitra comes under the department of science & technology, not ministry of health because of the bio-medical (not biotechnology) wing.
- only institute in India that integrates idea conceptualization to clinical trial of end product
- basic objective – products should be "affordable to the public" and quality is same as imported products
- "development of high quality ... affordable medical devices"
- "basically this is a research institution"
- "research component is very important"
- mainly focussing on the research for biomedical devices
- "what we stand for is ensuring that research ends up […] and the product is available...it is part of our culture"
- "we can keep on doing research we can publish a lot of papers but that is not going to get anywhere unless people convert them into technology"
- "People do research, people have publications that is also valued, but work that is involved in commercial development is also highly valued"
- "develop and provide very low cost indigenously made devices for health care" (researchers based in the hospital)
- "[For the founder], the priority was that" research would not end on the lab bench"
- "good quality health care"

Organizational identity orientation:

- "satisfaction you get out of this is that when somebody is using your product, and he is happy with the product"
- "very clear [that]...product should be for public welfare, to reach the market, in a cost effective [way]"

Statements made by clinicians at Hospital:

Organizational identity description:

- It is a really well functioning hospital primarily, but then we got the advantages, technology development centres"
- "I work for the neuro-surgery department, ... We have been the pioneers in the country"
- "basically this is a hospital. Everything else is being added on to that"
- Institute is for health care aspects for poor patients, and also promote research"
- "their priority is into teaching and treating poor patients, teaching and to some of them at least to do research also"
- "...basically it is [known] as a very good hospital...to the general public... which I believe counts among the best centres across the world..."

Organizational identity orientation:

- “this is one institution where you can find that kind of a [profit] motive is not there in the philosophy of any of the staff or employee of the institution”
- “private practice – I am against that because it will change the spirit of the [hospital]”
- “you get invited [to deliver lectures etc.]”
- not a profit making organization
- “doctors who are existing here they choose to be in this hospital because they want to do patient care activity, research and this academic activity”
- “government institution”
- what Chitra stands for, I think the USP is that of credibility, we can trust you with our life... they [the general public] are very sure and high quality care that we provide”