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Knowledge Transfer Challenges for Universities and SMEs in the USA

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ABSTRACT

Accompanying the global redistribution of commodity production to low wage countries, comes the need for companies to enhance innovation in order to remain competitive. Therefore, in order to better understand the barriers to leveraging research universities for revitalizing legacy industrial regions, field interviews were conducted with researchers at a Midwestern public university and its industry partners. The goal was to identify and better understand knowledge exchange barriers and facilitators. The constructs from Social Exchange Theory (reciprocity, cohesion, balance and power) guided the investigation of issues surrounding workplace collaboration and knowledge sharing across these organizations. The results of this investigation show that an important factor for productive exchange relationships is both maintenance and the awareness of mutual and *balanced* dependency (i.e. *cohesion*) between exchange partners. This can be facilitated by maintaining open communication channels that reinforce a perception of *reciprocity* and minimize perceptions of *power* and dominance among exchange partners.

KEYWORDS

Economic development, Innovation, Knowledge-based theory, Knowledge Transfer, Knowledge-intensive work, R & D, Social exchange theory, Small and Medium Enterprises

INTRODUCTION

In the United States, as in other advanced industrial societies, a fundamental change in the competitive landscape is well under way (U.S. Council on Competitiveness, 2008). Accompanying the globalization of the economy and the global redistribution of commodity production to low wage countries, comes the pressure on advanced industrialized societies to identify new sources of competitive advantage. Increasingly, the eyes of policy makers and industrialists alike are turning to innovation. Thus, the post-industrial society (Bell, 1973) of the twenty-first century, one in which competitive advantage comes from a company's and a country's ability to engage in continuous innovation, is at heart a knowledge society (Yeo, 2007). Hence, understanding the nature of innovation, how to encourage it, and how to leverage it, have become topics that are vital to a nation's economic well being (Dhillon et al., 2009; Florida 2002, 2007; Jeffrey & Craft, 2001). As a consequence, all sectors of society have become stakeholders in the effort to enhance innovation and the knowledge that results.

At the same time that innovation has become crucial to the economic health of our society, corporations are retreating from a model of innovation that has supported it for generations. Gone or quickly fading are the large research and development laboratories staffed by bright and highly educated individuals whose sole responsibility is to develop new – if not immediately practical – ideas. Instead, companies are searching for sources of innovation throughout the corporation, and beyond it (Lakhani et al., 2007; van Opstal, 2009). The motivation is, in part, *economic* necessity. Particularly since the 2008 recession, many firms can no longer afford large, dedicated R&D staffs. But the motivation is also *competitive* necessity. To look beyond the bounds of the R&D lab, is to open up the possibility for more – and perhaps better -- sources of innovation.

One underutilized source of innovation is the university. Public universities, in particular, are a potential source of innovation through technology transfer of the knowledge generated in the laboratories and other research venues. Thus, the potential exists for university knowledge to be transferred to industry. But along with the potential benefits come challenges. Universities and industry represent very different institutional cultures. Hence, collaboration across these different workplace cultures related to knowledge transfer and management can be impeded by these different workplace cultures, which, if not understood, can impede inter-organizational collaboration and knowledge sharing. This paper reports on a multiyear field study, supported by the National Science Foundation. The issues explored in this research involve the incentives for, facilitators of and barriers to industry – academic knowledge sharing when the context is legacy, industrial era small and medium sized enterprises (SMEs). In this paper we report on field work directed at identifying barriers to the effective capture, transfer and exchange of knowledge between the university and its industry partners. The overall goal of this research program is to develop best practice models for knowledge sharing so as to support industrial innovation.

SOCIAL EXCHANGE THEORY

The theory that was chosen to guide our investigation of issues surrounding workplace collaboration and knowledge sharing across organizations and industry cultures is Social Exchange Theory (SET). Social exchange theory grew out of the intersection of economics, psychology and sociology, focusing on the exchange relationship between specific actors (Blau, 1964). According to Homans (1958), the theory was developed to understand the social behavior of humans in economic behavioral undertakings. Social exchange theory consists of four constructs. *Reciprocity* refers to the mutual exchange that results from the need to reciprocate the benefits received. *Cohesion* refers to the 'gravity' that holds actors in the exchange within the same orbit, in the presence of conflicts in the exchange. *Balance* refers to the equilibrium or equality in the distribution of benefits due to mutual dependence between each of the actors in an exchange. Finally, *power* refers to the amount of monetary influence one actor can exercise on the other. Although modern social exchange theory exists in many forms, what remains constant is the central concept of actors voluntarily exchanging resources via a social relationship (Cook, 1977). Emerson (1962, as cited in Dibbern et al., 2004, p. 19) suggested that there were social exchange attributes which were highly applicable to a transactional style or a partnership-style relationship. Emerson (1962) advocated that such exchange attributes evolve through mutually satisfying interactions and increasing confidence in the relationship. In response to Emerson's view, Dibbern (2004) concluded that these constructs could be quantified.

Recently, contemporary SET has been adapted to deal with more sophisticated relationships. In terms of social transactions, SET's interactive scope has moved from two parties to multiple parties in a large-scale network structure. The theme of relationships among the parties in a network has shifted from a concern with reciprocity to a hard negotiation (Molm, 2000). To date, social scientists have applied social exchange theory to a number of domains. Nooteboom (1996) applied social exchange theory to investigate commitment, trust, and affective ties in social relationships. Keller and Dansereau (1995) and Westphal and Zajac (2006) examined the complex relationships of power in corporate governance in the workplace. Hui and Beath (2002) scrutinized outsourcing decisions and outcomes. Moreover, the explanatory power of the theory has been perceived in certain areas such as social power (Molm, 2000), networks (Cook, 1977), board independence (Westphal and Zajac, 1997), organizational justice (Konovsky, 2000), psychological contracts (Rousseau, 1995), and leadership (Liden et al., 1997). Davenport and Prusak (1998) constructed a framework that related SET to knowledge management in a knowledge market populated by a network of actors pursuing resource trading on a supportive platform.

Information Systems researchers have made implicit and explicit use of social exchange theory in their discussions of knowledge transfer, knowledge exchange, and knowledge sharing within and across organizations (Jarvenpaa and Staples, 2000, 2001; Juntiwasarakij and Trauth, 2009; Bock and Kim, 2002; Hall, 2003). Moreover, the theory is capable of guiding the researchers to invent optimal conditions for such relationships.

The four constructs of social exchange theory -- reciprocity, balance, cohesion, and power -- provide the theoretical tools to enable researchers to better understand knowledge transfer challenges among different actors in different organization settings. Hence, we chose SET to examine knowledge exchange issues between a university and industry, organizations which have diverse cultures, goals, and expectations regarding what would be taken from and contribute to the relationship. Using SET as the theoretical lens for this work, the following research question guided the project: *What are the barriers to leveraging research universities for revitalizing legacy industrial regions?*

METHODOLOGY

A Midwestern public research university received a grant from the National Science Foundation[1] to conduct a two-phased project. During the first phase (2007-2009) researchers from the university worked with three small and medium enterprises (SMEs) in an economically depressed area of the state. The purpose of this phase was to enact knowledge transfer from the university to these companies. In developing the grant proposal each of the companies identified a particular problem about which it sought knowledge for its solution. A senior manager from each of the firms agreed to work as the industry partner and be paired with a scientist at the university who had expertise in the domain of the company's problem. Both members of the industry-academic partnership were expected to work together to solve the company's problem. In the second phase (2009 – 2010) – the subject matter of this paper – university researchers conducted field interviews with both the university and the industry partners to identify and better understand the knowledge exchange barriers and facilitators for leveraging research intensive universities for revitalization of legacy industrial era regions now adjusting to a post-industrial economy. Data for the second phase were collected through a series of interviews conducted by the two authors with the members of

[1] (NSF # 0650124)

the industry-academic partnership.[2] To protect confidentiality of study participants, these organizations are referred to as: Company A, Company B, Company C and University D. The interview questions were grouped into the following categories:

- Effectiveness of academic-industry partnership
- Communication between academic and business community
- General thoughts about barriers to the flow of scientific knowledge from the university to industry
- Barriers to workforce diversity

Notes that were taken by the two researchers during the interviews were transcribed and then coded using the four constructs of social exchange theory. During the coding process, emergent themes not covered by SET also emerged. Both the theoretically-informed and the emergent themes about industry-academic partnerships are discussed below.

FINDINGS

Reciprocity

Reciprocity, or the exchange of benefit between partners, was manifested in several ways. A positive rendering of reciprocity was in evidence in company A. First, due to the social capital built up over a prior history of working together on a construction project, at the time that the first phase of this project began, this company had a prior relationship already established with University D that was seen to contribute to successful communication and cooperation in this project. It was this baseline upon which the interpersonal relationship was able to move forward, quickly and productively. Hence, this prior relationship was able to be leveraged in this new partnership. Second, the positive relationship that had already been established facilitated the task of clarifying goals, making sense of the action plan, and keeping the flows of communication between the business owner and the university constantly open. Personnel at Company A reported that they were able to arrive at an agreement about the action plan at the first meeting with respect to what resources and expertise the university could provide. After clarifying the goal University D and Company A proceeded to arrange a follow-up meeting a couple of months later to make sure that all of the stakeholder involved in this project maintained a consistent understanding of the problem and goals of the industry-university partnership project that would address it.

In contrast, the other companies did not maintain an ongoing flow of the communication with University D. This resulted in an inconsistent understanding of the goals of the respective partnerships, and was further complicated by changes in the industries and the market, the technologies, the customers, and the economy. In the case of Company B, the company and the university had the problem of keeping focused on the objective. Effective communication was needed as the project goal changed. As a consequence, the university lost touch with what was going on at Company B, which, in turn, became frustrated that the university did not appear to be doing all it could to help them to carry out their project. From University D's perspective, both Company B and Company C expected the university to contribute more effort to keeping in touch with the industry partners. This was support by comments from an executive at Company C who expected the university to update them on the project that the company subcontracted to the university. During an interview with Company C a remark was made to the effect that it had not yet seen a report from the university.

Cohesion

Cohesion, which characterizes the mutual dependency between actors in the exchange, was in evidence in the relationship that the university built up with the companies over time through a reliance on each other. Across the three companies, it could be observed that the companies had become dependent on certain university's resources. One executive at Company A reflected that his company had limited capabilities for conducting product tests. Thus, they depended upon the university's laboratory as a testing environment. Similarly, Company B benefited from the university's R&D environment and laboratories because the company no longer had a local product R&D unit. Moreover, the recent economic recession put additional pressure on corporate managers to cut cost and lower R&D expenditures. This affected the partnership between the business owners and the university. As a result, Company A had become leaner and more focused on specific technologies, relying more on its mature products and its mature production line. In terms of management, Company A adapted to these economic contingencies by deploying its 'available' staff to respond to these personnel and budget constraints. As a smaller staff was expected to explore new technologies, the company became more cautious about choosing its business partners, and

[2] The questions used in the interview resulted from three focus groups conducted during 2006 with 60 representatives from local businesses in the region. Participants were asked to talk about knowledge sharing between the university and local industry. The results of these focus groups were included in the grant proposal which was subsequently funded.

the interest of the company in its engagement with the university shifted toward more mature technologies and products. For Company C, geographical proximity was a factor in its dependency (on the university). In this regard, the company benefited from this geographical advantage as it leveraged interaction and communication between the company itself and the university. An executive at Company C conceded that, if it were not for the close proximity of the company to the university, the collaboration would have been difficult and burdensome.

While it may seem that the dependency was one way (the companies dependent on the university), in reality, that was not the case. Some of the company respondents reflected that the university relied on the R&D partnerships with industry in order to enact its outreach mission. As a public university funded by state taxes, it is incumbent upon University D to demonstrate its contribution to economic development in the state. Further, as Company B observed, the university was dependent upon industry partners in order to enact this economic development grant-funded program. Moreover, the university also financially benefited from receiving subcontracts on certain projects and by supplying technical solutions to local industry.

Balance

Balance refers to the equilibrium or equality in the distribution of benefits resulting from the mutual dependence between each of the actors in an exchange. A way in which University D benefitted from the partnership was through student internship sites at partner companies. Company A, for example, provided local universities (including University D) an industrial, production environment which the university and the students utilized for co-developing their senior projects with the companies or for pursuing their internships. In return, the university provided a testing environment for Company A. This relationship continued beyond the completion of the internship programs because Company A reported that some successful senior students in the internship pool were recruited to work there after graduation.

On the other hand, the cooperative relationship between the university and Company C was quite different from the case of Company A. Company C had contracts for several governmental cutting-edge projects, some of which Company C subcontracted to the university. Due to the characteristics of the projects and the nature of the contracts, Company C preferred working with the post-doctoral researchers rather than graduate students. In this regard, the university served Company C by providing an experimental space for conducting laboratory research which could be set up by the Company C, itself, and as a source of post-doctoral researchers.

In addition to supplying high quality workers to the local industry, the university also supplied the partner companies with technical solutions specifically designed to help the companies perform both their day-to-day operations and their advanced R&D research. Company C and Company A were differently satisfied with the technical assistance provided by the university. While an executive at Company A appreciates the practical solutions which could be instantly deployed and implemented, Company C enjoyed advanced testing laboratory settings which the company, itself, could not afford. An executive at Company A allowed the university to fully license the solutions invented by the university. However, an executive at Company C expressed concerns about the university's intellectual property policies with respect to the technologies the university co-developed with them. The concerns centered on the possibility of overrating intellectual property during licensing and underestimating the value and commercializability of the technology.

Power

Finally, *power* in Social Exchange Theory refers to the amount of monetary influence one actor can exercise over the other. Since the purpose of the project was to uncover barriers to leveraging advanced research knowledge from the university in order to stimulate innovation in legacy industrial era regions, the parties in the partnerships were not in a position to assert economic dominance over one another, other than indirectly through negotiations about intellectual property. However, the relationship found in this research situation was not typical of social exchange transactions in which all partners are motivated by economic gain during negotiation for resources in the exchange. And while power as explained in Social Exchange Theory was not in evidence, power as understood in other ways, was in evidence. University D is a large institution and an important player in the region. Hence it has a level of power and influence in regional and state policy making that smaller organizations – such as the SMEs who were its partners on this project – do not have. On the other hand, University D needs to be able to help SMEs such as those in this project in order to fulfill its outreach mission and to demonstrate its economic impact on the state. Hence, to the extent that University D is dependent upon the SMEs, they have power over it.

EMERGING THEMES

During the process of coding the transcripts according to the constructs of Social Exchange Theory, a number of themes emerged that have complemented our understanding of the issues surrounding university-industry knowledge transfer. They can be grouped into two categories: organizational dynamics and externalities. The first theme is about the difference in

organizational dynamics that affect (organizational) cultural barriers to communication and collaboration between the university and the local industry. The cultural difference results from the differences in mission and reward systems in universities and in industry. This cultural barrier was manifested in several ways. One was time horizon. Whereas the time horizon in a for-profit company is days, weeks, and possibly months, the time horizon for a university project is months and possibly years. It was noted by Company B executives that this partnership project was first discussed with them five years ago; many things have changed since then. And whereas companies often need fast turnaround on an opportunity to commercialize a product or idea, no matter what time of the year it arises, universities operate in cyclical fashion governed by the structure of semesters, and with 'down time' between semesters or over the summer when students and faculty might not be available to work on projects.

Another example of differences in organizational dynamics had to do with the issue of licensing. Company C and the university had different views over the licensability and the commercializability of the solutions and technology they co-developed. According to Company C's view, the university overvalued its IP license and did not understand how the licensability and the commercializability operated in the industrial world. In this regard, the industry partners thought the university needed to re-orient its understanding and culture to be more aligned with that of industry. Company B suggested that open innovation as a way to share innovation and knowledge be adopted. However, Company B needed specific, narrow-scoped technologies that could directly apply to its production line. In this regard, Company B gave priority to day-by-day operation over innovation since the company had to survive with less revenue now coming from its mature products.

The second category contained themes about external factors outside the control of the organizations. One theme was about dealing with the government. Company partners expressed frustration at the level of bureaucracy associated with a large, public institution in relation to government projects. University D has certain processes, procedures, and protocols that need to be satisfied before it can respond to opportunities, requests, etc., connected to funding from the government. Company C recommended that having a cultural liaison who was academically and industrially experienced would be a great help. The role of this liaison would be to facilitate dialogue between the exchange partners so as to make possible the communication through facilitating learning and understanding each other.

There was also a government effect regarding workforce development. Company A places itself on an international business landscape, so it realizes that workforce diversity is important. An executive at Company A expected that the university could help with some human resource diversity issues because the local economic development agency did not possess the expertise to deal with it. Likewise, Company C considered managing workforce diversity to be a challenge as an externality in that the university and Company C did not have control over government regulations regarding foreign students, for example.

Another external challenge that came up in all of the interviews was the topic of dealing with the effects of the economic recession. The impact of the economic recession could not be underestimated in this context. Company A's organizational reengineering resulted in 140 employee positions being eliminated. Company B's contemporary strategic plans were to survive the economic crisis, something that took precedence over innovation and R&D activities. Consequently, Company B became more reliant on the university's research labs and technology. Finally, Company A and Company C agreed that geographical proximity greatly drove the successfulness of communication and collaboration between the university and the local industry. Company C admitted that the effectiveness of the cooperation would be diminished significantly if Company C and the university were not located in the same area.

DISCUSSION

The question that motivated this research was about barriers to leveraging research universities for revitalizing legacy industrial regions. The goal was to identify specific challenges, successes and issues that could be addressed in order to enhance knowledge exchange between the university and industrial SMEs. The findings resulted in some themes related to the four constructs of the theory, as well as some emerging themes that can be thought of as potential best practices for facilitating the exchange of knowledge between the university and industrial era manufacturing firms. With respect to *reciprocity*, placing an emphasis on continuous communication and constantly updating each other about on-going activities in a reciprocal manner seems to contribute to the trust and sustainability of the relationship in a network. On other words, discontinuity in communication could cost the trust in the relationship as it prevents the stakeholders from leveraging reciprocity and collaboration in the future. *Cohesion* or mutual dependency means that each member of the partnership benefits from the relationship. Our field work revealed that the university benefits when students have sites for their internships and employment opportunities after graduation. On the other hand, SMEs with no dedicated R&D facilities benefit from access to the wealth of research resources and expertise at a university. The exchange relationship seems to be strengthened when each party in the partnership can see the benefit they receive from the exchange. For the partnership to be in *balance* both sides must believe that there is relative equality in the benefits each party receives from the relationship. The

perceived benefit to the companies from the university partnership came through more strongly than perceptions on the university's part about the benefit it was receiving. The reason might be that the individual researcher (or the research lab) that is offering the benefit to the industry partner is not necessarily the university entity that experiences the benefit from the exchange. Whereas the research lab might benefit in terms of 'real-world' research experiences for its students, other university benefits such as internship and student project sites, job placement, guest speakers for university classes and outreach activities will probably not accrue to the researcher or the research lab. The theme of *power* as defined by SET was not in evidence in the study. But the broader definition of power as control over another entity has the potential to enhance or inhibit industry-university partnerships, depending upon how it is managed. In addition to the themes linked to SET, the themes about the essential differences between university organizations and for-profit organizations revealed potential barriers to successful partnerships. Likewise the themes about external factors beyond and organization's control need to be recognized, even if they cannot be planned for.

CONCLUSION

This research makes a contribution to both practice and theory. With respect to practice, the results from this study offer practitioner insights for both workplace collaboration and knowledge sharing across organizations. In addition, insofar as industry and academe represent very different work cultures, these findings offer insights for navigating cultural differences in the process of knowledge sharing. With respect to theory, the constructs from Social Exchange Theory (reciprocity, cohesion, balance and power) guided the investigation of issues surrounding workplace collaboration and knowledge sharing between a university and three private sector companies. The results of this investigation show that an important factor for productive exchange relationships is both maintenance and the awareness of mutual and *balanced* dependency (i.e. *cohesion*) between exchange partners. This can be facilitated by maintaining open communication channels that reinforce a perception of *reciprocity* and minimize perceptions of *power* and dominance among exchange partners. Two emergent themes particular to the exchange relationship considered in this study (i.e. university-industry partnership) are navigating differences in organizational dynamics, and coping with the challenges of externalities beyond an organization's control such as an economic recession.

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