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Talent Management in R&D Settings

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Running head: TALENT MANAGEMENT IN R&D

Talent Management in R&D Settings

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Abstract

Despite more than a decade of hype around the concept of talent management, we still have a relatively limited knowledge regarding its application in practice. In this paper we examine how the concepts of talent management apply in research and development (R&D) settings. Two case studies of high-technology R&D groups are conducted. We adopt a novel approach and apply social network analysis (SNA) techniques to explore if the technological gatekeeper still represents a pivotal position in R&D settings. The specific talents exhibited by these individuals are then explored and we point to some organizational level interventions which can facilitate R&D organizations in fully exploiting their resources to maximize innovative capabilities.

Talent Management in R&D Settings

The global economic climate has altered significantly since a group of McKinsey consultants coined the phrase "The War for Talent" which brought the topic of talent management to the fore for practitioners and academics alike. While the economic context may have altered radically since the 1990s when the concept emerged, the underlying premise remains valid. That is that a firm's human resources that provide a key source of sustainable competitive advantage (Lowe, Milliman, De Cieri & Dowling, 2002; Caligiuri, Lazarova & Tarique, 2005). However, as we know from the resource based theory, possessing resources is insufficient to create competitive advantage. Firms must be appropriately organized to fully exploit their resources to attain a competitive advantage (Barney, 1997). Talent management plays a key role in assisting the organization to ensure its human resources are utilized to the fullest extent. While we acknowledge a degree of debate as to the definition of talent management (Lewis & Heckman, 2006), we adopt the following definition of strategic talent management for the current paper: activities and processes that involve the systematic identification of key positions which differentially contribute to the organization's sustainable competitive advantage, the development of a talent pool of high potential and high performing incumbents to fill these roles, and the development of a differentiated human resource architecture to facilitate filling these positions with competent incumbents and to ensure their continued commitment to the organization (Author, in press).

Talent management is regarded by many as one of the most critical HR challenges that organizations will face over the next decade (Frank, Finnegan & Taylor, 2004; Boston Consulting Group, 2007). Yet, despite a decade of debate on the importance of talent management, the concept itself remains somewhat under-developed and under-explored. In spite of the rhetoric of strategic integrated talent management systems in the practitioner literature,

paradoxically the evidence suggests that relatively few organizations manage talent on a coordinated or effective basis (Cappelli, 2008; Cheese, Thomas and Craig, 2008; Sparrow, Brewster & Harris, 2004).

A key stream in the talent management literature emphasises the identification of "pivotal talent pools" (Boudreau & Ramstad, 2005), or "A positions" (Huselid, Beatty & Becker, 2005), which focus on the first element of our definition, or unique human capital (Lepak & Snell, 1999), emphasising the second part of the definition, which have the potential to have the greatest impact on organizational performance. However, quantifying which roles are strategically important and what determines the difference in value represents a key challenge (Becker and Huselid, 2006). Indeed, Boudreau & Ramstad (2007) argue that a lack of a decision science to facilitate the identification of such pivotal talent pools, results in organizations investing too much in talent pools which are important but not pivotal, while failing to invest sufficiently in pivotal talent roles. To compete effectively in recessionary times, the identification of such roles, and the appropriate candidates to fill them will only increase in importance (Parise, Cross & Davenport, 2006).

In light of the above challenges, the purpose of this paper is to advance our understanding of talent management by identifying and examining talented individuals in the context of Research & Development (R&D). We specifically choose this setting given the strategic importance of R&D in driving an organization's innovation capabilities (Cohen & Levinthal 1990). In this effort, we revisit the highly influential technological gatekeeper theory and argue that the talented individuals who will contribute most to organizational success in R&D settings are the small number of individuals who occupy pivotal positions in the knowledge flow network. We argue that the gatekeeper processes of acquiring and disseminating external knowledge is central to the innovation process. However, much has changed since the

technological gatekeeper idea evolved in the closing quarter of the twentieth century. Most significantly, advances in information and communication technology (ICT) have made information much more accessible, while changing organization structures mean that the context of interactions has also evolved. Consequently we seek to answer two key questions: 1) Is the technological gatekeeper still a pivotal position in the modern R&D group, and 2) What are the specific competencies required by those individuals who occupy pivotal positions in the R&D knowledge flow network? Drawing on social network analysis (SNA) and interview evidence from two case studies, we find that the gatekeeper role is indeed pivotal. However, the role has evolved and undergone a division of labor. It is now rare for a single individual to possess all the talents necessary to effectively acquire and disseminate external knowledge.

This paper makes a number of important contributions. Firstly, we contribute to the literature on the identification of pivotal positions in the context of strategic talent management systems - a topic which has been heretofore under-explored. Specifically, we provide a framework for the identification of such pivotal positions in the R&D setting. Secondly, we identify the characteristics of key employees in the knowledge flow network.

What is Strategic Talent Management and why does it Matter?

In recent decades the term talent management has become well established in the managerial lexicon. It is clear that talent management occupies a significant amount of organization resources. Chief Executive Officers (CEOs) are increasingly involved in the talent management process, with the majority of those surveyed in a recent study spending over 20 per cent of their time on talent issues, some even spent up to 50 per cent of their time on the same (Economist Intelligence Unit, 2006). Notwithstanding this, a more recent study of 1,300 executives worldwide, argued that that senior managers do not spend enough time on talent management (Guthridge, Komm & Lawson, 2008). Indeed, a Boston Consulting Group (2007)

report identified talent management as one of five critical challenges for the human resource (HR) function in the European context.

However, despite the widespread use of the terminology and its perceived importance, there is a degree of debate, and indeed confusion around the conceptual and intellectual boundaries of talent management. For example, a UK survey found that 51 per cent of HR professionals surveyed undertook talent management activities, however only 20 per cent of them operated with a formal definition of talent management (CIPD, 2006). The academic literature suggests a similar trend, with Lewis and Heckman concluding that there is "a disturbing lack of clarity regarding the definition, scope and overall goals of talent management" (2006, p. 139).

Broadly there are four key streams of thought on what talent management is (Lewis & Heckman, 2006; Author, in press). Some authors merely substitute the label talent management for HR management. Studies in this tradition often limit their focus to particular HR practices such as recruitment, leadership development, succession planning and the like. A second strand of authors emphasizes the development of talent pools focusing on "projecting employee/staffing needs and managing the progression of employees through positions" (Lewis & Heckman, 2006, p.140). Cappelli's (2008) contribution is probably the soundest contribution in this regard. It links the idea of talent management to supply chain management. For Cappelli the key is to manage the uncertainty around forecasting talent needs through balancing in-house development with buying in talent from the open market. Studies in this tradition typically build on earlier research in the manpower planning or succession planning literatures. The third stream focuses on the management of talented people. Finally, there is an emerging body of literature which emphasizes the identification of key positions which have the potential to differentially impact the competitive advantage of the firm (Becker, Huselid and Beatty, 2009; Boudreau & Ramstad, 2005; Hulesid et al., 2005).

As noted above, we adopt Author's, (in press) definition: as activities and processes that involve the systematic identification of key positions which differentially contribute to the organization's sustainable competitive advantage, the development of a talent pool of high potential and high performing incumbents to fill these roles, and the development of a differentiated human resource architecture to facilitate filling these positions with competent incumbents and to ensure their continued commitment to the organization. They argue that the first step in any talent management system should be the identification of the pivotal talent positions which have the greatest potential to impact on the organization's overall strategic intent. This perspective calls for a greater degree of differentiation of roles within organizations and an emphasis on strategic over non-strategic jobs (Becker & Huselid, 2006; Becker, Huselid & Beatty, 2009), or organizational roles which have the potential for only marginal impact vis-à-vis those which can provide above-average impact (Boudreau & Ramstad 2007). However, the extent to which a variation in performance between employees in strategic roles is also a significant consideration (Huselid et al, 2005). This contrasts with the status-quo in many firms where over-investment in non-strategic roles is commonplace (Boudreau & Ramstad, 2008; Huselid et al., 2005).

The final element of the definition emphasizes the development of a differentiated HR architecture to support the identification of pivotal talent positions and those individuals who make up the organization's talent pool. For example, organizations are likely to rely on a knowledge based employment mode which emphasizes internal development and long-term employee commitment for those in knowledge based employment (Lepak & Snell, 1999). The emphasis of the current paper is on the first two aspects of the definition. Specifically, we attempt to shed light on the identification of pivotal talent positions in R&D settings which have the

potential to differentially impact performance. Additionally, we identify the characteristics of the individuals who occupy these positions.

Research and Development: The key to Organizational Sustainability

A recent report found that more than two-thirds of directors at leading global companies cite innovation as critical for the long term success of their organizations (Spencer Stuart, 2008). While we acknowledge the increasing need for the organization to be innovative in all its aspects, innovation continues to be the domain of the R&D division. R&D typically refers to the "creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of (hu)man, culture, and society, and the use of this knowledge to devise new applications" (OECD, 2008).

In today's rapidly changing business environment, new product design and development is more than often a crucial factor in the survival of a company. A company that fails to meet the changing preferences of customers and at least match the product offerings of competitors, will not be in business for very long. The purpose of R&D is relatively straight forward – develop new applications that customers want whilst also contributing to the firm's absorptive capacity i.e. it's ability to exploit external knowledge (Cohen & Levinthal 1990). Indeed, R&D has been referred to as 'an investment in survival.' The case of Apple is the often lauded example. When Steve Jobs returned to the company in the late 1990's, Apple were struggling to be profitable as a result of increased competition from Microsoft and Sun. Jobs recognized that R&D was key to Apple's future success and immediately set about restructuring and advancing R&D operations. As a result of products such as iPod, iPhone, and Macbook, today Apple is one world's most profitable companies and is synonymous with the term innovation.

The importance of good communication and optimal knowledge flows has been stressed throughout the study of management of the innovation process. This is because innovation is

typically a group effort. The image of the lone scientist single handily making breakthrough discoveries is more myth than reality. For example, Thomas Edison did not invent the light bulb, phonograph and motion picture on his own. In truth, those products were the results of years of hard work by teams of researchers employed in Edison's labs. The development of new products and technologies like these require an enormous amount of knowledge. Innovation necessitates that the R&D group continuously explore the outside world for knowledge of the latest scientific and technological developments, while at the same time exploiting this knowledge internally (Cohen & Levinthal 1990; Grant 1996). Thus we argue that our findings are applicable to all R&D settings - as for innovation to occur team members will have to be aware of advances in technology and thinking in the field in which they operate. To understand the process through which external knowledge becomes embedded in the R&D group, we now turn to the influential technological gatekeeper theory.

The Technological Gatekeeper: A Pivotal Position in R&D Settings?

Throughout the 1970s and 1980s, a rich stream of research examined the processes through which knowledge of the latest technological advances enters the R&D group. This particular stream was headed by MIT's Thomas Allen and his seminal book *Managing the Flow of Technology* (Allen 1977) documents over a decade's worth of studies with some of the largest American R&D corporations. Allen discovered that knowledge of the latest scientific and technological developments entered the R&D group through a two-step process. Not every R&D professional was directly connected with external sources of knowledge. Instead, a small minority had rather extensive external contacts and served as sources of knowledge for their colleagues. These individuals were termed 'technological gatekeepers' (Allen & Cohen 1969; Allen 1971; Allen 1977; Tushman 1977; Allen, Tushman & Lee, 1979; Katz & Tushman 1981; Tushman & Scanlan 1981; Macdonald & Williams 1994) as they served as the conduit through

which knowledge of external technology flows into the R&D group. Essentially, a gatekeeper is an individual who acquires technological knowledge from the outside world (step 1) and disseminates this to his or her R&D colleagues (step 2). A more formal definition explains that technological gatekeepers are those key individual technologists who are strongly connected to both internal colleagues *and* external sources of knowledge, and who possess the ability to translate between the two systems (Allen & Cohen 1969; Allen 1977; Tushman & Scanlan 1981). The gatekeeper concept is consistent with other theories of social diffusion, such as Roger's (1962, 1995) diffusion of innovations, Granovetter's (1974) strength of weak ties, Burt's (1992) structural holes, and Galdwell's tipping point (2000), which all point towards the crucial role a small number of exceptional people play in spreading valuable information, trends, and ideas.

Gatekeepers make a significant contribution to the innovation process by virtue of their pivotal position in the knowledge flow network. Not only do they act as the firm's antennae tuned to a variety of external broadcasting sources, they also exploit their familiarity of the internal knowledge network to internalize emerging technologies. Allen & Cohen (1969, p. 16) noted when studying gatekeepers in the R&D division of a large aerospace firm that "…if one were to sit down and attempt to design an optimal system for bringing in new technological information and disseminating it within the organization, it would be difficult to produce a better one than that which exists." Indeed, subsequent studies have provided the empirical evidence to support this claim. Development focused R&D projects containing gatekeepers have been found to be significantly higher performing than those without (Tushman & Katz 1980; Katz & Tushman 1981).

The gatekeeper has certain unique talents that make them pivotal to the innovation process. Firstly, previous studies have shown that oral communications and not written materials are considered the primary medium through which R&D professionals import and digest

technical information within the organization (Allen 1977; De Meyer 1985; Macdonald & Williams 1994). By extension, gatekeepers tend to be highly sociable and people-orientated individuals who can acquire and disseminate knowledge orally. Secondly, the gatekeeper is a highly competent technical performer. They tend to publish more papers and have higher peer and supervisor ratings than their colleagues. Thirdly, the gatekeeper's gathering of external knowledge is distinct from that of the general R&D professional. Gatekeepers are selective in the knowledge they acquire and are proactive in acquiring it. They tend to read scientific journals and maintain longer-term relationships with colleagues outside their own organization. Although the knowledge acquired maybe for their own use, gatekeepers are also keenly interested in passing it on to other R&D colleagues for their own use. Fourthly, the gatekeeper's principle contribution comes by way of the translation that they can perform (Allen 1977). The gatekeeper can convert knowledge gained from external contacts and journal papers into terms that are understandable and relevant to local R&D colleagues. It is because of this ability and their technical competence that they are frequently sought out by their colleagues.

While we argue that the gatekeeper theory provides a useful lens to examine talented individuals in R&D, we acknowledge that the theory is a little outdated. It has been over 20 years since any significant investigation into the gatekeeper concept has been conducted. In the time since, there have been huge advances in ICT. The gatekeeper existed in a time when it was a difficult and time consuming process for the average R&D professional to acquire knowledge from beyond the company's boundaries. Thus, the gatekeeper mediated with the outside world on their behalf. What technologies such as the World Wide Web have changed is the ease and speed with which employees at all organizational levels can access and disseminate information. As a result, recent studies suggest that the modern gatekeeper may have morphed into another role providing an altogether different range of services (Assimakopoulos & Yan 2006; Whelan &

Donnellan 2008). While we have a good understanding of the role and characteristics of the traditional gatekeeper, scant attention has been paid to how the gatekeeping function is performed in the modern R&D group. From the talent management perspective, this study seeks to explore whether the technological gatekeeper remains a pivotal position in the modern R&D setting and further highlight how organizations can identify and define those performing the gatekeeping function in the modern R&D group.

The technological gatekeeper concept informs us that a small number of skilled R&D professionals facilitate the flow of the latest technological developments into and around the R&D group. This process is illustrated in the conceptual framework in figure 1. The diagram highlights the role of Mike, a technological gatekeeper. Mike is well connected to external sources of knowledge. These connections enable Mike to keep abreast of the latest technological developments in the industry and indeed, in related industries. Mike is also well connected internally. Through these connections, Mike maintains an awareness of where the internal expertise resides. When Mike comes across potentially useful knowledge from the outside, he directs this to the internal colleague, Alan, Jane, Joe, Tina, or Simon, that he knows is best placed to exploit that knowledge. Through this process, external knowledge is continually imported into the R&D group, R&D professionals are kept abreast of the emerging technologies in their field, which in turn contributes to the R&D group continuously producing innovative outputs in the form of new technologies, products, and processes.

*****TAKE IN FIGURE 1 APPROX HERE*****

The Technological Gatekeeper and Talent Management

As discussed above, we argue that the first step in any strategic talent management system is identifying the pivotal talent positions which have the potential to differentially impact on the sustainable competitive advantage of the organization. This is premised on the idea that, while

every employee and every job contributes to the organization in different ways, it is ultimately only a small number of pivotal positions which have the potential to provide above-average impact on performance (Boudreau & Ramstad, 2007). Consistent with others we argue that organizations should disproportionately invest in these roles. Given the financial constraints within which even the highest performing organizations operate, it is important to focus resources appropriately. Thus, we argue, by focusing on those pivotal roles and filling them with high potential and high performing employees, resources are more strategically deployed within organizations.

However there is an increasing awareness of the challenges associated with identifying these pivotal position-reflected in a traditional over-investment in non-pivotal roles (see Becker et al, 2009; Boudreau & Ramstad, 2008; Huselid et al, 2005). Thus we view our contribution as valuable in considering the nature of pivotal positions in R&D settings. The importance of employees in stimulating innovation is a pressing concern for organizations of all sizes (Cohn, Katzenbach & Vlak, 2008). However, our argument is that having high potential and high performing employees is not enough - it is every bit as important to ensure they are appropriately deployed. Returning to our framework, we propose that the role performed by individuals like Mike makes a more telling contribution to strategic objective of R&D, which ultimately is innovation - and talent management initiatives should be centered on such roles. To test this proposition, our first research question asks: Is the technological gatekeeper still a pivotal position in the modern R&D group?

Once the pivotal positions are identified, the strategic talent management system advocates the development of a talent pool of high potential and high performing incumbents to fill these roles. In order to groom potential incumbents, management needs to know the specific talents of those occupying key positions in the R&D knowledge flow network. While the

definition of talent management adopted above, suggested the development of pivotal talent pools and the theorizing behind the definition argues for the development of more generic competencies rather than for developing employees for specific roles, we argue that the gatekeeper role is so significant in R&D settings that it may be appropriate to identify the knowledge, skills, and attitudes displayed by such gatekeepers and to include these in selection and development decisions around the talent pool. Thus, our second research question asks: What are the specific competencies required by those individuals who occupy pivotal positions in the R&D knowledge flow network?

The Case Firms

Utilizing a multiple case study approach, we studied the R&D groups of two medical device manufacturing firms operating in Ireland, MediA and MediB[1]. Details of both sites are summarized in table 1.

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The R&D groups at both firms, referred to in the rest of the paper as Group A and Group B, concentrated on product and process development with very little pure research being undertaken at either site. MediA designs and develops technologies and products that assist medical device manufacturers improve outcomes for patients. The company is Irish owned, employs approximately 400 people, and has an annual turnover of approximately $37 million. It's R&D group, Group A, primarily provides design and development expertise for medical device companies who wish to outsource their device design. The group will redesign an initial concept and bring it through to a stage where it can be manufactured for commercialization and market release. Group A numbers 42 in total, mostly consisting of design and mechanical engineers. MediB is an American multinational that has been in the medical device business for

[1] Company names are fictitious to preserve anonymity

over 25 years with an annual turnover of $8.3 billion. The company has advanced the practice of minimal-invasive medicine by providing a broad and deep portfolio of innovative products, technologies and services across a wide range of medical specialties. The company employs approximately 3,000 R&D engineers, scientists, and technicians worldwide. While the majority of these are based in the US, Group B consists of 76 R&D professionals co-located in MediB's Irish subsidiary. Although a high level of collaboration exists between the Irish and US R&D bases, Group B is largely a stand alone entity. Both the Irish and US groups are design owners of certain products, and it is the responsibility of each group to advance those designs. Both Group A and Group B are considered to be leaders in their particular niche markets. Group A recently won a top industry innovation award while MediB invested an additional €50 million in Group B, in recognition of the group's innovative output. To remain at the forefront of the medical device industry, it is necessary for both R&D groups to continuously scan the external environment in order to identify opportunities, address new disease areas, and develop new technologies that can reduce risk, trauma, cost, procedure time and the need for aftercare.

Identifying Pivotal R&D Positions through Social Network Analysis

Identifying pivotal positions is something organizations find difficult. We propose a novel approach in this regard. Given the well established centrality of knowledge flows in the R&D innovation process, we use SNA techniques to identify pivotal talent positions. SNA or sociometry is an established social science approach of studying human relations and social structures by "disclosing the affinities, attractions and repulsions between people and objects" (Moreno 1937). In simple terms, SNA is the mapping and measuring of relationships and flows between people, groups, organizations, computers or other information/knowledge processing entities (Scott 2000). SNA views social relationships as nodes and ties which can be illustrated visually and mathematically. As such, it can provide an x-ray into the inner workings of a

particular network. With this tool, important patterns become visible, the relationships between people can be better understood, the health of a group can be assessed and, the people playing key roles within the group can be identified (Cross and Parker 2004). In recent years, SNA has found increasing use as a structured way to analyze the extent of informal relationships that exist within various formally defined groups (Cross, Nohria et al. 2002). However, despite the knowledge intensive nature of R&D, SNA of the R&D function remain relatively rare (Allen, James & Gamlen, 2007).

The goal of this study is to demonstrate how SNA supports the identification of talented individuals in R&D settings. In our argument, these are the handful of individuals performing the gatekeeping role. We adopt the classic definition of a gatekeeper as an individual who is *both* an internal communication star (i.e. in the top 20% of internal communication measures) and an external communication star (i.e. in the top 20% of external communication measures). While it can be argued that this is an arbitrary measure, it serves our purpose of identifying the key individuals in the R&D knowledge flow network.

Figure 2 presents the SNA of Group A. To collect these data, all group members were asked to complete a short online questionnaire on their internal and external communications. The SNA software package UCINET (Borgatti, Everett & Freeman, 2002) was used to produce this diagram. The nodes in the diagram are the individual members of Group A and the lines represent the flow of technical knowledge between them. The more connected nodes tend to gravitate towards the centre of the network while those nodes with fewer connections are found on the periphery. Nodes 4, 16, 35 and 40 did not complete the questionnaire hence the reason they are isolated on the left. Nodes 2, 11, 38 and 42 are also isolates because they have no reciprocated interactions with another group member. The external communication stars of the group are represented as triangles. The size of the triangle is reflective of how well connected that

individual is to external knowledge sources. For example, node 9 is the biggest triangle as this individual is the most frequent user of external knowledge sources.

*****TAKE IN FIGURE 2 APPROXIMATELY HERE*****

Figure 2 reveals a number of key people in Group A's knowledge flow network. Firstly, there are nodes 7 and 37. Using the classic definition, only these two members (or 5%) of Group A can be classified as technological gatekeepers. While external knowledge is imported and disseminated around the group by these two gatekeepers, the SNA evidence indicates that separate communication specialists also combine to perform the gatekeeping role. One set of boundary spanning individuals acquire external knowledge, and a largely different set of individuals distribute this knowledge around the group. The relationship between node 5 and node 25 can be used to demonstrate this process (the relationship between nodes 17 and 28, nodes 9 and 6, or nodes 15 and 6 could also have been used). Node 5 is an external communication star. This individual is well connected to external knowledge sources but is not very well connected internally. Node 5 acquires external knowledge and communicates this to node 25. Node 25, on the other hand, is well connected internally and can distribute this knowledge around the group through his or her many connections. It must be noted however that the SNA evidence, and our interpretation of that evidence, only suggests that such a sequence of knowledge flow is evident. Semi-structured interviews with selected group members were also conducted to validate this interpretation, and to explore the specific talents exhibited by these key individuals. These interview findings are presented later in the paper.

Figure 3 presents the SNA of Group B. A similar pattern is evident to Group A, and a number of key individuals can be identified. While gatekeepers do exist in Group B, they are rare. Only four members (or 6%) of this R&D group fit the classic definition of a gatekeeper. The gatekeepers of the group are nodes 5, 9, 11, and 54. Figure 3 reveals that many of the individuals

that are highly connected to external sources of knowledge, are poorly connected in terms of internal communications. This finding is consistent with that from Group A and suggests to us that one set of boundary spanning individuals specialize in acquiring external knowledge and a largely different set of individuals specialize in distributing that knowledge around the group. A number of relationships between external communication stars and internal communication stars indicate such a scenario – nodes 51 and 53, nodes 37 and 13, nodes 37 and 38. Probably the clearest example of this relationship in figure 3 are nodes 62 and 66 (top left corner).

*****TAKE IN FIGURE 3 APPROXIMATELY HERE*****

Having used SNA techniques to identify the individuals occupying pivotal positions, qualitative interviews with a number of these key communication stars in both R&D groups were conducted in order to address our second research question. The section below presents the findings from these interviews.

Exploring the Competencies of the Pivotal Actors

We interpreted the SNA evidence from both R&D groups to purport that the gatekeeping role is performed either by single individuals – the gatekeepers themselves – or by a combination of external and internal communication specialists. We now present the interview findings using these terms as headings - starting with the external communication stars.

External Communication Stars

Keeping abreast of the latest technological developments in the field is vital to the success of both R&D groups. With the advances in ICT, all R&D professionals could easily acquire this outside knowledge. However, the SNA evidence indicates that external communications are monopolized by a small number of individuals. The interview evidence finds support for this statement. Knowledge of the latest technological developments are imported into both R&D groups largely by those individuals identified as externals communication stars in the SNA. So

what talents do these individuals exhibit? No particular individual or group of individuals are formally appointed to a technology scouting role at either R&D group. The process occurs more organically and is driven by the external communication stars. The following quote is representative of the views of most of the external stars interviewed. Reflecting on how Group A maintains awareness of industry developments, one external star offered his opinions and explained that some people just have a genuine interest in keeping abreast of the latest industry developments, while others:

> *…could walk into a room wallpapered with valuable information about the most cutting-edge technologies in our field…but if they are not interested, then they won't even notice.*

An early hunch formulated by the authors suggested that external communication stars were more likely to be recent university graduates, as the people in this age category would be more adapt at using the emerging Web technologies like blogs, wikis, and social networking sites to keep abreast of the emerging industry trends. However, this hunch did not pan out. While the Web is the primary channel through which external stars stay current with the most recent technological developments, external stars tend to be R&D professionals with a number of years industry experience. They also have the ability to understand exactly what external knowledge is relevant to the group. Having this ability only comes with a few years industry experience. One project leader in Group A explained the difference between these external stars and those younger engineers:

> *I think possibly it's because they've just seen a bit more. When they find information on the Web, they know the level it needs to be at in order to make it useful, whereas a younger guy would come back and say "so I found all this stuff" and you end up telling them that most of that is rubbish. The more experienced guys know exactly what we need from the outside world.*

Additionally, the external communication stars tend to possess a deep, as opposed to a wide ranging knowledge of a specific technology domain. Many of the external stars interviewed had acquired PhDs. Having a deep and narrow knowledge domain would seem to be an important antecedent to being an effective external communication star. With so much information freely available through the Web, an individual cannot decipher the truly novel technological developments from the rest unless they have considerable expertise in that particular domain. As one external star in Group B explained:

> *I think the Web is the most direct and open way to finding new things. I suppose the idea of finding a new concept that's out there - you can't really go looking for something new and unknown if you have no reference for it. That's particularly true in my area - drug eluting stents. Unless you know the field inside out, you are not going to know what the new developments are.*

The interviews also revealed that some external stars excelled in using search engines like Google to acquire very specific and detailed information relevant to the group's work. Even with the advances that Google have made, a search for any topic will return thousands of Web pages, the vast majority of which are irrelevant. It seems that these particular external stars possess an intimate knowledge of where and how certain information can be found on the Web - a human search engine of sorts. In the following quote, one of these external stars in Group B explains his specific search strategy. He starts off using Google as a first level search in order to find the general information he is after. Once he finds a Webpage with useful information, the second level search becomes more specific. He either explores an additional link contained in the Webpage, or he uses the new information he found to generate more specific keywords to re-enter into Google. This cycle may continue until he finds the specific information he is after:

> *I think the Web is the most direct way to explore what's out there. You could start off by even going into Google and looking up what you are after…and the next thing you would see a link to someone, for example, a link to a drug that Johnson & Johnson use…and before you know it, that brings you back to some university in some obscure place that developed the drug. Through that process, it's possible that you may get access to what you were originally after to begin with.*

Internal Communication Stars

The external stars interviewed in both groups explained that they primarily acquire external knowledge for their own use, but if they come across information that would be useful to others, they would try to distribute it. However, external communication stars are not effective disseminators of knowledge as they seem to be lacking the necessary skills. To be useful to the R&D group, the knowledge acquired from outside sources needs to be translated into a form that is understandable and relevant to group members. This is a specific skill that is most likely to be found in the R&D group's internal communication stars, hence it is these individuals that tend to disseminate the knowledge acquired by the external stars around the group. The interviews revealed that email is the primary system used to alert colleagues to new information from outside the company. This information is usually in the form of a Web link or an attached document. While many emails are disseminated around both group's containing information on current industry developments, many interviewees pointed out that only a fraction of these are given any attention. Two factors determine if the information contained in an email will actually be read and used further: (1) how the information in the email is presented i.e. translated so that it is relevant and understandable to the receiver, and (2) the sender of the email. Regarding the sender of information, certain members of the both group's have a reputation for blasting out

non-relevant information to the rest of their colleagues. One of Group A's internal communication stars refers to these individuals as 'email jockeys' and explained that:

> *…rather than taking ten minutes out to walk over and discuss that new information with someone, these guys constantly FYI emails around to everyone. That's not really transferring knowledge. These email jockeys are useless…nobody ever reads the emails they send around anyway.*

Unlike the 'email jockeys', the internal stars are aware that an email containing new information will only be read if it is translated into a form that is relevant and understandable to the recipient. Rather than blasting out an email under the title FYI, they tend to include a short introduction on the email that explains/translates why the information contained is relevant to the receiver. External knowledge will not disseminate effectively in Group A or Group B unless it is first translated into terms relevant to group members. It seems that the internal communication stars possess these translation skills and their emails gain the attentions of the intended recipients as a result. In contrast, the 'email jockeys' do not translate the information contained in their email messages, possibly because they do not have technical competence to perform the translation, and their messages are rarely read as a result.

While the external stars acquire knowledge of the emerging developments, the internal communication stars are largely responsible for disseminating that knowledge. Chris[2], an internal star in Group B, acknowledged that many of his colleagues often consult with him when they have discovered novel external knowledge. These discussions are almost always conducted face-to-face and focus on figuring out if and how outside knowledge can be used by the R&D group. Chris is a senior person in Group B and has 13 years experience in the medical device field, 8 of those with MediB. The analysis of the SNA data reveals that while he is one of the most

[2] Pseudonym

connected people internally, he has very low exposure to external sources of knowledge. Chris acknowledges that certain group members have the deep technical expertise needed to keep abreast of the latest developments in their field but they might not have the skills needed to translate that knowledge for others. His own knowledge base is wide-ranging as opposed to deep. As he explains, this provides him with the ability to see the bigger picture within the whole R&D group, and to understand how external knowledge needs to be modified in order to fit into that bigger picture:

> *So anything mechanical related…people would probably run it by me just to make sure it makes sense. The reason for that is probably – I wouldn't say it's my technical expertise – there are a lot of people in the group that would burn me in terms of pure technical expertise. My skill sets would lie in that I know a little about a lot of different things, and I probably have a good appreciation for how they all fit together into the overall picture. We do have people who are bond experts, who are crimping experts, who are balloon experts, [but] they probably wouldn't have as good an appreciation for the impact that something new would have on other people…whereas I probably would have that visibility. The skill set I have – other people probably don't have that.*

In addition to translating external knowledge, the internal stars have certain skills which enable them to effectively disseminate knowledge around their R&D groups. Internal stars need to have a good understanding of what expertise group members have so that they can direct relevant knowledge specifically to those individuals. The internal stars explained that they gain this familiarity through their networking talents. They have a reputation among their peers for being approachable and are frequently sought out for consultation. Through these interactions, they learn of other's expertise and build their network of contacts in this manner. As one internal star explained: *"I think I'm approachable...I love talking to people, I don't mind people coming*

to me with anything." Another explained that it is his deliberate strategy to develop a personal network which stretches to all parts of R&D. In his own words, he views his network of contacts as a *"two way street."* Having an extensive network enables him to distribute knowledge to the most relevant individuals, but also to access knowledge from his contacts when needed:

> *I would have a pretty good grasp of where the knowledge sits within the group…partly because I'm here so long. Over the years I've tried to build my network…I try to get to know the expertise people have so I can liaise with them when needed. I guess others see me a bit like the Golden Pages. If they need to know what is happening in the other teams or even in marketing or clinical trials, they come to me. If they do come to me with an information need, I try to give them a good service. I might say "Look, this is pretty much all I know about this topic, but talk to this guy, he's your man." What you'll find is that if you go back to them, they will try to reciprocate…you can even push them a bit further to get to what you're looking for because you helped them out the last time.*

Gatekeepers

Using the classic definition, few gatekeepers existed in either R&D group. The evidence emerging suggested that it is possible but rare for a single individual to possess both the depth of knowledge needed to be an external communication star, and the breath of knowledge needed to be an internal communication star. Our interviews with the gatekeepers focused on understanding how their methods differed from that of the external and internal communication stars. Regarding internal communications, we found little difference between the methods employed by the gatekeepers and the internal stars. Both are very approachable, use a combination of email and oral conversations to disseminate knowledge, and have excellent social networking skills. The difference lies in their contrasting abilities to acquire external knowledge. Gatekeepers have the ability to extend their network of contacts beyond the organization's boundaries. However, in

terms of external communications, gatekeepers differ significantly to external stars. While the external stars tended to use the Web to keep abreast of external developments, gatekeepers preferred to use oral communications. The gatekeepers have many contacts outside the company and they phone these on a regular basis. Certain social skills are needed to develop this network of contacts and to extract knowledge from them. These social skills do not come naturally to most R&D professionals and this maybe is one reason why the Web is the preferred source of external knowledge for others. Such high social skills are not needed to extract information from the Web. An example of the social skills needed to extract knowledge from others is provided in the following interview excerpt with one gatekeeper from Group A:

> *The guys in the tool workshop are a great source of ideas for me…but if you need to know something, it's no good sending these guys an email. They will only help you out if they think you are a peer. There's no point going down to these guys wearing a three-piece suit…if the tool guys don't see you as a peer or with a bit of dirt on you then the answer you will get from them will be different and probably not as helpful. I would say that most people in [Group A] are weary about going down to the tool workshop. You just have to know how to deal with them.*

The key findings emanating from our interviews with the external stars, internal stars, and gatekeepers, are summarized in Table 2.

*****TAKE IN TABLE 2 APPROXIMATELY HERE****

Discussion & Conclusions

This paper provides a very clear example of how pivotal positions can be identified in organizations. Recognizing the importance of knowledge flows in the context of innovation in R&D settings, we argue that the technological gatekeeper role continues to represent a pivotal position. We argue that the technological gatekeeper role will be relevant in any R&D setting

where the focus is on innovation - be that through new product development or innovation in existing product lines. In both of these instances our argument is that accessing external technological knowledge and disseminating it around the R&D network is central to the innovation process.

While we find that the gatekeeping tasks of acquiring and disseminating knowledge are integral to the R&D operation, we also find that these tasks no longer need to be performed by a single individual. Indeed, it is more likely that the gatekeeping role will be performed by external and internal communication specialists combining their unique talents together. Gatekeepers do exist, but they are rare. When Allen (1977) first formulated the theory, the gatekeeping role could only be performed by a single individual because technical communications were predominately oral based. Among other skills, the traditional gatekeeper needed excellent social networking abilities in order to effectively acquire and disseminate knowledge orally. While other R&D engineers may have wanted to perform the gatekeeping role, the lack of these social networking skills possibly impeded them. From the two R&D groups we have studied, we find that Web technologies now enable the individuals that are interested in external developments to easily access that knowledge. Rather than having social networking skills, these external communication stars possess analytical and Internet search skills. However, the lack of excellent social networking skills inhibits the ability of the external stars to distribute that knowledge around the R&D network themselves. This is the domain of a different set if individuals, the internal communication stars, who possess those excellent social networking abilities.

While clearly one could argue that it is the individuals that are pivotal and not the positions, our argument is that to maximize the level of innovation in R&D settings all project teams require people to perform the gatekeeper role. A key contribution of the current paper is to identify the competencies evident in both internal and external communication stars (see table 2).

This will provide organizations with the information required to identify these competencies in the individuals within their talent pools, to focus development interventions for the talent pool in developing these competencies and to facilitate the placing of internal and external communication stars in each R&D group. Managers would also be interested to know what they can do to facilitate the external and internal communication star positions. While we would not advocate that management formally appoint individuals to these positions, we do advocate that the handful of key individuals who exhibit the competencies of the communication star be given the opportunity to display their talents. External stars could be freed any mundane administrative duties and allocated the time they need to scan the external environment for emerging technologies and trends. In terms of resources, all they need is a PC with an internet connection. However, it would more beneficial if external stars are given priority for external networking events such as conferences or tradeshows. Internal stars have a natural flair for getting to know others. If management fails to recognize the valuable role performed by these individuals, there is a danger that their knowledge dissemination efforts could be stifled. Internal stars need the opportunity to network. Involving these individuals in multiple projects throughout the firm will enable them to build their network more rapidly, allowing them to become more effective disseminators of knowledge.

Finally, our approach demonstrates the usefulness of SNA in identifying such positions. This is a concrete tool that can be utilized in practice to confirm the technological gatekeeper role as a pivotal position in R&D settings. Additionally it is a tool that practitioners can use in the process of identifying high potential and high performing individuals for the organization's talent pool. Given the centrality of such internal and external communication stars in knowledge flows and innovation in R&D settings, such communication stars are central in the organization's R&D process.

This paper provides useful insights for both teaching and research in a wide range of domains. The paper is likely to be of interest to academics in a wide range of domains. Clearly, it will be relevant to HR scholars. However given that the majority of CEOs surveyed by the Economist Intelligence Unit (2006) felt that talent management was too important to be left to HR alone, the paper is likely to be of interest to strategic management scholars. Finally, given the focus on R&D settings, the paper is likely to be relevant to scholars in MIS and other research orientated domains. The paper provides a solid platform for the discussion of talent management. For example the meaning and contribution of talent management and validity of the construct would represent and interesting discussion in any session on the topic. More fundamentally the paper provides a solid insight into the identification of the talent management process in R&D settings. This provides a real example of how pivotal positions can be considered and identified. An expanded discussion of this issue could focus on if and how pivotal positions are identified in other organizational contexts.

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Table 1

Case Study Site Details

	MediA	*MediB*
Headquarters	Ireland	USA
Turnover (2007)	$37 million	$8.3 billion
Total Employees	400	25,000
R&D Employees	42 in Group A	3,000 in total, 76 in Group B
R&D Group's Expertise	Catheter-based minimally invasive devices	Drug eluting stents, stent delivery systems

Table 2

Summary Table of those Performing the Gatekeeping Role

	Key Skills	**Motivation/attitudes**	**Preferred Media**
External Communication Stars	• Ability to acquire relevant knowledge of external developments • Excellent research skills • Narrow and deep technology domain knowledge • Strong analytical skills	• Genuine interest in keeping abreast of emerging trends in their specialty • Primarily acquire knowledge for own use but lack the skills to disseminate effectively	• Predominately Web-based e.g. Google search, online communities, materials websites
Internal Communication Stars	• Ability to translate complex external knowledge into a form understandable and relevant to internal colleagues • Wider knowledge base which facilitates understanding the context of new knowledge and how it fits with extant knowledge • Ability to verify that Web-based information is accurate and reliable • Detailed knowledge of where expertise resides internally in the organization • High levels of credibility among co-workers	• Enjoy helping others • Develop their own knowledge from these interactions • Expect reciprocation	• Email and oral
Gatekeepers	• Display both depth of knowledge of external communication star and breadth of knowledge of internal communication star • Greater evidence of strong ties with external stakeholders- a strong network • Highly sociable with very good networking skills enabling them to develop extensive internal and external networks • Eliciting information from people in oral conversations	• May acquire knowledge for their own use but also transmit it others • Enjoy helping others	• External – both Web-based and oral • Internal – Email and oral

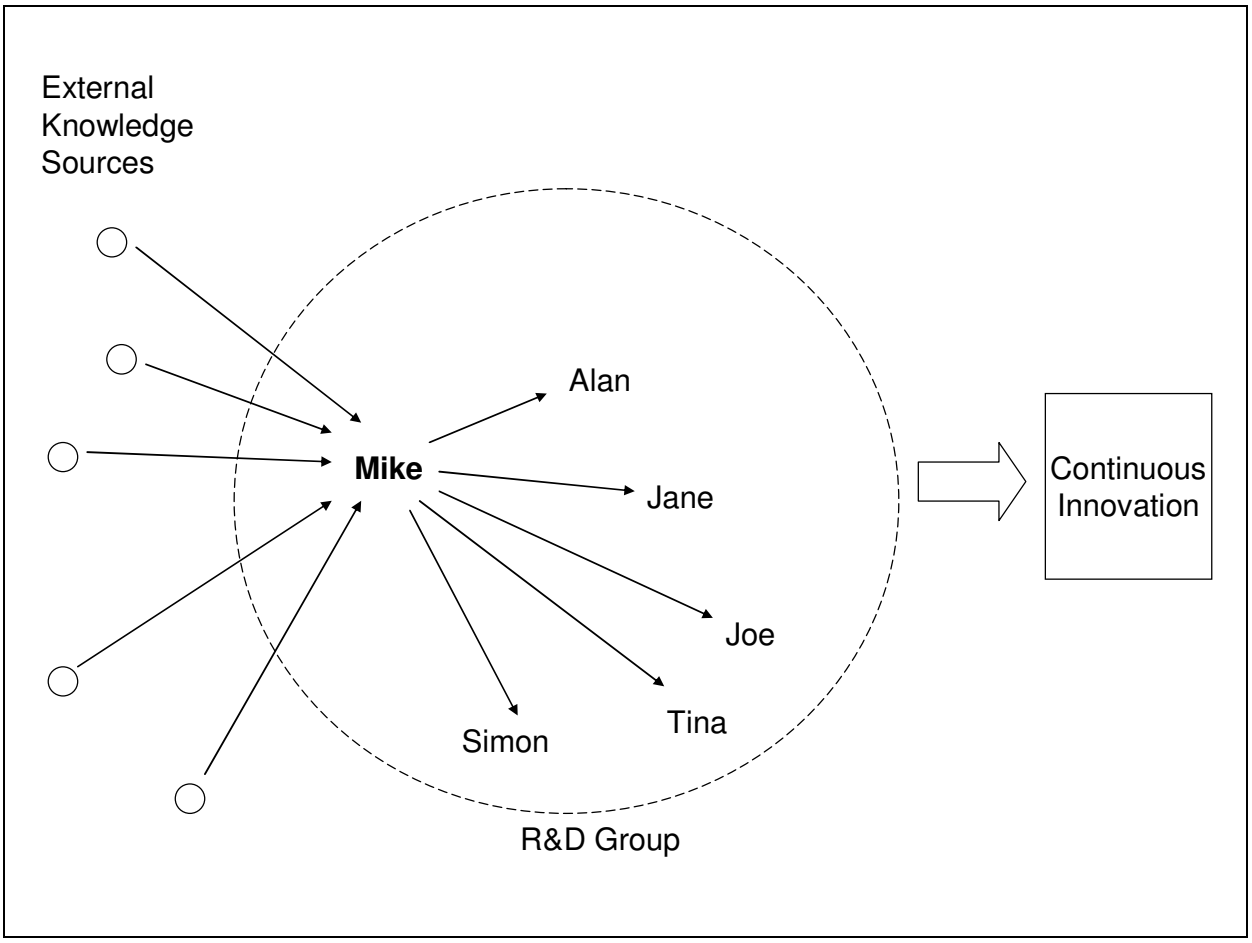

Figure 1. Illustrating the gatekeeper in action

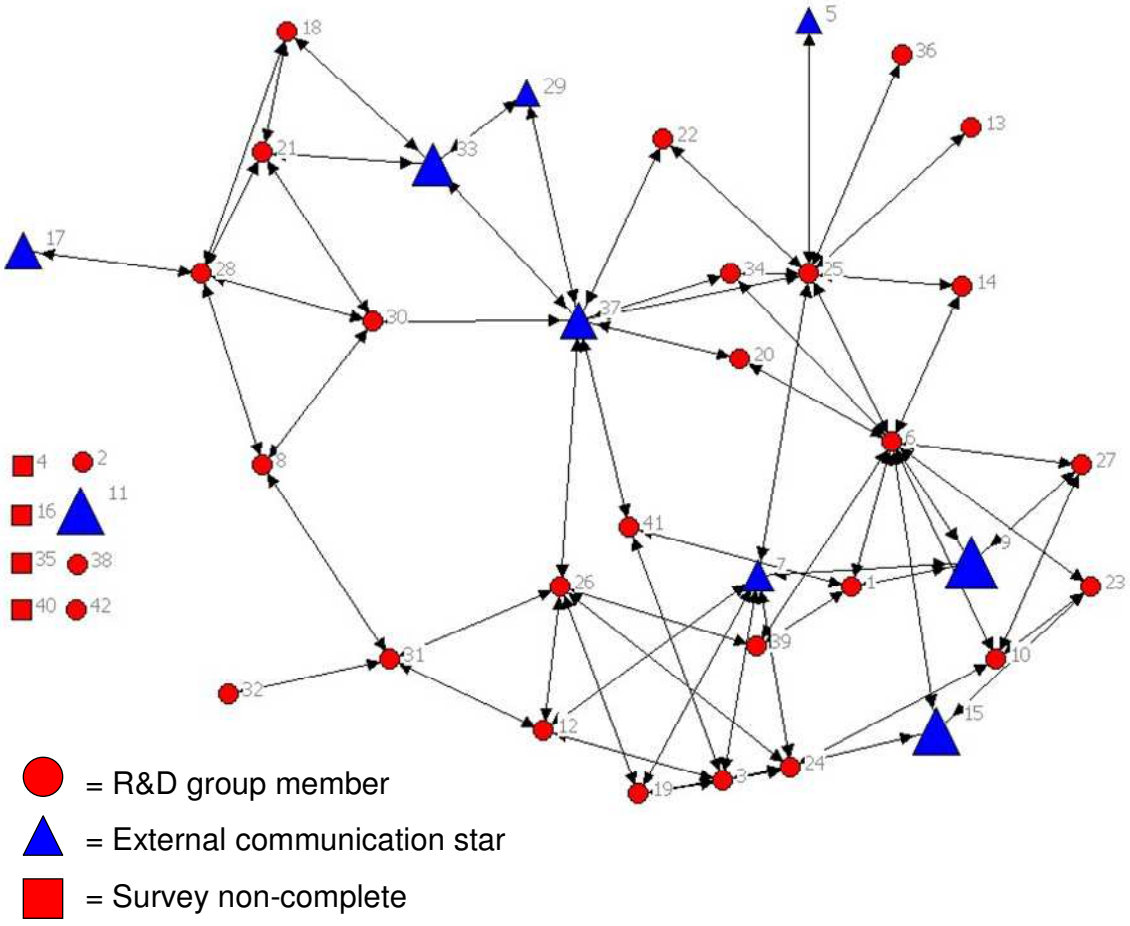

Figure 2. Group A's knowledge flow network

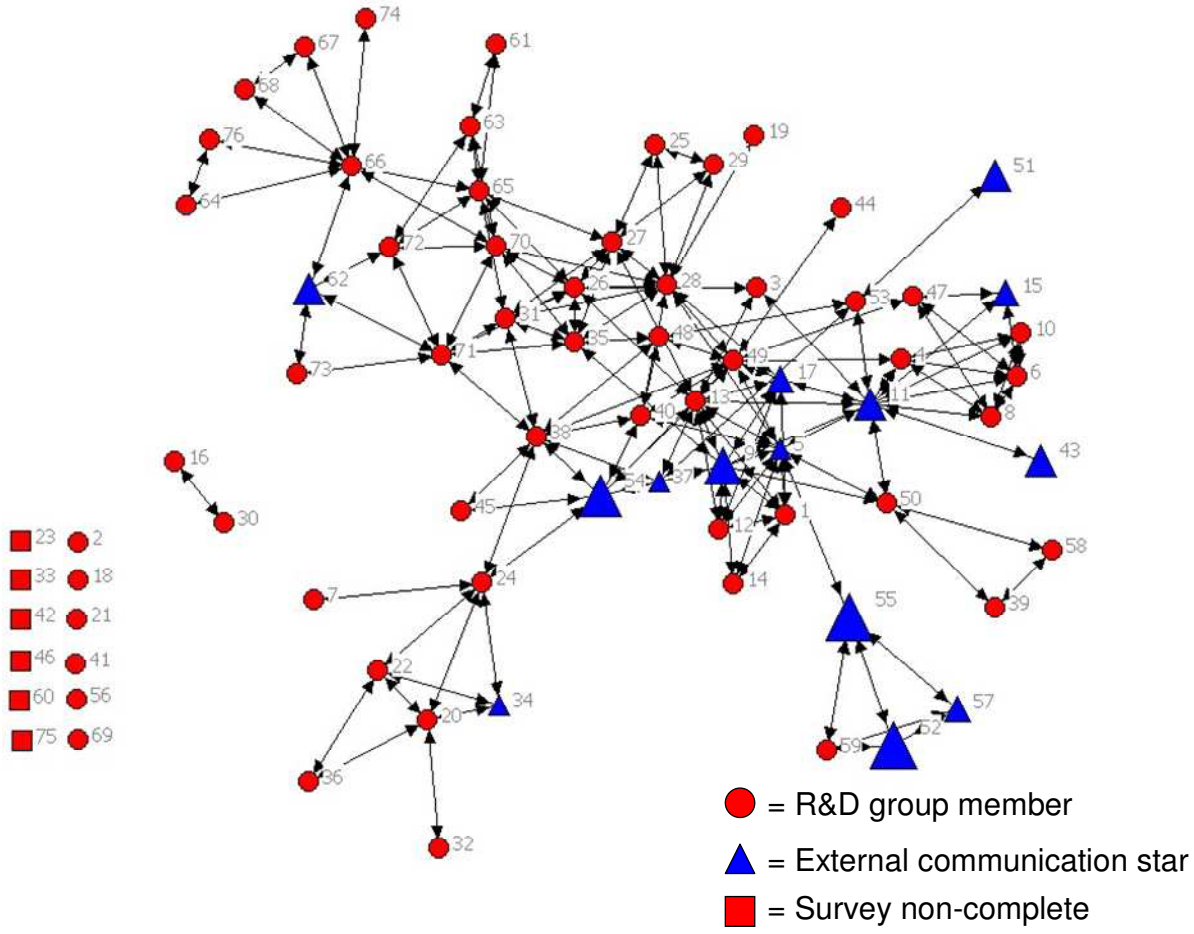

Figure 3. Group B's knowledge flow network