

**LABOR REQUIREMENTS IN INNOVATION AND
LOCAL-REGIONAL WORKFORCE STRATEGIES**

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ABSTRACT

This paper proposes a way to measure the internal organizational capacity as an important element for innovation in the context of the creative industry at regional scale. In particular, this paper pays attention to the commitment-based HR practices as critical factors in shaping organizational competency and innovation. Existing studies on innovation at regional scale have identified a set of factors external to organizations, such as knowledge spillover, local or global collaboration, and proximity to research universities and institutions, as the main mechanisms of innovation.

Presently, however, there is increasing evidence showing that the exclusive emphasis on external factors of innovation may in fact only capture one side of a continuum in which creativity and innovation are strongly influenced by internal organizational factors – i.e. internal skill pools and workplace culture (Lampel, Lant, and Shamsie, 2000; Collins and Smith, 2006).

Building on this problem orientation, this paper investigates the labor requirement of the digital content industry, corresponding organizational strategies (human resource practices) and their contribution to innovation. The connection between the HR practice and its role on technological innovation has not been made clear in the existing economic geography or planning literature. Therefore, theories from human resource management (high performance human resource management) have been adapted to form the theoretic background and inform the measurement and quantitative modeling.

The result of the logistic regression on 323 digital content industry firms cluster in Seoul, Korea indicates that the additive effect of various commitment-based HR practices including rigorous hiring of workers with high skills and educational attainments and worker retention is positively related to innovation, whereas the evidence for the contribution of local or international collaborations is vague at best.

The public policy implication of this finding is that micro level organizational human resource strategies are, in fact, an integral part of regional workforce development and long term economic growth, which may seem trivially obvious but is something that too often we seem to overlook. These research findings lend support to policy programs targeting new employment and longer retention (such as wage subsidies), as these programs help firms exercise commitment-based HR practices.

Keywords: labor requirement, organizational practice, innovation, local and regional workforce policies

INTRODUCTION

The claim that the creativity and innovation have become the source of economic growth is indisputable for post-industrial economies. With the emergence of ‘innovative regions’ and ‘creative cities,’ the local and regional capacity to support continuous creative idea development and innovation has been identified as a key resource of competitive advantage (Cooke, 1998; Hall, 2000; Storper 1997; Florida, 2002). Various approaches have been developed to explain the spatial logic of industry agglomeration and innovation. Albeit with some variations, these frameworks emphasize that innovation at a firm level is influenced by systemic forces external to the firm itself, including the spatial proximity, inter-firm social networks, culture, norms and conventions that shape social relationships, institutional settings, etc. Consequently, popular policy prescriptions tend to emphasize the creation of an ‘innovative milieu’ or a ‘creative milieu.’ These approaches have been criticized mere replication of the boosterist rhetoric of prior economic development policies (Lovering, 1999; Rheese and Sands, 2008), lacking in methodological and empirical rigor and policy relevance (Markusen, 2003), and neglecting existing industrial production systems (Scott, 2006) and the nation state (Cox, 2004). From another perspective, while these dynamic discussions have extended and deepened our understanding of the elements and mechanisms needed to strengthen local-regional creative capacity, they are still mute about the most crucial dimension of new knowledge creation and innovation: the internal factors and mechanisms of innovation.

Despite the wealth of information about important elements and mechanisms of innovation currently available, proposed models that describe various aspects of the innovation process largely understate the intra-firm capacity for innovation. Since structure- or system-theories in general are weak in recognizing the capacity and actions of agents (in the context of this paper, firms) and their influence (through both their capacities and actions), these external factor-centric accounts do not adequately address the role played by the intra-firm factors, in particular labor processes and their contribution to new knowledge creation and innovation. The current external view treats firms as unitary construct whose unique capacities have no influence on the creation of new ideas and innovation and whose organizational competencies are mostly pre-determined by the economic, institutional, cultural and political conditions of the region in which they reside. As a result, there is little discussion about important organizational elements and conditions, particularly the role knowledge- and creative-workers play in organizational

knowledge creation and innovation and the attributes of such workers. This is an important paradox, considering the strong emphasis placed on individual creativity as the most crucial element of knowledge creation and innovation in the new regionalism and creative city literatures. In an effort to bring a labor dimension to the analytical framework, some scholars have emphasized the occupation-based approach (Markusen, Wassail, DeNatale, and Cohen, 2008) and individual career development-based approaches. However, even in these frameworks, the labor dimensions are dissociated from the process of production and innovation.

Building on this problem orientation, this paper proposes ways to measure the internal factors of innovation and attempts to draw policy implications for local and regional workforce development. This can be done by understanding the internal labor requirement for production and innovation and investigating the corresponding firm strategies. This paper demonstrates that by using a firm as the unit of analysis and by focusing on those human resource practices that are positively correlated with innovation as measurements, we will be able to grasp a partial picture of the labor- firm-innovation nexus as opposed to the firm-space-innovation models where spatial aspects are much emphasized as critical elements for innovation. In doing so the focus is on exploring how labor requirements and organizational goals are reconciled through strategic human resource practices.

Special attention is given to small and medium size enterprises (SMEs) in this paper. Although a growing number of studies have compiled evidence that small and medium sized firms lead innovation in newly emerging industry sectors, resulting in the U-shaped curve of the rate of innovation in relation to firm size, not many studies have paid attention to the internal capacity of SMEs and how they cultivate organizational competence. Findings concerned with the internal capacities of SMEs will stimulate further research and will fill an important hole in existing knowledge of local and regional development.

This paper constructs its theoretic foundations on the concept of high performance HR practice that emphasizes the role of skilled and motivated workers as the peak resource for innovation (Pfeffer, 1994). Using logistic regressions drawn from the 2004 National Software Industry Survey in South Korea this paper extends that research agenda to digital content creators in Seoul. The renewed interest in and understanding of the labor dimension in the process of innovation carries significant repercussion for local and regional economic development policies. Innovation requires dynamic engagement of creative individuals within

organizations as well as outside of organizations, thus local and regional policy programs should understand the labor dimension as going beyond attracting and pooling creative workers. If the model does fit current knowledge about innovation well, it should be useful in guiding the practice of nurturing innovation.

DEFINITIONS

Creativity

The proliferation of the term ‘creativity’ in various contexts necessitates a clarification of the definition used in this paper. In the earlier conception, creativity was thought to be embodied in particular personality traits. Evidenced by anecdotal stories of the moment of inspiration or sudden realization at the conception of great artistic work, spontaneous scientific invention, or coincidental discoveries, creativity was perceived as a unique quality of unusually gifted individuals.

Recently scholarly investigations have moved away from this individualistic approach and have come to a reconciling view that there is an important symbiosis between creative individuals and an organization where those creative individuals reside in (cite). Creative ideas are inherently embodied in individuals. However, creative individuals also constantly interact and are influenced by their immediate organizational environment as well as external conditions. Organizations have advantages in pooling, managing, maintaining, and combining existing knowledge and creating new knowledge. In the same vein, firms in rapidly changing industries derive their primary competitive advantage through the ability of their employees to create and manage knowledge. Thus there exists an important interdependency and symbiosis between creative individuals and organizations.

This definitional extension is important in reflecting current industrial trends where the boundary between science-technology and cultural creative industries has been blurred by cross-breeding between information and communication technologies and cultural industries. As a result of this blurring, the spectrum of organizational forms in the cultural creative industries has widened. For instance, while, in some areas (typically traditional cultural industry sectors), creative people operate individually as atomic and autonomous self-organizing entrepreneurs, in others, such as the digital content industry, creative people tend to be part of an established economic organization—a firm—either because the existing production system is already

corporatized (i.e. the toy and fashion industries) or out of a desire to take advantage of a firm's capacities to break into a competitive market and build their career on a stable and gradually developing basis (Christopherson, 2008). This paper pays attention to the latest development in the cultural creative industry by focusing on the digital content industry (DC).

Digital Content Industry

The digital content (DC) industry aims to exploit the potential of the Internet- and telecommunication-related technologies in the creation, distribution and consumption of cultural content. Rapidly changing technologies create a restlessly precarious market and force DC firms to refresh their technological capacities regularly. On the other hand, while DC firms make extensive use of technical artifacts, the major processes of digital content production, such as idea development, technological enabling, and the incorporation of visuals, sounds, and narration, as well as marketing, are all conceived and created through interactive human processes (Augustsson, 2005; Jung 2007a). Therefore, it would not be an exaggeration to say that combining radically different sorts of knowledge is the key to organizational performance and innovation in the digital content industry

Studies of digitized cultural content were an international phenomenon in late 1990s and early 2000s with the success of dot.coms in Europe, North America, and some parts of Asia. These studies mostly focused on firms that provided services to create online websites and consultation for businesses for advertisement, marketing and consumer services (cite). In this study, I use the term digital content industry to indicate a broader set of related industry subsectors, ranging from enabling software embedded in other sectors such as film, internet digital content, and online education to major content developing activities such as digital publishing, digital animation, video game, online and mobile gaming, and mobile phone application development

REVIEW OF RELATED WORK

Critical Review on the Existing Innovation Related Literature

The theory of the innovation at local and regional scale can be largely divided into two distinctive bodies of literature: new regionalism, which is mostly focused on science and knowledge-based industries, and the creative cities thesis, which incorporates the creative class

and (cultural) creative industries. Many scholars state that the arcane nature of cultural creativity, for the most part, stymies all attempts to fit the cultural creative industries into the existing analytical framework (Lampel, Lant, and Shamsie, 2000). Under the recent trend of convergence and crossover between information and communication technology and traditional cultural industries, although the distinctive characteristics between the science-based and cultural content based creative industries remain considerable, both bodies of literature have become intertwined through the post-industrial organizational logic: flexibly specialized firms working and connected through the trust-based social networks and mobile workers who transfer important new knowledge. In the following, I will summarize how each body of literature builds the concept of innovation on the provisions of post-industrial lean production systems and mobile workers.

Science- and technology-based innovation and the spatial logic of innovation

The conceptual approach to innovation has changed with changes in the perspective on the source of creativity and new idea development. In the post-war era, the focus was given to such intra-firm determinants of innovation as firm size and R&D expenditure. In the post-industrial era, with the advent of information and communication technologies and new organizational forms (small and flexibly specialized firms), the intra-firm determinants were replaced by a more dynamic systems view that emphasizes 'innovation as interactive process.' In particular, the emergence of 'innovative regions,' meant that questions about the reasons for agglomeration, whether and how spatial agglomeration is related to innovation, became the center of scholarly interest in economics, regional science, and economic geography. In this discussion, the space became an integral part of trade and economic activities. There were two parallel approaches explaining the agglomeration of firms: The increasing-returns school continued the perspective that agglomeration is a mere result of individual maximization based on transaction-cost theory and the complexity school approach was based on non-mainstream assumptions such as imperfect information and competition, multiple pathways of development models, important roles played by rules, norms, and conventions. The latter gave a profound theoretic ground for regional science and economic geography.

In the mid-1980s, Piore and Sabel proposed an industry district model where trust and shared culture are emphasized as important elements for collaboration and innovation. (Piore and

Sabel, 1984; Sabel, 1990). In the US context, scholars expanded the discussion to assert that flexible specialization is the outcome of the very strong tendency toward vertical disintegration and thus small firms agglomerate to compensate for scarce resources through information exchange and co-projects. Thus, proximity matters for pooling technical expertise and skilled labor and socializing the risk of venturing into new industry sectors. These advantages were thought not only to provide stable business environments but also to allow continual innovation (Porter, 1990 add more people in this group). In these studies, the proximity among firms was used to measure the effect of geographical clustering; while the pooling effect was measured through R&D expenditure and the number of researchers of firms in the local area.

Another strand of scholars argued that the effect of spatial proximity on a firms' capacity goes beyond merely saving transaction costs, sharing informal information, pooling local labor or enhancing local collaboration. They argue that there is a socio-spatial logic inherent to knowledge transfer and learning, which they refer to as *untraded interdependencies* (Storper, 1997: p). The knowledge transmission and learning that preceded innovation is geographically bounded if, given the often tacit nature of the knowledge responsible for innovation, the knowledge-producing sources must be proximate to enable spillover to occur. In this, space is conceptualized as more than a physical space between actors and place to agglomerate, in addition, the regional space provides a strong sense of belonging as a set of regionally specific relationships are established between firms, institutions, and people, resulting in the highly developed capacity for cooperation typical of culturally similar people and institutions.

Scholars whose work is based on the concept of knowledge management have argued that the learning capacity of a region determines the ability to continuously innovate and grow, which is reflected in learning economies (Lundvall 1992), learning regions (Asheim, 1997), and regional innovation systems (Cooke and Morgan, 1998). The localization, they argue, matters because the spatial proximity facilitates the learning, especially by enabling the transfer of tacit knowledge (Lawson and Lorenz, 1999). In these conceptual frameworks, learning capacity and mechanisms are measured by the number of collaborative network within localities. Capello et al. extended the localized learning concept to localized collective learning (2005). The learning occurs in a collective way among local firms because mobile workers convey new knowledge and technology among local firms. In this, the localized collective learning was measured by the proportion of newly employed workers from the local labor pool (Capello, 2005).

On the other hand, as Granovetter (1985) and Uzzi and Lancaster (2003) pointed out, over-embeddedness or strong social ties have adverse effects on regional innovation by resulting in local lock-in. This perspective argues that firms strategically develop collaborations with long-distance partners in order to break out from the lock-in effect and highlights the importance of paralleling “local buzz” and “global pipelines” (Bathelt, Malmberg, and Maskell, 2004). To measure global collaboration, a number of global collaborative networks are added to the model. However, the new regionalism literature identifies neither intra-firm elements nor labor dimensions as pivotal elements of new knowledge creation and innovation.

Creative industries and creative cities

The creative class-based conceptual framework is more focused on the role of creative workers in the process of innovation. However, the account is still limited in that scholars confine creative capacity to the individual and do not pay much mind to the role of organization. Earlier research on organizational practices in creative industries emphasized project-based work organization and the linkage between individuals and organizations as a distinctive characteristic of creative work (Pratt, 2000; Christopherson, 2002). The project based work organization is not new. Historically, it has been an important form of work organization not only in arts, craft, and other cultural work but also in construction, shipbuilding, film, etc (Grabher, 2002). More recently, project-based organization is rapidly and widely being diffused to industries that have not been typified in this category, such as telecommunication (Grabher, 2002; Sydow, Lindkvist and DeFillippi, 2004). When it was resuscitated as the hallmark of organizational practice in the post industrial economy, in particular in the creative industry, much emphasis was placed on the efficacy of the project-based organization and the social network. Under the network-based economic structure, the self-organizing project-based group is viewed best suited to organizing mobile workers to respond to short product cycles and fast changing technology. In evolving and self-coordinating projects, neither the division of labor between team members nor the coordination of team activities follows traditional management principles (Heydebrand and Miron, 2002).

In this perspective, talented, self-expressive, and bohemian creative individuals are the key element of creative work. Working as ‘free agents’ in order to enjoy ‘creative freedom’, these individuals display a self-organizing and entrepreneurial attitude: they typically work as

independent contractors (freelance) or part time in a temporary project setting and collaborate in multiple projects simultaneously (Stolarick and Florida, 2006). This intrinsic mobility of creative people is arguably a central precondition for innovation as well as the diffusion of innovative know-how (Heydebrand and Miron, 2002; Florida and Stolarick, 2006) because creative capacity is embodied in individuals and the interactions between individuals with high human capital facilitates spillover and the growth of knowledge (Lucas, 1988).

Whereas earlier work was focused on the importance of spillovers between firms as the important driver of regional growth, more recent findings have shown the importance of the connections between individuals and have suggested that the diversity of those connections is a more important factor. The encounters that create these individual connections are more likely to occur in a region with higher density.

On the other hand, paradoxically, the increased independence of creative individuals also increased their dependency on locally embedded social network to obtain work and build careers (Florida, 2002). These new creative individuals invest a high portion of their personal time in acquiring new skills and moving from project to project as they move-up in their career ladder. Creative individuals' dependence on locally specific social networks manifests as spatial agglomeration. Some studies celebrated the spontaneous and mobile nature of these creative individuals, who are linked through locally embedded social networks because these new attributes were thought to support the spread of flexibly organized and network based work (Heydebrand and Miron, 2002). As such, the model of innovation in the creative class and creative cities literature take on how the labor dimension is intertwined with internal innovation processes is limited and abstract at best.

Re-interpreting the mobile workers in the context of organization and innovation

How the role of mobile workers is understood may carry significant implications for local and regional policy. However, the claim that mobile workers are the key to circulating and diffusing new knowledge is not well supported by empirical evidence, while studies at the organizational level report an adverse effect of mobile workers on innovation. In the following, I will review the evidence on the effect of mobile workers on innovation and re-interpret what the mobility of workers means to innovation at the concrete and practical level by bringing this dimension to the internal process of knowledge creation and innovation.

After the post-war perfect employment regime, the organizational practice of hiring mobile workers as a way learn from other organizations was popularly adopted by Silicon Valley start ups in 1950s-1960s (Lazonick, 2009). When information and communication technology was standardized across industry sectors and especially when the technology was relatively simple and easy to mimic, learning new knowledge by simply circulating workers from the local pool satisfied the organizational need.

However, does this logic still work in the post-industrial setting? Mobility, from the perspective of an organization, is turnover. Recently a growing number of studies documented the actual contribution of mobile workers (high voluntary turnover) to innovation and the evidentiary data shows how different reality is from the popularly cited accepted wisdom: that neither flexible work organizations nor contingent workforce practices are associated with innovation. For instance, Dess and Shaw (1990) showed that in the rapidly changing and highly competitive markets in knowledge-based service industries (i.e. financial industry), a high rate of voluntary turnover of key human capital plays a disproportionately negative role in firm performance. Thus, the actual contribution of mobile workers to firm performance, improvement or innovation is controversial at best.

The lean production and mobile worker based framework also dismisses the importance of organizing and long-term relationship among knowledge- and creative-workers, which is another problematic area. Knowledge workers tend to form strong social ties with their colleagues, which in turn helps the knowledge transfer and learning. The role of social capital increases when knowledge transfer occurs in the realm of tacit knowledge: strong ties allow repeated interactions, promote knowledge acquisition, and shorten project completion times (Argote and Ingram, 2000). Because of the social capital aspects of knowledge and knowledge creation, the loss of creative individuals can have a disproportionate effect on firm performance. The loss of key personal also means the loss of social capital and future opportunities (cite).

Thirdly, there is the question of the sustainability of this model. Two dimensions of sustainability can be discussed. One perspective stems from the equity and welfare aspect of employment. The other perspective is the long term gain of this model. If skilled labor poach becomes the hiring convention of a region, the situation can be detrimental for small firms competing with large corporations in the same end product market: large corporations have the upper hand in recruiting skilled workers from other firms by paying higher compensation. If

small and thin organizations were to heavily rely on exploiting mobile local workforce to reduce uncertainty and speed response in a volatile market environment, would it be sustainable in the long run? As March (1991) famously put it, ‘maintaining an appropriate balance between exploration and exploitation is a primary factor in system survival and prosperity’ (P 72). The constant exploitation of knowledge (labor poach among firms) without balancing long term investment is highly likely to generate a downward spiral of new knowledge and wealth creation in the long run.

High performance HR practice and the construction of testable proposition and hypothesis

From the discussion so far, it is now apparent that if an economic development planner wants to devise public policies that will enhance a continuing and sustainable local and regional capacity to stimulate creative ideas and innovation, then one should ask the following questions: What organizational forms and HR practices are focused more on knowledge creation and innovation? In order to retain the organizational capacity to continue creating new knowledge and innovation, what kinds of strategies should firms adopt? In what way can those strategies be embodied in concrete HR practices?

In this sense, existing studies on high performance HR practices and innovation is enlightening. Studies empirically have shown that implementation of a bundle of HR practices that empower and encourage workers can create mutually reinforcing high-investment employer and employee relationship (Arthur, 1992; Tsui et al., 1997). High performance HR literature argues that the implementation of strategic human resource practice can enhance organizational knowledge stock and worker performance, which will eventually contribute to improved organizational performance.

High performance HR practice is broadly defined by its goals more than by specific practices. For instance, Arthur, 1992; Tsui et al., (1997) emphasize compensation practices that focus employee motivation on group and organization performance indicators, training programs and performance appraisals that emphasize long-term growth, team building, and the development of firm specific knowledge. Pfeffer identified 16 HR practices including selective hiring, high pay, pay-performance linkages, employee ownership, information sharing, empowerment, an emphasis on team structure and training, and promotion from within, among others. Recently, there has been a considerable progress in determining which HR practices have

positive effects on firm performance. The consideration of individual firm level elements as critical factors in innovation had diminished over the last two decades because the conventional measures of firm level attributes, such as firm size, age, and R&D investment, are not applicable to small entrepreneurial firms. Recently a dynamic view of intra-firm capacity was developed that emphasizes the role of skilled and motivated workers as the preeminent resource for innovation (Pfeffer, 1994). Scholars developed a resource based perspective that source of competitive advantage of a firm lies primarily in the application of the bundle of valuable resources at the firm's disposal (Wernerfelt, 1984, p172; Rumelt, 1984, p557-558). By strategically allocating and managing that organizational resource—employees for the knowledge-based economy—an organization can sustain a competitive edge.

The view that emphasizes internal organizational capacity holds that employee's abilities, intelligence, and skills acquired from formal education and job experience (human capital, intellectual capital, or creative capital) constitute a key to an organization's creative capacity (Becker, 1964). The importance of prior knowledge in absorbing outside knowledge is also emphasized by Cohen and Levinthal (1990) and Bosch et al (1999).

In this sense, educational attainment and work experience can be robust measures of knowledge stock. Hiring employees with higher general knowledge and an ability to continuously learn and predict the outcome of problem solutions or new products accurately will help the firm greatly. Glaser (1984) argued that changes in knowledge base through education can produce sophisticated changes in cognitive performance. Education helps individuals improve their understanding of what they know, more accurately predict outcomes, better manage time and resources, and monitor results. In effect, education provides new explicit information and knowledge that greatly influences an individual's cognitive reasoning skills. This theoretic assumption was proven correct through empirical studies by Smith, Collins, and Clark (2001). This paper continues that research by testing whether educational attainment is in a positive relationship with innovation in the creative industry.

The experience of workers is also an important factor that has a positive impact on overall organizational knowledge stock (Smith, Collins, and Clark, 2005). Some researchers have argued that workers who have extensive work experience in an industry will have greater expertise and thus more relevant knowledge to bring to the exchange and combination process. In addition, more experienced workers have the ability to locate knowledge needed for problem

solving faster than do novices. These previous findings are of special relevance to the digital content industry, where already established industry-wide knowledge is not substantive because of its short history and continuously evolving industry sectoral characteristics. In a new industry where knowledge has not yet been consolidated into academic programs, much important information has to be developed within firms. For instance, information about customers and markets for digital content are not readily available or taught at school. Such information and knowledge is the basis both for new ideas and more realistic and practical directions in production, marketing, and other business processes. Therefore, we can use the years of operation of a firm in this industry as an important proxy for knowledge accumulation within the firm. In the manufacturing setting, HR bundles have been proven to contribute most to assembly plant productivity and quality when they are integrated with manufacturing policies under the organizational logic of a flexible production system. In flexible production plants with team-based work systems, ‘high-commitment’ HR practices (such as contingent compensation and extensive training, and low inventory) consistently outperformed mass production plants (cite). Based on the existing findings, the following hypothesis is established.

Hypothesis: By combining rigorous hiring policies and retention of skilled workers, a firm can increase the knowledge stock of the organization. It is possible to hypothesize that firms that employ these HR practices are likely to be more innovative firms.

The rigorous hiring policies can be broken down into 1) hiring based on one’s capacity to learn as represented by educational attainment and 2) high level skills.

MEASURES AND METHODOLOGIES

Samples

Samples are drawn from a national survey of software firms conducted by the Korea IT Industry Promotion Agency (KIPA) a subsidiary organization of the Ministry of Information and Communication (as of 2004), in 2004. For the purpose of this analysis, I chose 353 firms located within six digital content clusters in Seoul, Korea. I used this data because the survey contains information about the characteristics and HR practices of digital content creators in Seoul that coincided nicely with my study goal. The KIPA survey data analysis included 358 small- to medium-sized digital industry-related firms. Using a random sampling method, 3,187 firms were selected as a sample population for Seoul, a figure that represents 38% of the total population of

firms in Seoul. Among the 3,187 surveys sent to the selected firms, 443 surveys were returned properly. Of unreturned surveys, 1,086 were returned with notations that the firms had closed or with markings that indicated a delivery failure. Another 452 firms declined to participate in the survey. Another 103 survey attempts failed for unknown reasons. And the rest of surveys failed due to a mailing address error. Among these 443 responses, 358 responses fell within the boundaries of the six digital content industry clusters in Seoul.

Dealing with missing values

This study uses a combination of list wise deletion and the multiple missing data imputation techniques. There has been an increasing acknowledgment of the importance of dealing with missing values because there may be valuable information in the data that are missing. As most statistical procedures rely on complete-data methods of analysis, keeping the missing values will likely cause a biased result. Deleting records with missing values (list wise deletion) has been a common practice for dealing with missing values. It is simple and can be a robust method, if the deletion of cases does not significantly lower the sample size. In certain cases, deleting cases will decrease sample size, which will in turn decrease the power of the analysis. In this study, among the 358 respondents, five cases had many missing values in variables that I included in my analysis. I sought any common characteristics among these five cases and found that these firms are not closely correlated in terms of such firm characteristics as age, size, number of employees, and % of R&D investments. Therefore, I ruled out the possibility that there was a pattern to the missing data among these five cases. After eliminating the five cases, the pattern of missing data became much simpler; missing values were concentrated in 1 variable (average wage).

From this point, I used the multiple imputation (MI) method embedded in the SPSS. First, the SPSS MI method determines whether the manner in which missing data are distributed (missingness) is random or not: the process determined that the missingness of the data was not random. It suggests that deletion of the remaining cases will skew the analysis. Therefore, I used multiple missing value imputation to generate a likely estimate of missing values drawing from the predictive distribution of missing values given the observed data (cite). Other techniques for missing data imputation have serious shortcomings. For instance, the mean value substitution

will bias the variance and covariance toward zero. The multiple missing value imputation method yielded imputations for the five sets of missing value.

Variables and Measures

Theory driven additive indexes (independent variables) This study follows the procedures used by MacDuffies (1995), Youndt et al., (1996), and Batt (2002) to aggregate the measures of HR practices. The use of additive indexes is based on important findings that suggest that firms can improve performance either by increasing the number of practices they employ within the system or by using the practices in an HR system in a more comprehensive and widespread manner. HR practices affect performance not individually but as interrelated elements in an internally consistent HR bundle or system. In this paper, additive indexes are created based on the z-score index, a simple additive measure. To do so, I transformed the variables to z-scores and added them together. The additive index can hide information that each variable carries. However, this method provides an advantage by combining a range of variables into a single, more easily understood dimension. Thus the index provides a conservative estimate that may underestimate the synergies or multiplicative effects of combining practices.

Knowledge Stock Index Based on the hypothesis, the additive index that combines rigorous hiring practices and workforce retention is named the Knowledge Stock Index. This index consists of measurements as the following: the percentage of workers with masters degrees and the percentage of workers with high school diplomas, the percentage of workers with high level skills, and the average year of worker retention (Table 1).

Dependent Variable

The dependent variable, innovativeness, is measured by the proportion of original software (inclusive of both software programs used to create content and the content itself) sales compared to total sales. In much innovation literature, patents have been used as a proxy measure of innovation. However, complications of dealing with patents as a proxy for innovation have been reported. For instance the count of patent does not reflect how recently the invention occurred. Many old firms own original patents but have not engaged in any recent innovation activities. More importantly, the nature of digital content creation is such that it takes a long time for a firm to develop a new character, content, and technology that are patentable, and firms that

are in their early development may not have many patents. The many missing values in the patent question suggest that digital content firms located in Seoul are not focused on generating patents.

The original dependent variable is scale data. However the distribution of the variable was dyadic which violates the linearity assumption of the multiple linear regression (the first assumption) (Appendix Figure 1). Therefore, I transformed the dependent variable into a binary variable (0=less innovative, 1=more innovative) by dividing it at the median value.

Control Variable

I included several control variables that have been found to influence HR practices. For example, larger firms are likely to invest more on HR practices because they have the monetary and organizational resources. However, there are cases of small firms with high performance and higher revenue. Therefore, I included total sales. I also included number of local collaborative social networks and global scale collaborative networks.

Table 1 about here.

RESULTS: What distinguishes the more innovative firms in the digital content industry in Seoul?

Descriptive characteristics the digital content firms in Seoul

Digital content firms are small in size, averaging 21.3 workers per firm, and ranging from 1 to 186 workers and are relatively young with average firm age at 5.7 years old. The proportion of companies that started as independent enterprises (not spin-offs) is 84.4%, which well outweighs the proportion of spin-offs (11%). From this data, it is possible to assume that, in the social network among DC firms in Seoul, the strong social-ties that emerge from spin-off and mother company is absent. However, data on the previous occupation of CEOs reveals a different story: 76% of CEOs worked for Korean corporations and 6% worked for foreign corporations before starting their own businesses in the digital content industry sector.

On average, 30% of net profit is reinvested into R&D, which is high ratio given the small and medium firm size. DC firms also show a distinctively high average rate of full-time workers,

which reaches 98.81, compared with other multimedia or new media clusters such as Silicon Alley in New York City, where 32% of respondents were independent contractors or entrepreneurs, and the multimedia district in Toronto, where 63% of workers are full-time workers (Brail, 1997¹). In terms of employee training, the project process itself is an important employee training process, and 69% of the firms rely on in-house education. Based on both survey data analysis and in-depth interviews, most DC firms utilize internal resources in developing new technology (69%). Firms primarily rely on the Internet (56%) rather than on face-to-face interactions (17%) and on seminars or forums (14.1%) for new information. On the other hand, DC firms in Seoul are successful in attracting contract-in projects and show an average 11.45 projects per firm. Among various budget items, expenditures on technological workers occupied the highest proportion (17.86%).

Table 2 provides the means, standard deviations, and ‘pairwise’ correlations of the variables. Table 3 reports the results of logistic regression analyses in which a firm’s innovative capacity is the dependent variable. Over all, the results support the first hypothesis but not the second and the third hypothesis.

Model interpretation

Model 1 shows that the Knowledge Stock HR Index is statistically highly significant which suggests that firms employ rigorous hiring and the longer retention are likely more innovative than those firms do not. Model 2 shows that while the Knowledge Stock HR Index is still positively correlated with more innovative firms, the introduction of the control variable, global collaboration network decreased the level of significance of the Knowledge Stock HR Index. Model 3 shows that while the Knowledge Stock HR Index is still positively correlated with more innovative firms, the local collaboration network are not positively related to more innovative firms. These results support the hypothesis that by combining rigorous hiring policies and retention of skilled workers, a firm can increase the knowledge stock of the organization. It

1. 1997 Survey of Toronto's Multimedia Industry
<http://www.multimediator.com/publications/write035.shtml>

is possible to hypothesize that firms that employ these HR practices are likely to be more innovative firms.

SUMMARY AND CONCLUSION

This research has shown a ways to measure the internal factors of innovation, especially focusing on the labor dimension. The combined use of organizational practices that are supposed to increase a firm's knowledge stock and learning capacity, including selective recruitment, R&D investment and worker retention are important predictors of innovation capacity in the DC industry. The findings are preliminary evidence that commitment-based HR practices are important measures of innovation in a newly emerging and rapidly changing industry sectors such as the digital content industry. This corresponds with the existing theory of firm strategies for knowledge exploration and exploitation. Bosch et al. suggest that in different knowledge environments, stable or turbulent, firms focus on one of the two modes of adaptation and learning suggested by March (1991), exploitation and exploration: in a stable knowledge environment, firms focus on the exploitation of currently existing knowledge. On the other hand, in a turbulent knowledge environment, such as an emerging industrial complex, firms are likely to dedicate their efforts to exploration of new knowledge, which is more closely related to a tacit knowledge dimension. This suggests that this model can be used in other industry sectors that have attributes similar to those of the digital content industry. This result is also consistent with the information derived from in-depth interviews with top HR managers that emphasizes the importance of establishing a firm's own internal labor pool, retaining employees longer, and developing the internal production system.

These findings partially support the arguments of the high performance HR practice literature concerning the importance of organizational efforts to maintain an internal labor pool where organization specific knowledge and capacity for continuous learning is stored. These internal factors have been, for the most part, disregarded in the new regionalism and creative cities literature. Instead, the short-term project based- and contingent workforce driven-work organization practice has been popularly accepted as the dominant form. While local and regional policy makers did not intentionally facilitate or choose to be in support of high mobility of workers, the lack of institutional actions to provide better retention of workers at the

individual firm level not only leaves workers under the condition of chronic job insecurity but also leave firms at a sub-optimal level.

There are significant policy implications to be derived from this finding. The model suggests that unlike the prevailing argument, the stability of knowledge- and creative workers matter more than external factors in innovation. Thus firms should carefully choose between exploitation and exploration in managing their creative workers and creative capacity, because these practices may shape the firms competitive advantage.

One can also draw an important message for economic development planners. Although we know that a balance between short-term exploitation and long-term exploration (investment) would be desirable in any kind of system, when firms are solely left to the market mechanism, especially during the period of economic austerity, firms tend to go down the road of short-term exploitation because the rate of return on long term investment is uncertain at best (particularly in the newly emerging industry sectors). This means more lay-offs or transition from full-time to part time jobs. This paper proposes that government subsidies targeting labor retention can have the effect of absorbing the high uncertainty involved in the investment in workers. This way, jobs can be sustained and retained, so that SMEs do not have to lose the internal labor pool that creates their organizational competency.

Many localities have focused on attracting creative individuals to increase the density and diversity of the creative pool. However, this focus on creative individuals without knowing how they actually engage in the innovation process and what attributes are important highlights only one side of a continuum. The internal organizational aspects of firms, how they deal with creative workers, is at least important as the total supply of such talent in a region.

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APPENDICES

TABLE 1. Measures for Factors for Internal knowledge-stock Index

Variable name	Description
Independent Variables	
MA_P	% of employees with master's degree
HA_P	% of employees with high school graduate
Tenure	Average number of years of retention of workers (including part time workers)
HighskillwrksP	% of high skilled workers
Control Variables	
LocalColla	Number of local firms and institutions in collaborative partnership
GlobColla	Existence of foreign corporation in partnership on technological development (0=no, 1=yes)
LnFirmAge	Natural log of firm age
LnTotalSale	Natural log of total sales

Table 2. Means, Standard Deviations and Correlations

Variable name	Mean	s.d.	1	2	3	4	5	6	7	8	9
1. Innvtnss	.5108	.5006	1								
2. MA_P	12.5226	20.8113	0.092	1							
3. HA_P	4.2764	10.8579	0.039	-0.1	1						
4. Tenure	2.9806	1.10115	0.093	-0.022	0.024	1					
5. Highskilledwrks	.1447	.20013	.154**	.277**	-0.048	.167**	1				
6. LocalColla	5.3939	9.6452	0.08	0.015	0.012	0.072	-0.002	1			
7. Extr_Tech	.0464	.21076	0.069	-0.069	-0.052	0.001	0.013	0.118	1		
8.LnFirmAge	1.7438	.55172	-0.024	0.041	0.03	0.081	0.03	-0.024	0.06	1	
9.LnTotalSale	7.0895	1.7178	-.292**	0.022	0.023	0.033	-0.013	-0.056	-0.035	.495**	1

N=323, *. $P < 0.05$ level (2-tailed), **. $P < 0.01$ level (2-tailed).

TABLE 3. Results of Logistic Regression

Variables	Model 1	Model 2	Model 3
Constant	2.655	3.210	18.337
Knowledge stock HR Index_1	0.001 (0.198)*	0.001 (0.212)*	0.002 (0.235)*
Local collaboration			0.349 (0.018)
Pipelines		0.325 (-0.573)	0.374 (-0.587)
LnFirmAge	0.017 (0.624)*	0.022 (0.598)*	0.038 (0.640)*
LnTotalSales	0.000 (-0.518)*	0.000 (-0.513)*	0.000 (-0.493)*

N=323, *. $P < 0.05$ level (2-tailed)

Figure 1. Histogram of Y variable distribution (before transformation)

