Observations on Spatial Characteristics for Successful Smart Offices and Smart Work Centers

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Abstract Advances in information and mobile technologies have changed the traditional firm ways of working very flexible, collaborative and innovative, resulting in the changes in work place structures and layouts. Despite the growing body of literature examining the novel ways of working, which is called smart work, there is little academic attentions paid to the spatial aspects of new work places, namely smart offices and smart work centers. This research explores the spatial changes of work places that improve business efficiency and collaboration among workers suitable for the novel ways of working. Conducting in-depth field surveys on selected cases, we analyzed the changes in spatial structure and operation policies of smart offices and smart work centers. From this survey, we observed that the new work places under study take various novel spatial forms and they have flexible operating policies such as flexible seating and flexible work hours. We also found that it would be difficult to change existing business practices and typical ways of performing tasks, without changing the bureaucratic spatial designs and layouts. Future studies are suggested to examine how spatial structures and layouts of offices have impacts on space utilization, collaboration, creativity, and job satisfaction.

Keywords: Smart Office, Smart Work Centers, Smart Work, Spatial Design

1. INTRODUCTION

In June 2016, Toyota Motor announced that they would start the notable Telecommuting Program, and added that out of 72K Toyota employees, 25K people are eligible for the program. The main purpose of the program is to balance between work and life of Toyota employees by changing their ways of working with the help of advances in technologies (Nikkei Asian Review, 2016).

This revolutionary program was enabled by the advances in information, communication and mobile technologies. For example, IoT(Internet of Things) makes every work device is controlled through the Internet, cloud computing makes all the data, documents and workflows of a company are accessed and worked upon any time any place, and the mobile technology makes any office work is performed at any place, even during

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transitions. Consequently, these IT advances are changing the ways of working.

To accommodate these new ways of working, they are converting existing offices into new forms, called *smart offices*, and constructing off-campus offices, called *smart work centers*, allowing employees work at their convenient places nearby (Sanghoe Koo, etc., 2014). In recent years, a large number of smart offices and smart work centers have been constructed globally. Despite the growing research literature on novel ways of working, there is little academic attention paid in the spatial aspects of smart offices and smart work centers (Byungha Lee, etc., 2011; Koo, etc., 2014).

1.1 Purpose of Research

Due to the lack of academic attention paid toward spatial aspects of new offices, it is necessary to start in-depth analysis in order to offer desirable guidelines to the remodeling of traditional offices and to the planning of the smart work centers. The purpose of this research is to suggest desired structural and spatial characteristics of new offices to satisfy social and business needs. For this purpose, we examine and analyze the exemplar cases of smart offices and smart work centers in Korea.

1.2 Research Methods

Case studies(Robert Yin, 1994, Robert Stake, 1995) are useful for understanding the direction of research issues and for obtaining broad perspectives when previous studies or knowledge are not enough. Yin and Stake argue that case study is

a robust research method when a holistic in-depth investigation is necessary. Case studies are conducted in the order of exploratory research, descriptive research, explanatory study. The exploratory research finds important characteristics of the given study subject, the descriptive research formulates the description of the characteristics, and the explanatory research identifies the causal relationship between the characteristics.

In this paper, we conducted an exploratory case study to find the spatial characteristics of smart office and smart work centers. From this research, we conduct in-depth analysis on the spatial characteristics and propose several hypothetical observations in the hope of providing useful guidelines in the future. The subsequent descriptive and explanatory research will demonstrate hypothetical observations that we made.

We start with case selections. Most of the frequently referred smart office cases are IT companies such as Google, *Naver, AhnLab, Duzon*, etc. In this research, however, to provide general guidelines, we selected two representative exemplar cases in Korea that successfully implemented the new forms of offices regardless of their business types. They are *Yuhan Kimberly*, which we call simply YK, and Korea Telecom Corporation, which we call KT. Though YK is not an IT company, YK experienced the transforming process to import smart work practice into the traditional office spaces according to their corporate strategy. We selected these two cases since they are believed to be most informative in analyzing smart offices in Korea.

Case studies are conducted through document survey, interview, participation and observation. In this study, we performed two approaches, mainly interview and observation, because the documentation was not sufficient, as mentioned earlier, and participation was not allowed to external members. The interview includes a presentation session followed by Q&As which are provided by persons who worked on planning and constructing smart offices. Survey starts with measuring and drawing floor plans. Then observations are made on work behaviors, pictures are taken and notes made on floor plans for the analysis. When picture taking is not permitted, detailed situational descriptions are made instead.

2. BACKGROUND RESEARCH

According to the recent research (Hyunkook Cho, 2011, Byungha Lee, 2012), what matters in spatial design is to balance between promoting interactions among workers and ensuring personal spaces for focused works. Especially, to promote interactions it is good to keep distance short and to ensure visibilities among workers. This applies to both smart offices and smart work centers (Kyung ah Kim, etc., 2016; Koo, etc., 2014).

Smart office is defined as offices using beacons, mobile apps, sensors, etc., to make the way people work more interactive and innovating (Gensler, 2016). According to the proximity effect (Festinger, etc., 1950), physical proximity between people increases social ties. Hence they interact more and converse more to increase idea sharing which in turn promotes

collaboration and creativity. Smart office is designed based on these ideas which can be seen in Pixar's office design, Google's vertical ladder chutes and 150-feet from food rule (Alter, 2016).

Smart Work, defined as 'performing work collaboratively with any one any time any place using ICT including the Internet', was first introduced during 1990s in the United States (Committee of National Informatization Strategies, 2010). Recently, they added the concept of smart office that improve work collaboration, flexibility, performance, and creativity (Koo, etc., 2014). Smart work includes *telecommuting* which means they work at their own residence, *mobile office* works which means they work any time any place using mobile devices such as smart phones or tablet PCs, and *smart work center* works which means they work in smart work centers nearby without having to be at their own offices.

Research on smart work focuses on both social and technical aspects (Im, 2010). The social research aims to suggest policies for successful smart work by analyzing the behavioral aspects. They conclude in brief that smart work improves work productivity, increases work opportunities, and helps reduction of carbon dioxide emission. But workers often lost trust from their superiors or colleagues due to the lack of visibility (Im, 2010; Lee, etc., 2014). They argue that appropriate policies are necessary to overcome such difficulties. On the other hand, the technical research aims to provide tools that facilitate smart works. For examples, collaboration tools and social network services are useful in sharing current status of works as well as common knowledge, and mobile computing and cloud computing allow for workers to perform their tasks any time any place using any devices connected to the Internet.

From the point of architectural research, attentions need to be paid more to spatial design and desired characteristics of smart work centers. However, it is not easy to find such scholarly research in the literature. Recently Koo and Lee analyzed smart work centers from the perspectives of personal space, group space and supporting space by surveying centers in Korea. According to this research, most smart work centers in Korea are for business travelers, and they are good in providing personal and private spaces but not good for group or supporting spaces which promotes on- and off-line collaborations (Koo, etc., 2014).

Figure 1. Yuhan Kimberly home page promoting Smart Work (http://www.yuhan-kimberly.co.kr/)

Table 1. Floor Plan of YK Smart Office

The floor is composed of lounge area(A), work space(B), meeting rooms(C1) and group work space(C2). Pictures are taken from these areas. Starting from upper left picture clock-wise: a) big table in Lounge, b) small table in lounge, c) presentation in lounge, d) workspace, e) meeting room, f) mailbox, g) private locker room, h) OA room, i) lounge kitchen, j) private phone call room, k) rooms for expectant and baby feeding, l) lounge operation rules, m) meeting table in Lounge. Pictures c) d) and l) are provided by YK, and other pictures are taken by researchers.

3. CASE STUDIES

In this research, we selected two representative exemplar cases in Korea that successfully implemented a smart office and smart work centers. They are Yuhan Kimberly (YK) and Korea Telecom Corporation (KT).

3.1 Analysis of YK Smart Office

Yuhan Kimberly founded by Yuhan Corporation and Kimberly Clark in 1970, produces toilet papers, tissues, diapers, skin care products, etc. YK introduced flexible work hours as early as 1990s, and started smart work with flexible work spaces in 2011. Recently, YK accelerates employing smart work using advances in ICT and open YK firm culture. Figure 1 is a home page of YK which emphasizes that promoting smart work is one of the major corporate strategies. According to the pages, YK Seoul office converts the traditional office structure into the smart office which allows flexible operations of work hours and spaces. YK also is running smart work centers in two cities, Jukjeon and Gunpo in Gyeongi-do. YK is running telecommunication conference rooms and mobile work environments connecting all the workers and work places.

YK has become a plausible smart work bench marking case in Korea for both government agencies and private companies. Considering most of smart work companies are ICT firms, YK case could play a role of guiding general companies toward smart works.

Table 1 shows the floor plan of YK smart office. It is composed of lounges, work places, meeting rooms, supporting spaces, kitchens, rooms for expectants, etc.

The work spaces of YK are classified into various types, namely, Privacy Workstation, Premium Privacy Workstation, Open Workstation, Team Workstation, Private Workstation for Night Shifts, and Private Workstation for Expectants. Table 1 enumerate these types.
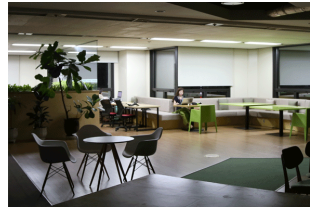
In addition to the space types, YK introduced operation modes of the space. First, they introduced flexible seating, contrary to fixed seating, in which seats are not assigned to specific workers and workers can choose their seats which ever they want. Before converting to smart offices, 100% of YK employees have fixed private work spaces. Afterwards, however, 80% of the whole employees are using flexible seating (Figure 1). YK could reduce work spaces needed by employing flexible seating. They also removed some of executive officers' spaces. The surplus space generated is allocated to shared lounges, meeting rooms, teleconference rooms, rest areas, etc.

Second, they provided Premium Privacy Workstation in which workers concentrate on his work in isolation, free from other persons, sounds, visions, etc. Third, they provide Private Workstation for Night Shift. At 7:30 pm, they put out all lights in the work areas. Workers who inevitably do the work after 7:30 pm, they have to move to this area.

It is reported that after turning out the lights, worker's concentration and productivities improved and energy is saved. Fourth, they are operating Privacy Workstation for Expectants.

Using this, pregnant women can choose their work places any time. And considering changes in the shape of body, table's shape and height are adjusted. These seats are preferably given to the expectants, but when available anybody can use them.

Table 2. Workstation Space Types of YK

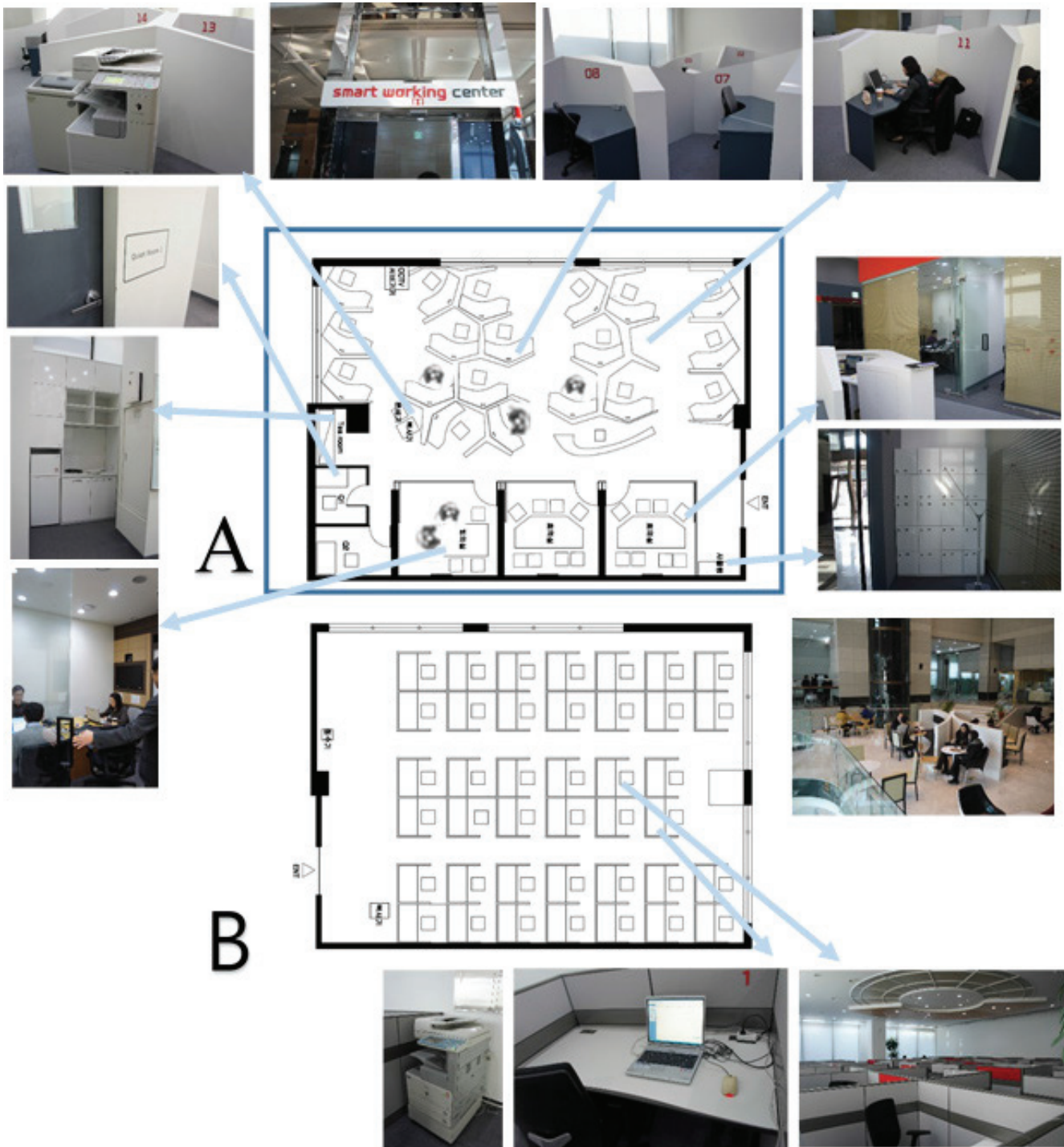| Type	Figure
Privacy Workstation - Flexible seating **Block B in Table 1**	
Premium Privacy Workstation - For focus work - taken by reservation **Left part of Block C1 in Table 1**	
Open Workstation - Freely taken **Block A in Table 1**	
Team Workstation - For Team work - taken by reservation **Block C2 in Table 1**	
Privacy Workstation for Night Shift - Separate spaces are provided **Block B in Table 1**	
Privacy Workstation for Expectants - Preferably taken by pregnant women. But anyone can use when available **Block B in Table 1**	

3.2 Analysis of KT Smart Work Centers

KT was originally founded in 1981 as a public utility company.

KT led Korea's transition to the information era and played a key role in transforming Korea into a major IT hub. As a state-owned firm, KT has had influence upon changing Korean telecommunications industry as a whole. In 2010, KT paid attentions to smart work, and started projects on building smart work centers. Since then, KT has been a leader in smart works in Korea.

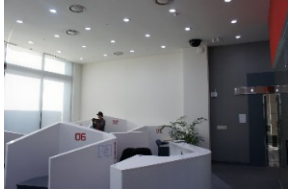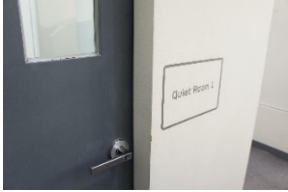Table 3. Floor Plan of KT Smart Work Center

The KT smart work space has two types, premium type(A) and general type(B). Pictures are taken these spaces. Starting from upper left picture clockwise: a) printer corner, b) SWC entrance, c) & d) premium work stations, e) meeting rooms, f) private lockers, g) lounge, h) general work stations, i) work space, j) printer corner, k) meeting room, l) kitchen, m) quiet room. All pictures are taken by researchers.

The first KT smart work center opened in KT head office in 2010 which is a very stereotypical one having booths for individual workers, quiet rooms for focused works, video conferencing rooms for distant meeting, and seminar rooms for general meeting.

Table 3 shows the floor plan of the first KT smart work center in KT head office. KT constructs the *honeycomb style* work spaces which are very useful for converting to various types. Table 3 describes the various work space types.

Table 4. Workstation Space Types of KT

Type	Figure
Privacy Workstation - Taken by reservation **Plan A in Table 3**	
Privacy Workstation - Flexible seating **Plan A in Table 3**	
Privacy Workstation for concentration - Taken by reservation **Plan A in Table 3**	
Team Workstation - For Team work - Taken by reservation **Plan A in Table 3**	

Only the internal employees may reserve seats on line in advance. Utilization is usually low at the beginning of the weeks and at the beginning of the months but it is high on Thursdays and at the end of the months, which reflects the style of works in KT. At first overall utilization was low, so they started to rent 8 seats for non-KT members from December 2011. It also has support spaces such as tea rooms, locker rooms, copy-and-print rooms, an information desk, rest rooms, and a fitness center.

Another smart work center opened in 2011 in KT head office. Spaces are separated for individual workers using partitions forming honeycombs of square seats, which are similar to the ones in the first center, but there are no supporting spaces

provided. Workers may use resting areas and fitness facilities in the first one. Workspaces can be used by both internal and external members. External users may reserve spaces on daily or monthly bases.

4. DISCUSSION

Smart offices and smart work centers are promising means of improving work efficiency, productivity, creativity and innovation in the information era. The purpose of this research is to analyze structural and spatial characteristics of smart offices and smart work centers. We selected and analyzed the representative bench marking cases in Korea, Yuhan Kimberly and Korea Telecommunication Corp. From this research, we observed the following interesting issues. They are not proven facts. However, they can be useful for designing smart offices and smart work centers. Additional study such as explanatory research, needs to be carried out on these issues.

Exit from bureaucracy: YK removed rarely used executives' office spaces to make room for meetings and seminars. They allocate space not by position and authority, but by need.

Flexible operation: flexible work hours and flexible seating seem to be a trend. According to the past research, they are said to give more control over to employees, which in turn helps to relieve stress and focus on work.

Focus on task types: it is necessary to provide optimal working spaces suited to the characteristics of the works as seen in privacy workstations, team workstations, open workstations, etc.

Balance between work and life: work-life balancing is an important factor in both work performance and job satisfaction. Work stations for pregnant women of YK are good examples.

Increased interactions: more interactions lead to more conversations which in turn increases collaboration and creativity. Both smart offices and smart work centers seem to be designed to promote interactions, they keep distance short and ensure visibility, whether online or offline.

Sufficient supporting facilities: supporting facilities improve work efficiency and raise job satisfaction. In both YK and KT cases, they try to provide a variety of supporting facilities, for examples, locker room, mail boxes, printing rooms, kitchens, rest areas, and so on.

Connections guaranteed: using ICT, it is necessary for employees to have access to any person, any data, any knowledge and any workflows in an organization.

Management's will: as seen in YK's case, management's strong will is needed. Otherwise, spaces for higher positions such as executive meeting rooms cannot be removed.

This research has limitations that it is based on non-systemic observations over very limited number of cases. However, this study can be a good starting point for the research on the spatial characteristics of smart offices that will prevail in the future. As a follow-up research of this study, we plan to analyze space utilization, collaboration, creativity, innovation and job satisfaction in the smart office environments.

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