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# Diversity and Innovation Management in Large Research Groups

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## Abstract

Contemporary research appreciates a diverse workforce as a potential source of innovation. Researchers explore the fine details of why diversity management is central for generating innovations in heterogeneous research groups and how it could be effectively implemented into organizations. Complex research associations that discuss topics with a high impact on society increasingly address the necessity of establishing a diverse workforce to confront the challenges of tomorrow. Characterized by complex management structures as well as hierarchies, research associations have not been a subject of investigation until now. For this reason, the presented research project aims to develop a diversity and innovation management strategy with the ultimate goal of inducing change in the corporate culture. The proposed approach consisted of six phases; the first two phases investigated the status quo of diversity in the existing organizational structures of member institutes and the variety of particular working cultures within the research association. The third and the fourth phases utilized qualitative and quantitative studies. The third phase focused on the connection of management level to diversity and innovation, and the need for diversity and innovation management, and tailor-made methods of implementing them. The first three phases have been accomplished successfully; preliminary results are already available. The fourth phase will mainly focus on exploring the mind-set of the employees. The fifth phase will consolidate the findings in the first four phases into an implementable strategy. The final phase will address the implementation of this strategy into the organization. Phases 4 to 6 have not yet been undertaken.

*Keywords: Diversity management, innovation management, research association, change management, engineering*

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## 1. Introduction

The potential of a diverse workforce and its positive effect on innovation processes is broadly scientifically discussed. Various studies have shown evidence on the positive impact of different forms of diversity (Østergaard, Timmermans & Kristinsson, 2011; Hewlett, Marshall & Sherbin, 2013; Hoogendoorn, Oosterbeek & van Praag, 2013; McKinsey, 2015). For this reason, companies of the private sector

increasingly strive to incorporate and implement a diversity management strategy as part of their corporate governance (Aretz & Hansen, 2002; Aretz & Hansen, 2003a; Köppel, 2012). Scientific organizations also increasingly make the potential of diversity a topic of discussion. Further, the German Research Foundation (DFG) promotes diversity in the scientific system as an indicator for excellent research (DFG, 2015). Since the focus of scientific organizations is mostly on scientific issues that

have a high impact on all social levels, there seems to be a need for diverse perspectives, especially when it comes to scientific development processes. For this reason, big research organizations increasingly address the need for establishing a diverse workforce to be more innovative (Philips, 2014). One example is the establishment of the Clusters of Excellence (CoE) in Germany. Jointly managed by the German Council of Science and Humanities together with the German Research Foundation (DFG), the Clusters of Excellence are interdisciplinary research organizations that involve topics with a high social and economic impact. In addition to their importance for the society, they are key drivers of the Excellence Initiative and German elite universities. The Excellence Initiative is a central element of the German scientific system. (DFG, 2016)

Despite the potential of diversity in the context of innovation, studies that suggest implementation of management strategies tailored to the needs, external such as internal influencing factors of research associations are virtually non-existent. This results from the fact that concepts for the implementation of strategies for diversity and innovation management are focused on specific organizational structures and are based on the requirements of the private sector (Walther, 2004; Dömötör, 2011; Strobel & Kratzer, 2017). Furthermore, organizational efforts to manage diversity focus almost exclusively on equal opportunity, and neglect to take measures that would actively stimulate the realization of the true value of diversity and lead to innovation (Ely & Thomas, 2001; van Knippenberg, Homan & Ginkel, 2012). With regard to the challenges posed by globalization as well as the resulting need for diverse competencies and profiles, global-acting institutions with mono-cultural attitudes appear to be rigid, past-oriented, and not adaptable (Hansen, 2002; Horx, 2011). With respect to accelerated economic dynamics with growing change and innovation pressure, there is a necessity to

use the resources of human capital effectively and efficiently.

The proposed project “Diversity and Innovation Management in Large Research Groups” is designed to put a greater emphasis on actively pursuing the benefits of gender, cultural/ethnic and disciplinary diversity as an informational resource resulting in greater team innovation. These diversity categories are from the results of the educational tasks of the Clusters of Excellence and from the streamlining of scientific working groups. This project is a part of the Cluster of Excellence “Integrative Production Technology for High-Wage Countries” at the Rhine Westphalia University of Technology Aachen (RWTH). It aims to develop a strategy that will lead to a corporate cultural change towards the reflection of diversity as a driver for innovation. The underlying thesis is that due to the scientific system, cluster-specific frameworks and structures require an approach that will strongly consider all influencing factors to achieve long-term success.

To establish a continuous improvement process, specific measures tailored to the organization and its structures are needed. Furthermore, evaluation tools must be developed to ensure a sustainable change from a long-term perspective. This is to pursue the goal of improving and increasing gender, cultural/ethnic, and disciplinary diversities.

This paper chose a conceptual approach for its research design. After the presentation of the current state of research, the diversity and innovation management approach as well as the different steps of strategy development will be discussed. Next, initial tendencies, which refer to the first research results, will be shown and an outlook will be presented.

## **2. Literature Review**

A large part of innovative work in the present business world is not carried out by individuals, but by teams (Edmondson & Nembhard, 2009). Any group in business

or in research is assessed based on its success. Depending on the type of work, success is measured differently. For numerous enterprises, innovations represent a central element of their corporate strategy (von Ahsen, Heesen & Kuchenbuch, 2009; Götzenauer, 2010). In addition to economic indicators such as profit, productivity and competitiveness, innovation is the one characteristic that defines successful businesses (Staroske, 2000; Schmeisser et al., 2008; Hauschildt et al., 2016).

To understand the challenges of implementing diversity and innovation management into an organization, it is essential to keep the different dimensions of the term 'diversity' in mind. Diversity itself is a complex, eclectic parameter that can be defined in several different ways. At least two main types of diversity attributes are commonly distinguished: more visible ones such as race, ethnicity, age, gender and physical disabilities; and less visible ones such as education, skills and abilities, values and attitudes, tenure in organization, functional background, personality differences and sexual orientation (Jackson, May & Whitney, 1995).

A study by Gardenswartz and Rowe (1998) provided another perspective and came up with the "four layers of diversity". In their framework, they divided diversity categories into: (1) dimensions of personality; (2) internal dimensions (e.g. age, race, gender); (3) external dimensions (income, religion); and (4) organizational dimensions (department, work location). Dimensions of personality include an individual's values and beliefs; the internal dimension includes characteristics which are not changeable or require a high amount of effort to change; the external dimension involves aspects that are controllable; and the organizational dimensions are those aspects that are easily changeable. (Collins, 2009)

Following, research on the potential, as well as challenging aspects of diversity is briefly presented in the section. The context between diversity and structural

factors that have an impact on the diversity and innovation management strategy will also be discussed.

## 2.1 Potential of a Diverse Work Force

The reports of Caye et al. (2011), the European Community (Focus Consultancy, 2010), and Rizy, Feil and Sniderman (2011), argued that there is a need for diversity in business and that benefits can be earned from it. Modern customers vary strongly in their behaviors, values, priorities, age, gender and other dimensions of diversity; therefore, a good mix of employees is necessary to cater to them. Additionally, scarcity of talent makes it indispensable to recruit from diverse groups. Heterogeneous teams are of special value when the tasks are cognitively complex and demand multiple viewpoints because such teams have a broader range of knowledge, expertise and perspectives (Hoffman, 1958). Diverse teams also exhibit greater creativity (Triandis, Hall & Ewen, 1965). With a focus on innovation, the presence of women in the top management can improve the company's performance due to information and social diversity which can increase motivation in women in the middle management (Dezsò & Ross, 2014). Studies in science and higher education have indicated an increase in productivity and creativity in culturally diverse teams, whose members differ in education and academic discipline (Santandreu Calonge & Safiulli, 2015). Age diversity can be a valuable asset and resource, influencing both individual and team performance (Pitt-Catsoupes, Mirvis & Berzin, 2013). Baldrige and Burnham (1975) indicated the positive effects of functional differentiation in organizations which lead to the collaboration of professionals from different fields resulting to improvements in the administrative systems. Functional diversity in teams in terms of specialists working together can lead to much improved products compared to isolated work (Ribberstrom, 2013).

Team diversity in organizations ultimately influences turnover and performance via its effect on cognitive, commu-

nitative, and symbolic processes (Milliken & Martins, 1996).

Diversity has been reported to be beneficial in encouraging innovation in business and in education which have been mentioned frequently in literature. An example is the study by Bantel and Jackson (1989), who examined the relationship between social composition of top management teams and innovation adoptions in a sample of 199 banks. However, not all forms of diversity have the same effects. Based on econometric analysis in the study by Østergaard, Timmermans and Kristinsson (2011), gender diversity and educationally diverse backgrounds can lead to innovation, but age diversity does not. Moreover, ethnicity as a single diversity category does not significantly affect the innovation potential of companies. To implement a diversity and innovation management strategy it is necessary to reflect on the potential challenges and on how to address these challenges.

## **2.2 Challenging Aspects of Diversity**

Despite the abovementioned potential of diversity, heterogeneity also involves challenges that must be taken into account; employee diversity correlates with the need for active exchange and coordination to avoid misunderstandings and conflicts in order for the team to become successful (Díaz-García, González-Moreno & Sáez-Martínez, 2013). It requires overcoming initial friction and conflicts resulting from different points of view (Ribberstrom, 2013). This is consistent with the work of Pelled, Eisenhardt and Xin (1999), suggesting that diversity in functional background can cause task conflicts. The need for the management of available diverse workforce is also pointed out by Bassett-Jones (2005), stating that diversity, although being a source of creativity and innovation leading to competitive advantages, could also cause misunderstanding, suspicion and conflict in the workplace, resulting in absenteeism, poor output quality, low morale and loss of competitiveness; hence, Andersen and Moynihan (2016)

described diversity as a ‘double-edged sword’. Pelled, Eisenhardt and Xin (1999) found that different forms of diversity shape different types of conflicts, and that conflict ultimately shapes team performance. Depending on task routineness and group longevity (mediators), diversity in race and tenure could lead to emotional conflict; whereas, age diversity does not.

Because diversity management is often accompanied by a change (Davis, Frolova & Callahan, 2016), it is important to consider the psychological aspects of change management (Graetz et al., 2012). For this reason, the active communication of the project goal by the management, as well as the involvement of employees in achieving the same goal, play an important role in integrating a diversity and innovation management strategy into research networks and enterprises (Kotter, 2011; Leicht-Scholten, 2012).

## **2.3 Structural Influencing Factors**

The role of leaders in managing diverse groups cannot be undermined. Irrespective of whether a group is ethnically homogeneous or heterogeneous, innovation of a team is at its highest when supervisors are perceived as being highly collaborative in conflict management (Reade and Lee 2016). Multicultural team leaders with high global identity encourage better team communication and inclusion in diverse working groups, and thus reap the benefits of diversity (Lisak et al., 2016). Sánchez, Sánchez and Escribá (2010) found that managerial team heterogeneity has a positive impact on strategic changes. They argued that the identification of existing misfits between the enterprise and its environment is easier in these teams. With increasing diversity in the workforce, the command-and-control leadership will become outdated, and modern leaders will have to be influential rather than hierarchical in order to be effective enablers (Caye et al., 2011). Presence of hierarchical levels in an organization can hinder the flow of innovative ideas because of the increase in the number of communication

links, resulting in lower innovation (Hull & Hage, 1982). Centralization of decision-making is also known to prevent innovation (Thompson, 1965). On the other hand, less rigorous working rules (Burns & Stalker, 1961; Thompson, 1965), flexibility and openness (Pierce & Delbecq, 1977) encourage the generation of novel ideas.

Effects of diversity on innovation also depend on the group size (Weiss & Hoegl, 2016). Studies show that team effectiveness as well as team processes are significantly related to the size of the team (Díaz-García, González-Moreno & Sáez-Martínez, 2013).

Communication, both external and internal, is another parameter that influences innovation. Internal communication helps disperse novel ideas within an organization and combine them with other ideas (Aiken & Hage, 1971) which help them be sustained (Ross 1974). External communication can promote exchange of innovative ideas between organizations (Tushman, 1977). Drach-Zahavy and Somech (2001) concluded that mutual willingness among heterogeneous team members to interact (via information exchange, learning, motivating and negotiating) is one of the keys to generate innovation based on team diversity.

### **3. Method: Developing a Diversity and Innovation Management Strategy for a Research Association**

In developing a diversity and innovation management strategy for a research aggregate such as the Cluster of Excellence (CoE), a framework that considers the aforementioned potentials, challenges and structural influencing factors is required. As the literature review shows, diversity dimensions have an impact on organizational structures such as teamwork and leadership. Conversely, this means that successful implementation of a strategy requires consideration of existing values, norms and beliefs that characterize an organization.

In the following, the conceptual framework for developing a diversity and

innovation management strategy for a research association will be described. Based on different diversity management approaches, key indicators that allow the development of a diversity and innovation management strategy with a holistic system and theoretically-oriented focus will be identified.

#### **3.1 Conceptual Framework for Investigating a Complex Research Association**

Klaffke (2009) noted that in the light of their individual strategic objectives, organizations have to consider how competitive advantages can be created by diversifying the employees. This means that management strategies must be developed in a manner that is specific to the organization, taking circumstances into account to ensure a successful implementation.

Klaffke's approach, the "3-S-Diversity Model", is composed of the following elements: skills, structure and strategy, which stand in an equivalent relation to the culture of diversity. The element Skills summarizes an appreciative attitude with a corresponding mind-set and measures to achieve this. This also encompasses the assignment of competences with regard to leadership and cooperation into diversity structures. The intention is that employees understand the range of possible individuality among the differentiated aspects of personality and competence under the influence of cultural, social, private, and organizational environments (Aretz & Hansen, 2003b). The pillar Structure stands for the targeted adjustment of instruments and processes such as recruitment policies. This element requires a strong integration in the management level. The commitment to the diversity strategy is manifested by defining target values and measurable goals. The third component Strategy stands for implemented concepts that lead to an organization considering both the organization's need for diversity, and an individual's need to be included in a diverse organization (Klaffke, 2009).

Aretz and Hansen (2002) stated that a system-theoretically oriented approach

takes organization-specific structures like hierarchy levels, recruitment processes and leadership concepts into account. They pointed out that diversity management goes beyond merely increasing diversity quotas and tolerance; it should aim at achieving long-term changes in appreciating diversity and its subsequent potentials. They also viewed diversity management in the perspective of entrepreneurial structures by assuming that the impact of a complex environment requires internal complexity.

This internal complexity is mirrored in a functional differentiation of subsystems that are tailored to the external environment while other subsystems are focused on the internal environment. Furthermore, these systems can be distinguished in those which provide intangible resources and those which supply tangible ones. This resulted in the four types of subsystems (shown in Figure 1) which are commonly used in the private industry and are described in detail below.

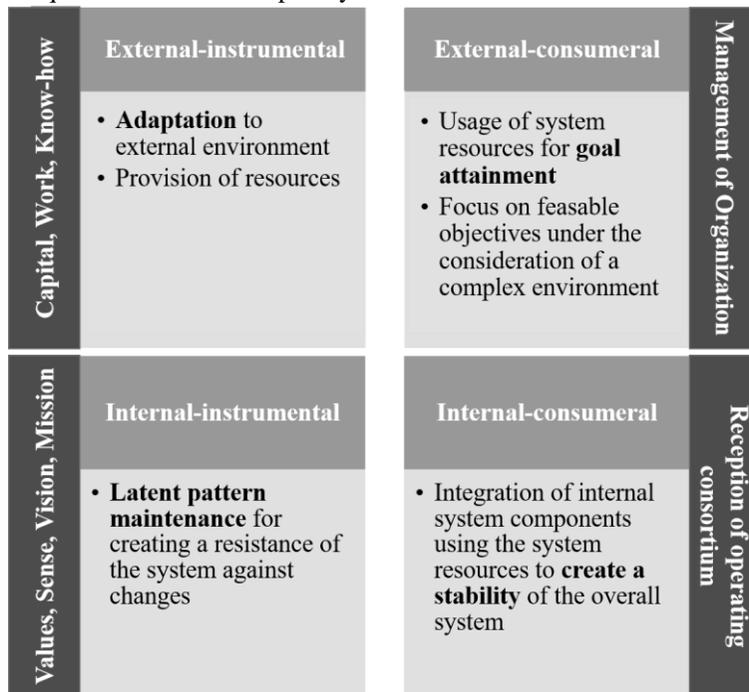


Figure 1: Entrepreneurial Frame: Subsystems and their Functional Tasks by Aretz and Hansen (2003)

“External-instrumental” subsystem describes the provision of resources to establish diversity. Employees need both time and knowledge to actively deal with changes and requirements. It is suggested that both resources could be provided through employee trainings that enhances knowledge and internal competencies. Furthermore, establishment of incentive systems and target agreements are other ways that could provide resources that support the implementation of diversity

management and an appropriate corporate culture.

The “External-consumeral” subsystem deals with the active usage of system resources to fulfill intended goals. The core of this dimension is the organizational action and thus, the organizational responsibility. The top-down representation of corporate values and culture is highly important especially for the implementation of diversity management. Measures should be linked to corporate strategies and targets since diversity management depends on the

institutions' organizational framework. In this context, human-resource contentions, market access contentions, creativity contentions, cost contentions and problem solving contentions have to be considered.

The "Internal-instrumental" subsystem states that diversity management should be a part of the corporate's vision and values to become fully integrated. As part of the corporate's identity, a clear definition of diversity and diversity management is necessary to enable its members to work together under those specific corporate structures. Especially at the beginning of the implementation process, it is necessary to train employees and to stimulate a critical reflection of the management strategy; therefore, it is essential to make potentials, as well as challenges in the context of diversity, a subject of discussion.

The "Internal-consumeral" subsystem describes that diversity management will be successful when measures are internalized by the system. This means that diversity must be integrated holistically into the entire organization in a context-sensitive way by considering processes, corporate strategies and organizational structures. To avoid the formation of subgroups, the management level, is again, of prime importance.

Lastly, the "Internal-consumeral" subsystem states that the management level has to objectively justify the strategy and connect it with the stakeholders' and shareholders' perspectives.

Cox (2001) considered the process in a more human-centered perspective. In his model, he defined different elements that need to be considered when implementing a diversity management in an enterprise. From his point of view, a successful change requires the involvement of the following elements: (1) Leadership; (2) Research and Measurement; (3) Education; (4) Alignment of Management; and (5) Follow-up. These elements are further discussed in the succeeding paragraphs.

Under "Leadership", Cox (2001) stated that change must be introduced by the

management in a top-down approach. Managers must exemplify and define corporate values, aims and directions. In the staff level, a recent theoretical analysis suggests that the key to benefiting from diversity, such as gender, lies in the team members' diversity mind-sets. In this context, mind-set refers to employees' mental representation of diversity which is reflected on how they engage and interact with a team composed of diverse members (van Knippenberg, van Ginkel & Homan, 2013). The corporate culture shapes the mind-sets of its employees. Specific behaviours exhibited by the management lead to imitation of the same behaviours by employees of all hierarchy levels (Marshall & McLean, 1985). Especially with regard to a change of an existing corporate culture, prevailing mind-sets need to be considered to prevent reactance and rejection; therefore, new diversity and innovation management should be linked to corporate strategies and guiding principles. The active communication of the necessity to establish a management strategy that takes diversity into consideration is an important milestone for its successful implementation (Schwarz-Wölzl & Maad, 2014).

The "Research & Measurement" element aims at data collection that allows the quantitative structure of an enterprise to be captured. For example, the demographic data of employees and confidence of customers and employees are analyzed and used as a basis for a diversity and innovation management strategy that is tailored to the organization. This allows the prevailing management strategies and personnel policies to be reflected on the management strategy (Ditzel, 2015)

All factors identified from specific indicators during the research phase that need immediate action has to be acted upon by employees throughout all hierarchical levels is necessary in order to achieve a successful organizational change (Kotter, 2011).

The "Alignment of Management" considers structures and processes of hu-

man resource management. To achieve a sustainable use of the potential of diversity during creation of innovation, processes have to be adjusted to this strategy. This implies the adaptation of recruitment processes, personnel branding and marketing (Ditzel, 2015).

The “Follow-Up” element aims to achieve a continuous improvement process and to control all measures. According to Cox (2001), the change process is “[...] continually accessed and refined over time in a process of continuous loop learning”. Establishing tools that measure the success of diversity and innovation management are important to identify barriers and adjust measures accordingly during the early phase of implementation. Instruments such as the Diversity Scorecard, the development of enterprise-specific key figures and an Open Balanced Scorecard are appropriate to measure success (Hermann-Pillath, 2009).

Taking the described aspects into account, a structured and transparent development and implementation of a management strategy is of particular importance.

### **3.2 Research Design for Developing a Diversity and Innovation Management Strategy for a Research Association**

Based on Cox (2001), Aretz and Hansen (2002, 2003a, b), and Klaffke (2009), the constructive handling of diversity in organizations must be understood and anchored as a leadership task. The transparent integration of a corresponding project into the organizational structure and the explicit support of the organizational management are important to achieve openness towards the project (Vedder, 2009). Because of their specific environmental requirements, this is even more challenging to implement in a research institutions (Leicht-Scholten,

2011). For this reason, this project is structurally supported by the Management Board of the Cluster of Excellence’s “Integrative Production Technology for High-Wage Countries” which advocates for the implementation of a diversity management strategy for promoting innovation. Due to the structural as well as conceptual role of the project and the consideration of the Cluster of Excellence as a unified organization, the project was assessed in the so-called Cross-Sectional Processes (CSP), which mainly focus on collaboration processes within the Cluster of Excellence (CoE “Integrative Production Technology for High-Wage Countries, 2017). With regard to the collaboration, employees, structures and results were considered. Considering the research question, the conceptual framework of the research project focuses on the following diversity categories: (1) gender, (2) specialization and educational background/ discipline, and (3) interculturality. These factors were positively discussed in the innovation context (Østergaard, Timmermans and Kristinsson, 2011; Díaz-García, González-Moreno & Sáez-Martínez, 2013; Lisak et al., 2016).

The different steps of an approach that lead to an organization specific diversity and innovation management strategy for a big research association are described in the succeeding paragraphs. The concept is based on the approaches of Cox (2001), Aretz and Hansen (2002, 2003a, b), and Klaffke (2009). The “Research and Measurement” of Cox as the special requirement for a big research association is not entirely comparable to those of an enterprise and thus, needs a detailed investigation. Figure 2 illustrates the different phases of the pursued research approach in the context of Klaffke’s (2009) pillars.

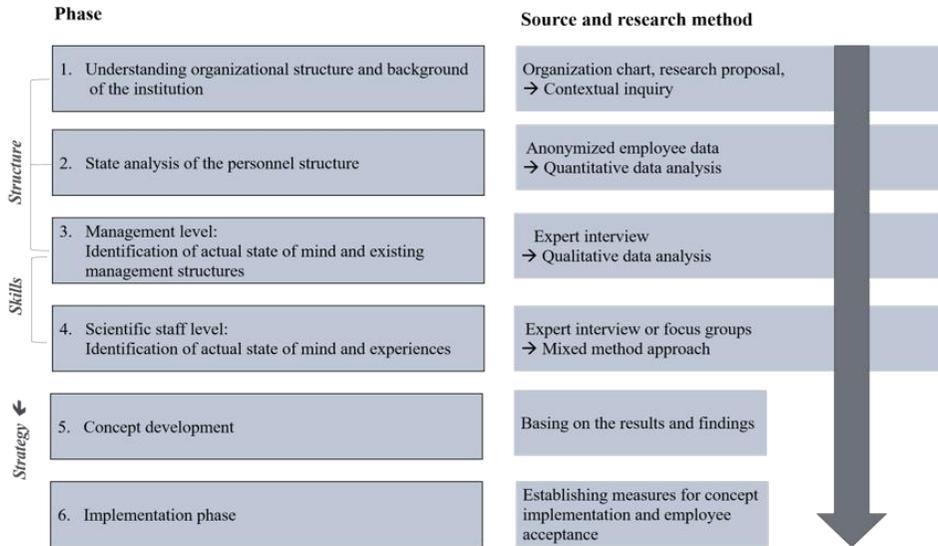


Figure 2: Six Phases of Corporate Culture Change

*Phase 1: Organizational Structure and Background of the Institution.*

To develop a customized diversity management strategy, it is crucial to understand not only the whole research association with its given structures and processes, but also the background and environment of the institution.

Considering Aretz and Hansens (2002, 2003a, b) model of a system-theoretically oriented approach, in company’s context, subsystems that are applicable to a research institution can be derived and are shown in Figure 3. The first phase was focused on the external factors which can hardly or cannot be influenced by the Cluster Management at all. Internal structures were considered in Phase 2 and Phase 3.

“Cluster-external” patterns and frames are based on the existence of submanagement levels in institutions. Defined as competitive research and educational institutions, the Clusters of Excellence are conglomerates of different specialists and researchers coming from various faculties and research institutions (DFG, 2014). They have been established in the frame of the so-called Excellence Initiative of the German federal and state governments, the German Research Foundation (DFG) and

German Council of Science and Humanities (DFG, 2016). These research networks are often highly complex, especially with regard to authorities assigned to issue directives. Furthermore, the university chairs and research organizations are characterized by their individual leadership styles and management structures and a great autonomy in structure and management which results from the independency of science. This aspect represents a fundamental structural difference from the implementation of diversity and innovation management strategies in research groups as individualized personnel management and open and learnable corporate structures represent core aspects of applied diversity management (Aretz & Hansen, 2003b). The independency of these institutions results in inconsistent recruitment processes, approaches in human resource management and handling of diversity and innovation processes. The heterogeneity of existing approaches requires a detailed investigation to enable a link to existing structures.

In addition, the Clusters are established as organizations with a high international visibility, and function as scientific networks among the participating institutions such as universities, professorial

chairs and research institutes (DFG, 2014). Due to the organizational anchorage of professorial chairs to specific faculties, the entrepreneurial background of research institutes, such as the Fraunhofer-Gesellschaft (2017), and the strong linkage to universities, Clusters are characterized by complex organizational structures. These structures differ from entrepreneurial structures especially with regard to authority in the underlying habits and working routines, accountability and corporate culture. As a consequence, the conditions for the establishment of a diversity and innovation management strategy differ considerably from those of private enterprises. The complexity of the Cluster of Excellence “Integrative Production Tech-

nology for High-Wage Countries” at RWTH Aachen University is comparable to multi-layered organizational structures of economic enterprises.

“Organization-external” patterns and frameworks include the influence of university management and faculties of organizational institutions. Embedded into the educational sector, Clusters of Excellence are influenced by the requirements of their environment. In Germany, lectureship and research are combined and have to be conducted by each institute. This results in a variety of task-fields for the workers. Because of this, researchers have to fulfill educational tasks, train junior managers, and fulfill duties for their research assignment.

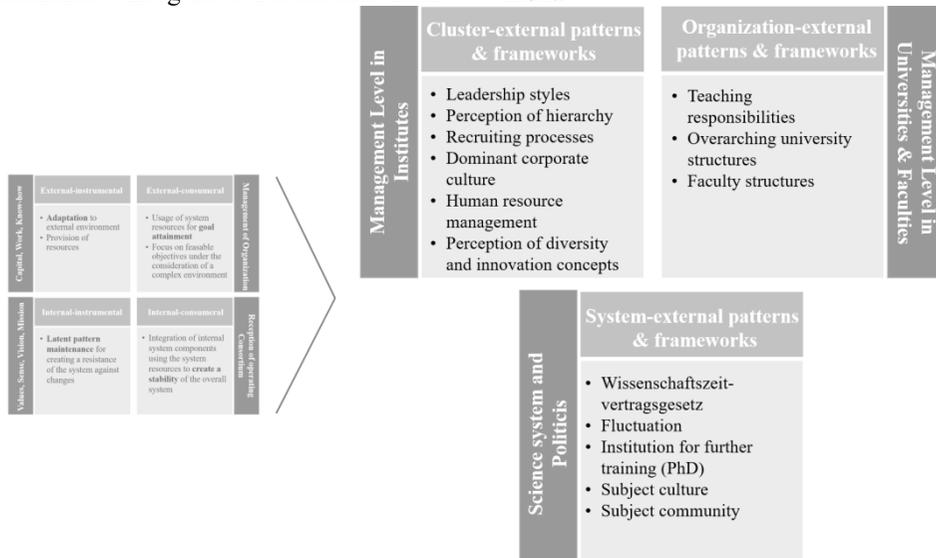


Figure 3: Subsystems of research organizations

With regard to “System-external” aspects, it must be considered that employees are embedded in their respective specialist/scientific culture. This means that, in comparison with companies that have a corporate culture and a superior common goal, these research groups consist of members who have heterogeneous specialist cultures, have been socialized in different organizations, and are representative of the individual interests of their respective units. The majority of scientific staff are

striving to achieve their doctorate degree. For this reason, working at a research institute can be considered as further training that aims at archiving the next step of a career path. This perspective is supported by the statutory framework called “Wissenschaftszeitvertragsgesetz”. The law dictates that working in a scientific institution must be considered as an individual scientific qualification phase; therefore, the law modifies the possibility of fixed terms for employment. Research assistants can be

employed at institutions for a maximum of six years (§ 2 Abs. 1 Wissenschaftszeitvertragsgesetz (WissZeitVG)). This influencing factor leads to a natural fluctuation and allocation of resources. The resulting effects must be considered in the development of the strategy, as staff structure underlies a continuous change.

The three categories discussed above represent external influencing factors which need to be considered in the development of a diversity and innovation management strategy for a research association. The analysis shows that predominantly external influencing factors shape the landscape of cultures, visions and attitudes. Considering Cox's (2001) step of "Research & Measurement", a research plan that allows the detection of all hidden structures and mindsets is necessary.

#### *Phase 2: Status quo of personnel structure*

After the analysis of structures, it is important to gain an impression of the existing diversity in the research alliance. This is important to develop a needs-oriented strategy that promotes diversity as a driver for innovation. Aretz and Hansen (2003b) pointed out that a suitable approach for handling diversity in a company depends on the specific "diversity mix" which each company must determine. Despite differences in conditions, this is also applicable to research facilities. To be able to identify the profile of a research association, it is necessary to analyze the structure of the company's personnel.

For this reason, a quantitative data analysis of anonymized employee data was the first step to get an impression of the personnel body of the organization. The focus of this first analysis was on the diversity categories of gender, status group, discipline and culture. An elicitation of the diversity category "age" was not possible in this project due to inconclusive data indications.

The descriptive data analysis of the diversity category 'gender' shows that the majority of the 381 employed Cluster members coming from 23 institutions are

male (86.4%); while 73.8% of researchers working in the network are doctorate candidates (research assistants), 8.1% post-doctorates, 0.5% are junior professors, and 8.5% are professors (see Figure 4). Considering the aspect of interdisciplinary, the analysis shows that 82.4% are from engineering sciences, 11.8% from the faculty of natural sciences and mathematics, 3.4% from economics and social sciences and only 1.3% from linguistic and cultural sciences. The remaining 1.1% have not given any indication with regard to their disciplinary affiliation. For the diversity category 'culture', 9.7% of the members employed in the Cluster of Excellence have a non-German background. Since this is a quantitative analysis, it must be added that the migrational background and thus, the extent of interculturality cannot be determined.

To sum up, the first results show the need to increase gender and cultural diversity. A higher heterogeneity with regard to the professional orientation would be desirable; however, the high proportion of engineers is based on the thematic orientation of the research group and is difficult to change.

#### *Phase 3: Mind-set of management on diversity and innovation*

Starting from this initial situation, the next step is to analyze the existing management concepts. The intention is to gather and understand the existing management approaches and mind-sets on the subject of diversity and innovation in order to connect the new strategy with the current state and thus, be able to develop a strategy tailored to the institution. This refers to the internal perspective of Aretz and Hansen (2003b) model (Figure 1).

To reveal persisting mind-sets, experiences and attitudes, a research design that allows a detailed discussion of the research object is necessary; therefore, a qualitative analysis was carried out based on Mayring (2015). The interviews were based on a partly structured interview guide including open questions, which vary in concrete

form and sequence. This allowed to consider the individuality of the interviewee.

In order to get an insight into the different institutions it is necessary to deal with each institution and the prevailing mind-sets of the management level. The professors, junior professors, supervisors

and group leaders of the institutions integrated in the Cluster of Excellence were the determined sample population. These status groups are characterized by a direct human resource responsibility, a decisive role in the recruitment process and experiences with the processes of the Cluster.

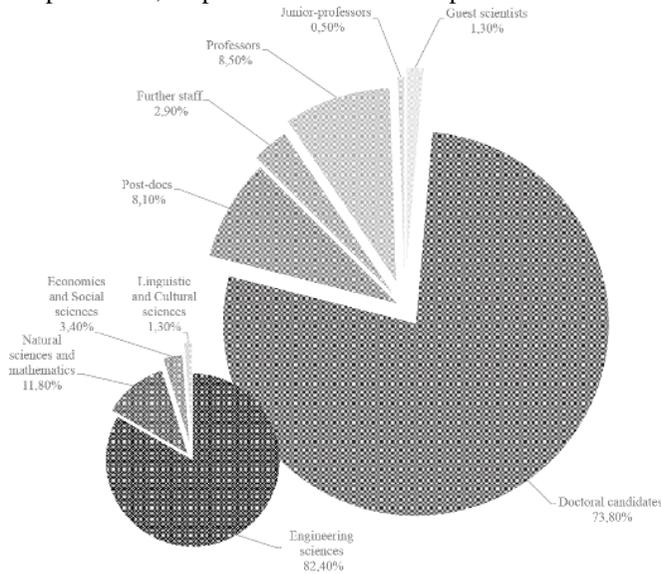


Figure 4: Personnel Structure of the Cluster of Excellence

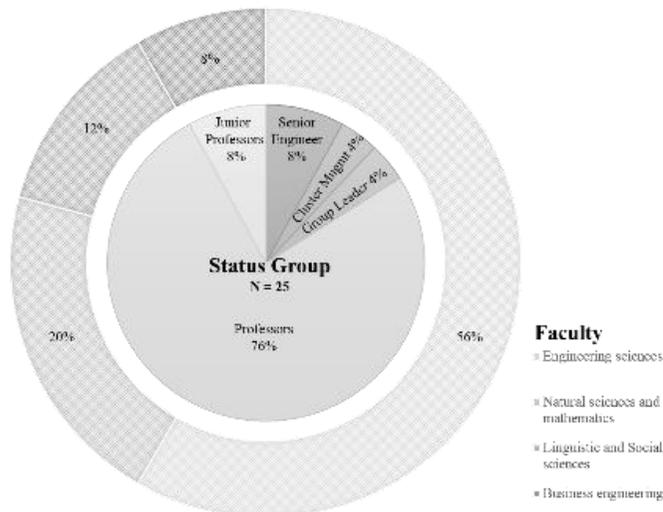


Figure 5: Status Group and Faculty Data of Interview Partners

After the analysis of employee data, the sample group was identified which consisted of 35 individuals including 29 professors, two junior professors and four

persons from group leading, senior engineering and Cluster management level. The sample consisted of 17.1% female researchers. A total of 25 individuals con-

sisting of 19 professors, two junior professors, and four group leaders, senior engineers and managers were chosen to participate in the interview (refer to Figure 5). The response rate was 71.4%; where 24% of which are women.

To get an insight into the internal structures and subsystems of the research object, a qualitative approach using semi-structure interviews was conducted. This approach promotes broad acceptance in the research group through personal encounter and allows a reflection process on the individual policy of the institutions. The results have shown that the qualitative survey supported the self-reflection on diversity and innovation as well as the management approaches of the directors of the institutes. Through communication of the project, the topics of diversity and innovation became subjects of discussion which caused a renewed active analysis.

The interviewees can be characterized as leaders of their respective research groups. They either lead an entire research unit or a team; thus, they all have corporate responsibility as well as a strong integration into the institute's internal recruitment processes. The participants were asked about their understanding of diversity and innovation, the existence of management structures, and their individual experiences with diversity. Furthermore, questions about hierarchical structures and their importance were included in the questionnaire. As already mentioned steep hierarchies can hinder the innovation process (Hull & Hage, 1982). This category allowed the different organizational structures to be analyzed and helped to understand the reason for their existence. These aspects are important in a qualitative interview because both, the causes of the current diversity profile as well as the structures for the management of human resources, were part of the investigation. The interviews were based on a semi-structured questionnaire in order to ensure a comparability of the statements.

The analysis of the 25 types identified in sub-codes led to the identification of 6 super-ordinated types (Steuer & Leicht-Scholten, 2017). In each case, these types stand for a group of interviewees, who represent equal or comparable attitudes. The six types are described briefly below.

The “superficially informed” are individuals with basic knowledge of diversity strategies. Most does not have or have a vague idea of the strategies on how to manage diversity. They assume that diversity does not have to be managed and therefore, handling of diversity is driven by the unanimous opinion that it happens consequentially. This becomes evident through statements such as: “I do not like the term [diversity management] because I do not distinguish. I believe that universities are much more subject to social influences, which we, as institutions, can only conditionally change” (Interviewee No. 6). On the basis of the preferred management style and attitude towards hierarchy, the assumption suggests that the interviewees have not yet been able to make any concrete experiences with diversity, and thus do not link them with a positive potential. As a result, the majority of the “superficially informed” do not see a connection between diversity and innovation or is unsure about it.

The “active follower” has a basic idea of diversity and diversity management. They see a connection between diversity and innovation and foster activities that in their opinion support processes of innovation creation. Although they do not have a deeper knowledge of diversity and innovation, this group pursues approaches of active diversity management, as they think that diversity has to be managed in order to have a positive impact. “I would say that you have to worry about it; and that is often implicit. And they go hand in hand.” (Interviewee No. 5).

The “passive follower” is fundamentally or basically informed about diversity and diversity management. The majority

applies forms of diversity management as they see a need to manage it. In contrast, they do not see innovation management as part of their scientific management task and therefore, use either a passive approach, or no approach at all.

The “intentional refusers” are fundamentally informed about diversity concepts; however, they have a specific idea of diversity management. They reflect the context between diversity and innovation but take a passive approach of diversity management or decide actively not to integrate any approach.

The “sceptics” are well-informed about diversity, but they show reluctance with regard to the implementation of diversity management approaches for different reasons. Consequently, in the description of concrete diversity management approaches, they showed an understanding that can be considered as basic knowledge. Nevertheless, they see the need to manage diversity; especially the environmental factors that may lead to skepticism of implementing diversity and innovation management strategies. In this context, an interviewee mentioned: “You just asked for the management, how should I deal with it? This is indeed a trade-off, it is a contradiction a bit, those are two conflicting goals. You are trying to reach a research result - in the shortest possible time, with as good a result as possible, as measured by publications, publications, etc.. But, that you may no longer only act in your own community [...], will not be rated, but is rather a shortcoming.” (Interviewee No. 17). This statement elucidates the perspective of the “sceptics”, as they strongly see management approaches like diversity and innovation management in the context of their environment. Based on structural barriers in this environment, they see the need to manage diversity to be more innovative; but they are hindered by restrictions and structural disadvantages.

The “reflected users” have a profound knowledge of diversity and diversity management. The majority of them are actively

pursuing a diversity management strategy. With regard to interdisciplinarity, one of the interviewees mentioned, “[t]he most important capability [...] is this - as I say - interdisciplinary openness. Or I’ll formulate it another way. The tolerance and acceptance of other specialized cultures as at least equal to themselves.” (Interviewee No. 12). Another participant stated that: “[...] because I believe that it is obviously also the presence and the introduction of arguments and aspects from the holistic view of society that leads us all much further.” (Interviewee No. 3).

The identified types allowed the authors of this paper to form conclusions on the prevailing mind-sets and institutional cultures in this research organization. In this context, managers function as role models and must embody the institution’s norms and values, and corporate culture (Sackmann, 2014). To compare the identified types with the employees, it is necessary to actively involve employees into the research concept (for further discussion see Steuer & Leicht-Scholten, 2017)

#### *Phase 4: Mind-set of employees on diversity and innovation*

Team characteristics are not to be equated with the characteristics of team members. The individual group dynamic is influenced by its individual team members which in turn also influences the individuals’ way of thinking and behavior (Díaz-García, González-Moreno & Sáez-Martínez, 2013); therefore, it is important to understand the dynamics in the Cluster of Excellence. To do so, the project investigated the understanding of the organization’s members on diversity and innovation.

Based on the quantitative analysis, research assistants (doctorate candidates) are the biggest group of employees in the Cluster of Excellence (73.8%). For this reason, it is crucial to integrate this group into the process to avoid reactance against the diversity and innovation management strategy. In order to obtain a broad perspective of the prevailing attitude towards the

topic and a detailed reflection of experiences, a mixed measure approach was conducted in this phase.

A qualitative employee survey was done to allow a deeper insight into the mind-set of research assistants. In addition to the identification of previously dominant attitudes, the aim of this phase is to supplement the data obtained from the interview of the management with that of the perspective of the employees. The results will be used to identify which approaches might be successful and which aspects do not lead to the desired results. Furthermore, the qualitative approach will allow comparisons of the mentioned existing approaches and strategies from management perspective with the expectations and perceptions of employees. This will allow to identify the gap and will assist in the development of a concept for a strategy that combines both perspectives that will have a long-term impact.

For the qualitative survey, focus groups will be identified which will consist of subsets of the entire institution that has already been studied quantitatively. The application of focus groups has advantages and disadvantages (Litosseliti, 2003). There is a possibility that employees might influence each other (false consensus), and especially in this case, they might know each other, which could, as a consequence, lead to a non-safe environment. On the other hand, focus group discussion will allow a critical dispute on the topic (Raab, Poost & Eichhorn, 2008). Furthermore, Gibbs (1997) mentioned that although focus groups are not empowered to make decisions, participants appreciate that they are allowed to be actively involved. Nevertheless, it is important to take into account the extent to which interactions and mood effects can have an impact on the survey, especially against the topic diversity and innovation.

This phase is currently being planned. Results will be published as soon as possible.

*Phase 5 and 6: Strategy development and sustainable implementation*

Based on the analysis of the given structure and skills, a tailored strategy can be developed (see Figure 3). As already mentioned, this methodology is important because of the given structure of the Cluster of Excellence and the associated dominant engineering habit (Bourdieu, 1982). In the framework of the strategy, the different findings in phases one to four are summarized and interwoven into a concept which aims at increasing diversity and fostering innovation through a diverse workforce.

Considering the implementation phase, the approach should be exemplified by the Cluster Management, but also by the leaders of institutions; however, it is particularly important not to "sell" diversity from a top-down perspective, but to listen to criticism and rejection, and to be sensitive to the specific approach (Aretz & Hansen, 2003b). In this context, employees' can be actively interwoven in a participatory approach that reflects the needs and barriers of a diverse workforce. With regard to the results of the qualitative interviews of professors (phase 3), the goal is to develop measures that actively convince and integrate members of the "superficially informed", "intentional refusers", and "sceptics" (Steuer & Leicht-Scholten, 2017). Against the background of numerous institutions that are included in the Cluster of Excellence, the exemplary function of the executives is of particular importance.

With regard to the enforcement of diversity, it is essential to integrate learning environments that encourage the practical handling of diversity. This strategy features an 'Innovation Lab' (Steuer et al., 2017) that allows institutionalized meetings of groups with diverse and frequently changing members under a specific research question and thereby, symbolizes a spirit of practiced diversity in the innovation context. In addition, the integration of strategic metrics, such as the Balanced Score Card, will allow a sustainable evaluation of measures which could result in a continuous qualitative improvement (Müller et al., 2016).

### **3.3 Challenges and Limitations**

The system-theoretically oriented approach allows a fundamental perspective on structures and strategies of the research association. It represents the basis for a sustainable reorganization process under the consideration of subsystems and influencing factors (Aretz & Hansen, 2003b). The presented approach is based on the approaches of Aretz and Hansen (2003a, b), Klaffke (2009) and Cox (2001) that considered the implementation of diversity management in an entrepreneurial frame. The limitation of transmitting these systems to an organization embedded in a scientific environment, makes adjustments necessary; especially factors such as the fluctuation of scientific staff which has to be considered in phase 4, the limitation of company affiliation which is reasoned by the “Wissenschaftszeitvertragsgesetz (WissZeitVG)”, and the high independency of research groups and institutions. All these require a specific approach.

The challenge is to develop strategies that will enable an organizational change through all levels of the research organization, taking into account the mentioned variables of insecurities. The aim is to implement a broad understanding of diversity and to avoid reactance against linked measures. Nevertheless, diversity results in higher complexity and requires good management and transparent communication processes to be successful. Based on the findings in phase 1, this is of particular importance as homogeneous and mono-cultural personnel structures have a higher probability of reactance. Furthermore, the high complexity of big research associations is accompanied by high efforts in understanding the enterprise and its members which aggravates the development of a suitable approach.

### **4. Conclusion and Outlook**

The presented project followed a conceptual approach that deals with the implementation of a diversity management strategy with a strong focus on innovation

creation in a research association with a very high complexity. As a consequence, there is a lack of comparable concepts dealing with this topic which leads to a lack of comparisons to other projects and experience reports. It would be highly interesting to discuss the experiences and results in the international community.

Although research groups claim to be an inherent organization (qua organizational chart), diffuse hierarchical structures exist; therefore, the development of diversity management in a research organization faces different challenges than the implementation of a corresponding strategy in companies with a stringent top down management. For this reason, it is important to establish a common corporate culture and, based on that, a common understanding of diversity management.

The implementation of the first three phases of the process has shown the necessity to actively deal with the workforce of research associations and to analyze the underlying structures and mind-sets.

In the first phase, the analysis of the organizational structure revealed key areas that can positively or negatively influence the integration of a diversity management system. As diversity management is always accompanied by a change in management approach, the identification of subsystems allowed the conscious integration of possible barriers or promoters. Phase 2 allowed the detection of individual needs that require action, which could serve as the basis for developing a strategy that could answer the specific requirements. Furthermore, the amount of an organization's diversity indicates how much of the team processes, which are influenced by diversity, are part of an employee's daily life. This will help understand if mind-sets and experiences are based on concrete situations in the working environment or are influenced by theoretical assumptions. To further investigate this, an employee survey is necessary which will be conducted in phase 4. Phase 3 connected the barriers or promoters identified in phase 1 with specific persons. The

qualitative approach made it possible to experience mind-sets as well as attitudes in the context of diversity and innovation management. As a consequence, the results of the third phase allowed integration of the key personas according to their type into the implementation process. On the other hand, the concept need to be tied to the prevailing mind-sets and strategies to actively follow-up on the different previous management approaches, and thus to actively integrate the management level and its perspective. This aims to minimize denials of new approaches and allow a broadly accepted change towards a joint strategy.

Subsequent to the implementation, further delicate adjustments of the strategy will be carried out. This opportunity will allow detailed aspects of the association between diversity management and innovation to be identified.

With regard to the presented Cluster of Excellence, the next step will be to develop and implement customized measures. Further research could investigate which measures work and why they work, in order to understand the logic, structures and control lever of such a big research organization. To achieve this, it is necessary to anchor controlling elements and measurement methods in the research approach. A corresponding need to adjust methods and instruments of control or a re-development might be required. In doing so, the research could contribute in the discussion of the development of tools which will allow measurement of the competitive advantage of diversity in an innovation context.

The analysis points out that the existing structures and mind-sets of research networks have a significant influence on the use of diversity as an innovation factor. This results in the need to break down these structures and thinking patterns in order to integrate them into a management strategy. The potential of the presented approach lays in its transferability on other complex research organizations. It represents a basic approach for achieving a

long-term integration of diversity for aiming socially responsible research and innovation creation.

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# The Relationship between the Degree of Importance of Service Dimensions and Attributes and the Zone of Tolerance of Hospital Patients: An Empirical Research on the Quality of Hospital Service

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## Abstract

Patient expectation, bounded by the upper and lower levels of the Zone of Tolerance (ZOT), which plays a role in defining the quality of hospital service, has already become a critical consideration. Previous publications have found empirical evidence in profit organizations that more important factors are likely to have a narrower and higher ZOT compared to less important ones; however, there is a lack of research that investigates the relationship between the degree of importance and ZOT of service dimensions and attributes in a non-profit organization. This study intends to investigate the relationship between the degree of importance, including the stated importance from the patients and relative importance, and ZOT of service dimensions and attributes. The study was conducted in one of the hospitals in Taipei City, Taiwan. A survey questionnaire containing the SERVQUAL dimensions was distributed and administered to the chosen hospital's patients. A total of 304 out of 552 returned questionnaires were considered valid and used in the study. Overall, this study found significant evidence that ZOTs are narrower and higher when patients consider the service attribute as highly important when compared to those that are considered less important. This is especially true for 'Tangibles' and 'Responsiveness' dimensions in a non-profit organization; though the correlation degrees are not as high as those found in profit organizations. This study suggests that increasing the confidence of patients on the hospital, through hospital staff training on empathy and efficient communication, should be focused on by the hospital management.

*Keywords: Zone of Tolerance (ZOT), importance, patient expectation, hospital service quality*

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## 1. Introduction

Hospitals need to provide services appropriate to the health needs of the population they serve (Al-Borie & Damanhour, 2013). Further, the satisfaction of patients with the quality of healthcare services they receive serves as a critical competitive consideration. The patients and their family must be recognized as consumers of hospital services; it is vital to thoroughly understand their needs and expectations in the

healthcare industry. Incorporating the patient's views during quality assessment is a way of making health services more responsive to the people's needs (Rao et al., 2006).

Several tools have been developed to measure service quality in order to understand patient needs. Among these tools is the SERVQUAL questionnaire which is popular in evaluating service quality. In this paper, SERVQUAL questionnaire tool will be used to assess patients' perception

of service quality to improve patient satisfaction; therefore, this paper aims to investigate the relationship between the degree of importance of service attributes and the ZOT of hospital patients in Taiwan, including their stated importance and relative importance, and the Zone of Tolerance (ZOT).

Subsequently, this present study employed correlation analyses to evaluate the following two hypotheses:

*Hypothesis 1: the dimensions/attributes of hospital service quality with higher importance/higher relative importance have lower WZOT.*

*Hypothesis 2: the dimensions/attributes of hospital service quality with higher importance/higher relative importance have higher HZOT.*

## 2. Literature Review

Ensuring service quality is critical for the success of service-oriented industries. Hospital services frequently combine in-tangible services supported by tangible goods, and tangible goods supported by intangible services (Pai & Chary, 2013). The measurement of quality in healthcare services is more difficult to define than services provided by other industries because the customer's or the patient's quality of life after receiving healthcare services is the one being evaluated (Herzlinger, 1997). Many studies have been conducted to measure hospital service quality from the physicians' viewpoint (e.g.,

Lee & Kim, 2017; Hensen et al., 2008; Gupta, 2008) and from the patient's viewpoint (e.g., Mitropoulos et al., 2017; Pai & Chary, 2013; Narang, 2010; Akter et al., 2008). A systematic review done by Jennings et al. (2015) found that quality services provided by the nurses in the emergency department have a positive impact on patients' satisfaction and waiting times. This indicates that the services being rendered in the emergency department is one of the most important indicators of patient satisfaction in the hospital industry.

Parasuraman, Zeithaml, and Berry (1985) developed a model to understand the gap between customer perceptions and customer expectations (shown in Figure 1). Customer perceptions are defined as subjective assessments of actual service experiences; on the other hand, customer expectations are performance standards or reference points with which service experiences are compared. According to the gap model of service quality, eliminating the gap between customer perception and expectation will result in increased customer satisfaction; thus, service providers should be able to assess, evaluate and integrate in their service strategies the factors that will reduce this gap (Kumar & Kumar, 2004). The service gap model also implies that service quality will increase when the customer gap decreases (Zeithaml, Bitner, & Gremler, 2006).

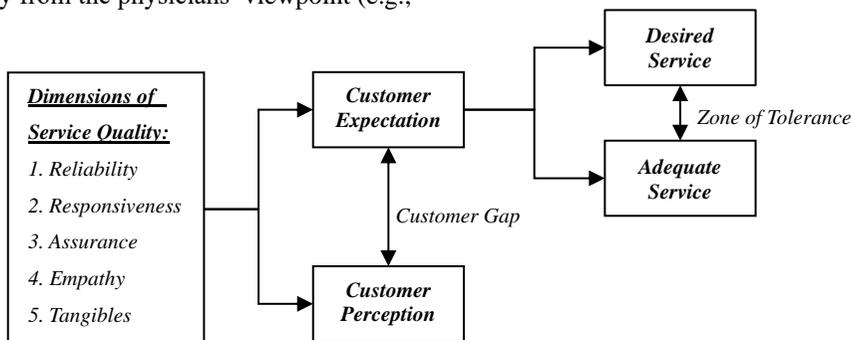


Figure 1: The Gap Model and the Dimensions of Service Quality

Parasuraman et al. (1990) refined the original SERVQUAL measurement tool

into a concise multiple-item scale with satisfactory reliability and validity that com-

panies can use to better understand the customer perceptions and expectations. Research suggests that customers do not perceive quality in a unidimensional manner; rather, they appear to evaluate quality based on multiple factors that are relevant to the specific context (Zeithaml et al., 2006). As shown in Figure 1, service quality consists of five dimensions, which are used in SERVQUAL, that reflect customer's perception. These are: (1) reliability, (2) assurance, (3) responsiveness, (4) empathy, and (5) tangibles. SERVQUAL, a multi-item scale, had been used for measuring customer perceptions of service quality across a wide variety of service environments including healthcare (Lonial, Menezes, Tarim, Tatoglu, & Zaim, 2010). Ali, Hamid, and Alireza (2015) used SERVQUAL in their study to collect data, including their demographics, from 361 patients to analyze the service quality in hospitals. Khorshidi, Nikfalazar, and Gunawan (2016) measured the quality of internal services of train using SERVQUAL and Analytic Hierarchy Process (AHP) method. Lonial et al. (2010) suggested that SERVQUAL and its dimensions of service quality are reliable and valid across cultural and economic environments in the context of the hospital industry with some need for adaptation. SERVQUAL model is useful in revealing differences between patients' preferences and their actual experience (Pakdil & Harwood, 2005).

Customer expectations are primarily based on customers' needs, and are also influenced by the company's reputation and the customer's previous experience with services or with the company's marketing efforts (Edvardsson, 1997). According to the gap model, customers assess service performance on the basis of two standard boundaries, desired service and adequate service, and the difference between the two boundaries is called the Zone of Tolerance (ZOT) (Zeithaml et al., 2006). This means that customer expectation can be divided into the upper boundary and the lower

boundary as shown in Figure 1. The upper boundary of customer expectation represents the service that customers desire; whereas, the lower boundary represents the acceptable level of service quality. The ZOT is the extent to which consumers recognize and are willing to accept heterogeneity in the provided service (Zeithaml et al., 2006). Rather than having only one level, consumer expectations are bounded by the upper and lower levels, which are both important (Walker & Baker, 2000). The ZOT can be established through the patients' expectations for a specific service attribute, even if it is not yet delivered. When the patient receives the service, the level of satisfaction with the service rendered can be evaluated through his or her own perceptions.

ZOTs vary for different service attributes or dimensions. Service attributes or dimensions that are perceived to be important by the customers are likely to have narrow ZOT since customers are likely to be less willing to relax these expectations. Service attributes deemed as important have smaller ZOTs, with the desired service level (upper boundary) and acceptable service level (lower boundary) higher (Zeithaml et al., 2006). Previous publications have found empirical evidence that important service attributes is likely to have narrow and high ZOT in some profit organizations. Campos and Nóbrega (2009) conducted a survey with 500 students who are customers of fast food to assess their level of satisfaction on fast food services in Brazil. They found that, as the level of importance of attributes increases, the distance between the upper and lower boundaries of ZOT becomes closer and the values becomes higher. Devi and Raja (2011) conducted a survey with 307 railway passengers in South Central Railway, India, and confirmed the results of the previous study mentioned that, as the importance of attributes increases, the distance between the upper and lower boundaries of ZOT becomes closer and the values become higher. Nadiri and Hussain (2016) deter-

mined the ZOT of patients in public and private hospitals by identifying their expectations before receiving the services and their actual level of satisfaction after receiving healthcare services. The patients' level of satisfaction was compared with their expectations to improve the hospitals' service quality. Veerabhadrapa, Jayanna and Kokatnur (2013) collected data from 500 customers of banks in India and revealed that there is a positive correlation between the degree of importance of service attributes and the height of ZOT, and a negative correlation between the degree of importance of service attributes and the width of ZOT. Since fast food restaurants, railways and banks are profit organizations, the authors of this study would like to explore the relationship between the degree of importance of service attributes and ZOT in a nonprofit organization such as a hospital; there is only a handful of literature that investigated this.

Parasuraman et al. (1985) defined service quality as the degree and direction of discrepancy between consumers' perceptions and expectations on the different but relatively important dimensions of service quality, which can affect their future behavior. It also can prioritize areas related to quality management and improve the satisfaction of patients (Mitropoulos et al., 2017). Customers often think everything is "very important" and previous analysis reveals that 78% of service attributes are "very important" with little variance in the degree of importance between these attributes (Garver, 2003). In other words, the stated importance ratings do not discriminate the degree to which the attributes differ (Myers, 2001). The Analytical Hierarchy Process (AHP) method, which has the advantage of providing a set of weights for measuring the relative importance of service attributes, is a robust approach that is easy to implement and uses pair-wise comparisons to determine the relative importance of various criteria (Seol & Sarkis, 2005). Previous publications have not discussed the relationship between the relative

importance of service attributes and ZOT in a non-profit organization.

### **3. Methods**

In Taiwan, the hospitals are categorized into three levels by size, strategy, quality, etc., and the three levels are: (1) medical center, (2) district hospital, and (3) local hospital. In Taipei City, there are 8 medical centers, 12 district hospitals and 21 local hospitals. There are 9 district hospitals owned and operated by Taipei City Government (TCG), but have poor performance on management as evidenced by low amounts of outpatients therefore, to increase the performance of hospitals, improvement of service quality should be focused on (Meesala & Paul, 2017). In order to improve management performance, these 9 district hospitals were merged to become the Taipei City Hospital (TCH). There are 24 divisions in Zhongxing Branch and the total number of outpatients recorded was 423,660 in 2014. The number of physicians, nurses and beds are 902, 3,446 and 725 respectively. Considering the wide service scope and scale, this paper employed convenient sampling and chose TCH as the case example to analyze service quality.

The five dimensions (reliability, assurance, responsiveness, empathy, and tangibles) of the SERVQUAL questionnaire developed by Parasuraman et al. (1985) were used to assess the degree of importance, adequate or acceptable level (upper boundary of ZOT) and the desired level (lower boundary of ZOT). The five dimensions of SERVQUAL were used as the service attributes for this study which was patterned after the study by Al-Borie and Damanhour (2013). This study interviewed two high-level executives in the selected hospital not only to confirm the dimensions and attributes of the questionnaire, but also to categorize the characteristics of the target patients. Based on the in-depth qualitative data from the high-level executives and the five SERVQUAL dimensions (reliability, assurance, respon-

siveness, empathy, and tangibles), the evaluation framework for the questionnaire was developed (shown in Table 1). Overall, 552 questionnaires were issued and distributed in accordance with the estimated number of outpatients in each division. A

total of 304 valid answered questionnaires were used in this study (a response rate of 55%). The returned questionnaires with missing items were not utilized. The descriptive statistics of the 304 respondents is shown in Table 2.

Table 1: Dimensions and Attributes of Hospital Service Quality

<b>Dimension</b>	<b>Attribute</b>
Tangibles (T)	Design of hospital departments makes it easier for the patients to access services. (T <sub>1</sub> )
	Internal organization helps achieve a rapid response to patient requests. (T <sub>2</sub> )
	Hospital facility, lounges, corridors and elevators are adequate and appropriate to the services. (T <sub>3</sub> )
	Hospital is equipped with the latest devices, technologies and medical equipment. (T <sub>4</sub> )
	Hospital staff are well groomed and have good appearance. (T <sub>5</sub> )
	Hospital's location is convenient and easily accessible. (T <sub>6</sub> )
	Hospital rooms are clean, comfortable and attractive. (T <sub>7</sub> )
Reliability (L)	Hospital staff are committed to providing services at specified time. (L <sub>1</sub> )
	Hospital staff are keen to resolve patients' problems and answer questions. (L <sub>2</sub> )
	Hospital services are correct from the outset. (L <sub>3</sub> )
	All the necessary medical specialties are available. (L <sub>4</sub> )
Assurance (A)	The hospital medical files and records are accurate and error-free. (L <sub>5</sub> )
	The procedure of registration is easy, convenient and accurate. (L <sub>6</sub> )
	Patients feel safe during the whole procedure of medical service administration and when dealing with hospital staff. (A <sub>1</sub> )
	The medical staff have sufficient knowledge while answering patients' questions. (A <sub>2</sub> )
	Hospital staff are always ready to cooperate with patients. (A <sub>3</sub> )
Responsiveness (S)	Patients are told about the time limit for delivering and completing the service. (A <sub>4</sub> )
	Patients are told about introductions of medicines and healthcare at home. (A <sub>5</sub> )
	Hospital staff are humane, decent, and civil. (S <sub>1</sub> )
	Hospital staff follow-up sick cases constantly. (S <sub>2</sub> )
	Hospital staff regard any patient information as confidential. (S <sub>3</sub> )
	Hospital staff regard patients' interests always at forefront. (S <sub>4</sub> )
Empathy (E)	The whole medical team is friendly. (S <sub>5</sub> )
	Work and time allotted for hospital are suitable for patients (S <sub>6</sub> )
	Patients can put full confidence in all the hospital staff. (E <sub>1</sub> )
	Hospital staff respond promptly and immediately to patients' inquiries and complaints. (E <sub>2</sub> )
	Hospital staff are familiar with and aware of patients' needs. (E <sub>3</sub> )
	Hospital workers are helpful, and sympathize with the patients. (E <sub>4</sub> )

Table 2: Descriptive Statistics for Distribution of the Respondents

<b>Item</b>	<b>Number (n=304)</b>	<b>Percentage</b>
<b>Gender</b>		
Male	131	43.1%
Female	173	56.9%
<b>Age</b>		
<18 years old	7	2.3%
18-29 years old	110	36.2%
30-39 years old	69	22.7%
40-49 years old	52	17.1%
50-64 years old	45	14.8%
≥ 65 years old	21	6.9%
<b>Education</b>		
Masteral/Doctorate	49	16.1%
Bachelor/College/Junior College	183	60.2%
High School	72	23.7%
<b>Place of residence</b>		
Taipei City	184	60.5%
Outside Taipei City	120	39.5%
<b>Average income per Month (NTD)</b>		
≤ 30000	129	42.4%
30,001-50,000	98	32.2%
50,001-75,000	51	16.8%
75,001-110,000	19	6.3%
≥ 110,001	7	2.3%
<b>Outpatient Visits to the Selected Hospital</b>		
Once	85	28.0%
Twice	119	39.1%
Thrice	46	15.1%
More than 4 times	54	17.8%
<b>How appointment was made</b>		
Through walk-in registration at the registration counter	60	19.7%
Through walk-in registration using the automatic machine	48	15.8%
Through online registration	174	57.2%
Through telephone registration	22	7.2%

All respondents were asked about the degree of importance, their levels of adequate service (AS) and desired service (DS) on each attribute of hospital service using a five-point linguistic scale. In terms of the adequate level and desired level, the five-point linguistic scale are as follows: 1 for 'extremely low'; 2 for 'low'; 3 for 'average'; 4 for 'high'; and 5 for 'extremely high'. In terms of the degree of importance, the five-point linguistic scale includes: 1 for 'extremely unimportant'; 3 for 'unimportant'; 5 for 'average'; 7 for 'important';

and 9 for 'extremely important'. In addition, this study used the five basic linguistic terms to compare the attributes of hospital service and obtain data for the relative importance. In the reliability analysis of degree of importance, the Cronbach's alpha values in the five dimensions of service quality was obtained using the SPSS 20 software. The values of Cronbach's alpha are shown in Table 3. All values of the reliability analyses were above 0.8, and the questionnaire was deemed valid and reliable.

Table 3: The Cronbach’s Alpha of each Dimensions of Service Quality

	Tangibles	Reliability	Responsiveness	Assurance	Empathy
Internal consistency	0.898	0.849	0.876	0.863	0.846
Reliability of AS	0.947	0.890	0.927	0.915	0.906
reliability analysis of DS	0.914	0.881	0.894	0.907	0.896

To calculate the relative importance of service attributes, this study employed the AHP method. AHP developed by Saaty in 1971 (Saaty, 1980), is a systematic procedure for representing the elements of a problem hierarchically. From Table 1, it could be seen that a hierarchy of hospital service attributes was already established. After structuring the hierarchy, the relative importance of each attribute with respect to another attribute was compared. All related values of the pair-wise comparison matrix (A) were constructed by fractions of importance values of any two attributes as follows:

$$A = \begin{matrix} & A_1 & A_2 & \dots & A_n \\ \begin{matrix} A_1 \\ A_2 \\ \vdots \\ A_n \end{matrix} & \begin{bmatrix} a_1/a_1 & a_1/a_2 & \dots & a_1/a_n \\ a_2/a_1 & \ddots & \dots & a_2/a_n \\ \vdots & \vdots & \ddots & \vdots \\ a_n/a_1 & a_n/a_2 & \dots & a_n/a_n \end{bmatrix} \end{matrix}$$

where  $a_1, a_2, \dots, a_n$  are the relative importance values of attribute 1 ( $A_1$ ) to attribute n ( $A_n$ ). For each pair-wise comparison matrix (A), the theory of eigenvector, i.e.  $(A - \lambda_{max}I)w = 0$ , was used to calcu-

late the eigenvalue ( $\lambda_{max}$ ) and the eigenvector ( $w_i = w_1, w_2, \dots, w_n$ ); then, the weights, representing the values of relative importance, were estimated. Super Decisions 2.8.0 was applied to aid all calculations of AHP. Zeithaml et al. (2006) reported that ZOT tends to be narrow for attributes that the customers find to be highly important. That is, the more important the attributes are, the closer the limits of AS and DS are; meanwhile, ZOT is wider for those attributes which the customers find less important as shown in Figure 2. The height of ZOT (HZOT) is the average of AS and DS values for each attribute. The width of ZOT (WZOT) corresponds to the difference between the level of AS and DS for each attribute. According to Veerabhadrapa et al., (2013), and Campos and Nóbrega (2009), the values of HZOT and WZOT can be computed as:  
 $HZOT_i = (DS_i + AS_i)/2 ; i=1, 2, \dots, n.$   
 $WZOT_i = (DS_i - AS_i) ; i=1, 2, \dots, n.$

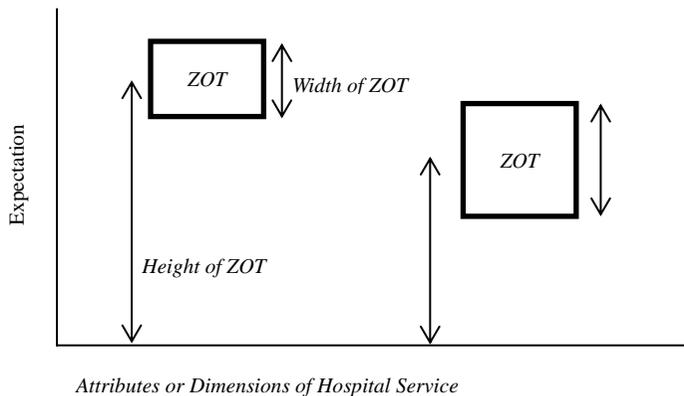


Figure 2: Height and Width of ZOT (Veerabhadrapa, et al., 2013)

#### 4. Results and Discussion

The data in Table 4 presents the degree of importance, and width and height of ZOT for each service attribute or dimension, and the resulting weights from AHP.

Based on the results of the survey questionnaire, ‘Empathy’, followed by ‘Assurance’, and ‘Reliability’, are the most important service dimensions. Further, according to the respondents, ‘Patient Full

*Confidence (E<sub>1</sub>)*, *'Clear Introduction of Medicine (A<sub>5</sub>)*', and *'Accurate Records (L<sub>5</sub>)*' are the top three most important attributes of hospital service. In terms of relative importance, the results of AHP show that

*'Awareness of Patient Needs (E<sub>3</sub>)*', and *'Helpful and Sympathetic Hospital Staff (E<sub>4</sub>)*' are the most important attributes of hospital service.

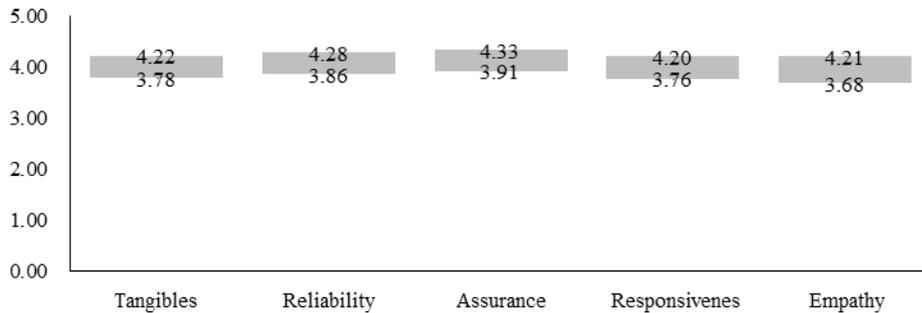


Figure 3: The ZOTs of the Five Dimensions

Notes: The grey areas represent the ZOTs of the five dimensions. The numbers on the upper level of ZOT are the means of DS; the numbers on the lower level of ZOT are the means of AS.

According to the results of the survey questionnaire, among the 28 service attributes, *'Patients' Full Confidence on Hospital Staff (E<sub>1</sub>)*' and *'Awareness of Patient Needs (E<sub>3</sub>)*' had the widest ZOT; meanwhile, *'Staff Appearance (T<sub>5</sub>)*' and *'Accurate Records (L<sub>5</sub>)*' had the narrowest ZOT. In addition, *'Staff with Sufficient Knowledge (A<sub>2</sub>)*', and *'Clear Introduction of Medicine (A<sub>5</sub>)*' had the highest ZOT; on the other hand, *'Humane, Decent, and Civil Hospital Staff (S<sub>1</sub>)*' and *'Always Putting Patients' Interest First (S<sub>4</sub>)*' had the lowest ZOT. Figure 3 illustrates the AS and DS of ZOTs (grey areas) of the five dimensions. The numbers on the upper level of ZOTs are the means of DS; and the numbers on the lower level of ZOTs are the means of AS. Based on the AS and DS shown in Figure 3, it can be seen that the sizes and positions of the five ZOTs are different. This is consistent with the results of the study of Zeithaml et al. (2006); that ZOTs vary for different service attributes or dimensions.

This study employed correlation analyses to test the hypotheses and the results are shown in Table 5. Overall, the two hypotheses are significant for the stated importance. That is, ZOTs of hospital service attributes considered to be highly important

are narrower and higher when compared with those that are less important. Furthermore, there is significant evidence that show that the width of ZOT and the height of ZOT have a negative relationship. These results are consistent with the findings of previous researches on profit organizations (Veerabhadrapa et al., 2013; Devi & Raja, 2011); however, findings from studies on profit organizations showed high correlations (correlation coefficients more than 0.7) between the degree of importance and ZOT. In this study of a non-profit organization, the relationship between the degree of importance and ZOT all had low correlations (correlation coefficients less than 0.7). This study also analyzed the relationship between relative importance and ZOT of hospital service Table 5 shows that there is a significant and positive relationship between relative importance and height of ZOT; and the relationship between relative importance and width of ZOT are not significant. Regarding the five dimensions, the correlation coefficients of the relationship between the relative importance and ZOT are small but significant. The two hypotheses are significantly valid especially on *'Tangibles'* and *'Responsiveness'*. Generally speaking, service is purely intangible. The study by Pomerai (2017) proposed that

service is an intangible aspect of customers' perception, and that the service is an interactive process between the patients and the hospital staff in a healthcare institution; therefore, interactions between the patients and service employees may provide a solution to improve patients' perception on the *Tangible* dimension of hospital service. Table 5 shows that attributes under the *Tangible* service dimension need to be improved to enhance the quality of hospital service. The facilities, equipment, appearance of hospital staff, and communication materials are important elements that may affect the perception of patients. The condition of the physical surroundings is a tangible evidence of the care and attention to detail that are exhibited by service providers. Kalaja et al. (2016) also indicated that hospital managers should be aware of these requirements by listening to their patients and being involved in further improvement projects. Moreover, the hospital managers should direct all their efforts to improve their facilities and equipment to make the hospital more attractive which may enhance the quality of services and patients' satisfaction in the future (Budiwan & Efendi, 2016). Lee and Kim (2017) indicate that responsiveness, efficient hospital staff communication, the amount of time physicians spend to attend to patients, and nurses showing genuine sympathy and care towards patients are important factors that determine the quality of hospital service and patient satisfaction. Lupo (2016) indicated that outpatients being given a short treatment time may lead to complaints and low patient satisfaction. Ali et al. (2015) indicated that there is a positive relationship between perceived service quality at each of the dimensional levels

and patients' overall satisfaction with medical practice. In this present study, *Responsiveness* is also an important dimension that needs improvement based on the results. Service providers should focus on their willingness to help customers and to provide immediate service. Customers being asked to wait for long periods of time without providing any valid reason may bring negative perceptions on the quality of service in the hospital which also creates a negative impact on the perception of responsiveness. Service providers should therefore study their service flow and review hospital procedures to reduce customer waiting times. In addition, the ability to recover quickly and with professionalism during service failure can create a positive perception on the quality of hospital service. This implies that the management of service flow is very important, and that service providers should be trained on how to face and solve different service failure that may occur unexpectedly. Aliman and Mohamad (2016) indicated that responsiveness is an important factor in evaluating the quality of service. Improvements in responsiveness through the hospital's ability to provide prompt service can also inspire trust and confidence in the hospital thereby improving the *Empathy* dimension. Further, service providers should provide individualized attention to patients and inform patients when and how the service will be provided. Hospital staff should also be able to answer and provide information about treatment, steps to follow, and associated therapies needed in a clear, straightforward, and easily understandable manner that will allow the patients to partake in the decision-making process.

Table 4: Measurements of the Degree of Importance, Width of ZOT and Height of ZOT of Service Attributes and Dimensions

	Stated Importance		Relative Importance		Width of ZOT		Height of ZOT	
	Mean±S.D. (Rank)		Mean±S.D. (Rank)		Mean±S.D. (Rank)		Mean±S.D. (Rank)	
<b>Tangibles (T)</b>	<b>7.47±1.06 (IV)</b>		<b>19.50%±1.59% (IV)</b>		<b>0.44±0.49 (II)</b>		<b>4.00±0.51 (III)</b>	
Hospital Design (T <sub>1</sub> )	7.58±1.33 (15)	7.58±1.33 (15)	2.83%±0.40% (22)	2.83%±0.40% (22)	0.49±0.61 (05)	0.49±0.61 (05)	4.03±0.56 (10)	4.03±0.56 (10)
Internal Helps (T <sub>2</sub> )	7.36±1.35 (25)	7.36±1.35 (25)	2.74%±0.39% (28)	2.74%±0.39% (28)	0.46±0.58 (10)	0.46±0.58 (10)	3.99±0.56 (16)	3.99±0.56 (16)
Adequate Facilities (T <sub>3</sub> )	7.44±1.36 (23)	7.44±1.36 (23)	2.77%±0.40% (27)	2.77%±0.40% (27)	0.47±0.59 (09)	0.47±0.59 (09)	3.97±0.62 (20)	3.97±0.62 (20)
Latest Devices (T <sub>4</sub> )	7.48±1.39 (21)	7.48±1.39 (21)	2.79%±0.40% (24)	2.79%±0.40% (24)	0.41±0.60 (20)	0.41±0.60 (20)	4.00±0.59 (15)	4.00±0.59 (15)
Staff Appearance (T <sub>5</sub> )	7.57±1.36 (16)	7.57±1.36 (16)	2.82%±0.40% (23)	2.82%±0.40% (23)	0.38±0.57 (27)	0.38±0.57 (27)	4.03±0.62 (11)	4.03±0.62 (11)
Adequate Location (T <sub>6</sub> )	7.43±1.37 (24)	7.43±1.37 (24)	2.77%±0.42% (26)	2.77%±0.42% (26)	0.48±0.64 (06)	0.48±0.64 (06)	3.97±0.61 (21)	3.97±0.61 (21)
Clean Environment (T <sub>7</sub> )	7.45±1.24 (22)	7.45±1.24 (22)	2.78%±0.35% (25)	2.78%±0.35% (25)	0.41±0.58 (18)	0.41±0.58 (18)	3.98±0.60 (18)	3.98±0.60 (18)
<b>Reliability (L)</b>	<b>7.77±0.96 (III)</b>		<b>20.29%±1.39% (III)</b>		<b>0.42±0.47 (V)</b>		<b>4.07±0.44 (II)</b>	
Services at Time (L <sub>1</sub> )	7.70±1.22 (14)	7.70±1.22 (14)	3.36%±0.44% (15)	3.36%±0.44% (15)	0.45±0.64 (12)	0.45±0.64 (12)	3.99±0.54 (17)	3.99±0.54 (17)
Solving Problems (L <sub>2</sub> )	7.74±1.27 (12)	7.74±1.27 (12)	3.37%±0.45% (14)	3.37%±0.45% (14)	0.45±0.61 (14)	0.45±0.61 (14)	4.09±0.51 (08)	4.09±0.51 (08)
Correct Services (L <sub>3</sub> )	7.80±1.34 (11)	7.80±1.34 (11)	3.39%±0.49% (13)	3.39%±0.49% (13)	0.41±0.57 (18)	0.41±0.57 (18)	4.08±0.59 (09)	4.08±0.59 (09)
Medical Specialties (L <sub>4</sub> )	7.87±1.22 (07)	7.87±1.22 (07)	3.42%±0.42% (11)	3.42%±0.42% (11)	0.40±0.55 (22)	0.40±0.55 (22)	4.12±0.54 (06)	4.12±0.54 (06)
Accurate Records (L <sub>5</sub> )	7.95±1.24 (03)	7.95±1.24 (03)	3.46%±0.43% (10)	3.46%±0.43% (10)	0.38±0.56 (27)	0.38±0.56 (27)	4.16±0.55 (04)	4.16±0.55 (04)
Easy Registration (L <sub>6</sub> )	7.53±1.36 (17)	7.53±1.36 (17)	3.27%±0.47% (17)	3.27%±0.47% (17)	0.40±0.60 (23)	0.40±0.60 (23)	3.98±0.59 (19)	3.98±0.59 (19)
<b>Assurance (A)</b>	<b>7.79±0.99 (II)</b>		<b>20.37%±1.49% (II)</b>		<b>0.42±0.47 (IV)</b>		<b>4.12±0.47 (I)</b>	
Safe Procedure (A <sub>1</sub> )	7.32±1.30 (26)	7.32±1.30 (26)	3.83%±0.53% (09)	3.83%±0.53% (09)	0.46±0.58 (11)	0.46±0.58 (11)	3.95±0.55 (23)	3.95±0.55 (23)
Staff with Sufficient Knowledge (A <sub>2</sub> )	7.90±1.23 (04)	7.90±1.23 (04)	4.13%±0.51% (06)	4.13%±0.51% (06)	0.43±0.56 (17)	0.43±0.56 (17)	4.18±0.55 (01)	4.18±0.55 (01)
Staff Cooperation (A <sub>3</sub> )	7.88±1.19 (06)	7.88±1.19 (06)	4.12%±0.46% (08)	4.12%±0.46% (08)	0.44±0.57 (15)	0.44±0.57 (15)	4.17±0.52 (03)	4.17±0.52 (03)
Clear Time Limitations (A <sub>4</sub> )	7.89±1.19 (05)	7.89±1.19 (05)	4.12%±0.50% (07)	4.12%±0.50% (07)	0.39±0.53 (26)	0.39±0.53 (26)	4.15±0.55 (05)	4.15±0.55 (05)
Clear Introductions of Medicine (A <sub>5</sub> )	7.98±1.23 (02)	7.98±1.23 (02)	4.17%±0.50% (05)	4.17%±0.50% (05)	0.39±0.55 (25)	0.39±0.55 (25)	4.18±0.56 (01)	4.18±0.56 (01)
<b>Responsiveness (S)</b>	<b>7.42±1.07 (V)</b>		<b>19.35%±1.61% (V)</b>		<b>0.44±0.50 (III)</b>		<b>3.98±0.47 (IV)</b>	
Humanity, Decency & Civility (S <sub>1</sub> )	7.00±1.45 (28)	7.00±1.45 (28)	3.04%±0.50% (21)	3.04%±0.50% (21)	0.40±0.59 (21)	0.40±0.59 (21)	3.85±0.56 (28)	3.85±0.56 (28)
Staff Following Sick-case (S <sub>2</sub> )	7.50±1.41 (20)	7.50±1.41 (20)	3.26%±0.51% (19)	3.26%±0.51% (19)	0.39±0.58 (24)	0.39±0.58 (24)	4.02±0.58 (12)	4.02±0.58 (12)
Staff Handling Information (S <sub>3</sub> )	7.53±1.38 (18)	7.53±1.38 (18)	3.27%±0.44% (18)	3.27%±0.44% (18)	0.43±0.59 (16)	0.43±0.59 (16)	4.01±0.59 (13)	4.01±0.59 (13)
Patient Interest Always First (S <sub>4</sub> )	7.12±1.46 (27)	7.12±1.46 (27)	3.09%±0.50% (20)	3.09%±0.50% (20)	0.47±0.59 (08)	0.47±0.59 (08)	3.91±0.54 (27)	3.91±0.54 (27)
Friendly Staff (S <sub>5</sub> )	7.83±1.18 (09)	7.83±1.18 (09)	3.42%±0.39% (12)	3.42%±0.39% (12)	0.45±0.60 (13)	0.45±0.60 (13)	4.11±0.53 (07)	4.11±0.53 (07)
Suitable Work & Time (S <sub>6</sub> )	7.53±1.28 (18)	7.53±1.28 (18)	3.28%±0.42% (16)	3.28%±0.42% (16)	0.48±0.63(06)	0.48±0.63(06)	4.01±0.57 (14)	4.01±0.57 (14)
<b>Empathy (E)</b>	<b>7.84±1.07 (I)</b>		<b>20.50%±2.04% (I)</b>		<b>0.53±0.57 (I)</b>		<b>3.94±0.49 (V)</b>	
Patient Full Confidence (E <sub>1</sub> )	7.99±1.15 (01)	7.99±1.15 (01)	5.25%±0.69% (01)	5.25%±0.69% (01)	0.57±0.65 (01)	0.57±0.65 (01)	3.94±0.51 (24)	3.94±0.51 (24)
Inquiries & Complaint Respond (E <sub>2</sub> )	7.70±1.29 (13)	7.70±1.29 (13)	5.04%±0.71% (04)	5.04%±0.71% (04)	0.53±0.63 (03)	0.53±0.63 (03)	3.92±0.56 (26)	3.92±0.56 (26)
Aware of Patient needs (E <sub>3</sub> )	7.85±1.36 (08)	7.85±1.36 (08)	5.11%±0.73% (02)	5.11%±0.73% (02)	0.53±0.65 (02)	0.53±0.65 (02)	3.97±0.58 (21)	3.97±0.58 (21)
Helpful & Sympathized Staff (E <sub>4</sub> )	7.82±1.38 (10)	7.82±1.38 (10)	5.10%±0.73% (03)	5.10%±0.73% (03)	0.51±0.65 (04)	0.51±0.65 (04)	3.94±0.58 (24)	3.94±0.58 (24)

Table 5: Correlation Coefficients by Pearson Tests

		Stated Importance			Relative Importance		
		Importance	Width of ZOT	Height of ZOT	Importance	Width of ZOT	Height of ZOT
<b>Overall</b>	Importance	1.000	-0.083***	0.572***	1.000	0.005	0.196***
	Width of ZOT		1.000	-0.214***		1.000	-0.214***
	Height of ZOT			1.000			1.000
<b>Tangibles (T)</b>	Importance	1.000	-0.207***	0.660***	1.000	-0.114*	0.394***
	Width of ZOT		1.000	-0.290***		1.000	-0.290***
	Height of ZOT			1.000			1.000
<b>Reliability (L)</b>	Importance	1.000	0.024	0.517***	1.000	0.175**	0.061
	Width of ZOT		1.000	-0.192***		1.000	-0.192***
	Height of ZOT			1.000			1.000
<b>Assurance (A)</b>	Importance	1.000	-0.064	0.568***	1.000	0.050	0.116*
	Width of ZOT		1.000	-0.167**		1.000	-0.167**
	Height of ZOT			1.000			1.000
<b>Responsiveness (S)</b>	Importance	1.000	-0.168**	0.647***	1.000	-0.179**	0.321***
	Width of ZOT		1.000	-0.201***		1.000	-0.201***
	Height of ZOT			1.000			1.000
<b>Empathy (E)</b>	Importance	1.000	-0.022	0.487***	1.000	0.064	0.078
	Width of ZOT		1.000	-0.186***		1.000	-0.186***
	Height of ZOT			1.000			1.000

Note: \* p<0.05; \*\* p<0.01; \*\*\* p<0.001

#### 4. Conclusions

This study assessed the quality of hospital service based on the ZOTs of modified service attributes suitable for hospital industries. The results of the statistical analyses showed that the dimensions and attributes considered as highly important have narrower and higher ZOTs compared to those that are considered less or not important. This is especially true on the 'Tangibles' and 'Responsiveness' dimensions; though the correlation degrees are not as high as those in profit organizations. This study suggests that managers of the selected hospital should concentrate on increasing patients' confidence to the hospital by improving on the staff's empathy and by training them on how to provide clear and accurate medical information since these are considered important by the patients

One of the limitations of this study is that the results is specific only to the chosen hospital and may not be generalizable to the whole hospital industry in Taiwan. This study distributed the questionnaires only at Zhongxing Branch because of restrictions in time and financial support. Cultural factors, cost of service, service process, and patient experience are factors that might influence the limits of ZOT. Finally, the degree of importance and ZOTs on service dimensions and attributes provide vital information about the factors of hospital service that need to be improved. Future research that will focus on finding, examining, and measuring the determinants of patient expectation would add value to monitoring service quality.

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## A Case Study on Manufacturing Execution System Integration in Mergers and Acquisitions

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### Abstract

With the increasing global competitions, a company should increase its competitiveness and productivity while facing rising of commodity prices and labor costs; and may therefore adopt Mergers and Acquisitions as an option to address these problems. This study had several research objectives. First, its aim is to identify the key factors that affect MES integration. Second, it aims to clarify the effects of business mergers and information system integration, both of which influence relevant areas such as production, employees, shareholders, and the like. It is worth exploring these affected aspects because it may provide feedback that will impede or enables the merger and integration process. In this study, we adopted a system integration case study by conducting interviews, analyzing case data, and identifying key factors that affects the system integration. By conducting the case study, we identified the key factors affecting system integration and determined whether those factors would indeed affect the speed of the process, and from there finally drew conclusions and made suggestions.

*Keywords: Manufacturing execution system, merger and acquisition, system integration, case study*

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### 1. Introduction

With the increasingly obvious trend of industry convergence, there have been more cases of synergies achieved via business consolidation or strategic alliances. Since the release of the Act of Business Mergers and Acquisitions on February 6, 2002, there has been a merger and acquisition (M&A) case every four days on average in Taiwan. According to statistics from the Department of Commerce - Ministry of Economic Affairs of Taiwan, there were up to 288 domestic M&A cases in the last three years; making a new record of 151.89 billion TND (Taiwan New Dollar) spent on M&As. Recently, an increasing number of Taiwan-based enterprises had undertaken M&A's, such as the merger of Chi Mei Optoelectronics with Hon Hai Precision Corporation, the acquisition of Thermaltake by TteSports, the merger of MO-

TOTECH with Accton, and the acquisition of Qwest Communications - a local phone company - by CenturyTel - an American regional telecommunication company. With increasing global competitions during the 21<sup>st</sup> century, a company should increase its competitiveness and productivity while facing rising of commodity prices and labor costs, and may therefore adopt M&As as an option to address these problems.

Employees facing M&A's will probably experience great anxiety and are not certain whether they may adjust to the new business culture. When experiencing a big organizational change, employees should adapt to new policies, regulations, and personnel changes in a merged company, and the degree of perceived procedural justice should be adjusted according to the work environment of the new organization. To date, few studies have explored organizational justice and organizational behav-

iors related to the employees that survive reorganization (Kernan & Hanges, 2002). Among the few studies, Kernan and Hanges (2002) developed a cause-and-effect model of organizational justice in a study of employees in an R&D department of a multinational pharmaceutical company after reorganization and demonstrated that procedural justice, informational justice, and interpersonal justice were all closely associated with organizational behavior variables; including organizational commitment, work satisfaction, turnover rate, and employees' trust in managers (Peng, Lin and Guo, 2004). Moreover, Yang (2006) investigated a single M&A case and pointed out that the dominant company should consider the situation of the merged or acquired company and adopts good integration management to achieve the expected business culture integration.

The Manufacturing Execution System (MES) is a core business system employed by many semiconductor industries. Wang (2007) pointed out that with an MES installment; a firm's production process may change from a manual operation process to an information-oriented process and improve the overall throughput and financial status of the company. Since the release of the first MES software in 1990, MES has increasingly drawn attention from manufacturers (Mourtzis et al. 2014). By continuously using the most cutting-edge software and computer technology, MES has rapidly improved and become suitable for a variety of manufacturing industries; such as for aerospace, automobiles, semiconductors, biochemicals, petrochemicals, steel, plastics, and medical devices. Enterprise information systems are often composed of several business applications such as Enterprise Resource Planning (ERP) systems, MES, and Product Lifecycle Management (PLM) systems (Ikbali et al., 2017). When conducting system integration, companies may have some problems with information system integration - such as workflow problems and other issues in the data creation process, which thus affects

the integration speed (Gou et al., 2003). During these days, there are few studies of MES integration during mergers. To fill in the knowledge gap, this study investigates MES integration during a merger.

This study had several research objectives. First, its aim is to identify the key factors that affect MES integration. When enterprises are conducting merger or when multiple factories are integrating systems, there will be different data or data formats to handle; different factories have different regulations and policies, and need to use different data planes. Moreover, enterprises must complete all the merger steps very rapidly when they decide to conduct a merger. If the key factors in MES integration are identified, mergers or multi-factory integration may be achieved within the expected time. Second, it aims to clarify the effects of business mergers and information system integration, both of which influence relevant areas such as production, employees, shareholders, and so on. It is worth exploring which of these affected aspects may provide feedback that impedes or enables the merger and integration process.

## **2. Literature Review**

### **2.1 Merger and Acquisition**

Mergers and acquisitions have attracted considerable interest in academic research since the 1980s. Ferdinand and Martin (2017) examined the long-term performance of German acquiring firms for M&A transactions that occur from 1981 to 2010. In contrast to many U.S. studies, the results do not find significant negative long-term performance for full sample. Baker and Niederman (2014) examine 22 mergers and acquisitions to investigate business-IS strategies employed. M&A outcomes are successful when strategies are aligned and not aligned based on alignment theory. Besides, M&A often uses emergent strategy formation, not normative strategy formation.

Siedschlag et al., (2014) indicates that foreign acquisitions had stronger effects on

firm performance in services than in manufacturing based on comparable firm-level data from six advanced small open economies over the period 2001–2009. Schiffbauer et al., (2017) examines the causal relationship between foreign acquisitions and firm productivity in the UK. The research finds that productivity gains are related to acquisitions by foreign firms operating in industries intensive in R&D. However, productivity gains had fewer possibilities when foreign acquirers conduct in marketing-intensive industries. Most research in the past focuses on firm performance and productivity and rarely discuss about information system, human resource and workflow integration.

## 2.2 Information System

When merging companies, information system integration issues are the most difficult. Accenture (2006) found that only 30% of managers involved in mergers and acquisitions believed that the combined

companies had successfully integrated their IT systems. Lohrke et al. (2016) discussed four of the most critical IT integration issues within mergers and acquisitions summarized in Table 2-1: (1) Viewing IT as a key M&A consideration from the start; (2) Integrating disparate IT systems following the merger; (3) Reducing IT security vulnerabilities during and after M&As; (4) Using IT to enhance a merged firm's sustainable competitive advantage.

Pai (2009) proposes that companies have to face a lot of problems when implementing the information system as follow: (1) Business model change; (2) Work approach change; (3) Employee turnover; (4) Different capability of external consultants; (5) Work loading of key users; (6) System integration with work process; (7) Customization level; (8) technical ability. From these points of view, the study found the key factors that affect MES integration within mergers and acquisitions.

Table 2-1: Key Information Technology Issues within Mergers and Acquisitions (M&As)

Challenge	Solution	Illustrative Example
Viewing IT as a key M&A consideration from the start	Involve the two firms' Chief Information Officers very early in the M&A process	When Land O' Lakes considered acquiring GeoSys, a French company that used satellite data to inform farmers about crop health, its CIO assessed the age, scalability, and average downtime of GeoSys' IT systems to look for potential risks.
Integrating disparate IT systems following the merger	Carefully match one of three options-complete integration, partial integration, and coexistence-to the firm's internal capabilities	Oracle's consolidation of 70 internal IT systems into a single enterprise-resource-planning system helped it make more than 50 acquisitions from 2005 to 2009 and to integrate most of them within 6 months.
Reducing IT security vulnerabilities during and after M&As	Quickly align disparate IT security policies across the merged firm	20% of 761 major IT breaches in 2011 involved merging firms. Combining different IT systems often creates increased cybersecurity vulnerabilities in a newly merged firm.
Using IT to enhance a merged firm's sustainable competitive advantage	Please emphasis on building proprietary systems for data analytics that rivals will struggle to copy	United Healthcare acquisition of Humedica provided it access to electronic health records data to complement its hospitalization information, which, in turn, allowed it to develop new services for its client hospitals.

## 2.3 Human Resource

The employees in mergers and acquisitions will feel uncertain and have to adapt to the institution, regulations and personnel

changes. Few studies discuss survivor reactions to reorganization. Kernan and Hanges (2002) conducted the study to all employees of the research and development facility of one division of a major multinational

pharmaceutical corporation. The division was responsible for innovation and new product development for consumer health products in both the United States and the United Kingdom. The results showed that procedural justice was strongly related to organizational commitment, job satisfaction, turnover intentions and management trust. Interpersonal and informational justice added unique variance to the prediction of management trust.

Yang (2006) proposed that the dominating company in the merging and acquisition should consider the status of the company being consolidated and make integration management well to achieve the expected influence of business culture integration. Most studies focus on how acquirers use their power to change practices at the acquired company during the integration process. Weber and Tarba (2010) argues that the changes in acquirer's HR practices, including training methods, communication, and increased autonomy of HR managers can contribute to M&A performance. The study suggest that to enhance M&A performance, acquirers have to use human resources (HR) practices that develop integration capabilities during post-merger integration from a knowledge-based view of acquisitions.

Jordão et al., (2014) analyzed the influence of organizational culture on the post-acquisition management control system (MCS) of the Brazilian company and provide two suggestions: (1) The changes in the acquired company's management control system were derived from the new financial results-oriented culture introduced by the acquirer. (2) The culture implementation implied modifications in production, financial and quality controls. Companies have to provide some incentives, including financial and job guarantee etc., will not lose their talents after the mergers and acquisitions and influence their future operations (Xue, 2000).

## 2.4 Workflow

The MRP system records product usages, customer orders, and materials re-

quired; and sends requests to the manufacture execution system layer to build more products to satisfy these needs. The MES systems are responsible for product manufacturing, and all operations associated with the creation of those products (Mehta and Reddy, 2015). Integration can be seen as a process including high levels of interaction between people, machines and applications, which enhances the synergy within a company (Vernadat, 1996)

Gou et al., (2003) proposed that the virtual enterprise integration can be hierarchically classified into three levels: (1) Physical system integration; (2) Application integration; (3) business integration. The study presents several definitions about general business processes: (1) Business process: one or more linked procedures or activities; (2) Activity: a piece of work that forms one logical step within a process; (3) Resource: an entity that actually performs activities of a business process. According to Bordeianu et al. (1998), the departments' mergers enable libraries to centralize activities and streamline workflow which often results in increased efficiency and productivity.

## 2.5 The Research Model

Based on previous literature reviews, the proposed research model drawn from the constructs of information system, workflow, human resource and MES integration is shown in Figure 2-1.

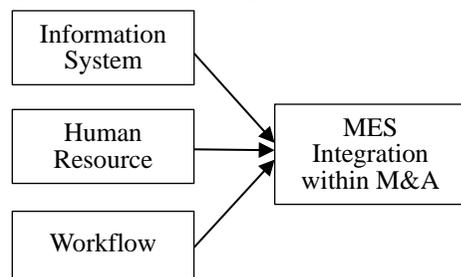


Figure 2-1: The Research Model

## 3. Research Method

In this study, we adopted a system integration case study by conducting interviews, analyzing case data, and identifying

key factors that affect system integration. By conducting the case study, we identified the key factors affecting system integrations and determined whether those factors would indeed affect the speed of the integration process, and from there finally draw conclusions and make suggestions.

### 3.1 Research Subject

The case company was founded in 1997 and listed in the Gre Tai Securities Market (OTC market) in January 2002. Their corporate office is located in the Hsinchu Science Park. This company is a professional semiconductor bump manufacturer within the downstream semiconductor packaging and testing industry. It is the only domestic company that has mobile devices for the whole process of IC packaging and testing, and is the largest contract manufacturer for packaging and testing globally. This business line primarily includes producing and selling bumps (e.g., gold, tin and lead) and providing posterior segment tape carrier packaging (TCP), chip-on-film (COF) packaging, and chip-on-glass (COG) packaging, and its products were mainly used in LCDs to drive IC. Bumps are an important part of the semiconductor production process. Metal bumps on wafers have protruded points that can be used as IC signal contact points; metal bumps are classified into gold bumps, eutectic sold bumps, high lead solder bumps, and others. The case company employed 1,974 people in 2009, of which 66.21% of all employees had junior college degrees. And after the merging, the company grew to 3,657 employees. The product and revenue ratio of the case company are gold bumps (35%), carrier packaging

(10%), chip-on-glass (14%), tap carrier packaging and chip-on-film (41%).

In this study, we interviewed the core staff involved in the merger, including IT professionals and other regular engineers alongside production line staff in the production team. From the interviews, we found out the factors and analyzed them. Especially the main factors that affects the system integration and merger.

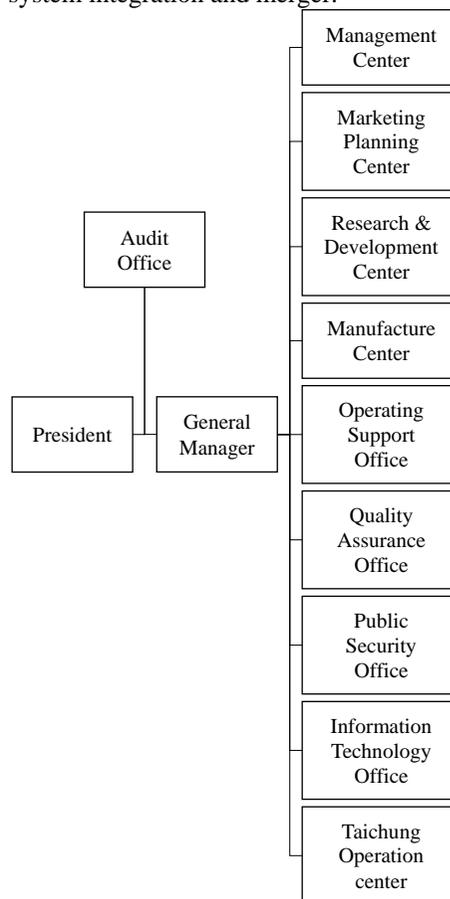


Figure 3-1: The Organization Chart of Case Company

Table 3-1: Outline of the Interviewees

Staff	Factory category	Technical title	Yearly salary	Role in the merger
A	Merging company	Project manager	7.7 Y	IT Leader
B	Merging company	Engineer	8 Y	Project integration
C	Merging company	Senior engineer	12 Y	Production line representative
D	Merged company	Manager	7.79 Y	Product department representative
E	Merged company	Engineer	2.67 Y	Product offline representative

### 3.2 Manufacturing Execution System

MES can, at any time, monitor the operating status of the bottom devices and collect the status parameters of the devices and equipment. After analyzing, computing, and processing data; MES triggers new events instantaneously and reliably integrates the control system with the information system. Also, sends production status data back to the managers in a timely manner. Figure 3-2 illustrates the MES

architecture. The case company had 12 types of MES sub-systems, including: basic data creation; product-parameter; cargo arrangement; mask management; recipe management; environmental EDC management; product EDC management; equipment EDC management; control wafer management; abnormality management; real-time abnormality reporting; real-time equipment monitoring system.

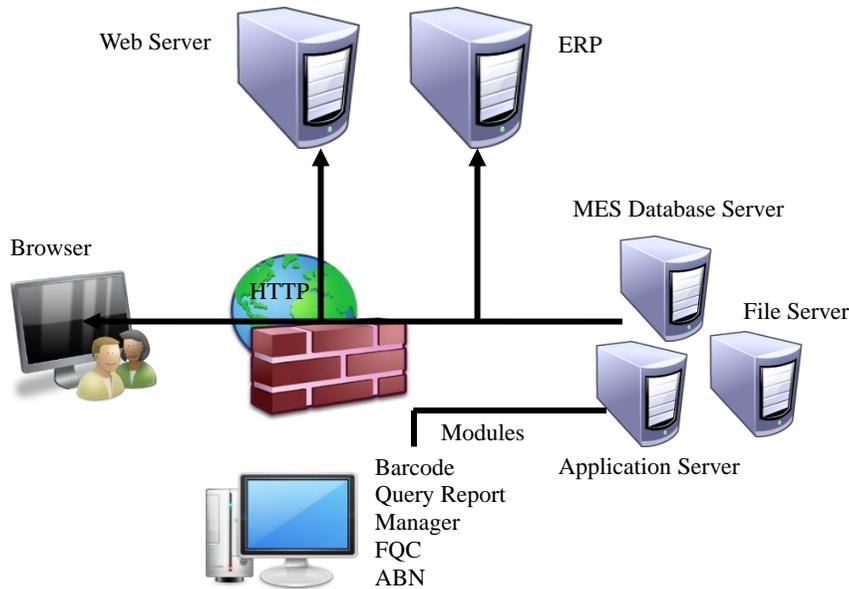


Figure 3-2: The MES Architecture of the Case Company

According to the MES data architecture prior to the business merger, the product part number (PPN) was the main part of the control product and system link product,

while after the business merger, the MES data architecture employed PPN and the factory category (FC) for product differentiation, as shown in Fig. 3-2.

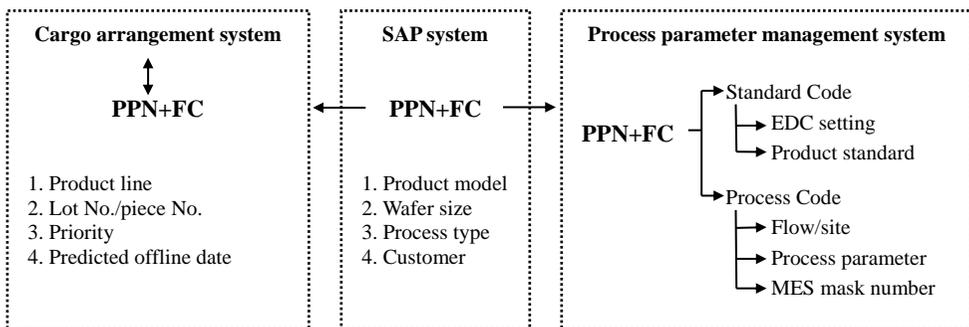


Figure 3-2: The Metadata Architecture after MES Integration

#### 4. Case Analysis

When conducting the system integration, the case company encountered many problems in the system, human resource, and procedural levels. We expected to find the key factors in MES integration from the data collected in each interview.

##### 4.1 System Factors

During the system integration, this case study showed that there were some functions that the company could not integrate as expected and thereby required IT professionals to use plug-in codes to aid the integration. Due to project schedule problems, some project functions did not cause production problems. They were arranged to be developed or corrected only after the system integration was complete. Now, the main objective of the project management was to promote the system integration, as indicated by the following comment recorded in an interview with interviewee B:

*“The two factories had very different data coding rules. Data fusion and data integration encountered many difficulties. Challenges existed in the method of interpersonal communication. The second largest problem was that the data format was not consistent; therefore, many data could not be directly placed to the (database), which required manual entry and was very time-consuming. With respect to the production operation, given the discrepancy across the different operation system; the acquired employees needed re-training.”*

*“When conducting the system integration, the company did not consider purchasing a new system; which was likely depending on whether the cost of a brand-new system purchase would be higher than the cost of repairing the current system. Moreover, if the data would be placed into the brand new system, all employees of the two factories would need to be re-trained. At last, there was a scheduling problem. If a brand-new system was used, the project deadline would be postponed.”*

The original MES primarily provided the product part number (PPN), and the merged company also employed this method before the merger. After the merger, the product was labeled with the PPN + factory category (FC) as its only number. Moreover, the merged company did not have the same product coding rules as the acquiring company. Which led to difficulty in inputting data to the system, and batch data entry was not possible. Therefore required manual input, which most of the users considered very tedious.

Due to various cost problems, the merging company did not consider using a brand-new system. The problems included are the cost of training the employees, purchasing the brand-new system, and assessing the provider of the new system. All these costs would be greater than the labor cost just to modify the existing system.

##### 4.2 Human Resource Factors

If a supervisor did not have an effective communication channel, or the management method was inappropriate then supervisor would not be able to obtain clear orders from the higher management levels. Also, collect important information or listen to and respond to employees' advice which would result in discrepancies in the perceptions between the management levels and the actual executors. And these discrepancies, once formed, would greatly hamper the project implementation. The supervisors in our case company followed up with each department on whether the required projects had already been completed within the deadline.

Cooperation and support from employees is a factor affecting work efficiency. Project implementation is advanced when employees are dedicated to the work, get well along with one another, and have a high work efficiency. In our case company, the employees were highly cooperative. When implementing a project, support from senior managers is very important. If senior managers do not show enough support or give advice, it would not be properly implemented or resolved in many

cases, and consequently, only superficial problems would be resolved and not achieving a thorough improvement. In general, the degree of support from senior managers is positively proportional to the coordination capability of all departments; a higher degree of senior management support is associated with a higher degree of department coordination. Senior managers can enhance inter-department communication. In our case company, most of the senior managers showed a high degree of support and cooperation.

If a company has a new policy to implement and employees have a high degree of agreement with the policy, the employees will have a high degree of support and cooperation and thereby give a high degree of compliance. Which would enable smooth implementation and improve work efficiency. However, these are the prerequisites that the employees should accept from the company policy. In our case, the employees of the acquired company were not certain about the details of the policies and therefore concerned. But these negative emotions were dissipated through consultation with the supervisors and the company's announcement that not all of the employees would be laid off.

### 4.3 Workflow Factors

There were different viewpoints among the interviewees about their difficulty with the workflow. When a system is under integration, many tasks should be completed within a limited time frame. Each employee could be in a different stage in the workflow and from their perspective, experience a high level of difficulty. With respect to this issue, three interviewees considered that these items would not have been so difficult if more time and resources could be allocated. While two other interviewees held opposite opinions, thinking that different departments should be mobilized to collect operation information from different parts and then brainstorm to determine the most appropriate practices suitable for the current situation. And all

these processes should be reviewed for improvement.

In the workflow of this case company, many interviewees considered that the employees from an acquired company should enter the acquiring company and maintain good contact with its employees; this practice would be equivalent to providing educational training earlier than planned and ensuring that the employees receive more thorough training. Educational training for employees would enhance the individual's value and responsibility, correct work attitude and ethics, strengthen professional skills, and improve the current work efficiency and production. From the company's perspective, educational training planning is developed according to the company's regulations with the purpose of improving the company's performance. One of the interviewees' replies to a question about what should be improved in the workflow integration:

*“The collaboration between the two factories could be closer. When the merger occurred, their collaboration was not as high as expected. I feel that this limitation may be further improved, and even from the very beginning of the merger, the employees (key users) from the acquired factory may be allowed to directly enter the acquiring company for more contact and study.”*

## 5. Conclusion and Discussion

Based on case observation, subjects' interviews and analysis, we generalize the following conclusions and suggestions:

### (1) Difficulty in the system integration

The extent to which a system may be integrated should be determined prior to the integration by evaluating the effect and referring to the polices. The older the system to integrate is, the more difficult the integration process becomes and the higher the integration cost is; thereby, the higher the failure possibility is. Given that system developers differ across different systems, there will be difficulty in integrating the

system which blocks inter-system communications that will not only make it difficult to combine and analyze operational information, but also increase the labor cost due to data processing.

Provided that the data integration is conducted beforehand across business units and systems, the firm prepares to expand the systems such as more deeply developing e-operations like e-commerce, customer relationship management (CRM), and supplier relationship management (SRM). The company can reduce much of the time that can be spent on discussion and avoid the difficulties or errors in data acquisition, thereby expediting the development of new system functionality for online use.

#### (2) Customization problems

The introduction of many customized systems affects enterprise information systems. However, given marginal profits nowadays; system customization seems to be inevitable, and each enterprise system has, more or less, customized functions. To appear “slightly different” than other companies, a company may develop a software; meaning that regular employees would know nothing about that software when the company recruits them. Since the employees do not know how to operate the software, managers should implement training; if they use a standard, universal software, then the employees would know it well before beginning to work for the acquiring company. Thereby greatly reducing employees’ learning curve to operate the information system. As well as preventing information staff from spending much time on follow-up updates and corrections.

#### (3) Support from supervisors

Employees with a highly supportive supervisor will have a high like-mindedness to the company and thereby a high passion for the work and high work efficiency. The employees may, on a regular time basis, bring the reports and descriptions of the business merger in formal working meetings; thus allowing the supervisors to know the status and difficulties in the current stage of integration. In

addition, to accurately know the resources that each project member used and the contributions that each project member made.

#### (4) Collaboration from employees

The study tries to classify employees into four types and provided some points to pay attention after conducting interviews as well as analyzing case data. The list is as follows:

- I. Learning-and-growth type: this employee has a high degree of collaboration, but have low working capability. They are highly collaborative with their supervisors and the work processes across different departments, do not have many opinions, and are willing to coordinate various task assignments. Most of the new hires belong to this type, and are easy to lead.
- II. Crisis-awareness type: this type of employee has high working capability and good job performance that depends on the situation. They perform well on tasks they prefer, yet become passive and unproductive when doing a job that they dislike. This type of high-capability yet low-collaboration employees are most challenging to supervisors; they will not only influence other colleagues’ work attitudes and work performance, but also make the supervisors feel frustrated and impotent. In general, most of the employees who trouble supervisors most may fall in this type.
- III. Care-and-adjustment type: this type of employee gives others the impression that they are passive, inactive, and indifferent. They work with the least dedication and passion. Their work performance is not good, and they have low collaboration with the management levels. When facing problems and difficulties, they will not report proactively. When the company prepares to lay off unsuitable employees, it will give priority to dismissing this type of employee.

IV. Motivation-and-challenge type: this type of employee works hard and responsibly, is proactive, and has strong capability and high willingness. When facing problems or difficulties, they will take the initiative to solve them. When unable to solve the problems on their own, they will take the initiative to report the problems to supervisors for support and assistance. For supervisor-assigned tasks, they will do their best to get the job done. And they can consider all kinds of issues and policies from supervisors' perspectives. However, once disappointed with the supervisors or the company, this type of employee is very likely to be poached or to quit.

The above four types of employees exist in each company. Employee collaboration and execution affects production efficiency. Companies should pay more attention to the crisis-awareness type and the motivation-and-challenge type of employees because of their high working capability; if the companies can help those employees improve their drawbacks, they may obtain additional competitiveness. In our case company, most of the key users were the motivation-and-challenge type. Moreover, this study found that key users not only needed integration capabilities, but also needed power because they needed to allocate each task after they were informed of the business merger, and later follow up on the integration. This can only be achieved smoothly with some power.

#### (5) Difficulty in workflow

There were many workflow issues during the merger process. Each of the work tasks needed key users or people in charge to follow up on the implementation. Except for tasks that needed more time to complete, each specification should be confirmed and unified, which was the most difficult part of the workflow in our merger case.

When solving workflow issues, if supervisors find that the employees have

complaints about some problems, they should help the employees solve the problems and reduce their difficulty in using the new tools. Implementing process management requires some skills. For example, when making a big change, departments that show the best execution and collaboration will be asked to conduct a trial. On the other hand, opinions from those departments will be considered seriously to make improvements. When these departments succeed in implementation, it is easier to persuade other departments.

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## Addictive Facebook Usage – Does Narcissism Matter?

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### Abstract

Nowadays, social networks have become an integral part of our life. They have influenced our daily behavior and our way of interconnecting with each other. Particularly in the way they provide for a person to review one's acceptance in the social network. One may show off to or sought approval by other people on social networks, such as Facebook. Narcissism has been identified by many researchers as an important factor in the usage of these networks. This study examines continuous Facebook usage based on the expectation confirmation theory (ECT), determining the relationship between perceived feedback, confirmation, satisfaction, continuance intentions and most important of all, the moderating effects of narcissistic traits with these relationships. The invalid responses are collected through self-administered questionnaires. This study reveals three main results: (1) Continuance Facebook behavior intention is jointly influenced by perceived feedback and satisfaction, which in turn is determined by confirmation. Then, confirmation is influenced by perceived feedback; (2) Narcissism has a moderate effect on the relationships between feedback and confirmation as well as confirmation and satisfaction.

*Keywords: Facebook behaviors, narcissism, perceived feedback, continuance intentions*

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### 1. Introduction

Nowadays, information technology aims to satisfy our personal needs and desires while putting us in the driver's seat. The internet is more I-centric than ever and it is becoming all about us. "I" is omnipresent in cyberspace and the entire digital world is at the disposal of the first-person pronoun (Aboujaoude, 2012). A recent cross-temporal meta-analysis found narcissism levels amongst American college students to have been rising during the past two decades (Twenge et al., 2008). Twenge & Campbell (2009) found a phenomenon where the rise of narcissistic tendency coincides with the extravagant use of the Internet and social media. It is just like an infectious disease overspreading in a fashion called 'Narcissism Epidemic'. There is no doubt that the Internet has radically and

irreversibly changed our behavior and how we relate to one another. Thus, the relationship between narcissism and network behaviors has gained more and more attention recently and has become a popular research topic.

The Social Network Sites (SNSs) offer an environment as a virtual stage for narcissists to establish self-presentation and construct their ideal identities (Ellison, 2007; Mehdizadeh, 2010; Zhao et al., 2008). However, narcissism has received particular attention in research examining predictors regarding on Facebook use. Previous research shows there is a relationship between narcissistic personality traits and the use of SNSs (Buffardi & Campbell, 2008; Bergman, et al., 2011; Ryan & Xenos, 2011). Studies on Facebook usage behavior focus mostly on the correlation between narcissistic personality and Facebook usage.

However, little is known about the satisfaction with Facebook behaviors (e.g. posting status updates and photos of oneself, updating profile information) and the influences of narcissism on the continuous usage. The questions asked are, “Why is the society becoming increasingly addicted to Facebook?” and “What role does narcissism play in the Facebook phenomenon?” The answers to these questions can improve our understanding of personality expression and the continuous usage of Facebook.

Expectation-confirmation theory (ECT) is established on the basis of consumer satisfaction model (Oliver, 1980) and is widely used in related research of repurchasing behavior and continuous usage of information system (Bhattacharjee, 2001a; Chiu et al., 2013; Hsu & Lin, 2015). Facebook offers people an outlet for attracting their friends to their posts like giving them thumbs up or commenting on self-relevant information, photos, and in their check-in locations. Friends’ feedback will motivate people to use Facebook to satisfy their vanity. Therefore, feedback is very likely an important factor for an individual to continue using of Facebook.

The purpose of this research paper is to observe the relationships between perceived feedback, confirmation, and satisfaction. Moderating effects on the relationships between the perceived feedback and confirmation as well as between confirmation and satisfaction are also tested. The study begins with the perceived feedback on the basis of ECT. Narcissistic personality traits are used as the moderators in investigating their influences on the continuous Facebook usage behavior. There will be further understandings and findings on the phenomenon of Facebook usage as well as empirical research for related studies and practices in the future.

## **2. Literature and Hypotheses**

### **2.1 Expectation-Confirmation Theory and Perceived Feedback**

ECT is adapted from prior researches (Bhattacharjee, 2001a, Wen et al., 2011; Hsu & Lin, 2015) to explain how consumers’ intention to repurchase a product or reuse a service is determined primarily by their satisfaction with the prior use. Satisfaction is jointly determined by confirmation and perceived feedback. In this model, confirmation is the immediate influence on satisfaction. ECT is widely used in the consumer behavior literature to study consumer satisfaction, post-purchase behavior and service marketing in general. The predictive ability of this theory has been demonstrated over a wide range of product repurchase and service maintenance contexts. Bhattacharjee (2001b) applied ECT to examine cognitive belief and influence on the individuals’ intention to continue using information systems. Since expectations are denoted in their research model as perceived usefulness, a positive effect can be theorized from confirmation to perceived usefulness. Bhattacharjee (2001a) integrated ECT, Technology Acceptance Model (TAM) and agency theory to examine the key drivers of consumers’ intent to continue using B2C e-commerce services in online brokerages. There have been a variety of studies in recent years relating to continued IS usage behavior, IS continuance, and post-adoptive IT usage (Bhattacharjee, 2001a; Ortiz de Guinea & Markus, 2009; Chiu et al., 2013; Hsu & Lin, 2015).

Being visible within a social network is regarded as an important aspect of popularity; young people maintain a social network by having a presence on network sites such as Facebook (Christofides et al., 2009). Facebook offers people an outlet for attracting their friends to provide “like” or “comment” by means of posting self-relevant information, photos, and check-in locations. These are likely the important factors in continual usage of Fa-

cebook to satisfy their vanity. The term “selfie” is a kind of Facebook post. It is the most typical manifestation of narcissistic behavior through smart phones and social networking sites. It is a way of self-expression and it requires feedback from the audience. Individuals may enjoy involvement in other people’s feedback on their Facebook posting. London & Smither (2002) argued on the likelihood of acting on the feedback to guide behavior change and performance improvement. In our study, perceived feedback is defined as Facebook users’ perception of how friends’ respond, fulfill their needs, expectations, and desires. Song & Zinkhan (2008) theorized that interactivity is a key feature of websites and suggested that message type (i.e., how personal a particular message is) is the strongest predictor of interactivity perceptions. Facebook can be an ideal tool for self-promotion as users can frequently post status updates, comments or photos of themselves and reasonably expect timely and frequent positive feedback. Accordingly, feedback on social media is predominantly supportive for users (Valkenburg et al., 2006). Furthermore, Hepper et al. (2010) have shown how narcissists utilize various self-enhancement and self-protection strategies to regulate and satisfy their self-view. Facebook offers a unique way in providing the audience of an individual where the feedback received from them presumably takes on particular importance. Therefore, our study shows that perceived feedback is the key factor in continuous use of Facebook. Based on ECT, we integrated perceived feedback to research model to test how it affects continual Facebook behaviors.

This paper examines a determinant of users’ intention to continue posting on Facebook. Compared to previous studies of using different determinants to examine the continuance intention (e.g., perceived, usefulness, perceived usability, perceived quality, and perceived value), our study is based on Bhattacharee’s theory. Perceived

usefulness is denoted in our study as perceived feedback.

## 2.2 Narcissism and Facebook Use

Narcissism is typically characterized as a tendency to consider oneself to be better than others, to constantly seek veneration from others, and to engage in self-centered thinking and behavior (Campbell, et al., 2002; Morf & Rhodewalt, 2001). From a basic trait perspective, narcissism is associated with a high degree of extraversion/agency and a low level of agreeableness or communion (Miller & Campbell, 2008; Paulhus & Williams, 2002). Narcissists lack empathy while centering on oneself, exaggerating one’s own importance and have few close relationships, yet they strongly desire social contact, as others serve as their primary source of admiration and attention (Bergman et al., 2011). Because narcissists are unable to regulate their own self-esteem, they must rely on external sources for affirmation (Campbell & Foster, 2002; Morf & Rhodewalt, 2001). Thus, narcissists engage in a variety of strategies aimed at maintaining their inflated egos, such as exhibitionism and attention-seeking behavior (Buss & Chiodo, 1991). Indeed, narcissists like to present themselves so as to be noticed at all times (Ackerman et al., 2011).

Facebook is exactly the stage for narcissists to showcase themselves. Recent literature has documented the manifestations of narcissism in Facebook usage. Among studies of the relationship between Facebook usage and narcissism, most point to a positive correlation between narcissism and amount of Facebook usage (Ryan & Xenos, 2011; Carpenter, 2012). Facebook offer users near complete control over self-presentations, making them a useful venue for the deployment of strategic interpersonal behaviors that narcissists use to construct and maintain a carefully considered self-image (Morf & Rhodewalt, 2001). Buffardi & Campbell (2008) proposed that Facebook provide excellent platforms for narcissistic self-regulation, because Facebook allow almost full control over

self-presentation and afford the ability to maintain large social network bases of superficial relationships, which narcissists would be especially drawn to. For college students, posting on Twitter, is associated with the superiority component of narcissistic personality while Facebook posting is associated with the exhibitionism component (Panek et al., 2013). Based on the results of structural equation model analysis, communication in Facebook has the biggest impact on self-disclosure; information, entertainment and privacy concerns were also influential. These studies described the relationship between narcissism and different kinds of behaviors on Facebook, but little is known about the satisfaction with Facebook behaviors and the influences of narcissism on the continuous-use behavior. As expected, narcissists have more Facebook friends and wall-posts. They also have their profile pictures rated by other people to be more physically attractive and more self-promoting than the profile pictures of non-narcissists. Our study argued that narcissism has a moderate role on Facebook postings. Our study is one of the first to examine the moderating role of narcissism on Facebook postings in social network services.

### 2.3 Development of the Research Model and Hypotheses

This study proposed a model for continuous posting on Facebook (Figure. 1). The model is adapted from the ECT and related literatures. It used narcissism as the moderating variable in proposing an integrated research model to observe Facebook behaviors.

Facebook provides an ideal channel for people to admire their own performance. They tend to show off themselves to friends and get their adoration on Facebook (Mehdizadeh, 2010). Perceived feedback refers to the extent to which Facebook users' perception of how friends will respond in fulfilling their needs, expectations, and desires. Facebook behaviors need the feedback received from their friends. In our study, we argue that perceived feedback is

the key driver of consumers' satisfaction with Facebook behaviors. Therefore, the following hypothesis is proposed:

*H1. Users' level of satisfaction with Facebook behaviors is positively associated with the extent of perceived feedback.*

Confirmation refers to the discrepancy between the different perceptions of an individual regarding the performance of products or services and their expectation levels (Oliver, 1980; Limayem et al., 2007). In our study, we define feedback confirmation as the individuals' perception of feedback and their expectation levels. Positive confirmation arises when perceived feedback exceeds one's expectations. It results into a positive relationship between perceived feedback and confirmation. Therefore, the following hypothesis is also proposed:

*H2. Users' confirmation to Facebook usage is positively associated with the extent of perceived feedback.*

Satisfaction is the individuals' feelings of pleasure or disappointment resulting from comparing a product's perceived outcome in relation to their expectations. In our study, we defined satisfaction as an individual's feelings of pleasure resulting from comparing perceived feedback from friends in relation to his or her expectations. Satisfaction is jointly determined by confirmation. IS researchers have provided empirical support for the relationship between confirmation and satisfaction (Hsu & Lin, 2015). Therefore, the following hypothesis is proposed:

*H3. Users' level of satisfaction with Facebook behaviors is positively associated with their confirmation to Facebook usage.*

Oliver (1980) theorizes that satisfaction is positively correlated with future intention, both directly and indirectly via its impact on attitude. Satisfaction determines the intentions to patronize or not to patronize the store in the future. Past studies found a strong link between satisfaction and continuance intentions (Limayem et al.,

2007). Therefore, the following hypothesis is proposed:

*H4: Users' continuous usage intention is positively associated with their level of satisfaction with Facebook behaviors.*

To expand the finding of Kernis & Sun (1994), more narcissistic individuals regard positive feedback as confirmation of their glowing self-concepts. It may refer to narcissistic individuals who are interested in the feedback they receive on their own Facebook post. We studied the relationship between narcissism and Facebook posts behaviors. We propose that the level of narcissism moderates the relationship between perceived feedback and confirmation.

*H5: The influence of one's perceived feedback on one's confirmation is moderated by the level of narcissism.*

Hepper et al. (2010) have shown how narcissists utilize various self-enhancement and self-protection strategies to regulate and satisfy their self-view. Lee & Sung (2016) showed that the more narcissistic individuals are, the more involved in the feedback (e.g., comments and "likes") they receive on their selfie-posting behavior. They also found that the individuals with a higher sense of narcissism regards the act of posting selfies more positively and are more willing to continue posting selfies in the future. Therefore, we propose:

*H6: The influence of a users' confirmation on their satisfaction is moderated by the level of narcissism.*

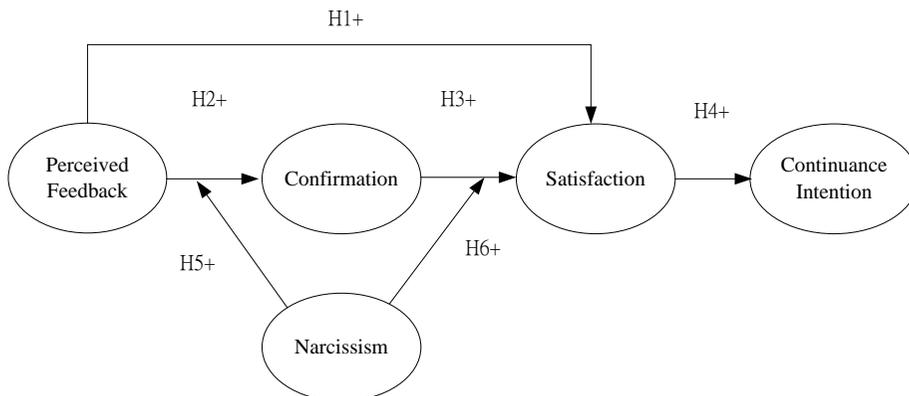


Figure 1: Research Model and Hypotheses

### 3. Data Analysis

#### 3.1 Sample, Setting, and Procedures

An online survey was conducted over a two week period in December 2015. The survey respondents were recruited by PTT, the most famous Bulletin Board System (BBS) in Taiwan. The initial sample consisted of a total of 459 users who had posted on Facebook. Among them, four participants did not complete the survey, resulting in a final sample size of 420 for analyses. The demographic profile of the respondents is shown in Table 1.

#### 3.2 Instrument

Items measuring continuance intention were adapted from prior work by Bhattacharjee (2001b). Items related to satisfaction were adapted from prior work by Oliver (1980). Items for perceived usability were adapted from prior work by London & Smither (2002). For the aforementioned measures, a 7-point Likert type was used, with anchors ranging from strongly disagree (1) to strongly agree (7). Narcissism was assessed using the 13-item Narcissistic Personality Inventory (NPI-13) that was developed by Gentile et al. (2013). The NPI-13 is a brief measure of the most

widely used 40-item Narcissistic Personality Inventory (NPI) that was designed to be used for nonclinical populations. Higher scores on the NPI indicate more narcissistic

personality traits. The participants responded on a five point Likert scale (1 = strongly disagree to 7 = strongly agree).

Table 1. Demographic profile of the respondents

Characteristics	Category	Freq.	%	Characteristics	Category	Freq.	%
Gender	Man	144	34.3%	The time of using FB	never	0	0%
	Female	276	65.7%		< 1 year	9	2.1%
	Under 18	38	9.0%		1-3 years	68	16.2%
Age	18-21	135	32.1%	over 3 years	343	81.7%	Daily FB use
	22-25	178	42.4%	< 1 hour	77	18.3%	
	26-30	39	9.3%	1-2 hours	125	29.8%	
	31-35	25	6.0%	3-4 hours	140	33.3%	
	above 36	5	1.2%	over 5 hours	78	18.6%	

**3.3 Measurement Model**

The measurement model was first evaluated in terms of reliability, convergent validity, and discriminant validity. Reliability was examined using the Cronbach’s alpha values. (The table is not shown, due to space limitation, and can be obtained upon request). All constructs and narcissism were above 0.7; the result indicates a commonly acceptable level for explanatory research.

Convergent validity was evaluated for the measurement scales using two criteria suggested by Fornell and Larcker (1981): (1) All indicator factor loadings should be significant and exceed 0.70 and (2) Average variance extracted (AVE) for each construct should exceed the variance due to measurement error for that construct (i.e.,

should exceed 0.50). As shown in Table 2, most items exhibited loading higher than 0.7 on their respective constructs (perceived feedback, confirmation, satisfaction and continuance intention), providing evidence of acceptable item convergence on the intended constructs. There were two exceptions were the third item of the confirmation scale and the fourth item of the satisfaction scale, which loadings were slightly below 0.7. Moreover, Factor loading of narcissism ranged from 0.53 to 0.79. These results are similar to NPI-13 developed by Gentile et al. (2013). AVE ranged from 0.61 to 0.89, greater than variance due to measurement error. Hence, all two conditions for convergent validity were met.

Table 2: Scale Properties and Correlations

	CR	AVE	PF	CO	SA	CI	NA
PF	0.87	0.79	0.89				
CO	0.91	0.89	0.58	0.94			
SA	0.94	0.89	0.48	0.80	0.94		
CI	0.86	0.82	0.35	0.60	0.70	0.90	
NA	0.89	0.61	0.38	0.31	0.25	0.19	0.78

Notes:

- 1. CR: Composite Reliability
- 2. AVE: Average Variance Extracted
- 3. PF= Perceived Feedback, CO=Confirmation, SA= Satisfaction, CI= Continuance Intention, NA= Narcissism

For satisfactory discriminant validity, the square root of the AVE from the construct should be greater than the correlation shared between the construct and other constructs in the model (Fornell & Larcker,

1981). Table 2 lists the correlations between constructs, with the square root of the AVE on the diagonal. The diagonal values exceed the inter-construct correlations; hence, the test of discriminant valid-

ity was acceptable. Therefore, we conclude that the measurement of each construct satisfies construct validity.

### 3.4 Structure Model Testing Results

The partial least squares (PLS) method was used to solve the hypothesized model. The use of PLS can model latent constructs under non-normality and can be used for small to medium sample sizes in a component-based estimation (Chin & Newsted, 1999). PLS is better than covariance-based estimation for testing moderating effects (Chin & Newsted, 1999). Moderating effects can be integrated into a PLS path model with the so-called interaction

term approach. Typically, the interaction term in PLS path modeling is an implementation of an additional latent variable covering the product of the independent and the moderator variable (Henseler & Fassott, 2010). In moderated analysis, a new latent variable is added to address the interaction and is calculated with the product of factor scores, tallied with mean-center approach. PLS has minimal restrictions on normality, scales, sample size, and moderating effect testing. Thus, in our study, this study uses the PLS method and the SmartPLS software for our data analysis.

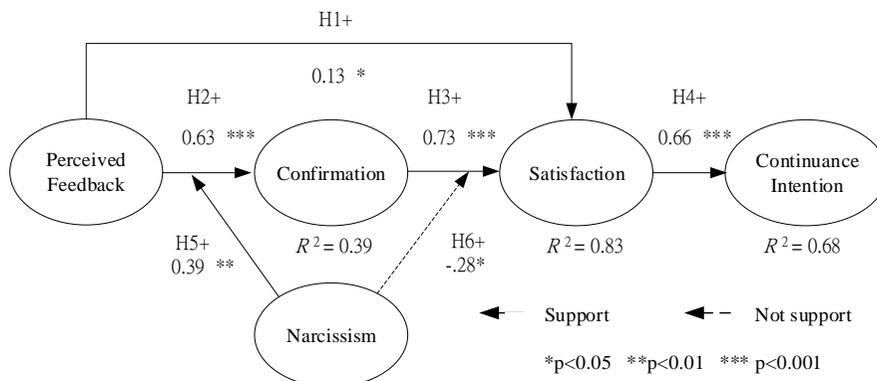


Figure 2: The Research Model

The significance of individual path was examined and summarized in Figure 1. All paths exhibited a P-value of  $<0.05$ . The path from Facebook feedback to satisfaction was significant having path coefficients of 0.13. The path from perceived feedback to confirmation and confirmation from Facebook behaviors satisfaction were significant having path coefficients of 0.6 and 0.73. Satisfaction exhibited a strong effect on continuance intention with path coefficients of 66%. Hypotheses 1, 2, 3 and 4 are supported. Narcissism resulted as a significant moderating effect on the relationship between perceived feedback and confirmation with path coefficients of 0.39, while it had negative moderating effect on the relationship between confirmation and satisfaction with path coefficients of -0.28.

Therefore, the influence of a user’s perceived feedback with their confirmation and a user’s confirmation on their intention are affected by the level of narcissism. This supported Hypothesis 5.

The explanatory power of the research model was also shown in Figure 2. The  $R^2$  values showed that perceived feedback accounts for 39% of variance in confirmation. The confirmation accounts for 83% of variance in satisfaction and satisfaction accounts for 68% of variance in continuance intention.

### 4. Discussion

This study is to explore the experience of Facebook users when interacting with friends through the relationship between perception of feedback, confirmation, satisfaction, and continuance intention. The

results show that narcissism plays as a moderating role on the relationship between perceived feedback and confirmation. Data analysis shows that all the hypotheses are supported and that the results are consistent with past related studies (Chiu et al, 2013; Hong et al, 2006.).

#### **4.1 Results and Discussions**

The present study is able to explain a significant amount of variance in Facebook behavior satisfaction (83%) and continuance intention (68%). The results suggest that the research model provides a good explanatory power for user satisfaction. Individuals with higher narcissism regard the act of posting selfies more positively and are more willing to continue posting in the future (Lee and Sung, 2016). This study found that perceived feedback exerted a strong effect on confirmation with path coefficients above 0.5. It means that users' perceived feedback of Facebook posts is better than expected. This study supported the notion that confirmation is a significant determinant of satisfaction. The path from confirmation to satisfaction was significant. The sum of path coefficients from perceived feedback to confirmation and usability confirmation to satisfaction were greater than that from perceived feedback to satisfaction. It showed that perceived feedback through confirmation to influence satisfaction is more significant. It indicates that users' perceived feedback have a minor influence on Facebook post satisfaction. Users further confirmed the degree of perceived feedback and deepened on Facebook posting satisfaction. As expected from ECT, confirmation was a stronger predictor of satisfaction than perceived feedback in this study.

Tobin et al. (2014) indicated that a lack of information sharing and feedback can threaten belonging needs. This study suggests that the essential function of Facebook is social interaction where people are eager to get positive feedback. This is indicative of the fact that Facebook's charm is not in complex functions, but in fulfilling people's needs. It also shows that

the feedback mechanism of Facebook does affect user's continuous usage. The interactive features and functions of Facebook are important factors in maintaining the related services' popularity. The results suggest that Facebook should develop a long-term strategy of improving service interactivity to maintain or enhance users' loyalty to the service.

We assumed that there was a theoretical moderating effect on the relationship between perceived feedback continuance Facebook behaviors, including that the influence of a user's perceived feedback on his or her confirmation is affected by the level of that user's narcissism. Moreover, the influence of a users' confirmation on their satisfaction is affected by the level of that user's narcissism. Our results showed that narcissism have a positive significant moderating effect on the relationship between perceived feedback and confirmation especially among more narcissistic individuals, who regard positive feedback as confirmation of their glowing self-concepts (Kernis & Sun, 1994)). Accordingly, more narcissistic individuals are likely to be more attentive and interested in the feedback that they are receiving on their Facebook posts.

Our study has a negative significant moderating effect on confirmation and satisfaction. One possible explanation is that they perceive a friend's feedback in a positive way, but may not be satisfied with his/her response because the narcissistically entitled think that good things will come their way due to them deserving of favorable outcomes (Raskin & Terry, 1988; Twenge & Campbell, 2009). On the contrary, people who relate to low-level narcissism care less about a friend's response and are easily satisfied with his/her feedbacks. Another explanation is that people who relate to high-level narcissism tend to take everything for granted and they are never satisfied. People in a common narcissism groups are usually observed as self-centered and self-absorbed. Moreover, their expectation in receiving attentions

from others may indirectly indicate that their behavior of feeling let-down by friends when a single “like” or a short comment are the only feedback on their social media post. When they perceive posts on social media as quickly as gathering the positive comments and attentions that they are looking for, their addiction of repeatedly posting online will increase. In general, studies on the relationship between social media design and high-level narcissistic user behaviors are definitely worthy of further discussions.

#### 4.2 Limitations and Suggestions

Some limitations and suggestions of the present study must be considered. First, because our respondents were college students, we need to be careful in generalizing our statistical results with the other sample groups. Second, reliability is sometimes improved in studies that rely on third-party observer reports rather than self-reports. Relying on observer ratings helped improve internal consistency. Using third-party observer reports, it will possibly make our study more objective and reliable.

Future research should determine whether narcissism will lead to increased Facebook usage, whether Facebook use promotes narcissism, or whether other variables could better explain the relationship between the two (Panek et al., 2013; Twenge & Campbell, 2009). Therefore, an interesting area for future studies is to continue distinguishing the various kinds of sites by identifying the absence or presence of various characteristics. Future studies are needed to delve into the interactive nature of selfies that may shed light on the yet-to-be discovered psychological matters underlying Facebook use.

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