The Effect of Personality on Knowledge Creation Processes
Toward KC Optimization in Teams based on Human Attributes

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Abstract: In organizations, knowledge is mainly created by individuals in interaction. What individuals do is determined not only by external influences (the main focus of other studies), but also by their own intrinsic characteristics. As a consequence, it is important to elucidate how some of these characteristics can potentially impact knowledge creation (KC) in organizations. Based on previous research and on empirical data collected from two business organizations operating in Japan, this study found that certain personality traits of the human resources can significantly affect specific KC processes. This finding is discussed in the final section, where the paper concludes emphasizing the possibility to optimize KC in teams through a synergistic scheme that considers not only the technological aspects, but also the human aspects.

1 INTRODUCTION

When one considers the basic definition of a system (a set of interrelated elements forming a collective entity to accomplish a specific function or goal), it is easier to see that any kind of organization can be viewed as a knowledge system. The human components of organizational systems have certainly knowledge, and there is also knowledge embedded in routines, procedures, culture, products, processes, technology, and structures (Horvath, 2000; Gamble and Blackwell, 2001). As a consequence, the management of all this knowledge, spread throughout the organization, is indispensable to ensure the organization's survival and success in highly competitive contexts.

Thus knowledge management (KM) has become an influential field of study helpful to improve the competitiveness of organizations by promoting the creation and application of knowledge. Among many factors positively affecting KM, information and communication technologies have conspicuously achieved a preeminent status quo. This study recognizes the importance of the technology-oriented perspective, but it intends to bring the attention toward the soft side of knowledge management. This is because organizations are not merely mechanical systems, but to a great extent they are biological systems. The fact that knowledge is primarily created by 'individuals in social interaction' has been pointed out in the KM literature (e.g. Nonaka et al., 2008). But still there seems to be a tendency to forget that a comprehensive KM strategy is not only technology-oriented, but also people-oriented. Specifically, this paper uses quantitative data collected from two different business organizations to empirically show that, among several attributes of the human resources, the personality dimension can significantly impact knowledge creation in organizations.

2 THEORETICAL BACKGROUND AND HYPOTHESES

2.1 Human Attributes and KM

Human-related aspects can be harnessed to promote knowledge creation and innovation. Recognizing that individuals are the principal repository of knowledge, and that knowledge is created by people in their interaction with each other and the environment (Grant, 1996; Nonaka et al., 2008), ample research have shown that organizational members' commitment (Zelaya-Zamora and Senoo,

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2012; Chiang et al., 2011; van den Hooff and de Ridder, 2004), cooperation and trust (Zelaya-Zamora and Senoo, 2012; Casimir et al., 2012; Lee and Choi, 2003), national culture (Moller and Svahn, 2004; Magnier-Watanabe and Senoo, 2010), motivation (Martín Cruz et al., 2009), skills (Lee and Choi, 2003), attitudes (Yang, 2008), and several other human-oriented factors (Heisig, 2009) can positively influence knowledge management processes in organizations. Since KM is about the interconnection of content, context and the people involved, very often KM efforts focusing only on developing a technological capability fail because they neglect vital attributes in the human resources (Ruggles, 1998).

2.2 Personality

One of the most difficult challenges in KM is to influence the behavior of organizational members (Ruggles, 1998). But in trying to influence the behavior of people in organizations, it is often forgotten that not everything human beings do is due to external influences. The theory of organizational behavior and the theory of personality suggest that underneath adaptations (e.g. values and attitudes, commitment, motivation, memory, skills) and external influences (e.g. experiences and life events, the situation or context, cultural norms, organizational investments) there are enduring basic traits that can largely explain, *ceteris paribus*, human behavior (Robbins, 1998; McCrae and Costa, 1996).

These widely recognized personality traits are typically known as the Big Five and originate from a robust theory that provide a practical model for research (Funder, 2001). A general definition of each of the Big Five is presented in Table 1. Evidence shows that these factors have external validity and predictive utility. For example, it is reported that low agreeableness and low conscientiousness predict juvenile delinquency; conscientiousness and openness predict school performance (John et al., 1994; Robins et al., 1994); extraversion predicts success in sales and management positions; agreeableness and low neuroticism predict performance in jobs involving team work (Barrick and Mount, 1991). As these personality traits are stable across cultures (Gosling, 2001), permanent during adulthood (McCrae, et al., 2000), highly heritable (Loehlin et al., 1998) and are fundamentally explanatory of human behavior (Goldberg, 1993; McCrae and Costa, 1999), they have also been studied in relationship with organizational aspects such as job satisfaction (Judge et al., 2000), organizational commitment (Erdheim et al., 2006), and knowledge sharing (Matzler et al., 2008).

2.3 Knowledge Creation

The capability to continuously create and materialize knowledge in innovative products, services, and processes can lead to organizational success. The revisited version of the knowledge creation theory posits that knowledge creation (KC) occurs when tacit and explicit knowledge interact repeatedly at the individual, group, organizational and inter-organizational levels in a spiral fashion. The type of interaction composes four distinct KC processes (formerly called conversion modes): socialization, externalization, combination, and internalization (Nonaka and Toyama, 2003). These are described further in section 2.4 below.

In light of the increasing amount of overlapping concepts and terminologies frequent in the literature of KM, it merits noting that “knowledge creation” is a broad concept that encompasses several KM processes. For in socialization and externalization, knowledge sharing and knowledge generation occurs; and in combination and internalization, knowledge accumulation and knowledge exploitation essentially takes place (Nonaka and Takeuchi, 1995).

These processes (sharing, generation, accumulation and exploitation) broadly correspond to the labels other researchers have come up with, e.g. dissemination, acquisition, storage and application, respectively (Lee and Yang, 2000; Shin et al., 2001; Holsapple and Singh, 2001; Heisig, 2009).

Among other KM frameworks, the theory of knowledge creation is used in this study because it has stood the test of time and has been extensively applied and validated in several fields and contexts (e.g. Lee and Choi, 2003; Rice and Rice, 2005; Magnier-Watanabe and Senoo, 2009), has been singled out as the most influential theory in the knowledge management literature based on citation, network and factor analytical techniques (Ma & Yu, 2010), and has been identified as the most-frequently-applied theory in the citation classics of knowledge management (Serenko and Dumay, 2015). Some studies have examined the relationship between personality traits and knowledge sharing in general (Matzler et al., 2008; Cabrera et al., 2006), but the association between personality and specific KC processes has never been analyzed empirically.

Table 1: General definition of the Big Five factors of personality.

Big Five factors	Definers
Extraversion (E)	Active, assertive, energetic, enthusiastic, outgoing, talkative, skilled in play and humor, rapid personal tempo, facially and gesturally expressive, gregarious
Agreeableness (A)	Appreciative, forgiving, generous, kind, sympathetic, trusting, not critical or skeptical, behaves in a giving way, considerate, arouses liking, warm, compassionate, basically trustful
Conscientiousness (C)	Efficient, organized, planful, reliable, responsible, thorough, dependable, productive, able to delay gratification, not self-indulging, behaves ethically, has a high aspiration level
Neuroticism (N)	Anxious, self-pitying, tense, touchy, unstable, worrying, thin-skinned, brittle ego defenses, self-defeating, concerned with adequacy, fluctuating moods
Openness (O)	Artistic, curious, imaginative, insightful, original, has wide interests, introspective, has unusual thought processes, values intellectual matters, judges in unconventional terms, aesthetically reactive

2.4 Hypotheses

2.4.1 Extraversion and KC Processes

Research has demonstrated that the personality trait of extraversion is significantly associated with performance in positions involving the interaction with others–such as sales and management positions (Barrick and Mount, 1991; Ashton, 1998; Mount et al., 1998). Given that people who have high level of extraversion tend to be sociable, gregarious, adventurous, enthusiastic, and enjoy any kind of close interaction with other people (John, 1990; Costa and McCrae, 1992), it is reasonable to expect that extravert employees tend to spend more time in socialization activities, where tacit knowledge is transferred to others (Nonaka and Takeuchi, 1995). For this reason, the first hypothesis is:

H_1: There is a positive association between Extraversion and knowledge Socialization (E–S).

Extraversion also defines individuals who speak their minds and are assertive, talkative and non-reserved (Barrick and Mount, 1991; Costa and McCrae, 1992). These attributes are crucial to convert tacit knowledge into explicit knowledge, i.e. the externalization process (Nonaka & Takeuchi, 1995). Then, we can expect that extrovert employees will be inherently predisposed to externalize their ideas, thoughts and feelings with more frequency and ease. Consequently:

H_2: Extraversion is positively associated with knowledge Externalization (E–E).

2.4.2 Agreeableness and KC Processes

Highly agreeable individuals are especially friendly, sympathetic, cooperative, helpful, collaborative and generous (Barrick and Mount, 1991; Costa and McCrae, 1992). Mount et al. (1998) found that agreeableness is related to performance in occupations where collaborative and cooperative interactions are necessary. And Digman (1997) concluded that agreeableness is related to socialization and communion. But Jensen-Campbell and Graziano (2001) explain that the social behavior associated with agreeableness is different from extraversion. Extraversion is related to the impact of social behaviors (i.e., extraverts are more likely to make an impact on others during social situations), whereas agreeableness is related to desires to preserve harmonious social relationships. Because knowledge socialization is characterized by sharing experience (tacit knowledge) unselfishly (Nonaka & Takeuchi, 1995), it is hypothesized that the personality trait of agreeableness facilitates the socialization of knowledge in organizations. Formally stated:

H_3: Agreeableness is positively associated with knowledge Socialization (A–S).

2.4.3 Conscientiousness and KC Processes

Conscientiousness describes individuals who are hardworking, achievement-oriented, dutiful, responsible and organized (Barrick and Mount, 1991; Costa and McCrae, 1992). Not surprisingly, research shows that conscientiousness significantly explains job performance (Barrick and Mount, 1991; Hurtz and Donovan, 2000) and is related to knowledge sharing in general (Matzler et al., 2008). These characteristics seem to indicate that conscientious individuals have more predisposition to carry out intellect-and-time-demanding activities such as collection, analysis and reconfiguration of

useful information and data, that is to say, to perform the systematization and combination of organizational knowledge. Thus:

H_4: Conscientiousness is positively associated with knowledge Combination (C–C).

Internalization also requires dutifulness, self-discipline and deliberation (definers of conscientiousness) for the employees to engage in explicit-to-tacit knowledge conversion through consideration of or reflection on success stories, organizational experiences and goals (Nonaka and Takeuchi, 1995). Accordingly, the fifth hypothesis is:

H_5: Conscientiousness is strongly associated with knowledge Internalization (C–I).

2.4.4 Neuroticism and KC Processes

Neuroticism characterizes individuals with the propensity to experience distress and negative affect (McCrae and John, 1992; Emmons et al., 1985). Representative behaviors coupled with neuroticism include being depressed, angry, worried, insecure, emotionally unstable and anxious (Barrick & Mount, 1991) as well as being inclined to feel more strongly negative life events (Magnus et al., 1993). High neuroticism has not been found positively related to any beneficial organizational outcome. To the contrary, research has found that neuroticism is negatively correlated with job satisfaction (Judge et al., 2002) and negatively related to performance in jobs involving group work (Mount et al., 1998). Due to the negative nature of this trait, no positive associations are expected between neuroticism and KC processes. Hence:

H_6: Neuroticism is not positively associated with any of the KC processes.

2.4.5 Openness and KC Processes

The personality trait 'openness' involves active imagination, intellectual curiosity, predilection for variety, originality, unconventionality and sensitivity for aesthetics (Costa and McCrae, 1992). Openness is related to creativity, flexibility, broad-perspectives and intelligence (Judge et al., 2002; Digman, 1990). Other studies have found that openness has a significant relationship with knowledge sharing in general (Cabrera et al., 2006; Matzler et al., 2008). But, how is openness associated with specific KC processes?

Openness to new ideas and curiosity are important conditions for socialization, where the conversion of tacit-to-tacit knowledge occurs primarily through observation, imitation, practice or direct experience (Nonaka and Takeuchi, 1995). Employees who score high in openness are more likely to acquire knowledge via socialization due to their intrinsic tendency to be curious, flexible and experimental (Costa and McCrae, 1992). Therefore, it is hypothesized that:

H_7: Openness is strongly associated with knowledge Socialization (O–S).

The active imagination and creativity of those who have a high degree of openness can be useful for the conversion of tacit-to-explicit knowledge (externalization) because this KC process takes place through the ability to generate metaphors and analogies, and by "intuitively understanding one thing by imagining another" (Nonaka and Takeuchi, 1995). Therefore, it is expected that individuals with high level of openness are more prone to effectively externalize their knowledge. In other words:

H_8: Openness is strongly associated with knowledge Externalization (O–E).

Openness is also characterized by the intellectual capacity, the broad-perspective orientation and the originality of individuals. These features are likely to be associated with knowledge combination, because the conversion of explicit-to-explicit knowledge requires the creative use of existing explicit knowledge to generate more of it by being able to see the interaction between concepts and to reconfigure organizational knowledge in original ways (Nonaka and Takeuchi, 1995). Accordingly:

H_9: Openness is significantly associated with knowledge Combination (O–C).

No hypotheses were developed for other pairs of personality trait and KC process because a theoretical basis to support them could not be sufficiently elaborated. However, they were still considered in the analysis as explorative, latent associations. Figure 1 presents a summary of the main hypotheses introduced in this study.

3 RESEARCH METHODOLOGY

3.1 Sample and Operationalization of Constructs

In order to empirically test the theoretical model developed in this study, data was collected from two Japanese companies, one dedicated to the manufacturing and commercialization of pharmaceutical products, the other dedicated to the construction and commercialization of real estate.

Personality traits were measured using the 44-item, Big Five Inventory (BFI) originally developed by (John et al., 1991) and refined subsequently by

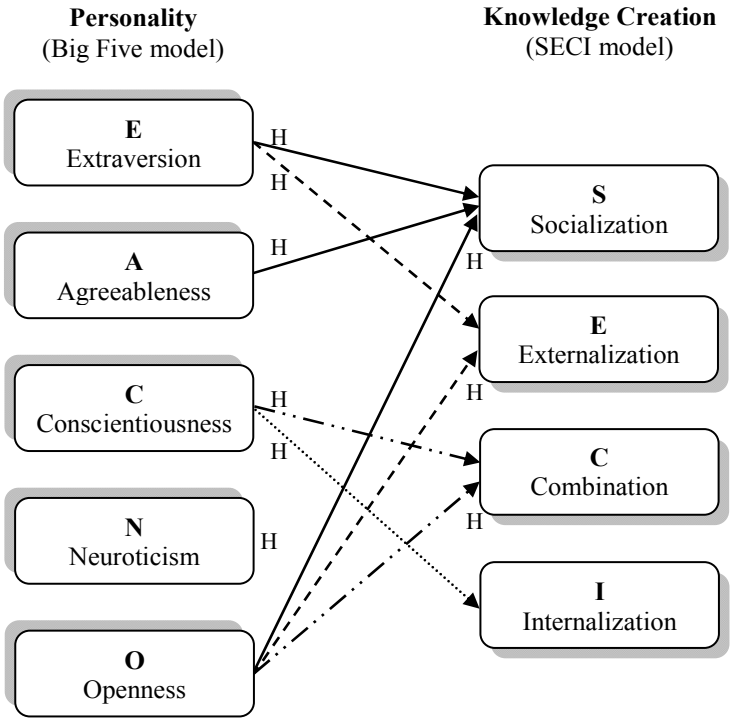

Figure 1: A model on the relationship between personality and knowledge creation processes.

(Benet-Martinez and John, 1998). The BFI is more practical for research studies than other scales available in the literature (e.g. TDA and NEO) and its reliability and convergent and discriminant validity have been documented (John and Srivastava, 1999).

KC processes were assessed using the SECI scale originally developed by Nonaka (1994) and subsequently revised collaboratively by several professors and practitioners of KM. This 24-item scale consists of six tested indicators for each KC process. Reliability and validity evidence has also been provided in detail by Nonaka (1994) and subsequently corroborated by studies in diverse research settings, e.g. (Magnier-Watanabe and Senoo, 2009; Riera et al., 2009). Both personality and KC were measured with question-items using 5-point Likert scales in Japanese language which were responded anonymously by individuals working in sales. Out of 150 questionnaires submitted, 142 contained usable data for the subsequent analysis.

3.2 Quantitative Analysis and Results

After the mandatory steps regarding data preparation, confirmation of adequate level of reliability and validity of the scales, and assessment of the basic requirements for the statistical procedures, correlation and regression analyses were conducted. Due to space limitations, only the results of the regression analysis for the independent variables with the greatest explanatory power (high R-Square contribution) are presented in Table 2.

Generally speaking, the results indicate that the personality traits openness and extraversion are significantly associated with both knowledge socialization and knowledge externalization (H1, H7, H2 and H8 are supported; but not H3). This means that individuals scoring high in these personality traits are more likely to contribute to the socialization and externalization processes in organizations. In addition, openness and conscientiousness are significantly associated with knowledge combination (H4 and H9 are supported). As expected, neuroticism was not found significantly associated with any KC process (H6 is supported) and openness, rather than conscientiousness, was found significantly associated with knowledge internalization (H5 is not supported). In all, seven out of nine hypotheses in the research model were supported empirically.

Initially, stepwise regression was conducted, but in light of the unanimous influence of openness on all KC processes, hierarchical regression was also conducted in order to confirm that openness indeed explains most of the variance of the dependent variables above and beyond the other personality traits. The results revealed the same conclusions.

Table 2: Main results of the regression analysis.

Dependent (KC)	Independent (Personality)	Std. coeff.	Sig.	Adj. R-Square
Socialization	Openness	.346*	.000	20.3%
	Extraversion	.239*	.007	4.7%
Externalization	Openness	.424*	.000	34.5%
	Extraversion	.253*	.002	6.3%
Combination	Openness	.292*	.000	11.3%
	Conscientiousness	.255*	.001	5.7%
Internalization	Openness	374*	.000	26.2%

4 DISCUSSION AND CONCLUSION

4.1 Findings

The theoretical background and the empirical analysis performed in this study indicate that human resources with high level of openness and extraversion can contribute more to the socialization and externalization processes of KC. Both sharing tacit knowledge (in socialization) and producing explicit knowledge (in externalization) understandably require the assertive and interactive propensity of individuals scoring high in extraversion as well as the curious tendency of individuals scoring high in openness.

Agreeableness was not found sufficiently associated with any KC process, not even with socialization as hypothesized. This could be because agreeableness, in contrast to extraversion, has to do more with a desire to preserve harmonious social relationships rather than making an impact on others during social interactions (Jensen-Campbell and Graziano, 2001)

But socialization in the KC theory entails impact on others (i.e. individuals must effectively share tacit knowledge and/or absorb it from others). It seems that agreeableness cannot create an adequate level of impact necessary for the socialization of knowledge.

This study also found that openness and conscientiousness are significantly associated with knowledge combination. The organizing and dutifulness tendency of conscientious individuals together with the intellectual and insightful characteristics of high openness can explain individuals' involvement in the systematization of knowledge (i.e. combination of explicit-knowledge). The trait openness additionally appears to influence the internalization of knowledge in organizations because the widely-interested and curious individuals are naturally prone to try out and experiment with what they have learned in different contexts.

4.2 Implications and Further Research

In general, the findings of this study suggest that personality, like many other variables related to people in organizations (such as leadership, culture, commitment, trust, motivation, etc.), is important for KC. Technological aspects undisputedly support KM activities, but this should not obscure the fact that other aspects related to the human elements in organizations also require managerial attention. There are two main sides or perspectives of KM: the hard/technological and the soft/biological. Normally it is not wise to over-emphasize one at the expense of the other. Ruggles (1998) broadly suggests getting an approximate 50/25/25 people/process/technology balance right from the outset of any KM endeavor.

In particular, the findings of this study indicate that the personality traits more important for KC in organizations are openness, extraversion and conscientiousness. Because personality can influence the behavior of people independently of adaptations and external influences, managers can apply the findings of this study to affect KC without making significant investments. It is possible to select individuals (either from the same organizational unit, from different units, or recruited from outside the company) with high scores in these three important personality traits and form with them teams assigned to knowledge-intensive projects. This is an implication worth experimenting within a controlled setting. Do teams composed of members scoring high in openness, extraversion, and conscientiousness actually perform significantly better in KC than teams randomly formed without care for the personality of the members? This is an agenda for further research, which can serve as a

stepping-stone toward the optimization of KC in teams based on human-attributes considerations.

As it happens with most research papers, this study has limitations related to the size and variety of the sample surveyed, as well as the *ceteris paribus* condition assumed. When further research is done overcoming these limitations, the findings of the study will be much more generalizable.

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