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Contents

The Concept of Open Creativity: Collaborative Creative Problem Solving for Innovation Generation – a Systems Approach

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Collaborative creativity is a prerequisite for the generation of innovation. It is of even greater interest when attempting to move from incremental to radical innovation that aims at huge instead of incremental improvements of products, processes, services, or structures that actually changes social practices. The main objective behind this paper is to call for an extension of the creativity perspective by abandoning an exclusive focus on individual creative capabilities, and extending inner-organizational collaborative creative sources with a goal of creating an "open creativity" system by including external creative sources. In addition to a system's internal creativity (such as of an organization or a region), the synergetic interplay between internal and external sources of creativity at the individual and collaborative levels also needs to be utilized in the attempt to create innovations. In a way, what "open creativity" is for creativity, Chesbrough's "open innovation" is for innovation. This is particularly true with regards to radical innovations. Such an approach is becoming more important as environmental and system complexity increases and also as higher degrees of innovation are required. In order to understand and manage such multifacetted aspects of creativity, the "Planetary Model of Collaborative Creative Problem Solving" is introduced here as a conceptual framework and is correlated with the underlying working process oriented towards the generation of innovations.

[1] An earlier version with the title "Organizational Creativity as a Prerequisite for the Generation of Innovation" was prepared for the annual meeting of the Western Decision Sciences Institute, Hawaii, U.S.A., 11-15 April 2006 and received the Best Paper Award in the track "Management and Organizational Behavior".

"I've always been an optimist and I suppose that is rooted in my belief that the power of creativity and intelligence can make the world a better place" (Gates, 2007). This statement, made by Bill Gates, appeared in *The Saturday Evening Post* in the March/April 2007 issue and illustrates a good example of what "unleashing the power of creativity" can do, not only in respect to innovation, but to the entirety of society as well. Creativity as a prerequisite for innovations certainly needs to be investigated from a broad systems perspective and from the viewpoint of various disciplines. To date, many creativity researchers have been too focused on single issues of investigation and have shown little interest in promoting interdisciplinarity with a focus towards greater real world application of innovation processes. While understanding creativity at the level of the individual – as seen in the personality traits approach – complies with the tenets of mainstream psychology (Simonton, 2003; Paulus & Nijstad, 2003), this also seems to be true for most other disciplines, including business sciences, anthropology, and sociology. The current (and relatively restrictive) perspective has only marginal implications for superordinated creativity systems such as organizations and various forms of cross-border cooperation. Although most approaches still lack an exhaustive systems perspective, environmental issues in creative problem solving have been gaining increasing attention within the business sciences, and have served to make the work environment, creative climate and innovation climate the subject of scientific discussion (Amabile & Conti, 1999; Anderson & West, 1994; Brodbeck & Maier, 2001; Ekvall, 1997; Isaksen, Lauer & Ekvall, 1999; Lapierre & Giroux, 2003; Zain, Richardson & Adam, 2002;). The same is also true for the academic relevance of specific creativity tools (Geschka & Yildiz, 1990; King, 1995; McFadzean, 2000; Schlicksupp, 1999; Smolensky & Kleiner, 1995).

Referring to the need for dealing effectively with creativity in an organizational context, Ford and Gioia stated a decade ago that although it is important as a basis for organizational learning, development, innovation and competitive advantage, there is still a lack of clear and guided instruction with respect to comprehensive creativity management (Ford & Gioia, 1996). In general, this is still true of the vast majority of today's efforts in creativity research. Still, very little effort has been placed on the management of the overall system of creative problem solving. As Simonton (2003) pointed out, comprehensive research of creativity "[…] must view it as a complex phenomenon that occurs at multiple levels, from individuals, interpersonal interactions and problem solving groups to cultures, nations, and civilizations." One reason for the lack of research effort might also be that all-embracing models of creative problem solving processes do not lend themselves readily to scientific investigation (Steiner, 2006; Woodman, Sawyer & Griffin, 1993), even though they are of obvious importance as a prerequisite for the generation of innovations. Woodman et al. (1993) pointed out the dilemma entailed in matching the need for a broad understanding of organizational creativity with the simultaneous fear of doing research on organizational creativity, since "research on organizational creativity will, by definition, cross multiple levels of analysis" and further, because a strong tendency "[…] to avoid multilevel research because of their theoretical orientations and because of methodological and conceptual problems inherent in aggregating data across different levels of analysis" (Woodman et al., 1993, p. 315). Although this thorough

theoretical investigation dates from the year 1993, the tendency it describes still dominates creativity research today.

Furthermore, "open creativity" as an extended creativity system, encompasses internal and external collaborative creative sources as well, and is of an even higher complexity than group and organizational creativity. "Open creativity" also makes thorough research even more difficult because highly innovative developments require collaborative creative capabilities within organizations. In addition, research and development need to be increasingly based on cooperation, not only with other companies in the value chain, but also in terms of the development of strategic partnerships and network activities with other external players, including with so-called think tanks and even with competitors. An example of this is the joint development of new technologies within the car-manufacturing industry. Other examples are cooperation and partnership between internal and external sources within individual innovation projects. All these forms of transboundary processes of "open creativity," reveal that there is not enough research on this specific form of creativity taking place.

With regard to the major roots of creativity research, stronger interplay between sociological research related to organizational, societal, and environmental problems and psychological research that concerns both individuals and groups, is needed (Woodman et al., 1993). Greater integration of anthropology, applied business and innovation sciences, educational sciences, and design research (such as design-based communication for dealing with complex systems) might also prove fruitful in attempting to develop interdisciplinary and holistic approaches with respect to organizational and meta-organizational systems of creativity like "open creativity".

This paper aims to provide guidance to those who have to monitor creative organizational efforts in innovation development. It also aims to offer broad support for future thoughts and empirical investigations on creativity-guided innovation research. The paper is divided into several sections. In the first section, the question of how one can differentiate between problem solving processes and creative processes is posed, and what kinds of problems call for creative solutions and collaborative creativity. Creative problem solving is then considered with respect to change, innovation, knowledge, sustainability and wisdom. Subsequently, the role of creativity with respect to innovation (especially radical innovation), is briefly discussed. The linkage between various forms of creativity is then investigated, covering both individual aspects, as well as various forms of collaborative effort. In order to understand the complexity of creative problem solving, the Planetary Model of collaborative creative problem solving is introduced in order to point out the major and minor factors entailed in the collaborative creative problem solving processes. This is followed by the application of the Planetary Model to the innovation-directed working process, with a goal of explaining how prevailing shortcomings in the ability of many companies in utilizing their internal and external creative capabilities can be overcome. A brief description on future directions of innovation-relevant research on collaborative creative problem solving processes concludes the paper.

Creativity in Problem Solving

The question of whether problem solving processes and creative processes are the same cannot be answered without making further distinctions. Often used synonymously, their separation is controversial. One view is that creativity is independent of problem solving. Creativity may simply be an undirected act of self-expression also. An example of this is the process of painting of a picture. Here, there is no task in mind requiring a solution. The other view is that the mere act of self-expression and self-realization itself can be viewed as a kind of problem solving.

In terms of the mental perception of an external world, "problem solving occurs when we understand the external world by exploring an internal model of that world, instead of poking around in the external world directly" (Hunt, 1994, p. 216). That means the mental anticipation of a given state of a system, together with the task of generating potential solutions for the further development of the system by simultaneously considering its objectives, becomes a crucial part of problem solving. Furthermore, the distinction between routine problem solving and creative problem solving seems to become useful.

There is reasonable agreement that the essential features of a problem are given when there is a goal (namely to generate a solution for the problem), but there is a lack of a clear or well-learned route to that goal (Dominowski & Bourne, 1994). In a similar way, Treffinger, Isaksen and Dorval (1994, p. 226) define a problem as "[…] any important, open-ended, and ambiguous situation for which one wants and needs new options and a plan for carrying a solution successfully." In terms of the degree of complexity, problems can be divided into the categories of simple, complicated, and complex (Probst & Gomez, 1991).

Simple problems consist of a small amount of elements which exhibit relatively little interaction. They also show a strong tendency towards stability over time (Probst & Gomez, 1991). This is also true for complicated problems that are similar to simple problems, but consist of comparatively more elements and exhibit more interaction. In contrast to complex problems, the patterns here are still relatively stable over time. Of course, in order to solve complicated problems, more sophisticated methods are needed. Although in contrast to complex problems, the simple problem still tends to be of a deterministic nature (Probst & Gomez, 1991). Consequently, simple and complicated problems can be solved mainly by applying standard methods of reproductive thinking based on routine problem solving, and without a special need for creative problem solving processes.

Complex problems cannot usually be solved by routine problem solving, but instead require solutions that are not yet available and are dependent on novel connections of the various aspects of the problem in linkage to prior knowledge (Lubart, 1994). Such problems may also relate to situations for which there is no current awareness. Generally speaking, complex problems can be characterized by certain system peculiarities. It is typical that the features that characterize a good target state of the problem solving process are unknown, or at least ambiguous, and that the system's initial state often cannot precisely be described either (Scholz & Tietje, 2002; Lubart, 1994). As an example, the attempt to accurately explain the success factors of

product innovation are not only an ex ante problem, but also an ex post problem because they pose the question: Are the set of responsible factors comprehensive and the interactions among them really understood? Furthermore, characteristics of complex problems make up a large amount of interacting elements and subsystems in conjunction with high system dynamics. This leads to changes in patterns, structures and related intensities over time (Probst & Gomez, 1991). They also prevent the applicability of many deterministic problem solving methods, like those used in routine problem solving. Divergent thinking and more creative approaches are needed because, the more complex the problem, the harder it will be for an individual to creatively develop solutions and make use of the collaborative creativity of several interacting individuals. The higher the innovativeness of new product development is, the more complex the system usually gets as a result of the higher uncertainties regarding future effects.

Although all problem solving processes (routine and creative), involve certain common fundamental steps, such as finding and defining a problem solving goal, scanning and generating relevant information, deriving suitable solutions from this information and evaluating and refining the proposed solutions (Lubart, 1994; Weisberg, 1993), they still differ with respect to their peculiarities. A creative problem solving process is not actually equivalent to a creative process. Therefore, distinctions between creative processes, routine problem solving processes and creative problem solving processes can be made based on the following criteria:

(1) *Initial event:* The starting point of the underlying process can either be based on a problem such as the need for new product development (applicable on routine problem solving processes and creative problem solving processes) or without a problem context (i.e. non-goal oriented activity such as the painting of a picture as a kind of self-expression). Within creative problem solving in a real-world context, the initial problem is more of a starting point where the problem needs to be recursively identified, revised and redefined in order to approach the "real" underlying problem.

(2) *Process characteristics:* Though the fundamental process steps are the same as above, the difference between routine and creative problem solving lies in the quality with which the process steps are performed (Lubart, 1994). For example, when identifying the underlying system as the basis for the generation of solutions, creativity will probably lead to more complex and novel connections concerning the various aspects of the initial problem. Such creativity may also lead to insights behind the initial problem. Furthermore, flexible and creative working processes usually require more time for individual working steps, and involve the redundancy of several steps based on recursive feedback loops. In many cases this is needed in order to find the "real" problem behind an initial problem, and often occurs within the generation of innovation. In contrast, routine working procedures based on approved sequences will not find novel system connections but will consume less time since repetition of single steps is mostly unnecessary. Creative problem solving requires both divergent and convergent thinking modes,

whereas problem solving does not need divergent thinking since neither novel procedures nor novel outcomes are needed. Lubart (1994, p. 314-316) states that "psychoanalytic theorists have proposed that regression to primary-process material (unmodulated thought) is a central feature of the creative process that the routine problem-solving process does not involve." This state of the unknown characterizes most attempts to generate innovations, especially where a higher degree of innovativeness is required. The third phase of the popular four-stage creative process consisting of preparation, incubation, illumination and verification, is similar (Poincaré, 1924; Wallas, 1926). Here the problem solver is often not consciously engaged with the problem. It acts as a kind of "preconscious information processing" (Runco, 1994).

(3 *Novelty of the outcome:* Creative problem solving processes and creative processes lead to solutions with a higher degree of novelty compared to routine problem solving processes. Hence, the outcome of creative problem solving goes beyond what can deterministically be predicted and provokes surprise "because it is more than the logical next step" (Lubart, 1994, p. 290).

Based on this distinction, many problem solving processes refer to a specific problem, whereas routine problem solving requires neither a creative working process, nor novelty of outcome. In sum, problems do not necessarily require creative procedures or creative solutions, since simple and complicated problems can usually be solved by applying standard procedures in a more or less sophisticated manner. However, complex problems usually call for solutions based on creative problem solving. Conversely, creativity does not necessarily call for a problem, but it can be a driving force behind the development of solutions to complex problems.

Creative Problem Solving in a Broader Context: from Innovation, Knowledge, and Sustainability to Wisdom

This paper is not directed at collaborative creative problem solving and open creativity (as a specific form of collaborative creativity) as ends in themselves. Instead, the focus lies on the more general question of how creativity depends and/or interacts with innovation and knowledge, and on meta-concepts such as sustainable development and the need for wisdom within creative endeavors.

Change has become the determining factor of most facets of life. To deal with change, concepts such as restructuring, downsizing, and reengineering can be useful to some degree, but are limited because they adopt an inward-looking perspective and tend to be inherently negative. This is not very useful for future-oriented companies who depend on innovation (Kalthoff, Nonaka & Nueno, 1997). Creativity is the basis of every successful innovation since it provides companies with a means of coping with change in an increasingly complex world (Amabile, 1997; Ford & Gioia, 1996; Lubart, 1994; Peters, 1993; Ulrich, 1994; Utterback, 1994). Here, increasing complexity is not only related to products and services, but also to organizational systems, most business sectors and society as a whole. This calls for creativity at both

the individual and societal levels (Lubart, 1994). With regard to the degree of innovativeness, the more creativity that is needed, the higher the degree of innovativeness necessary. In other words, radical respectively disruptive or breakthrough innovations improve a certain system and can lead to changes in application and social practices. Consequently, they may also require more creativity to encompass the whole innovation systems rather than incremental ones (Hauschildt & Salomo, 2007; Christensen, 2000; Christensen & Overdorf, 2001). With respect to the generation of innovation, creativity is a fruitful strategy in attaining new knowledge. As Nonaka, Konno and Toyama (2001) pointed out, knowledge itself is dynamic and therefore, cannot be defined based on a traditional epistemological view that sees knowledge as "justified true belief." Rejecting this "absolute, static, and nonhuman view of knowledge," they maintain that knowledge is of either an explicit or implicit kind, context-specific, relational, humanistic and dynamically created in social interactions (Nonaka et al., 2001). Knowledge is also distinct from information. While the latter can be considered as a flow of messages, the former is "created by that very flow of information and is anchored in the beliefs and commitment of its holder" and can be defined as "a dynamic human process of justifying personal belief toward the truth." It needs to be stressed that this paper is based on a constructivist point of view and consequently does not consider truth as an ontological reality, but as a reflection of individual cognition and experience.

With respect to the utilization of a system's creative capabilities and particularly to mechanisms based on "open creativity," the dynamic nature of knowledge is amplified by the relative magnitude of the innovation effort and by the peculiarities of complex collaborative efforts in the context of inter and transdisciplinarity (Steiner & Posch, 2006; Steiner & Laws, 2006; Scholz & Tietje, 2002), heterogeneous teams, networking, integration of contingent work, etc. Furthermore, when it comes to the direction of influence, there is a twofold relation between creativity and knowledge. On the one hand, a certain degree of basic knowledge of the underlying subject matter is a prerequisite in order to make sense of the creative outcome while, on the other hand, creativity itself leads to an extension of the knowledge base. This means that creativity and knowledge are part of a double-loop system.

Since innovation is not an end in itself, but rather a means of coping with change and future development, the question arises of how sustainable an innovation and its preceding creative processes are in terms of economic, ecological and social perspectives. The more radical an innovation is, the higher its potential influence on the future development of related systems. Consequently, it is of interest how sustainable the innovation is. Although it is widely known that knowledge is a prerequisite for many sustainable competitive advantages (Drucker, 2006; Nonaka et al., 2001; Teece, Pisano & Shuen, 1997). In most cases, a limited understanding of the potential implications of an extended sustainability orientation, with regards to the creation and the management of knowledge and innovation, seems to exist. Generally speaking, innovation that contributes to sustainable development from an economic, ecological, and social point of view will be considered in the following as sustainable innovation. For more on questions of sustainability see Edwards, 2006; Laws et al., 2002; Perman, 1997; Posch & Steiner, 2006; Strebel, 2002; U.N., 1992; WCED, 1987.

The attainment of economically sustainable innovation and/or sustainable competitiveness seems to be obvious for most companies as a prerequisite for their survival, while the other facets of sustainability seem to be much more critical. There has been extensive research on ecological sustainable development (e.g., Strebel, 2002; Posch & Steiner, 2006), but its integration within companies' everyday business processes seems to be far more sensitive. Research shows that ecological concerns only find consideration if economically sustainable development can be ensured (e.g., Strebel, 1997). Within creative problem solving processes, it is clear that people play a crucial role as well. This concerns both those people involved in the problem solving process, and those who are affected by the innovation. However, the related research regarding socially sustainable development remains far from adequate. In contrast, collaborative creativity is characterized by dynamic patterns and becomes even more complex with regard to the development of sustainable innovations. Innovation not only entails the development of new and more appropriate solutions, but also–to some degree–the destruction of former solutions (Schumpeter, 1980). However, these former solutions stand in close relation to people, such as users and/or creators. Therefore, it is necessary to generate awareness of these diverse effects on different stakeholder groups and not merely make decisions based on a majority principle. Where possible, decision making needs to be based on intense communication and interaction in order to attain consensus. An extensive stakeholder analysis is therefore, a necessary prerequisite (Steiner, 2008). Examples of crucial questions that need to be considered are:

- Who is affected by the specific form of innovation (internal and external stakeholders)?
- What are the value systems and expectations of the stakeholders?
- What might the roles and the creative potential of the stakeholders be within the innovation process?

Further far reaching but also controversial exemplary questions are:

- What might the specific role played by future generations be?
- What about animals as an additional stakeholder group?
- What about rights for the comprehensive "spaceship" earth itself?

The question of how creativity can be utilized without sacrificing one's own values and principles and those of other stakeholders is closely connected with the implementation of sustainability. Creativity has not only led to beneficial developments, but at times, has proven to be disastrous. This calls for an extended perspective of creative performance, which takes into account social and ethical considerations and a revised definition of creativity. If creativity is understood as the ability to produce an outcome that is both novel and appropriate (Lubart, 1994; Barron, 1988; Ochse, 1990), this needs to also call for an outcome that is not only novel and appropriate, but wise as well. Since he has made major contributions in the field of creativity and intelligence research, Sternberg (2003) points out that some of

the world's cruelest despots and greediest business tycoons can still be considered successful and intelligent, even though they have acted at the expense of many other people. Therefore, in addition to intelligence and creativity, wisdom also needs particular consideration. Wisdom can be understood as "the value-laden application of tacit knowledge not only for one's own benefit but also for the benefit of others, in order to attain a common good" (Stenberg, 2003). Sternberg (2003) further states that, "The wise person realizes that what matters is not just knowledge, or the intellectual skills one applies to this knowledge, but how the knowledge is used." For a detailed review of the major approaches to wisdom see Baltes and Staudinger (2000), Sternberg (2003), and Sternberg and Jordan (2005). With creativity as a prerequisite for innovations, this implies taking such considerations into account immediately prior to market implementation, and also at the earliest stages of the innovation process (e.g.,, within the definitional and modeling phases). This allows for not only having a broader view of creativity and its impact, but also for the integration of a truly holistic approach to sustainability. As a complex problem, the development of innovations (i.e., particular sustainable innovations) needs creative solutions and therefore, the utilization of available internal and external creative capabilities.

The development of an innovation is always heavily influenced by a wide variety of impact factors that the innovator cannot completely control and may not even be aware of in some cases. For instance, when developing a radical innovation, uncertainty becomes the determining factor of the system's future. The innovator might have the most expertise within the target market, but relying on experience gained with former products in previous markets is no longer possible since the more radical an innovation is, the higher the uncertainty concerning the reaction of the marketplace is. Traditional means of marketing have very limited success in predicting future market behavior with regard to radical innovations. At best, the observation of lead users (von Hippel, 1986) and the use of future-oriented procedures such as the Delphi-method, and various forms of scenario-analysis (Reibnitz, 1992; Scholz & Tietje, 2002), can support the attempt to depict potential future scenarios. However, they certainly cannot provide a reliable forecast of the future states of a particular system. Future developments of radical innovations cannot be accurately predicted and at most, only relatively rough patterns of development can be discovered. In particular, the overall target of an economically, ecologically and socially sustainable innovation is quite vague. Thus, there is no clear target state to aim at. We are confronted with a highly complex situation with dynamic and non-linear phenomena.

Understanding the complex relations between humankind and nature becomes a prerequisite for overcoming cognitive barriers (Scholz et al., 1998). Because of their specific characteristics, complex problems cannot usually be solved by applying routine problem solving processes and standard solutions, no matter how useful these may be for simple and complicated problems. Instead, complex problems demand innovative solutions, which require creative problem solving capabilities on the part of the problem solving agents. To further clarify the potential of creative problem solving processes below, creativity is discussed in terms of the individualistic and collaborative creativity perspective. Based on a systems approach, it can be said that open creativity is one of the most complex forms of collaborative activity.

Systems of Creativity

Individual Creativity to Open Creativity

In order to generate creative solutions for complex systems, instead of specializing in smaller units of investigation, a more holistic view is required (Mulej, 2007). Authors such as Probst, Raub and Romhardt (1999) stress that complex problems cannot be solved by monocausal thinking within linear cause-effect relations but instead, require holistic systems thinking, or a socio-cybernetics point of view (von Bertalanffy, 1998; von Foerster & von Glasersfeld, 1999; Forrester, 1961; Gomez & Probst, 1999; Probst & Gomez, 1991; Ulrich, 1968; Wiener, 1948). In addition to rational and convergent thinking, the dynamics of systems exhibiting permanently changing patterns require the development of new and creative approaches for solving complex problems. This entails extending standard approaches in order to encompass collaborative problem solving processes at various system levels (i.e., both at a content level so as to cover various disciplines and areas of expertise), and also at the level of organizational design. This includes the system's internal and external potential for creativity (e.g., the use of external creativity professionals in industrial design companies or the use of users and non-users). By directing participants' attention to the most essential system mechanisms, and by preventing an excessively restrictive focus when dealing with highly complex problems, informal systems thinking, and the dialectical systems theory proposed by Mulej (2007) can be very useful (Mulej et al., 2003). These systems provide for the structure and flexibility needed to handle complex innovation systems in an uncertain future.

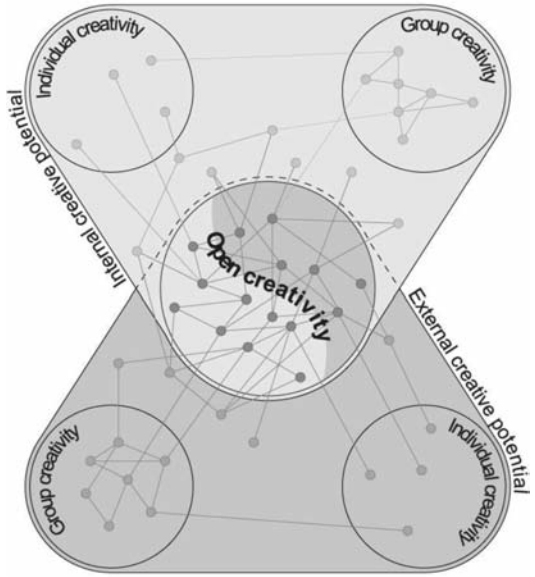
In order to enhance the overall creative capability for generating innovations, the interplay among creative systems of various scales becomes of special interest for releasing and making available the highest possible creative potential. Figure 1 shows that the various scales of creative systems can be roughly divided according to:

- their system affiliation, either the internal or external creative potential of a system (such as an organization), and
- their personal dynamics, either on an individual basis or in interaction with other individuals or groups.

Collaborative creative sources (such as groups, organizations, cooperative activities, and networks), show increasingly higher dynamics compared to individual creative sources. Along with changing behavior patterns, the more stakeholders that are involved (including internal and external creative sources) and the more interaction occurs among them, the higher the system complexity is.

Figure 1 shows that open creativity takes into account the internal and external creative potential of a system (i.e., individuals and groups). Individual creativity is an important ingredient for group creativity and for the overall system's creativity, like that of the organization. When a highly creative and strong individual becomes a driving force for collaboration, it further stimulates the creativity of others. In order to be understood and utilized properly, the single dimensions of creativity are explained in more detail below.

Figure 1: *Sources of Open Creativity*



Individual creativity

Individual creativity is crucial for all other forms of creativity that are needed at the group or organizational level. By focusing on the creative person as an individual, the creative performance can be understood as a function of a person's behavioral style, attention, motivation, specific context (e.g., peculiarities of the problem), knowledge, skills, process expertise, emotional intelligence, the given work environment and the available time (Steiner, 2004). Hence, the creative performance of the individual depends on the individual's competences in the underlying environment, and the time available for the creative problem solving process. The objective is to attain a "competence congruence," required by the creative problem solving process and the individual's competences.

CP_{Ind} = f(Style, A, $M_{I,E}$, Cont, K, Sk, Exp, EI, Env, T,) **(1)**

CP_{Ind}	"Creative performance" of the individual at a specific task
Style	"Behavioral style" of the individual (Czichos, 2001)
A.....	"Attention" encompasses "focused attention" as well as "broad attention deployment" (Runco, 1994)
$M_{I,E}$	"Intrinsic motivation" as a driving force combined with a sufficient "extrinsic motivation" (Amabile, 1997).
Cont	"Context" of the task and the problem solving process (= relevant domain)
K.....	"Knowledge" includes explicit and implicit knowledge with respect to the relevant fields of expertise and the design and management of the creative problem solving process.

Sk	"Skills" encompass context (domain) relevant skills and creativity relevant skills as well (Amabile, 1996, p. 93-95)
Exp	Process "expertise" related to the creative problem solving process
EI	"Emotional" intelligence as the ability to perceive, assess and manage the emotions of one's self and of others (this includes the relation to superordinated positions within the firm such as the principal of the firm, who might not be involved in the process, but who nevertheless has a high impact on the project)
Env	"Work environment" including organizational culture, leadership behavior, management practices, available resources, affect of colleagues and the physical environment of the organization (this is mostly neglected) (Steiner, 2006, 2004)
T	"Time" there is available for the problem solving process. This is not always a question of providing more time for the creative performance, but rather a question of determining what an appropriate amount of time is. Too much time may lend to a loss of focus.

The interplay between single factors forms the basis for the potential creative performance of the individual. Hence, the underlying assumption is that there is not a single typical set of personality traits that characterizes the creative person, but that the interplay between the single variables of CP_{Ind} is more responsible in determining how creative a person can be. Thus, in a complex system, many different factor combinations can lead to creative success.

The creative performance of an individual (CP_{Ind}) is also not constant over time since the variables, including a person's behavioral style, are volatile themselves. While a personality style is typically understood as a constant factor (such as described by the Myers-Briggs Personality Type Indicator (MBTI)), the behavioral style as described by the Life Orientations Method developed by Katcher and Atkins (LIFO-Methodology), describes behavioral preferences and not behavioral competences. An exhaustive overview of diverse typologies on behavioral styles (including the Life Orientations Methodology), as well as personality styles, is given by Czichos (2001). This approach proves especially useful when applied to creative processes. It provides those involved with greater scope for developing effective forms of collaboration, allows for behavioral change and avoids typecasting of people. Something that may have negative influences on attitudes, motivation, and creative climate can lead to substandard performance.

Going a step further, several crucial questions need to be considered when extending the individual creativity perspective. How does the creative performance of an individual person differ from the creative performance within collaboration? How do individual and collaborative creativity influence each other? What are the specifics of collaborative creativity seen from the perspective of open creativity?

Collaborative creativity

The term "collaborative creativity" is a rather confusing one. It begs the question: why can't the expression "group creativity" be used instead of "collaborative creativity?" Although they have a very similar meaning, from a system's perspective, "group" is commonly used with a stronger inward looking perspective, such as a group within a corporation. Collaborative creativity leaves more possibilities for border-crossing creative cooperation. In order to avoid seeing a group as a more stable formation, the term collaboration leaves more space, allows for greater flexibility with regard to team formation over the phases of the innovation process and in terms of the need for different constellations of individuals in different projects. A crucial difference between group creativity and collaborative creativity is that the first implies a more segmented work processes based on the division of single obligations without necessarily having strong interaction between single participants. The latter is more inherently concerned with the mutual processes of creativity. Also, while collaborative creativity captures a large focus, group creativity has a much smaller focus.

Creative collaboration is a crucial process for finding solutions to the complex problem of generating innovations, especially with respect to radical innovation. It is the characteristic of a collaborative entity that the "joint creative problem solving process" takes places in an ongoing interactive process between various units working towards a common goal (such as the development of a new product, a new service, or a new strategy). In this context, the collaborative entity might be a group of interacting individuals, but it might also consist of interacting groups, a group interacting with a professional individual within or outside the own organization, a network of interacting organizations, or even an organization interacting with a heterogeneous external group of professionals and users/non-users. When the collaborative process involves external sources in interplay with the system's internal creative sources, this is considered to be "open creativity" (Figure 1). Collaborative creativity, especially open creativity, calls for considering the impact and creating awareness of the possible diversity of participants engaged in the collaborative process as a result (Steiner, 2008).

Within a collaborative creative problem solving process such as a group or an organization (Amabile et al., 2005; Fay et al., 2006; Ford & Gioia, 1996; Nemeth et al., 2004; Paulus & Nijstad, 2003; West, 2004; Woodman et al., 1993), overall creativity is much harder to determine, since it cannot be assumed that it is just the sum of the single individual performances. It is also much harder to determine because synergies might allow creative solutions to emerge as a result of associative thinking among different people with different backgrounds, different experiences, different value systems and different expectations (Steiner, 2008; Risopoulos, Posch & Steiner, 2004). In addition to their positive effects, collaborative processes can also have considerable drawbacks when process complexity is not considered appropriately. The creative performance of collaboration can be described as a function of the creative performance of the individual(s), the composition of the group, prevailing rules of collaboration, the set of objectives of the underlying project, group productivity, communication peculiarities of participants and the prevailing group climate.

$CP_{Coll} = f(CP_{Ind,}$ Compo, Ru, Obj, Prod, Comm, Clim) **(2)**

CP_{Coll}	"Creative performance of the collaborative entity" (such as a group)
$CP_{Ind.}$	"Creative performance of the individual"
Compo	"Composition" and diversity of the group with regard to disciplines and hierarchies and with respect to system's internal and potential external creative sources
Ru	Group "rules" (e.g., participative or hierarchical)
Obj	Set of stakeholder "objectives" for the project
Prod	"Group productivity" (Steiner, 1972) within the creative problem solving process implies that process losses can reduce the overall productivity of the group. Group productivity also depends on the type of problem at hand; some call for sharing of the task within a group, others do not.
Comm	"Communication" (including the provision of appropriate means of communication for the respective problem solvers)
Clim	Group "climate" "[…] affects organizational and psychological processes such as communication, problem solving, decision making, conflict handling, learning and motivation, and thus exerts an influence on the efficiency and productivity of the organization, on its ability to innovate, and on the job satisfaction and well-being that its members can enjoy." (Ekvall, 1987, p. 183). Climate dimensions might encompass empathy, freedom, positive challenge and involvement, supervisory and organizational encouragement, work group support, sufficient resources, idea time, playfulness and humor, debate and conflict, and risk-taking (Ekvall, 1997; Amabile & Conti, 1999; Steiner, 2004)

With regard to the elements of equation (2), there is no ideal extent or domain for any one element since every element has to be seen with respect to its interplay with the other elements in a specific situation. Innovation processes hardly ever repeat themselves in the same manner, even though a highly sophisticated methodological framework for their generation may exist.

As an illustration, we can consider the effect of "diversity" on creative performance during collaboration. Diversity among the participants engaged in the creative problem solving process is not automatically fruitful (e.g., Williams & O'Reilly, 1998). In fact, it may even be destructive when incompatibilities among those collaborating are too powerful. Diversity can also hamper the creative process if the other constituting factors of creative performance are not aligned appropriately (see equation (2)). That also poses a great challenge for designing the appropriate environment because the more diverse people are with regard to their values and

preferences, including perceived image norms (e.g., Giannantonio & Hurley-Hanson, 2006), behavioral styles, backgrounds and demographic characteristics, the more difficult it is to create an environment that best fits the individual needs. A collaborative entity such as a group that is incorporating different disciplines or individuals from different hierarchical levels of a corporation, will only be able to effectively generate a fruitful creative outcome when the appropriate communication is provided (i.e., a common language basis). If the single behavioral styles of the individuals are mutually complementary, the participants share a common vision for the overall project success. If participants jointly collaborate (i.e., avoid purely segmented individual work in isolation that then is finally brought together), and if groupthink phenomena, polarization and process loss are not overwhelming, the potential positive synergies of collaboration will predominate.

Organizational Creativity

"Organizational creativity" is a special form of collaborative creativity, but differs from "open creativity" in that it does not encompass the external creativity potential found among professionals or users and non-users. Instead, it only makes use of the organization's (such as a corporation, or NPO) internal creativity potentials (Figure 1). The internal creativity potential of an organization then results from the interaction arising between creative individuals and creative groups.

$$CP_{Org} = f(CP_{Ind/Int,}\ CP_{Coll/Int}) \qquad (3)$$

CP_{Org} ..... Creative Performance of the organization

$CP_{Ind/Int}$ ..... Creative Performance of the Individuals of the organization (as a source of internal creativity)

$CP_{Coll/Int}$..... Creative Performance of groups within the organization (as a source of internal creativity)

The greater the number of inner-organizational levels that are involved within the collaborative creative process, the higher the inherent complexity of the creativity system. Hence, appropriate means of communication are a prerequisite for the functioning of complex creative problem solving processes. Without these, it will prove impossible to engage in effective communication.

Open creativity

Accelerating change, increasing problem complexity, higher demands for innovation, and the crucial question of how to create a sustainable future are the driving forces behind the need for greater individual and collaborative creativity, as was discussed earlier. In addition, two paradigm-shifts, one involving innovation characteristics, and one involving general thinking patterns, further demand more sophisticated methods for making use of potential sources of creativity based on the idea of open creativity.

According to the *Harvard Business Review's* breakthrough ideas for 2007, we are now facing a paradigm shift from producer-centered innovation to user-centered innovation (von Hippel, 2007). This calls for a reorientation in the way innovation is done.

According to von Hippel (2007), 70% to 80% of new product development fails "not for lack of advanced technology, but because of a failure to understand users' needs."

Another paradigm shift is taking place with respect to prevailing models of thinking. As Pink (2005) points out, society is changing now from the Information Age which is dominated by "left brain" capabilities (i.e., sequential, logical, and analytical thinking), to a Conceptual Age that further extends the capabilities of the Information Age to include right-brain qualities such as inventiveness, empathy and "big-picture capabilities" that show more non-linear, intuitive, and holistic thinking patterns.

Both the above paradigm shifts strongly support the usefulness of an open creativity system which makes use of internal creative capabilities and accessible external sources of creativity as a special form of collaborative creativity (see Figure 1 and equation (4)).

$$OC = f(CP_{Int}, CP_{Ext}) \qquad (4)$$

OC	Open Creativity
CP_{Int}	Internal Creative Performance of a system (such as an organization or a region)
CP_{Ext}	External Creative Performance of a system

The concept of "Open Creativity" is based on a systems thinking perspective. Open relates to an open system, implying that the sources of creativity cannot only be found within the borders of the system (i.e., an organization or a region), but that sources outside these borders are gaining increasing importance for the system's ability in creative problem solving. Therefore, the concept of open creativity calls for an extension of the problem solvers involvement by further potential stakeholders from outside the system's borders. An example of an open creativity system would be an industrial enterprise engaged in a joint problem solving process with independent industrial design companies in the role of "creative spark" or innovative "think-tank." The philosophy of open creativity allows the involvement of external professional and non-professional parties as well, including lead users and present non-users. Non-users might be the customers applying the innovation of tomorrow. Such stakeholder groups are not only important for the later economic success of the innovation, but also for social sustainability. Hence, the question is not only how innovations can best fulfill the needs of the customers, but also how single players or groups such as lead users can become active players within the creative problem solving process. This lead user concept was originally introduced by von Hippel (1986, 2005). This might also entail the inclusion of professionals and non-professionals within product development workshops and rapid-prototyping processes (Steiner, 2007b). Additionally, the involvement of scientific institutions within the creative problem solving process (described as the transdisciplinary approach), can also lead to an improvement of the accessible creativity potential (Steiner & Posch, 2006; Steiner & Laws, 2006; Scholz & Tietje, 2002).

While Chesbrough's concept of "open innovation" takes into account the whole innovation system, including considerations of how to find the most suitable business model (either this exist within or outside the company), the concept of "open

creativity" focuses mainly on the joint working process of creative problem solving in collaboration with internal and external problem solvers (Chesbrough, 2006). The open innovation concept "[…] assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, […]" (Chesbrough, 2006, p. 24), without going deeper into the underlying creative working process. However, the open creativity concept is about how to collaborate in order to develop creative outcomes, instead of combining already available internal and external ideas to create value. In other words, open innovation involves more of what makes today's firms more innovative and successful. Open creativity however, revolves around how to make use of all available internal and external creative sources as the basis for innovation and economic success. Since the "open innovation paradigm" has a broader focus than previous "closed innovation paradigms," and already calls for an extended systems perspective, the open creativity concept can fruitfully contribute to an open innovation paradigm that makes use of the most appropriate internal or external business models.

The innovation project becomes the linking element for synergistically utilizing internal as well as external sources of creativity. Focusing on open creativity as an attempt to synergistically utilize internal and external sources of creativity requires that the creative performance of collaborative effort is not just viewed as a simple summing up of individual creative performances, but that it be extended to include communication processes, since these are a crucial element in collaborative creative problem solving (equation (2)). Communication as the link between external and internal creativity sources has outstanding importance for the collaborative process and calls for the provision of adequate means with regard to creative processes. Collaborative creativity has been said to be even more crucial for open creativity. In order to handle these complex processes, support can be provided by design-based means of communication such as rapid-prototyping, modeling, storytelling and persona-based scenarios. These are especially useful because they make use of more human senses than traditional methods usually do (Steiner, 2007b). They can also become crucial vehicles within creative collaboration in terms of complex issues, since many traditional means of communication are inappropriate for doing so. Besides, in order to constructively and synergistically include external creativity within the organization, the crucial roles of a common, appropriate, and "understandable" language, complementary value systems, behavioral styles and clearly defined competences become obvious.

Though creative effort within an organization occurs in relation to one specific organizational setting (e.g., within a specific culture, climate, or leadership environment), by bridging internal and external creativity, two potentially divergent organizational views are brought together which in turn, helps create positive synergies within the cross-border problem solving process. The appropriate organizational, environmental and communicational means have to be established in accordance with the given system peculiarities. In order to illustrate how collaborative creativity may be directed with a view towards generating open creativity, the Planetary Model is introduced below.

The Planetary Model: a Framework for Dealing with a System's Internal and External Potential for Collaborative Creative Problem Solving

Making use of and actually further improving the inherent creative potential of a system – such as the organization and its environment, the innovation/creativity professionals, the users and non-users – requires an understanding of operation processes. Since creative problem solving processes are complex systems exhibiting nonlinear behavior (e.g., Joye & Van Locke, 2007), and on biomorphic constructions (Steiner, 2005) regarding creative systems, a flexible guiding framework is needed in order to avoid becoming lost within destructive chaotic disorder, and also to learn how to cope with uncertain and nondeterminable future system conditions.

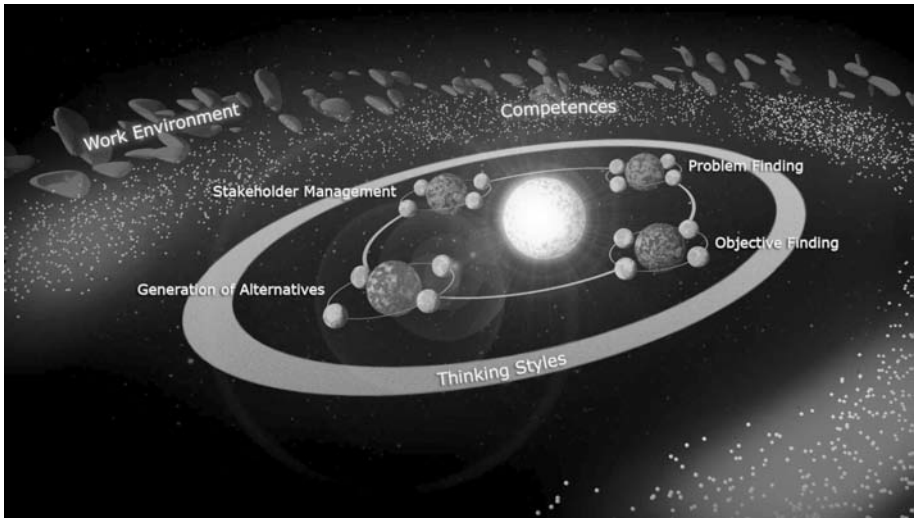
In order to help organize the complex system of creatively generating ideas for innovations, the Planetary Model is introduced. This model is intended to provide internal guidance by making use of the metaphor of a planetary system that consists of the sun, four planets with four moons, and three kinds of cosmic clouds. In contrast to most other models used for explaining creative processes, this model takes into account the dynamic interaction between the subsystems of the creative problem solving processes. This means that the complex and real-life processes of creative problem solving can be better understood. Collaborative creative problem solving processes, in terms of both integration of internal and external creative potential, and the need to take account of individual creative effort, are always determined first by the peculiarities of the underlying system (which may or may not be reflected in the problem definition). They are then determined by the related system objectives, the potential for solution development (usually combinations of new and existing solutions enable a broad set of options to be made available for generating appropriate solutions) and by the choice, involvement, and/or participation of the appropriate problem solving actors in accordance with the specific needs of the specific stage of the problem solving process. Additionally, the problem solving group possesses the appropriate competences and make use of the right mix of divergent and convergent thinking capabilities within an appropriate supportive environment. This enables the inherent creative capabilities of those involved to flourish.

The Planetary Model can roughly be divided into three dimensions: the sun, the planets and the cosmic clouds. In the middle of the Planetary Model is the sun, standing for the solutions and ideas generated within the problem solving process. Although solutions, as well as ideas, are both outcomes of the creative problem solving process, solutions are directly connected to a certain problem, whereas ideas may have no obvious relation to the problem one is working on. The sun is surrounded by the planets: "Stakeholder Management," "Problem Finding," "Objective Finding," and "Generation of Alternatives." These act as the relevant subsystems of the creative problem solving process. Each planet also acts as a potential source for solutions and ideas, not only the planet "Generation of Alternatives." The sun and all the planets are embedded within cosmic clouds, which stand for the needed thinking styles and competences, as well as the work environment (Figure 2).

In an organizational context, creativity and creative problem solving are usually focused on the generation of solutions and ideas and consequently, on the creation of

knowledge. Therefore, it needs to be stressed that the creative problem solving process is by no means restricted to problems presented to the problem solving agents. Instead, it is a characteristic of highly creative organizations and individuals that they continuously work on and search for new problems. Based on Popper's words "all life is problem solving" (Popper, 1999), this extension also proves highly fruitful in creative problem solving processes aiming at the generation of innovations.

Figure 2: *Planetary Model of Collaborative Creative Problem Solving*



Since the whole system is strongly interconnected, the planets can be seen neither in isolation from each other, nor as being isolated from the influence of the rest of the cosmos. They are all continuously interacting. These interdependences also lead to permanently changing patterns. Circularity instead of linearity becomes the determining element.

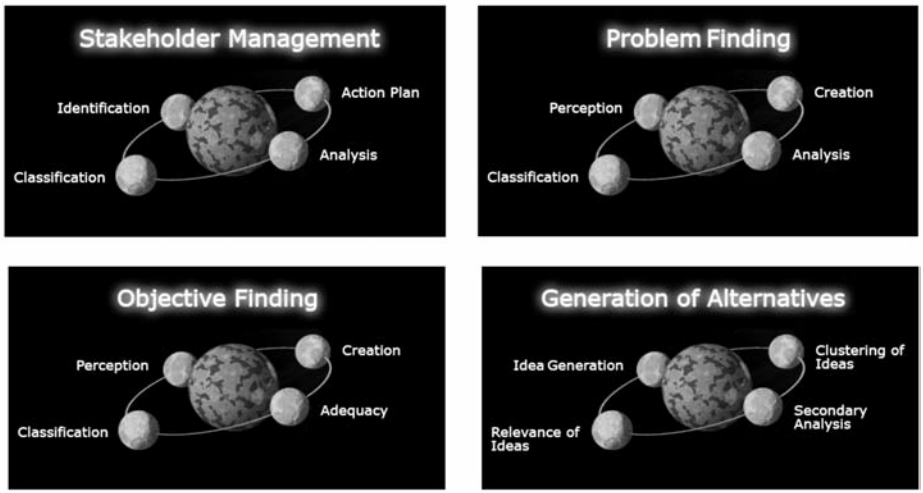
In focusing on the single planets, it becomes obvious that each planet itself stands for another more detailed microcosmos, in which single moons (as subsystems of the single planets) revolve dynamically around the planets. Moreover, the moons are influenced by the other planets and the cosmic clouds as well (Figure 3).

The planet "Stakeholder Management" is surrounded by the moons "Stakeholder Identification," "Stakeholder Analysis," "Stakeholder Classification," and "Stakeholder Action Plan." Who are the relevant stakeholders with respect to the creative problem solving process and its outcome? Who should be involved actively within the process? An example would be the involvement of non-users within the problem finding stage. This could help in finding out what prevents someone from using a certain product and could also act as a starting point for developing new product characteristics.

The planet "Objective Finding" is surrounded by the moons "Perception of objectives," "Creation of objectives," "Adequacy of objectives," and "Objective classification." Relevant questions here are: How far is the objective of the creative problem solving process known, not only with regard to the innovation project at

hand, but also with regard to its stakeholders? What stakeholders are to be involved? How can awareness about subobjectives among problem solvers and stakeholders be generated? Is the set of project-related objectives consistent with meta-objectives, such as organizational vision, strategy, or sustainability objectives? What about individual time preferences? How far can differences with regard to priorities among stakeholders be negotiated in order to get from individual to collective objectives?

Figure 3: *Planetary Model: the Planets with their Moons*



The planet "Problem Finding" is surrounded by the moons "Perception of problems," "Creation of problems," "Problem analysis," and "Problem classification." Further relevant questions here include: How far is the overall problem known or how can it be discovered? What are the stakeholder specific perceptions of the problem and how do their respective priorities differ? To what extent does the problem need to be reconstructed, discovered, or simulated (Runco, 1994)? Within the innovation generation phase, the creative problem solving process is usually related to various interconnected single problems. To what extent are nested subproblems a part of the overall problem? Distinctions can also be made between both problem content and characteristics. For example, a problem can be related to technical or user-related issues. Although the overall problem is complex, it can also contain simple and complicated sub problems that may be solved by existing means, based on rational and logical thinking processes.

The planet "Generation of Alternatives" is surrounded by the moons "Secondary analysis," "Idea generation," "Clustering of ideas," and "Relevance of ideas." Crucial questions to be answered are: How can creative solutions and ideas be generated? How can available solutions and new creations be compounded or combined? What kind of creativity and other problem solving techniques can be applied while still taking into account the peculiarities of the single problem solvers and the specific stage of the problem solving process (i.e., "System-Analysis and Design," "Conceptualization,"

"Specification," and "Selection and Implementation") (Steiner, 2007a). How relevant are the generated potential solutions and ideas with regard to the underlying objectives? As already mentioned, novel solutions and ideas are not only generated within the planet "Generation of Alternatives," but often occur within the other planets as well. As an example, the discussion of a problem or potential set of stakeholder objectives can be a powerful source of creative sparks.

Although the sun includes specific procedures of instrumental evaluation and selection, in real world scenarios this is only one facet of evaluation and selection. However, in the context of the sun, concentration is on potential solutions such as dependence on a generated set of alternatives, a formal and an informal evaluation. Selection procedures also occur for all other planets and moons. These concern the interpretation of a problem, the construction of goals and the choice of certain creativity techniques that have to be applied.

It also seems necessary to broaden the paradigms of many traditional approaches of innovation management since they often consider problems as something that are given. Within sustainability-oriented change processes, a shared vision between the various stakeholders acts as a set of meta-objectives that is usually not something given but instead, has to be constructed. Additionally, as expressed in the planet "Objective Finding," cognitive processes play an important role. Hereby, the planet "Stakeholder Management" strongly influences the process of the creation of a shared vision among the problem solving agents and other stakeholders. Consequently, the linearity of cause and effect can no longer be assumed. Therefore, the Planetary Model can support problem solving agents who are working together with other stakeholders on the complex task of developing sustainable innovation. This may include students and teachers working on case studies (e.g., in a regional context) (Steiner & Laws, 2006).

The Planetary Model as a Guide within the Innovation-oriented Working Process

The Planetary Model can also aid appropriate design of the creative problem solving processes and support the provision of a suitable creative climate at various stages of the working process. As shown, the Planetary Model realistically determines how creative solutions and other ideas are generated within the process of problem solving. Nevertheless, the problem solving agents need further process orientation when working on complex problems. By combining this model with the various single stages of a sequential innovation-oriented working process, which can easily be translated into specific working steps, the project related performance can be further improved by providing for positive organizational effects in the long run, and by raising the probability of achieving sustainable innovation.

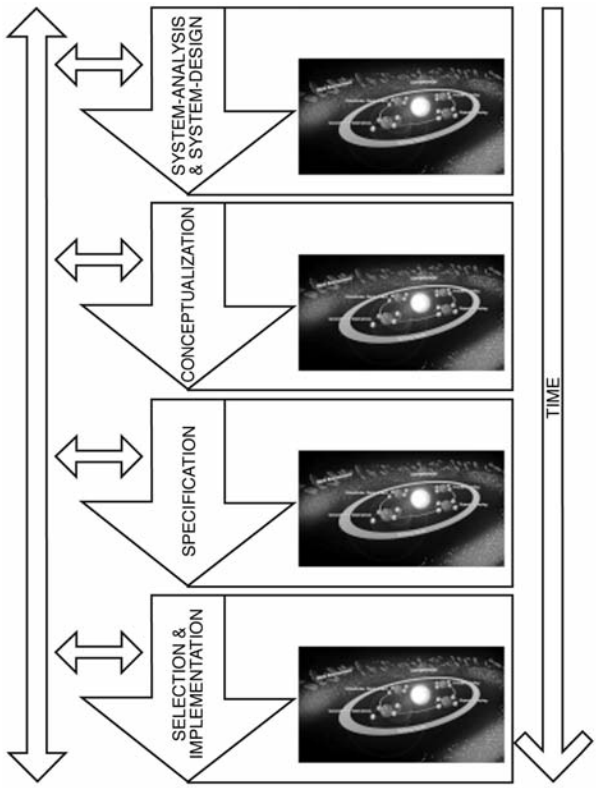
The Planetary Model aids understanding of creative processes by providing orientation for sequential processes without running the risk of oversimplification (Figure 4). This also implies enabling flexibility as well as providing necessary structures. In fact, the Planetary Model could be combined with every other sequential process guide. Here, working steps are introduced that are especially adequate when working on complex real world problems.

The underlying working process is roughly divided into four main interconnected phases:

1. System Analysis and Design
2. Conceptualization
3. Specification
4. Selection and Implementation

It is important to be aware that these four phases are intended to assure an effective and efficient work flow, allowing for constant revision of earlier process stages, while avoiding erratic jumps back and forth. This four-stage process is based on personal experience gained in managing product development and industrial design projects. As an example, IDEO's innovation process characterizes the process focus of one of today's most innovative companies, and it consists of the following: "understand," "observe," "synthesize," "visualize-realize-refine-evaluate-visualize" (as ongoing circle), "communicate," and "implement". An example of another broadly applied model is one provided by Thom (1980), based on a three-stage innovation process. Overviews of various innovation processes are provided by Vahs & Burmester (2002).

Figure 4: *Creativity management within the innovation process*



System Analysis and Design is the basis for understanding the underlying system, its main elements and interdependencies, its structure and patterns of behavior, its environment, and its initial state. It also includes some rough ideas or a rough vision of the target state of the system. Based on the understanding of this system identified within the conceptualization phase, different variants for future developments of the systems or potential solutions for an improvement of the underlying system are created by applying all kinds of rational and creative means. During the specification stage, the goal is to choose among potential alternatives, reduce them to the most promising ones, and move forward to more detailed developments. In the last stage, final selection between the remaining potential alternatives provides the basis for further measures of implementation concerning the final outcome of the whole innovation process.

Real world innovation processes, such as product development processes, require an easily understandable project structure in order to provide the project team with orientation. The danger of reducing a complex system, such as the underlying creative problem solving process needed for the creation of an innovation, into an easily understandable, interconnected four-stage working process that is also easy to communicate, lies in the potential of dangerously oversimplifying a complex problem and consequently being confronted with the negative outcome of having neglected important system peculiarities.

In order to overcome that potential danger, I suggest a two-dimensional procedure for the working process. Firstly, the four stages of system-analysis and design, conceptualization, specification and selection and implementation form the basis for structuring and guiding the working process in the sense of a project management philosophy. Secondly, every stage has to be seen in the context of its implications for the whole problem solving process and be expressed within the Planetary Model. The reason for this is that the ongoing problem solving process produces further knowledge and understanding of the whole problem solving system as perceptions of problems and objectives change in interaction with new stakeholder solutions and ideas. Therefore, each stage always has to be considered with regard to the problem, the system of objectives, the implications for the various stakeholders, and the resulting impact on the generation of alternatives in interplay with the needed thinking styles and competences. Interplay with the work environment also needs to be considered.

By going from one stage of the innovation process to the other, and consequently moving along the timeline, the system itself achieves increasing precision and concreteness with respect to the target state of the system. Potential solutions are attained, as in an improved level of knowledge, not only concerning the potential solutions themselves, but also in terms of process capabilities and experience gained.

The model described here has been applied and further adapted in various projects within industrial design, mainly as part of a joint endeavor of the School of Industrial Design at the University of Applied Sciences in Graz and various companies such as Audi and BMW. The model has also been used in other realworld innovation projects carried out in cooperation with industry and industrial design companies.

Conclusions and Directions for Future Research

This paper is directed towards creativity scholars as well as business people involved in real-life innovation processes. It was found that concentrating purely on the creative capabilities of individuals is seldom sufficient for creating successful innovations. Additionally, the increasing complexity of most innovation systems requires a collaborative creative effort that often exceeds the borders of the individual organization, and calls for the involvement of further external stakeholders based on an open creativity system. To handle creative processes within such open creativity systems, restricted research perspectives, such as approaches which focus purely on personality traits, or the application of methods aiding the generation of creative ideas like creativity techniques, are far too limited and only help generate partial understanding of isolated subsystems within the overall system of collaborative creativity. Consequently, the Planetary System, as a model for understanding and dealing with collaborative creativity involving internal and external creative potential, needs to be employed as well. The utilization and potential improvement of the overall creative capabilities of the underlying system, serve as vehicles for dealing with ill-defined complex problems in a real-life context. For this, the general model of collaborative creativity needs to be implemented within a practicable working process for the generation of innovations in order to provide orientation and process advice for those going through the "adventure" of innovation generation.

Empirical findings gained from Austrian and German industrial design companies provide tentative support for the model (Steiner, 2004), but more comprehensive empirical research is needed, especially with regard to collaborative creative problem solving within innovation systems based on cross multiple levels of analysis. Consideration of creativity systems must be undertaken. This includes people, problem solving processes, supportive environments and methodological support. Hence, potential cultural differences in leadership philosophies, inter and transdisciplinary collaboration, applied forms of communication designed to enhance creativity and work environment all need further investigation as well. Hereby, systems thinking might play a key role.

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Vision Analysis on Taiwanese Businesses in China

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This study utilizes the vision concept to construct visional indices for Taiwanese business in China. The study summarizes two dimensions: Vision Perception and Organizational Management. The research structure is based on two dimensions and the factors under each. FAHP is used to analyze the opinions collected from a sample of managers and members of Taiwanese businesses in China. The study found the top five critical indices to be Leader Philosophy, Leader Concept, Interactive Communication, Environmental Assumption Toward Leader, and Personal Life Planning. A discussion of the key findings and suggestions for future research is provided.

For historical reasons, Taiwan faced opposition and isolation from China since 1949. After 1988 however, China invited Taiwanese businesses to come and invest through several preferential regulations. Facing increasing wages, eco-awareness, and low-cost competition from developing countries, the attraction of cheap labor cost and ancillary regulations from China, some Taiwanese businesses still decided to invest there. After that, high-tech industries in Taiwan began entering China. There is a stream of literature that indicates that not all investments in China were successful. Some faced managerial dilemmas, such as employees' attitudes, values, and habitual problems. To solve these divergent problems, it became necessary for Taiwanese businesses to develop a general sense of direction to guide the organization and its employees (Adamson, 2004; Dionne et al., 2004; Barthélemy, 2006).

Businesses accomplished this with breakthrough management of divergent problems. Vision is a basic element of sustainable development (Duncan, 2001). A body of studies pointed out that the most successful strategy is based on a clear vision (Adamson, 2004; Barthélemy, 2006) and therefore, is necessary to have visionary leadership. Studies also argue that a leader could announce his/her goals to help the organization build a shared vision, promote resource translation, confirm commitments made by members and motivate them to make the shared vision come true (Ashcroft, 2002; Edgar & Nisbet, 1996; Godet, 2001; Patton, 2003; Reddington, Withers & Williamson, 2004). In this regard, the present study discusses the development of vision for Taiwanese business in China by constructing visional indices.

Literature Review

Organizational Vision

In building a global business or operating a high performance organization, there is often a conflict between managers and employees since both have different visions at times. Thus, once they resolve their conflicts and develop a shared vision and operating directions, it is possible for them to achieve high performance (Ananthanarayanan & Gibb, 2002). Extensive literature states that organizational shared visions bring a united voice, compliance, and nourishment for sustained growth from members (Barthélemy, 2006; Buklin, 2003; Christianson, 2003; Cole, Harris & Bernerth, 2006; Hodgkinson, 2002; Johnson, 1999; Karr, 2005; Krais & Bloomfield, 2005; Lipton, 2004; Rosenberg, 2003; Williams, 2005). Vision serves as an inspiration and a guiding idea. In addition, vision also offers an image of the future (Denton, 1997). The vision also has to be different from competitors (Killen, Walker & Hunt, 2005) and must contain unique meaning to help leaders produce special outcomes (Wibowo & Kleiner, 2005). An increasing amount of literature also reveals that an organization has the ability to change problems into opportunities by creating a shared vision to motivate the core value of members' behavior. Personnel transferring, organizational restructuring and consciousness revolution can also be used to develop more values (Denton, 1997; Friedman, 2006; Kouzes & Posner, 2007; Marquard, 2002; Saxberg, 1993; Skinner & Mabey, 1997). Organizational members can also use self-management first (Covey, 1994; Denton, 1997; McClendon, 2003; Wibowo & Kleiner, 2005) through shared vision.

Vision Perception

Many different forms of literature point out that shared vision comes mainly from a leader's vision. The leader not only spreads his or her vision, but also communicates with organizational member. The leader also tries to understand their thinking and personal visions in order to achieve a shared vision (Draper, 2006; Razeghi, 2006; Streharsky, 1997; Tanda, 2000). In this regard, this study argues that both the leader's and members' vision are the core values of the development of organizational vision.

Leader's Vision

Most importantly, the leader should have the ability to meet followers' needs (Day

& Schoemaker, 2006). Leaders who adopt transformational and visional leadership style must have a sense of the environment. Leaders also need to present viewpoints and assumptions for both the present and future (Glover, Friedman & Gordon, 2002a). They have to build self-awareness and create these four characteristics: cultural competency, knowledge management, synergy from diversity, and holistic vision (Faure, 2006; Glover, Rainwater & Friedman, 2002b; Landale, 2005).

The leader also needs to have intuition, creativity and imagination (Hackett & Spurgeon, 1998). Leaders can look ahead to a future direction (Landale, 2005) and produce a unique and profound "end in mind" vision by integrating factors like parascience, transpersonal science, philosophy, and management (Cacioppe, 2000). This can also be achieved by basing the vision on values and experiences (McEwan, 1998; Kowalski, 1999). Leaders can utilize personal philosophy, concept and thinking, in order to remain flexible and make assumptions for the future (Bolton, 2005; Gragnolati & Stupak, 2002; Reddy & Gupta, 2006). The visions they put forth must also be based on factual customer and market insights, leadership committed to perpetual innovation, alignment across the extended enterprise and organizational capabilities that make innovation habitual (Byrne, Lubwe & Blitz, 2007; Faure, 2006; Glover et al., 2002a; Tanda, 2000).

The creation and development of vision needs a shared concept (Hackett & Spurgeon, 1998; Johnson, 1999; Razeghi, 2006). The leader translates his or her vision into an organizational vision and improves that vision (Day & Schoemaker, 2006) by abstract concepts like hopes and dreams (Gragnolati & Stupak, 2002). He or she must enunciate clearly and share an eager vision (Gokenbach, 2003) to present conscientiousness and respect toward active followers (Williams, 2005) in order to rid those elements that cause members to lose their enthusiasm (Kouzes & Posner, 2007; Streharsky, 1997;)

Leadership is a philosophy that manifests itself in many ways in daily life, whereas management is an identifiable process (Gokenbach, 2003; Kibort, 2004). When considering leadership style, the leader needs to have an in-depth understanding, commit to self-actualization, and put self-concept and leading developmental plans into effect (Bolton, 2005; Hanna & Glassman, 2004). Before asking people, the leader first should present his/her working style and behavior (Gabris, 2004; Khan, 2006). He/she will create opportunities and shoot for their own concept by committed motivation (Allio, 2005; Byrne et al., 2007; Friedman, 2006; McKee, 2003; Patton, 2003; Senior, 2004; Wibowo & Kleiner, 2005). Based on the above literature, this study extracts four evaluating indices crucial for developing a shared vision: Leader Philosophy, Leader Concept, Environmental Assumption toward Leader, and Leadership Style.

Member's Vision

Related research has argued that the member's vision will have beneficial effects for people affected by it and will also incorporate the personal values of participants (Johnson, 1999). Personal value-based vision is the result of members' self-exam, learning, confirming self-value and knowledge skills. Increasing life desires and planning come from past experiences and future visions. Life planning concerns the

adaptability of self-skill and knowledge. It seeks speedy adjustment, continuous learning, job identification, and long-term activity on the job (Jans, 2004; Kouzes & Posner, 2007; Neck & Milliman, 1994). In this regard, leaders need to help members improve job satisfaction and find meaning in what they do.

Recent studies also indicate that members exhibit different behaviors and responsibilities through self-cognition (Glover et al., 2002a). Leaders upgrade members' knowledge, strengthen value-cost ratio and build up "outcome" concepts with their communication (Moorcoft, 2006). When shared vision and organizational commitment have been developed, members' learning will be a great benefit for an organization (Boyle, 2002). Thus, the process of developing organizational vision needs not only members' input but their agreement also. Such coherence must take into consideration members' lives, must upgrade members' commitment and also strengthen their self-cognition (Hackett & Spurgeon, 1998; Boyatzis & Akrivou, 2006). In accordance with this part of recent research, the study summarizes three evaluating indices crucial for the development of a shared vision: Personal Life Planning, Organizational Commitment, and Self-Cognition.

Organizational Management

Vision construction is a creative process. It involves the appearance of organization change and whole organizational performance in the future. Thus, it is necessary to create a suitable organizational culture and structure to motivate members and also to find a shared direction in order to make organizational vision come true (Allio, 2005; Day & Schoemaker, 2006; Faure, 2006; Gragnolati & Stupak, 2002; Karr, 2005; Kodama, 2006; Moorcroft, 2006; Zaccaro & Banks, 2004). Based on these recent studies, the present study deems that organizational culture and structure are key characteristics to developing a successful organizational vision.

Organizational Culture

To make the vision come true, it is necessary to build an appropriate organizational culture, to create an open and cooperative communicative atmosphere, to arouse members' needs, and to also change members' thinking (Eigeles, 2003; Friedman, 2006; Fuggett, 1999; Glover et al., 2002a; Kibort, 2004; Moorcroft, 2006). In addition, leaders need to handle the cultural diversity of members (Karr, 2005). Leaders should also promote the different backgrounds of members in order to emphasize organizational direction (Glover et al., 2002a; Moxley, 2004). Based on the above literature, the study argues that the organizational culture plays both an invisible and a critical role.

Numerous studies indicate that communication plays a crucial role in developing shared relationships (Hackett & Spurgeon, 1998; Kelly, 2000; Cacioppe, 2000). Vision gives an organization a "move-in" direction and vision-based communication offers a credible way to move towards that direction (Kouzes & Posner, 2007; Skinner & Mabey, 1997; Wibowo & Kleiner, 2005). In this regard, without interactive communication between leaders and members, it could be difficult to develop a shared vision within an organization.

Leaders who have vision should inspire members to perform at their best on a daily

basis (Lipton, 2004). Inspiring members in such a way requires visional delivery (Zagotta & Robinson, 2002). The process in visional delivery is to listen to members, to search for a shared direction, to inject life into vision, to state a core concept, and to search for shared value (Kouzes & Posner, 2007). Therefore, vision delivery and sharing are also critical in constructing organizational vision.

Vision is both dynamic and proactive (Louisot, 2003; Byrne et al., 2007). Vision also represents leaders' convictions, worldviews, values and long term-oriented meaning (Killen, Walker & Hunt, 2005). Based on the above statement, innovative thinking is very important (Doppelt, 2003; Karr, 2005). Vision offers a long-term goal in the work process (Draper, 2006), and innovative thinking reallocates organizational strategic behavior (Killen et al., 2005). Both of these reveal the core ability in promoting organizational competitive advantages (Zaccaro & Deanna, 2004). Thus, organizations which hold such visional capacity could challenge competitors and offer extensive advantages (Day & Schoemaker, 2006).

Vision is a description of a future state that contains crucial field identification, such as benefit, growth, and quality (Karr, 2005). It means that concern about members' rights in the development of vision is important. Therefore, leaders need to build up a suitable environment, appropriate entrepreneurship, and a flexible relationship with members (Senior, 2004) by listening, communicating about goals and their meaning, and developing a trusting organizational atmosphere to motivate members to make their vision come true. In addition to utilizing extrinsic rewards, intrinsic rewards such as prestige, innovative opportunity, job challenge, turning problems into opportunities, and innovative design and ideas are also preferable in order to upgrade job satisfaction, commitment, and performance (Robbins, 2002; Kouzes & Posner, 2002; Barthélemy, 2006). According to a stream of literature, the study summarized five evaluating indices critical to develop a successful shared vision: Interactive Communication, Long Term-Oriented Thinking, Innovative Thinking, Vision Sharing, and Motivated Planning.

Organizational Structure

Organizational structure represents the cooperative relationship of members in an organization (Cummings & Worley, 2001). An organization needs clear roles and suitable relationships that are based on visional strategy operations and keeping current members. Vertical and horizontal relationships in an organization are interdependent. Thus, it ought to be seen as a part of a whole business. In addition, it also needs an appropriate allocation. An effective framework also needs the right person, relationship, and resources (Senior, 2004). There are three types of organizational structure: Learning, Matrix, and Bureaucratic (Cummings & Worley, 2001). After interviewing related background experts, these three types of organizational structure were found to be suitable for utilizing Taiwanese business in China and thus, are adopted in this study.

Introduction of Taiwanese Business Invested in China

Since 1988, China has attracted many Taiwanese businesses by offering favorable regulations, especially for small and medium-sized industries. The investment in

China can be separated into three stages: explore (1981–1986), extent (1987–1991), and overall investment (after 1992). Based on information from the Taiwan Department of Statistics of Ministry of Economic Affairs, the speed of investment in China by Taiwanese business is increasing. The sum of Approved Chinese Investment in 1991 was USD 1.229 billion, and last year it was USD 7.642 billion. Total investment from February to September 2007 was USD 6.8567 billion. Compared to 2006, the annual growth rate was 28.8%, or 71% Outward FDI (Department of Statistics, Ministry of Economic Affairs, 2006). The main investment industry type is a traditional manufacturing organization. Computer, electronic, and optical industries are also increasing. With growth investment and expansive industrial fields, the economic-based interdependence between Taiwan and China is upgraded. However, Taiwanese businesses in China have to face problems from law and infrastructure as well as management issues. Some of these issues include different employee backgrounds and the communication between Taiwanese and China's managers (Department of Statistics, Ministry of Economic Affairs, 2006). According to the above information, it is critical for Taiwanese businesses to emphasize the problems of operational management.

Fuzzy Analytic Hierarchy Process (FAHP)

Fuzzy Set Theory

Professor L.A. Zadeh first came up with the fuzzy set theory in 1965 while trying to solve fuzzy phenomenon problems such as uncertain, incomplete, unspecific, and fuzzy situations that exist in the real world. Fuzzy set theory has more advantages to describe set concepts in human language than the traditional set theory does. The theory shows unspecific and fuzzy characteristics in language on the evaluation and it uses a membership function concept to represent the field in which a fuzzy set can permit situations such as "incompletely belong to" and "incompletely not belong to."

Fuzzy Number

We order the Universe of Discourse such that U is a whole target we discuss, and each target in the Universe of Discourse is called an element. Fuzzy $\tilde{A}$, which on U stated that random $x \rightarrow U$, appointing a real number $\mu_{\tilde{A}}(x) \in [0,1]$. We call anything above that level of x *under A*.

Universe of real number *R* is a triangular fuzzy number (TFN): $\tilde{A}$, which means $x \in R$, appointing $\mu_{\tilde{A}}(x) \in [0,1]$, and

$$\mu_{\tilde{A}}(x) = \begin{cases} (x - L)/(M - L), & L \le x \le M, \\ (U - x)/(U - M), & M \le x \le U, \\ 0, & otherwise \end{cases}$$

The triangular fuzzy number above can be shown as $\tilde{A} = (L, M, U)$ where *L* and U represent fuzzy probability between the lower and upper boundaries of evaluation zinformation, as Figure 1 shows. Assume two fuzzy numbers $\tilde{A}_1 = (L_1, M_1, U_1)$ and $\tilde{A}_2 = (L_2, M_2, U_2)$:

(1) $\tilde{A}_1 \oplus \tilde{A}_2 = (L_1, M_1, U_1) \oplus (L_2, M_2, U_2) = (L_1, + L_2, M_1 + M_2, U_1 + U_2)$

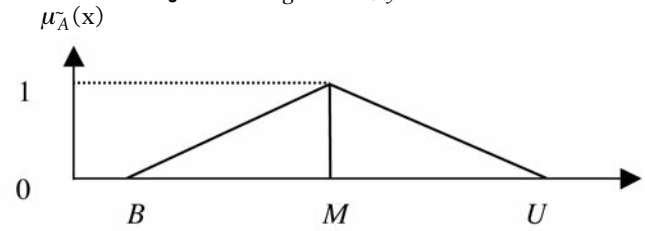
(2) $\tilde{A}_1 \otimes \tilde{A}_2 = (L_1, M_1, U_1) \otimes (L_2, M_2, U_2) = (L_1 L_2, M_1 M_2, U_1 U_2)$, $L_i > 0$, $M_i > 0$, $U_i > 0$

(3) $\tilde{A}_1 - \tilde{A}_2 = (L_1, M_1, U_1) - (L_2, M_2, U_2) = (L_1 - L_2, M_1 - M_2, U_1 - U_2)$

(4) $\tilde{A}_1 \div \tilde{A}_2 = (L_1, M_1, U_1) \div (L_2, M_2, U_2) = (L_1 / U_2, M_1 / M_2, U_1 / L_2)$. $L_i > 0$, $M_i > 0$, $U_i > 0$

$\tilde{A}_1^{-1} = (L_1, M_1, U_1)^{-1} = (1 / U_1, 1 / M_1, 1 / L_1)$, $L_i > 0$, $M_i > 0$, $U_i > 0$

Figure 1: *Triangular Fuzzy Number*



Fuzzy Linguistic Variable

The Fuzzy linguistic variable is a variable that reflects the different levels of human language. Its value represents the range from natural to artificial language. When precisely reflecting the value or meaning of a linguistic variable, there must be appropriate ways to produce change. Variables on a human word or sentence can be divided into numerous linguistic criteria, such as equally important, moderately important, strongly important, very strongly important, and extremely important (Figure 2). From these linguistic criteria, it can then be determined how specific fuzzy numbers, and their importance, correspond with a triangular fuzzy number (Table 1). For the purpose of the present study, the five criteria above (i.e., equally important, moderately important, strongly important, very strongly important, and extremely important) are used.

Figure 2: *Fuzzy membership function for linguistic values for attributes*

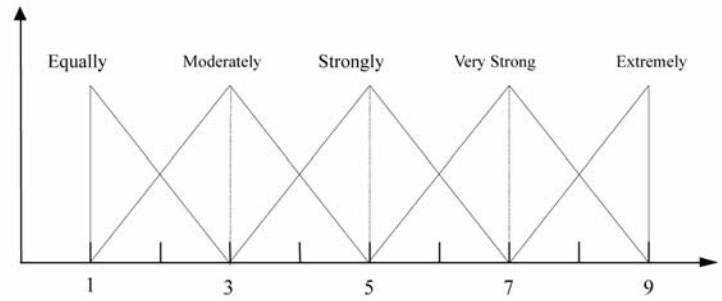


Table 1: *Definition and membership function of fuzzy number*

Fuzzy Number	Linguistic Variable	Triangular fuzzy number
$\tilde{9}$	Extremely important/preferred	(7,9,9)
$\tilde{7}$	Very strongly important/preferred	(5,7,9)
$\tilde{5}$	Strongly important/preferred	(3,5,7)
$\tilde{3}$	Moderately important/preferred	(1,3,5)
$\tilde{1}$	Equally important/preferred	(1,1,3)

Steps of FAHP Calculation

The four-step-procedure of this approach is given as follows:

Step 1: Compare the performance score

Assuming *K* experts, we precede to decision-making on *P* alternatives with *n* criteria.

Step 2: Construct fuzzy comparison matrix

We use a triangular fuzzy number to represent the meaning of questionnaires, and construct positive reciprocal matrixes.

Step 3: Examine consistency of fuzzy matrix $\tilde{A}_i$

Assume $A = [a_{ij}]$ is a positive reciprocal matrix and $\tilde{A} = [\tilde{a}_{ij}]$ is a fuzzy positive reciprocal matrix. If $A = [a_{ij}]$ is consistent, $\tilde{A} = [\tilde{a}_{ij}]$ will be consistent also.

Step 4: Calculate fuzzy evaluation of number $\tilde{r}_i$

$\tilde{r}_i = [\tilde{a}_{i1} \otimes \ldots \otimes \tilde{a}_{in}]^{1/n}$

Step 5: Calculate fuzzy weight $\tilde{W}_i$

$\tilde{w}_i = \tilde{r}_i \otimes (\tilde{r}_i \oplus \cdots \oplus \tilde{r}_m)^{-1}$

Step 6: Defuzzy

This study finds the best crisp value (or nonfuzzy value) in accordance with the Center of Area (COA or Center Index, CI), which was developed by Teng & Tzeng (1993), which means that we calculate clear weights to each index. The calculation method is as follows:

$BNP_i = [(UR_i - LR_i + (MR_i - \mathrm{LR}_i)] / 3 + LR_i, \forall i$

Methodology

After summarizing from recent literature and interviewing relative experts for the purpose of this research, the study extracts 15 indices within four criteria which play a critical role in making a successful vision of Taiwanese businesses in China (Table 2). The study utilizes a sample of businesses owned by the Taiwanese in China; 165 questionnaires were sent and 144 were returned. The complete response rate was 87% (one questionnaire was discarded due to a statistical error).

Sixty-four percent of the respondents were male, 77% of the respondents were under 30 years old, and 23% were 31–35 years old. More than half (57%) of the respondents had an education level below a Bachelor's degree and 43% received a Bachelor's degree. Details of the demographic information are given in Table 3.

The rank of all indices is provided in Table 4. For the first evaluation, "Vision Perception" (0.670), it is better to construct a Taiwanese business's vision rather than

"Organizational Management" (0.330). The relative weights of the evaluation criteria in the second level are ranked as follows: "Leader's Vision" (0.563), "Organizational Culture" (0.274), "Member's Vision" (0.109), and "Organizational Structure" (0.053). The weights of the evaluation indices in the last level are as follows: "Leader philosophy" (0.274), "Leader Concept" (0.184), "Interactive Communication" (0.113), "Environmental Assumption of Leader" (0.077), "Personal Life Planning" (0.069), "Innovative Thinking" (0.051), "Leadership Style" (0.048), "Long Term-Oriented Thinking" (0.047), "Functional Organization" (0.034), "Vision Sharing" (0.023), "Organizational Commitment" (0.022), "Self-Cognition" (0.0160), "Motivate Planning" (0.0157), "Matrix Organization" (0.0145), and "Bureaucratic Organization" (0.011). The C.I. and C.R. value of the study both are less than 0.1.

Table 2: *Hierarchical Evaluation Structure of This Study*

Goal	Dimension	Evaluating Criteria	Evaluating Indices
Vision Analyze upon Taiwanese Businesses in China	Vision Perception	Leader's Vision	Leader philosophy
			Leader Concept
			Environmental Assumption Toward Leader
			Leadership Style
		Member's Vision	Personal Life Planning
			Organizational Commitment
			Self-Cognition
	Organizational Management	Organizational Culture	Interactive Communication
			Long Term-Oriented Thinking
			Innovative Thinking
			Vision Sharing
			Motivated Planning
		Organizational Structure	Learning Organization
			Matrix Organization
			Bureaucratic Organization

Table 3: *Hierarchical Evaluation Structure of This Study*

Variable	Item	Distribution	Percentage	Variable	Item	Distribution	%
1. Sexual	(1) Male	92	64	3. Educational Degree	(1)Under Bachelor	81	57
	(2) Female	51	36		(2) Bachelor	62	43
2. Age	(1) Under 30	110	77		(3) Master	0	
					(4) Doctor	0	
	(2) 31–35	33	23				
	(3) 36–40	0	0				
	(4) 41–45	0	0				
	(5) Above 46	0	0				

Table 4: *FAHP Result of This Study*

Goal	Dimension	Relative Weight	Evaluating Criteria	Relative Weight	Evaluating Indices	Overall Weight	Rank
Vision Analyze upon Taiwanese Businesses in China	Vision Perception	0.670	Leader's Vision	0.563	Leader Philosophy	0.274	1
					Leader Concept	0.184	2
					Environmental Assumption Toward Leader	0.077	4
					Leadership Style	0.048	7
			Member's Vision	0.109	Personal Life Planning	0.069	5
					Organizational Commitment	0.022	11
					Self- Cognition	0.160	12
	Organizational Management	0.330	Organizational Culture	0.274	Interactive Communication	0.113	3
					Long Term-Oriented Thinking	0.047	8
					Innovative Thinking	0.051	6
					Vision Sharing	0.023	10
					Motivated Planning	0.0157	13
			Organizational Structure	0.053	Functional Organization	0.034	9
					Matrix Organization	0.0145	14
					Bureaucratic Organization	0.011	15

Conclusion and Discussion

Research Findings

This study aims to develop visional indices for Taiwanese businesses invested in China. The sample of the study is managers and organizational members in China. The study found that vision perception is more crucial than organizational management, especially the leader's vision. After vision perception, organizational culture and member's vision are second and third in importance. Organizational structure is less important when compared to the above dimensions. Within the fifteen indices, the leader's philosophy, concept, and environmental assumptions toward the leader are the most crucial. Also, personal life planning is highly emphasized. Compared with organizational commitment and self-cognition, personal life planning is considered significantly important.

In accordance with the hierarchical evaluation structure of this study and the result, organizational vision ought to combine with leader's vision and member's vision. Therefore, interactive communication becomes critical. In communication

process, vision sharing is much more important. Organizational vision is a future-based shared direction. Thus, innovative thinking and long term-oriented thinking are also emphasized. As an organizational structure dimension, functional organization is more suited to develop organizational vision than the other two types of organizational structure.

This study also noted that the leader's philosophy, concept, and assumptions toward the future are the core values of Taiwanese business in China in developing an organizational vision. The leader should adopt vision-based interactive communication that is fully interactive with members. With a long term-oriented thinking culture and with vision sharing, an organization can acquire members' organizational commitment and self-motivation that come from self-concept. Finally, utilizing functional organization benefits the development of a successful shared vision.

Managerial Practice Recommendations and Future Research

In practice, leaders should think in-depth about their personal philosophy and beliefs. They should analyze the environment and make assumptions. Leaders need to create a personal vision about the future position of an organization through these processes. After that, leaders should adopt a vision-based leadership style and continuously communicate with members. The communication process needs to proceed under an open, long term-oriented, and innovative thinking situation. In addition to their personal vision, leaders need to consider members' visions. By going through such a vision-based communication process, both leaders and members share their views with each other and understand the importance of members' personal life planning. At the end of the process, leaders and members need to develop an overall shared vision together.

In academic research, most managers and members working in Taiwanese businesses in China were mainlanders. Although there are great differences in the economic systems, managerial style, and cultures of Taiwan and China, the findings of this study do have something in common with analysis in Taiwanese-based industries (Chen & Chen, 2007). Therefore, future research could discuss the similarities and differences of the two areas.

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Agent Characteristics and Compliance Behavior in Supply Chain Disruptions

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The literature suggests that compliance behaviors are important in sustaining supply chain relationships when dealing with supply disruptions. This study empirically examines the role of agent-level factors on compliance in supply chain relationships, departing from previous research that focused mainly on firm-level factors. We find that after controlling for dependence and relational norms, some dimensions of agent cooperativeness and assertiveness are still significantly related to compliance. These findings suggest that certain characteristics of decision-making agents do matter in supply chain relationship dynamics, and encourage further research on the role of agent-level factors in affecting various aspects of supply chain phenomenon.

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Introduction & Background

Firm Compliance

Compliance has been studied in much of the existing buyer-supplier relationship literature (e.g., Gassenheimer & Calantone, 1994; Heide & John, 1990; Joshi & Arnold, 1998; Payan & McFarland, 2005). It is a reaction portraying the sacrifices and generation of alternative solutions made by firms to preserve an existing firm relationship. Compliance communicates a sense of involvement that takes into account the position of the channel partner as well as available alternatives. It also communicates the desire to maintain relational ties, even if just for a short while (Etzioni, 1961). Etzioni (1961, p.3) describes compliance as referring "both to a relation in which an actor behaves in accordance with a directive supported by another actor's power and to the orientation of the subordinated actor to the power applied." It is positively driven by supplier assistance and economic dependence, and the expectation of financial rewards is an additional dealer incentive to comply, since most organizations have economic goals (Gassenheimer & Calantone, 1994).

Buyer compliance can be defined as the reception given by a buying firm to a request made by its supplier for relationship continuance, despite potential costs incurred by the buying firm when agreeing to such a request (Etzioni, 1961; Gassenheimer & Calantone, 1994; Kumar, Stern & Achrol, 1992). Buyers who are dependent on their supplier are expected to comply more readily with supplier requests. However, buyers that make specific investments in supplier relationships will be more willing to undertake relationship maintenance actions, such as accommodating particular requests by the supplier. This is because sustaining existing firm relationships is a necessary means by which to recover the value of their specific asset investments (Ganesan, 1994; Heide & John, 1990), an argument that is echoed in the transaction cost economics literature (Williamson, 1985). Greater levels of dependency encourage buyers to comply with the requests of their supplier (Anderson & Narus, 1990). By complying with partner requests, the dependent party gives up the opportunity to extract benefits from its partner. In comparison to prior research (e.g., Keith, Jackson & Crosby, 1990, p. 33), the costs (or benefits foregone) of compliance are significant (Joshi & Arnold, 1998).

The Relational Supply Chain

For nearly two decades, the issues of trust and partnerships among firms have been discussed in the buyer-supplier and supply chain literature. Studies have shown that through long-term, close firm relationships, mutual collaboration and accommodation, companies and suppliers can create high performing supply chains together (Dyer, 1996; Dyer & Ouchi, 1993; Stank, Keller & Daughterty, 2001). Some major industry sectors (i.e., the automotive sector), have seen the movement toward such partnerships through the use of massive supply base reductions and longer-term relationships between automakers and their key suppliers (Helper & Sako, 1995). One of the most well-known models of supplier management is the Japanese keiretsu. With its interlocking board of directorates, the keiretsu creates a sense of mutual destiny for both the manufacturer and its supplier network (e.g., Chang, 2002;

Cusumano & Takeishi, 1991; Kamath & Liker, 1994). It is also based on a high degree of trust and close bonds between the buyer and supplier (Dyer & Ouchi, 1993). More recent terms such as 'relational contracting' (Dyer & Singh, 1998) and 'relational exploration strategies' (Tokman et al., 2007) describe this hybrid form of governance between the use of market and vertical hierarchy.

Inspired by the high supply chain performance observed in the partnerial Japanese buyer-supplier networks (Clark & Fujimoto, 1991; Cusumano & Takeishi, 1991; Dyer, 1996; Dyer & Ouchi, 1993), many firms have emulated characteristics of the more relational supply chain model in their own supply chains. These more committed firm relationship structures foster greater continuity through the use of longer-term contracts and trust-based mechanisms, as well as a greater supply chain resiliency in both organizational and production processes in order to address unforeseen uncertainty and disruptions that can arise. Having resilient, close-knit, long-term buyer-supplier relationships can help absorb the impact of various supply chain disruptions that may occur. In these types of relational supply chains, partners are more willing to accommodate each others' needs and comply with their partner's requests in order to preserve the working relationship. For example, in February of 1997, a devastating fire broke out at Aisin Seiki Co., a supplier to Toyota. Since it halted production in all of Toyota's Japanese plants, the company rallied the help of its other keiretsu suppliers to help replace the lost capacity. This also allowed Toyota to accommodate and comply with Aisin Seiki's need for recovery time from the disastrous and disruptive fire (Sheffi & Rice, 2005).

The Problems with Disruptions

Supply disruptions can come in various forms with many different causes. They can come in the form of production or shipment delays caused by labor strikes and material shortage, and can also include random events such as natural disasters, accidents, or even intentional disruptions like sabotage or acts of terrorism (Hendricks & Singhal, 2005; Sheffi & Rice, 2005). Supply chain disruptions can interrupt the normal flow of goods and materials within a supply chain and expose supply chain partners to operational and financial risks (Craighead et al., 2007). For example, the longshoreman union strike at the Los Angeles-Long Beach port in 2002 disrupted the supply chain and interrupted supply deliveries to many U.S. firms. Its damaging impact on the port operations and schedules lingered for six months after the strikes had ended. Another supply disruption incident took place as lightning struck a Philips semiconductor plant in New Mexico in 2000. The resulting 10-minute blaze contaminated millions of chips and delayed shipments to Nokia in Finland and to Ericsson in Sweden, disrupting the flow of their operations.

But whatever the form, a disruption essentially indicates a firm's inability to match its supply to the demand. Such supply chain disruptions can hinder the delivery of product to customers at stipulated times. Recently, disruptions have been recognized as having the potential to cause significant negative economic and financial impacts on firms and their supply chains (Hendricks & Singhal, 2005). As a result, the topic of supply disruption is receiving more and more attention in much of the literature (e.g., Billington, Johnson & Triantis, 2002; Kilgore, 2003; Lee, Padamanabhan & Whang, 1997).

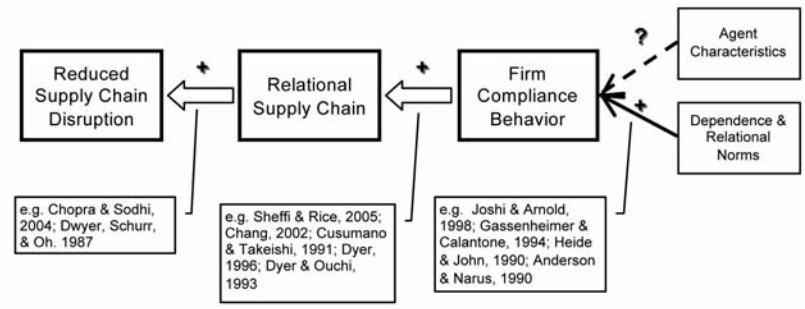
Supply chains are more susceptible to disruptions today than they were several years ago. Some reasons for this are increased global competition, more volatile demand, increased product variety, rapid advances in product technology, and shorter product life cycles – all of which make it challenging to match supply to demand and manage the supply chain (e.g., Mylnek et al., 2005). Once supply disruption occurs, there is little evidence to suggest that the resulting economic and financial recovery of firms experiencing disruption happens quickly (Hendricks & Singhal, 2005). Earlier work has shown that firm relationships that weather such disruption crises and thrive over the long-term, are characterized by an attitude of dynamic adjustment, cooperation and collaboration (Chopra & Sodhi, 2004; Dwyer, Schurr & Oh, 1987). Regardless, the significant negative impacts of disruptions and the lack of quick firm recovery provide the impetus to give close attention to the risk of disruptions and the supply chain characteristics to absorb the impact.

Focus of the Study

We take the position that since supply disruptions can be difficult to predict, supply chain managers can cope with such problems by developing more resilient, accommodating and relational relationships with firms in their supply network. The literature discussed above suggests that compliance behaviors in supply chain relationships are characteristic of longer-term, trust-based, relational supply chains, which can enhance the supply chain's capability to cope with disruption risks. Thus, understanding what factors influence compliance behaviors in supply chain relationships could prove useful in creating resilient supply chains.

The literature has suggested that dependence is a key factor in commanding compliance behaviors from exchange partners, whereas relational norms moderate the relationship between dependence and compliance (e.g., Joshi & Arnold, 1998). To extend the current knowledge on compliance behaviors in supply chains, we empirically examine the role of agent characteristics in influencing compliance, which departs from previous research that focuses primarily on the effects of firm-level factors (i.e., dependence and relational norms) on compliance. Specifically, this study investigates the effects of agent cooperativeness and assertiveness on compliance in supply chain relationships. The focus of this study is summarized in Figure 1 below.

Figure 1: *Flow of Arguments*



Hypotheses: Cooperativeness, Assertiveness, & Compliance

The exchange relationship literature is filled with studies regarding how buyer and supplier firms behave and relate towards one another. However, managers in buyer and supplier firms often act as decision-making agents in terms of firm exchange decisions (i.e., purchasing and parts procurement). These individual agents in the buyer-supplier dyad may engage in dynamic processes embedded in their exchange relationships such as information sharing, negotiation, and conflict resolutions. Therefore, the agents' behaviors in these processes could make or break the relationships between firms whom the agents represent.

Wilmot and Hocker (2001) base negotiation characteristics on a cooperativeness and assertiveness framework. According to Wilmot and Hocker, cooperativeness is required in the presence of concern for others. That is, individuals with greater concern for others have greater cooperative tendency. Cooperativeness is a multifaceted construct consisting of social acceptance (hereafter acceptance), empathy, teamwork orientation/helpfulness (hereafter teamwork), compassion, and conscience (Cloninger et al., 1994; Cloninger, Svrakic & Przybeck, 1993). Highly cooperative individuals are described as tolerant, empathetic, supportive, compassionate, fair and principle-centered, and are service-oriented. They also attempt to cooperate with each other as much as possible. We contend that when it comes to complying with the request from a supplier in distress, buyer agents possessing high degrees of cooperativeness that are concerned for others and focus more on mutual benefits, will be more likely to comply with supplier requests. This line of reasoning yields the following hypotheses:

Hypothesis 1: *The Cooperativeness of the decision-making agent has a significant effect on compliance when controlling for dependence and relational norms in the buyer-supplier relationship.*

Hypothesis 1A: The Empathy of the decision making agent has a significant effect on compliance when controlling for dependence and relational norms in the buyer-supplier relationship.

Hypothesis 1B: The Compassion of the decision making agent has a significant effect on compliance when controlling for dependence and relational norms in the buyer-supplier relationship.

Hypothesis 1C: The Teamwork of the decision making agent has a significant effect on compliance when controlling for dependence and relational norms in the buyer-supplier relationship.

Hypothesis 1D: The Acceptance of the decision making agent has a significant effect on compliance when controlling for dependence and relational norms in the buyer-supplier relationship.

Hypothesis 1E: The Conscience of the decision making agent has a significant effect on compliance when controlling for dependence and relational norms in the buyer-supplier relationship.

Referring back to the same cooperativeness and assertiveness framework proposed by Wilmot and Hocker, assertiveness is required when a tendency of concern for oneself exists. That is, individuals with a greater concern for self have a greater assertiveness tendency. Like cooperativeness, assertiveness is also a multifaceted construct, comprised of initiation, request refusal/right expression (hereafter expression), and confrontation (Chan, 1993; Kearney et al., 1984; Law, Wilson & Crossini, 1979). Highly assertive individuals tend to stand up for themselves, take initiation, exercise their rights, refuse requests from others when within their legitimate rights, and openly confront with others in disagreement (Rathus, 1972; Rathus, 1973). Assertiveness thus enables individuals to act in their own best interests. We assert that decision-making agents exhibiting high degrees of assertiveness are less likely to comply with a supplier when the request is putting their own interests at risk. This line of reasoning suggests the following hypotheses:

Hypothesis 2: *The Assertiveness of the decision-making agent has a negative significant effect on compliance when controlling for dependence and relational norms in the buyer-supplier relationship.*

Hypothesis 2A: The Initiation of the decision making agent has a negative significant effect on compliance when controlling for dependence and relational norms in the buyer-supplier relationship.

Hypothesis 2B: The Expression of the decision making agent has a negative significant effect on compliance when controlling for dependence and relational norms in the buyer-supplier relationship.

Hypothesis 2C: The Confrontation of the decision making agent has a negative significant effect on compliance when controlling for dependence and relational norms in the buyer-supplier relationship.

Research Methodology

Experimental Design & Subjects

We conducted a scenario-based experiment with 161 business professionals in MBA courses to test our proposed hypotheses. Seven students did not complete the survey and were excluded from the study. In the final sample of 154 subjects, 62% had at least five years of professional working experience and 97.4% had at least one year of professional experience, with the average of 6.7 years. 20% of the subjects had at least five years of management experience and 50.0% had at least one year of management experience, with the average of 1.8 years. The management responsibilities of these subjects ranged from supervisory to executive positions. 55%

of the subjects had executive, senior-level or mid-level management experience. 60.4% were male and 39.6% were female with the average age of 28.7 years old. In addition, 76.6% were Caucasian, and 23.4% were non-Caucasian.

We used the validated buyer-supplier relationship scenario from Joshi and Arnold's study (1998) (see Appendix A for the full description of the scenario) and randomly assigned subjects into four groups based on a two-by-two experimental design of low versus high relational norms and low versus high dependence. The subjects read a short business case verbatim that was taken from the validated scenario created by Joshi and Arnold (1998). In the business scenario, subjects were asked to assume the role of a manager at a midsize electronic equipment manufacturer responsible for the purchase of microchips from a partnering supplier. Each subject was also exposed to a combination of dependence and relational norms manipulations, depending on which group the subject was assigned to. After reading the scenario, subjects were asked to rate their reaction in terms of their compliance to the supplier's request for order, knowing that the supplier was faced with a labor dispute potentially leading to a supply disruption and that this could cause problems for the subject's firm in meeting delivery schedules to its customers.

The manipulation checks were successfully performed as t-tests indicated (1) that the average rating on the manipulation check item, "I personally feel that my company is highly dependent on the supplier." The average rating of subjects in the High Dependence groups (mean = 6.04; 1 = strongly disagree, 7 = strongly agree) was statistically different from that of subjects in the Low Dependence groups (mean = 3.74) at $p<0.001$ level, and (2) the average rating on the manipulation check item, "I personally feel that my company has an informal, close, cooperative relationship with the supplier" of subjects in the High Relational Norms groups (mean = 5.95) was statistically different from that of subjects in the Low Relational Norms groups (mean = 2.78) at $p<0.001$ level.

Measurements and Statistical Models

Dependent variable: Compliance. We measured subjects' compliance using Joshi and Arnold's (1998) validated instrument consisting of six 1-7 scale items (1 = strongly disagree, 7 = strongly agree), including (1) *'I would hang in there and wait for the labor dispute to be resolved,'* (2) *'I would be continually looking out for another supplier to replace the existing supplier* (reverse coded),' (3) *'I would patiently wait for the supplier's performance to return to its original level,'* (4) *'I would accept the terms and conditions of an alternative supplier* (reverse coded),' (5) *'In my negotiations with this supplier, I would imply that they were in danger of losing our business* (reverse coded),' and (6) *'I would terminate our relationship with this supplier* (reverse coded).' Principal Component Analysis (PCA) showed that the four items of compliance (items 1, 2, 3 and 6) were highly correlated and loaded onto a single component with a Cronbach's alpha of 0.75. The other two items did not load significantly onto the factor and were excluded from the analysis. Therefore, these four items were combined into a single component measure of compliance in this study, indicating the likelihood that the subjects will comply with the request from the supplier (i.e. placing an order with the supplier while knowing that there is a potential for supply disruption).

Independent variables: Cooperativeness and Assertiveness. We used a 30-item survey instrument with a 1-7 rating system to measure cooperativeness. This instrument was developed based on the notion that cooperativeness is a multifaceted higher-order construct that consists of acceptance, empathy, teamwork, compassion, and conscience. The original instrument developed by Cloninger et al. (1993) and Cloninger et al. (1994) was not appropriate for the study due to its length. Initially, our instrument had 39 items, which are existing questionnaire items in the literature (Goldberg, 2006; O'Shea et al., 2004; Yilmaz & Hunt, 2001). After we pretested it with 48 undergraduate business students, 9 items were dropped due to their low intercorrelation with other items, and several items were reworded to improve their clarity. The final version of the 30-item instrument (6 items per sub-scale) used in this study is shown in Appendix B.

We performed correlation analysis and PCA to assess the fit of the items in each subscale. We found that the selected items for *Empathy* (B1, B2, B3 and B4) were highly loaded onto a single component with a Cronbach's alpha of 0.83. The selected items for *Teamwork* (C1, C2, and C4) were highly loaded onto a single component with a Cronbach's alpha of 0.62. The selected items for *Compassion* (D2, D3 and D4) were highly loaded onto a single component with a Cronbach's alpha of 0.75. We also found that certain items of the acceptance subscale were more strongly correlated with some items of the conscience subscale and vice versa. Thus, we reassigned those items accordingly.

We grouped items A2, A3, A6, and E3, and renamed them *Considerateness*. Originally, A2, A3, and A6 measured the Acceptance dimension of Cooperativeness, while E3 measured the Conscience dimension of Cooperativeness. Further analysis of these items showed that these items could explain an agent's inclination to being considerate, which is more specific than Acceptance and Conscience. PCA indicated that A2, A3, A6, and E3 were highly loaded onto a single component with a Cronbach's alpha of 0.62. We grouped items A1, A4, E5, and E6, and renamed them Humility. PCA also indicated that A1, A4, E5, and E6 highly loaded onto a single component with a Cronbach's alpha of 0.64. According to Collins' (2001) findings in his Good-to-Great research, level-5 leaders, who are the most effective leaders with personal humility and professional will, tend to put the best interest of their organization above all else. It is possible that business professionals of humility will honor the greater purpose of their organization and make their decision accordingly. As such, they are less likely to put their organization's viability at risk by simply complying with the supplier's request without exploring other possible alternatives in the face of impending supply disruption. Finally, the factor score from each PCA was later used as a single-component measure for each of the five cooperativeness dimensions.

We measured assertiveness using an 18-item instrument with the 1-7 rating system. We developed the assertiveness scale based on existing questionnaire items in the literature. The items of the assertiveness scale developed by Rathus (1973) were initially considered. However, some empirical research has indicated that Rathus's assertiveness scale is not unidimensional, and assertiveness appears to be a multi-dimensional construct consisting of initiation, expression, and confrontation (Chan,

1993; Kearney et al., 1984; Law et al., 1979). Therefore, the items used in this study were organized into these three subscales. Initially, our assertiveness scale had 24 items. After the pretest, 6 items were dropped due to their low intercorrelation with other items, and some items were reworded to improve their clarity. The final 18-item instrument (6 items per sub-scale) used is shown in Appendix C.

Similarly, we conducted correlation analysis to identify groups of items with strong correlations among those for assertiveness. We followed with PCA and found that the selected items for *Initiation* (F1, F2, F3, F4, and F5) were highly loaded onto a single component with a Cronbach's alpha of 0.85. The selected items for *Expression* (G3, G4, G5, and G6) were highly loaded onto a single component with a Cronbach's alpha of 0.70. The selected items for *Confrontation* (H1, H2, H3, and H5) loaded onto a single component with a Cronbach's alpha of 0.70. Finally, the factor score from each PCA was later used as a single-component measure for each of the three assertiveness dimensions in this study.

Control variables: Dependence, Relational Norms, Subjects' Managerial Experience, Responsibility, Campus, and Gender. Since the main thrust of the study was to investigate the effects of agent-level factors (i.e., cooperativeness and assertiveness) on compliance in buyer-supplier relationship contexts, we controlled for dependence and relational norms, which are major firm-level factors influencing the dynamics in buyer-supplier relationships and well-established in the literature. Dependence and relational norms were experimental manipulations both of which were coded as 1 and 0, respectively. Relational norms conditions were as well. We also controlled for other variables including (a) subjects' years of managerial experience, which was kept as a continuous variable, (b) subject's professional responsibility – executive, middle-management, first-line management, staff experience, and other positions without management responsibilities, which were coded as 5, 4, 3, 2 and 1, respectively, (c) campus: 2 for urban campus, 1 for suburban campus, and 0 for rural campus, (d) gender – female and male coded as 0 and 1, respectively.

Statistical Models: We used a regression model to test our proposed hypotheses by examining the effects of agents' Cooperativeness and Assertiveness on Compliance in the buyer-supplier relationship after controlling for Dependence, Relational Norms and other control variables (Hypotheses 1 and 2). The regression model is as follows:

$$\textit{Model: Compliance} = \textit{constant} + b_1\textit{Empathy} + b_2\textit{Compassion} + b_3\textit{Teamwork} + b_4\textit{Considerateness} + b_5\textit{Humility} + b_6\textit{Initiation} + b_7\textit{Expression} + b_8\textit{Confrontation} + b_9\textit{Dependence} + b_{10}\textit{Relational Norms} + b_{11}(\textit{Dependence x Relational Norms}) + b_{12}\textit{Managerial Experience} + b_{13}\textit{Responsibility} + b_{14}\textit{Campus} + b_{15}\textit{Gender} + \textit{errors}$$

Data Analysis & Results

Descriptive Statistics and Correlation Matrix

We began the data analysis by performing correlation analyses, the results of which are depicted in Table 1. Correlations summarized in Table 1 indicate that there are some significant associations among our control variables. For example, a subject's Managerial Experience had a significant positive association with Responsibility, indicating that the longer managerial experience was associated with the higher level

of managerial responsibility. Empathy had significant positive associations with Considerateness, Compassion, Teamwork, and Humility, while Initiation had significant positive association with Expression and Confrontation. Despite the correlations among these variables, Variance Inflation Factors did not indicate multicollinearity among them. Thus, the underlying assumptions of multiple regression analysis were not violated.

Table1 : *Correlation Matrix*

	Mean	Std Dev.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14	15
1. Compliance	0.00	1.51	1.00														
2. Empathy	0.00	1.63	0.10	1.00													
3. Compassion	0.00	1.41	0.02	0.22**	1.00												
4. Teamwork	0.00	1.31	-0.05	0.20*	0.19*	1.00											
5. Considerateness	0.00	1.37	0.14	0.50***	0.28***	0.11	1.00										
6. Humility	0.00	1.38	-0.20*	0.25**	0.36***	-0.10	0.30***	1.00									
7. Initiation	0.00	1.78	-0.02	0.02	0.01	0.22**	-0.07	-0.18*	1.00								
8. Expression	0.00	1.46	-0.11	-0.23**	0.04	-0.06	-0.11	0.04	0.39***	1.00							
9. Confrontation	0.00	1.47	0.00	-0.07	-0.13	0.16*	-0.04	-0.21**	0.45***	0.30***	1.00						
10. Dependence	0.49	0.50	0.21**	0.14	-0.04	0.01	0.01	0.00	0.07	0.02	0.02	1.00					
11. Relational	0.51	0.50	0.46***	0.05	0.07	0.02	0.06	0.07	0.00	0.06	0.02	0.00	1.00				
12. Managerial Exp	1.76	2.67	0.04	-0.14	0.04	0.04	0.04	0.03	0.29***	0.14	0.08	0.03	0.04	1.00			
13. Responsibility	1.81	1.02	0.03	-0.13	0.07	-0.09	0.04	0.06	0.20*	0.15	0.08	-0.02	-0.06	0.58***	1.00		
14. Campus	1.25	0.82	-0.11	-0.05	-0.11	-0.06	0.03	0.08	-0.09	-0.11	0.10	-0.02	-0.03	-0.19*	-0.03	1.00	
15. Gender	0.60	0.49	-0.02	-0.21**	-0.19*	0.15	-0.09	-0.27***	0.21*	0.17*	0.26**	0.07	-0.03	0.15	0.08	-0.12	1.00

* p<0.05 ** p<0.01 *** p<0.001

Hypotheses Testing

Table 2 displays the results of multiple regression analyses with Compliance as the dependent variable. Models A1, A2, and A3, in addition to the control model, were used to test the effects of Cooperativeness and Assertiveness (agent-level factors) on Compliance (Hypotheses 1 and 2). Results of Model A1 indicate that after controlling for the control variables, the measures for Cooperativeness, Teamwork ($p<0.1$), and Humility ($p<0.001$) were negatively related to Compliance, while Considerateness ($p<0.05$) was positively related to Compliance in the buyer-supplier relationship. The incremental R^2 for Model A1 over the control model was highly significant ($p<0.001$), with the agent Cooperativeness improving the total explained variation in Compliance by 38.6% (28.4% R^2 in the control model versus 39.3% R^2 in Model A1).

Results of Model A2 indicate that when only Assertiveness dimensions were used as independent variables, Expression ($p<0.05$) was negatively related to Compliance. However, the incremental R^2 for Model A2 over the control model was not significant with the agent Assertiveness improving the total explained variation in Compliance by 8.4% (28.4% R^2 in the control model versus 30.7% R^2 in Model A2). Results of Model A3 indicate that when both Cooperativeness and Assertiveness dimensions were used as independent variables, Teamwork ($p<0.1$) and Humility ($p<0.001$), among the measures for Cooperativeness, were negatively related to Compliance, while Considerateness ($p<0.05$) was positively related to Compliance in the buyer-supplier relationship. The incremental R^2 for Model A3 over the control model was highly significant ($p<0.001$), with the agent characteristic variables improving the total explained variation in Compliance by 43.2% (28.4% R^2 in the control model versus 40.6% R^2 in Model A3). In short, the results of Model A3 show that after controlling

for firm-level factors—Dependence and Relational Norms and other control variables—some dimensions of agent Cooperativeness were still significantly associated with Compliance, whereas agent Assertiveness was not significantly related to Compliance in the presence of agent Cooperativeness variables.

Table 2: *Regression Analysis Results for Compliance*

Dependent Variable: Compliance	Standardized Beta			
	Control	Model A1	Model A2	Model A3
Control Variables:				
Dependence	0.32**	0.33***	0.31**	0.34***
Relational	0.57***	0.58***	0.57***	0.59***
Dependence x Relational Norms	-0.18	-0.20†	-0.16	-0.20†
Managerial Experience	-0.06	-0.04	-0.06	-0.03
Responsibility	0.09	0.08	0.11	0.09
Campus	-0.11	-0.09	-0.13†	-0.10
Gender	-0.04	-0.08	-0.03	-0.06
Independent Variables:				
Empathy		0.02		0.00
Compassion		0.07		0.08
Teamwork		-0.13†		-0.13†
Considerateness		0.19*		0.18*
Humility		-0.35***		-0.34***
Initiation			-0.01	-0.02
Expression			-0.17*	-0.11
Confrontation			0.05	0.01
R Square	0.28	0.39	0.31	0.41
Adjusted R Square	0.25	0.34	0.26	0.34
F Value	8.26***	7.61***	6.35***	6.30***
Incremental R Square		0.11	0.03	0.13
Incremental F Value		5.08***	1.64	3.56***

† p<0.1 * p<0.05 ** p<0.01 *** p<0.001

These results yield partial support for Hypothesis 1 but not for Hypothesis 2. That is, these results indicate that the agent-level factors in Cooperativeness: Teamwork, Considerateness and Humility do seem to influence Compliance behavior even after controlling for Dependence and Relational Norms, whereas Assertiveness does not significantly influence Compliance behavior over and above Cooperativeness and the control variables. Thus, these results support only Hypotheses 1C, 1D, 1E, but not Hypotheses 1A and 1B (i.e., Empathy and Compassion) and Hypotheses 2A, 2B and 2C (i.e., Initiation, Expression and Confrontation). This still provides support for our overall argument that agent-level factors matter in buyer-supplier relationships even after taking firm-level factors – Dependence and Relational Norms – into consideration.

Exploratory Analysis

Since the results in Table 2 showed that certain agent-level factors could significantly influence Compliance, we performed four additional regression analyses to explore the effects of such agent-level factors on compliance across four different Dependence-Relational Norms conditions: (1) Low Dependence, (2) High Dependence, (3) Low Relational Norms, and (4) High Relational Norms, using

regression Models B, C, D and E in Table 3A and 3B. The sample was grouped into four subsamples according to the Dependence and Relational Norms conditions. Then, the data from four sub-samples were analyzed based on the respective regression models. Results in Table 2 indicate that only four dimensions from Cooperativeness and Assertiveness: Teamwork, Considerateness, Humility, and Expression had demonstrated some significant associations with Compliance. Thus, we only focus our exploratory analyses on these variables.

Table 3: *Exploratory Regression Analysis*

a) Low and High Dependence Conditions

Dependent Variable: Compliance	Standardized Beta			
	Low Dependence		High Dependence	
	Control B	Full B	Control C	Full C
Control Variables:				
Relational Norms	0.52***	0.53***	0.38***	0.40***
Managerial Experience	-0.03	0.08	-0.06	-0.08
Responsibility	0.23*	0.22*	-0.09	-0.05
Campus	0.03	0.01	-0.27*	-0.26*
Gender	-0.03	-0.04	-0.03	-0.05
Independent Variables:				
Teamwork		-0.24*		-0.04
Considerateness		0.31**		0.21†
Humility		-0.27**		-0.28*
Expression		-0.22*		-0.09
R Square	0.32	0.48	0.26	0.36
Adjusted R Square	0.27	0.41	0.21	0.27
F Value	6.70***	7.10***	4.92***	4.08***
Incremental R Square		0.16		0.10
Incremental F Value		5.52***		2.50†

b) Low and High Relational Norms Conditions

Dependent Variable: Compliance	Standardized Beta			
	Low Dependence		High Dependence	
	Control B	Full B	Control C	Full C
Control Variables:				
Relational Norms	0.52***	0.53***	0.38***	0.40***
Managerial Experience	-0.03	0.08	-0.06	-0.08
Responsibility	0.23*	0.22*	-0.09	-0.05
Campus	0.03	0.01	-0.27*	-0.26*
Gender	-0.03	-0.04	-0.03	-0.05
Independent Variables:				
Teamwork		-0.24*		-0.04
Considerateness		0.31**		0.21†
Humility		-0.27**		-0.28*
Expression		-0.22*		-0.09
R Square	0.32	0.48	0.26	0.36
Adjusted R Square	0.27	0.41	0.21	0.27
F Value	6.70***	7.10***	4.92***	4.08***
Incremental R Square		0.16		0.10
Incremental F Value		5.52***		2.50†

† p<0.1 * p<0.05 ** p<0.01 *** p<0.001

The results of Full Model B in Table 3a indicate that under the low dependence condition, after controlling for the control variables, agent Teamwork ($p<0.05$), Humility ($p<0.01$), and Expression ($p<0.05$) were negatively related to Compliance, whereas agent Considerateness ($p<0.01$) was positively related to Compliance. The incremental R^2 for Full Model B over the control model was highly significant ($p<0.001$), with the agent Teamwork, Considerateness, Humility, and Expression improving the total explained variation in Compliance by 52.9% (31.5% R^2 in Control Model B versus 48.1% R^2 in Full Model B). The results of Full Model C in Table 3a indicate that under the high dependence condition, Compliance had a significant positive association with agent Considerateness ($p<0.1$) and a significant negative association with agent Humility ($p<0.05$) after controlling for the control variables. The incremental R^2 for Full Model C over the control model was significant ($p<0.1$, the actual value was 0.051), with the agent characteristic variable in the model improving the total explained variation in Compliance by 37.4% (26.3% R^2 in Control Model C versus 36.1% R^2 in Full Model C).

Overall, these results show that after controlling for Relational Norms and other control variables, Humility had a significant negative effect on Compliance under both low and high dependence conditions ($p < 0.01$ and $p < 0.05$, respectively). Teamwork and Expression only had significant negative effects on Compliance under the low dependence condition, while Considerateness had a far more significant positive effect on Compliance under the low dependence condition ($p < 0.01$) than under the high dependence condition ($p < 0.1$). These results indicate that the effect of agent characteristics variables on Compliance could be potentially moderated by the dependence context of the buyer-supplier relationship.

Moreover, the results of Full Model D in Table 3b indicate that under the low relational norms condition, agent Humility ($p<0.01$), and Expression ($p<0.05$), were negatively related to Compliance, whereas Teamwork and Considerateness had no significant effect on Compliance after control for Dependence and other control variables. The incremental R^2 for Full Model D over the control model was highly significant ($p<0.001$), while the agent characteristic variables improving the total explained variation in Compliance by 117% (17.1% R^2 in Control Model D versus 37.0% R^2 in Full Model D). Thus, under the low relational norms condition, these agent characteristics tend to drive towards noncompliance without a significant balancing effect from agent Considerateness. Finally, the results of Full Model E in Table 3b suggest that under a high relational norms condition, agent Considerateness ($p<0.05$) was positively related to Compliance while Humility ($p<0.05$) was negatively related to Compliance after controlling for Dependence and other control variables. The results also show that Teamwork and Expression had no significant effect on Compliance in high relational norms. The incremental R^2 for Full Model E over the control model was significant ($p<0.05$), with the agent characteristic variables improved the total explained variation in Compliance by 158% (7.5% R^2 in Control Model E versus 19.5% R^2 in Full Model E).

The results of this set of exploratory analyses also indicate that the effect of these agent characteristics variables on Compliance could be potentially contingent on the relational norms context of the buyer-supplier relationship. Specifically, after

controlling for Dependence and other control variables, Humility had a significant negative effect on Compliance under both low and high relational norms conditions. However, Expression only had a significant negative effect on Compliance under the low relational norms condition, while Considerateness only had a significant positive effect on Compliance under the high relational norms condition.

Discussion & Conclusion

The findings of this study show that agent-level factors (i.e. certain dimensions of cooperativeness and assertiveness) play an important role in influencing compliance behaviors in the face of an impending supply chain disruption. Specifically, Teamwork and Humility are negatively related to compliance behaviors, while Considerateness is positively related to compliance behaviors. A possible explanation is that under an impending supply disruption, buyer agents with strong Considerateness characteristics tend to be more accommodating and understanding with the problems the supplier is encountering and thus, are more likely to comply with the supplier's request. The counter-intuitive finding of the negative effects of Humility and Teamwork on compliance behaviors could be explained in the same line of Collins' (2001) logic; agents with strong Humility characteristics may realize that the collective interest of their organization should, above all else, include individual preferences, while agents with strong teamwork orientation may tend to hold their exchange partners accountable and expect their partners to contribute a fair share to the team outcomes. Thus, these buyer agents are less likely to comply with the supplier's request under an impending supply disruption at the supplier's own operations. This can cause damage to the buyer firms unless a contingency plan is put in place.

The exploratory analyses in this study also indicate that there are possible moderating effects of firm-level factors (i.e., dependence and relational norms) on the relationship between compliance and agent-level factors of cooperativeness and assertiveness. Specifically, Teamwork and Expression have significant negative effects on compliance behaviors in a low dependence context, but not in a high dependence context. Similarly, Considerateness has a substantially stronger positive effect on compliance behaviors in a low dependence context than in a high dependence context. A possible explanation is that the buyer firm agents are free to choose whether to comply with the supplier's request when the buyer firm has low dependence on the supplier. As such, agents who tend to hold the exchange partner accountable (i.e., high teamwork orientation) or those who tend to act based on their legitimate rights (i.e., high expression) have less likelihood to comply with the supplier's request in this low dependence context than in the high dependence context. In a similar fashion, agents who have a high tolerance are more willing to honor the request from the supplier in the low dependence context in which their compliance is perceived as a chosen behavior, rather than a coerced behavior as it would be in the high dependence context.

Regarding the relational norms contexts, the findings indicate that Considerateness has a significant positive effect on compliance behaviors in a high relational norms context but not in a low relational norms context. In contrast, Expression has a significant negative effect on compliance behaviors in a low relational norms context, but not in a high relational norms context. This is largely due to the fact that when the exchange relationship is contentious and competitive in nature—although agents could be very tolerant in general—they may be reluctant to help the supplier by honoring its request. On the other hand, in such a contentious and competitive exchange relationship, agents who tend to act upon their legitimate rights are not reluctant to exercise their rights by turning down the request from the supplier. These behavioral patterns of the agents are not the case in the highly cooperative exchange relationships between the buyer firm and the supplier.

As the extant literature suggests, compliance behaviors are fundamental to relational supply chain partnerships, and can help firms manage the impacts of supply chain disruptions. Given that the compliance tendency is significantly driven by certain dimensions of agent cooperativeness and assertiveness, choosing buyer agents with appropriate characteristics can thus influence the long-term viability of supply chain relationships that are capable of coping with potential supply disruptions. In addition, the dynamic interplay between firm-level factors (dependence and relational norms) and agent-level factors (cooperativeness and assertiveness) may imply that in the process of designing the supply chain and selecting supply chain partners, managers may need to take these two sets of factors into account rather than taking the one-size-fits-all best practice approach, given that the dependence and relational norms contexts in which firms operate tend to vary. The behavioral patterns of agents with different characteristics tend to vary across these contexts as well. Nevertheless, further investigations on the interaction between firm-level and agent-level factors emerging from this study are needed.

Despite several interesting results, we acknowledge that this study has some limitations. First, the study used business professionals in MBA courses as surrogates for actual purchasing and supply chain managers in a buyer-supplier relationship. This may limit external validity of the findings. Nevertheless, the extant subject surrogacy literature does suggest that MBA students exhibit similar decision-making patterns to those of actual managers in various decision-making contexts and thus, can be used as reasonable surrogates for practicing managers (e.g., Corfman & Lehmann, 1994; Ford & Hegarty, 1984; Remus, 1986). Future research can address the external validity limitation by replicating the experiment in this study, using manager subjects. Another limitation is that our scenario-based experiment was built on a hypothetical supply chain purchasing scenario. Although this scenario has been validated by Joshi and Arnold (1998), it is not a 'real world' situation involving real-time decision making. To strengthen the realism of the scenarios used in the experiment, future research may consider empirically deriving scenarios from actual business incidents. Future researchers may also examine the agent-level factors on compliance behavior using alternative data collection techniques, such as field observation and survey, other than scenario-based data. Leveraging multiple data

collection techniques allows researchers to triangulate the research findings, thus strengthening the validity of the study (Jick, 1979).

In conclusion, although this study is not all-inclusive, it does shed some light on the role of the decision-making agent in an impending supply disruption circumstance. As mentioned earlier, much of the extant literature addresses this issue at the firm level whereas the behavior of the agent is largely ignored. This study has filled the void of agent-level factors in the literature by revealing that the characteristics of agents do matter to compliance behaviors in the impending supply disruption, thus making a contribution to the literature. We also encourage future research to expand the domain of this line of research by investigating various roles and characteristics of the agents that can be consequential in the context of supply chain disruptions, so that the agent-driven impacts on compliance and other relevant behaviors to this important supply chain circumstance can be better understood.

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Appendix A: Scenario and Experimental Manipulations

Introduction

You are a purchasing manager responsible for the purchase of microchips for a midsize electronic equipment manufacturer. Microchips are an important component for the equipment that you manufacture; therefore they need to be purchased on a regular basis. You have one existing supplier for this component.

Low Dependence

As purchasing manager responsible for microchips, you find yourself in a situation wherein it is not difficult for you to find a suitable replacement for the existing supplier. If you decide to stop purchasing from this supplier, you could easily replace their volume with purchases from alternative suppliers. There are many competitive suppliers for microchips and you can switch to them without incurring any search costs. Switching suppliers is not going to have any negative effects on the quality or design of the equipment that you manufacture. Your production system can be easily adapted to use components from a new supplier. The procedures and routines that you have developed are standard and they are equally applicable with any supplier of this component. The skills that your people have acquired in the process of working with the supplier can easily be changed to fit another supplier's situation. You can therefore terminate your relationship with your present supplier without incurring any costs.

High Dependence

As purchasing manager responsible for microchips, you find yourself in a situation wherein it is difficult for you to find a suitable replacement for the existing supplier. If you decide to stop purchasing from this supplier, you could not easily replace their volume with purchases from alternative suppliers. There are very few, if any, competitive suppliers for microchips and you cannot switch to them without incurring significant search and verification costs. Switching suppliers is also going to have negative effects on the quality or design of the equipment that you manufacture. Your production system cannot be easily adapted to use components from a new supplier. The procedures and routines that you have developed are unique and hence they are not applicable with any other supplier of this component. The skills that your people have acquired in the process of working with the supplier cannot easily be changed to fit another supplier's situation.You cannot therefore terminate your relationship with your present supplier without incurring significant costs.

Low Relational Norms

Both you and your supplier bring a formal and contract governed orientation to this relationship. Exchange of information in this relationship takes place infrequently, formally, and in accordance to the terms of a prespecified agreement. Even if you do know of an event or change that might affect the other party, you do not divulge this information to them. Strict adherence to the terms of the original agreement characterizes your relationship with this supplier. Even in the face of unexpected situations, rather than modifying the contract, you adhere to the original terms. You have and "arm's length" relationship with your supplier. You do not think that the supplier is committed to your organization—in fact; you think that if you did not carefully monitor this supplier's performance, they would slack off from the original terms. Above all, you see your supplier as an external economic agent with whom you have to bargain in order to get the best deal for yourself.

High Relational Norms

Both you and your supplier bring an open and frank orientation to the relationship. Exchange of information in this relationship takes place frequently, informally, and not only according to a prespecified agreement. You keep each other informed of any event or change that might affect the other party. Flexibility is a key characteristic of this relationship. Both sides make ongoing adjustments to cope with the changing circumstances. When some unexpected situation arises, the parties would rather work out a new deal than hold each other responsible to the original terms. You tend to help each other out in case of unexpected crises. If your supplier is unable to fulfill an order, they recommend an alternative source of supply for the same. Above all, you have a sense that your supplier is committed to your organization and that they work with you keeping your best interests in mind. You see each other as partners, not rivals.

Conclusion

Recently, the supplier informed you that they are involved in a labor dispute. Consequently, they are temporarily unable to guarantee on-schedule delivery. This creates some uncertainty for your organization. Delayed delivery of microchips, may, for example, cause problems for your organization in meeting delivery schedules to customers. The supplier has called to get your regular order. Drawing from experience, how would you be most likely to react in this situation? Please rate each of these statements to the extent that they match with your expectation of your reaction.

Appendix B: Cooperativeness

Cooperativeness Items	Sources
Social Acceptance:	
A1: I impose my will on others. (-) (re-assigned to *Conscience*)	IPIP
A2: I easily accept people as they are.	IPIP (modified)
A3: I assume that others have good intentions.	IPIP (modified)
A4: I am quick to judge others. (-) (re-assigned to *Conscience*)	IPIP (modified)
A5: I readily accept change.*	IPIP (modified)
A6: I comfortably tolerate people who are different from me.	IPIP (modified)
Empathy:	
B1: I sympathize with others' feelings.	IPIP
B2: I have a soft heart.	IPIP
B3: I often take time out for others.	IPIP (modified)
B4: I feel others' emotions.	IPIP
B5: I seldom make people feel welcome. (-)*	IPIP (modified)
B6: I anticipate the needs of others.*	IPIP
Teamwork:	
C1: I enjoy activities that involve a high level of cooperation with other people.	Yilmaz & Hunt, 2001
C2: I prefer to work independently more often than in a group. (-)	Yilmaz & Hunt, 2001
C3: I enjoy helping others with their problems when working in the team environment.*	IPIP (modified)
C4: I believe that teamwork allows common people to achieve uncommon results.	O'Shea et al., 2004
C5: I believe that a person can best achieve his/her goals if others around him/her achieve theirs too.*	O'Shea et al., 2004
C6: I feel that working with others usually distracts from the goal. (-)*	O'Shea et al., 2004 (modified)
Compassion:	
D1: I forgive others when they offend me.*	IPIP (modified)
D2: I believe that people should revenge wrongs that are done to them. (-)	IPIP
D3: I hold a grudge. (-)	IPIP
D4: I do things out of revenge. (-)	IPIP
D5: I often have compassion on those less fortunate than me.*	IPIP (modified)
D6: I find it easy to forgive others.*	IPIP (modified)
Conscience:	
E1: I listen to my conscience when making decisions.*	IPIP
E2: When deciding to do something, I ask myself, "what in it for me?" (-)*	IPIP (modified)
E3: I often think of the good of others before my own good. (re-assigned to *Social Acceptance*)	IPIP (modified)
E4: I do not do things that violate my conscience.*	IPIP (modified)
E5: I tell stories about myself that make me look good. (-)	IPIP (modified)
E6: I enjoy playing tricks on others. (-)	IPIP (modified)

Scale: 1 = very inaccurate and 7 = very accurate in describing you as a person
*: excluded from the analysis
(-): reverse coded

Appendix C: Assertiveness

Assertiveness Items	Sources
Initiation:	
F1: I take charge.	IPIP
F2: I wait for others to lead the way. (-)	IPIP
F3: Other people would describe me as a person who likes to take initiative.	IPIP (modified)
F4: I take control of things.	IPIP
F5: I try to lead others.	IPIP
F6: Even if others have different opinions, I do not hesitate to express my own.*	IPIP (modified)
Request Refusal/Expression of Right:	
G1: Most people seem to be more aggressive and assertive than I am. (-)*	Rathus, 1973; Chan, 1993; Law et al., 1979
G2: I usually avoid hurting other people's feelings, even when I feel that I have been offended. (-)*	Rathus, 1973; Kearney et al., 1984
G3: If I am pressured by others to do something I do not want to do, I usually give in. (-)	Rathus, 1973; Kearney et al., 1984 (modified)
G4: To be honest, people often take advantage of me. (-)	Rathus, 1973; Kearney et al., 1984
G5: I often have a hard time saying 'No.' (-)	Rathus, 1973; Kearney et al., 1984
G6: I avoid doing things that upset other people, even when I have the right and the desire to do so. (-)	Rathus, 1973; Kearney et al., 1984 (modified)
Confrontation:	
H1: When the food served at a restaurant is not done to my satisfaction, I will complain about it.	Rathus, 1973; Kearney et al., 1984 (modified)
H2: I will confront someone if he/she has upset me.	Rathus, 1973; Kearney et al., 1984 (modified)
H3: When in disagreement with others, I will argue my position.	Rathus, 1973; Kearney et al., 1984 (modified)
H4: I complain about poor services in a restaurant and elsewhere.*	Rathus, 1973; Kearney et al., 1984
H5: I will confront somebody attempting to push ahead of me in a line.	Rathus, 1973; Kearney et al., 1984 (modified)
H6: I strive harder than other people to get ahead.*	Rathus, 1973; Chan, 1993; Law et al., 1979

Scale: 1 = very inaccurate and 7 = very accurate in describing you as a person
*: excluded from the analysis
(-): reverse coded

Cluster Competitiveness: The Six Negative Forces

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Regional clusters have gained great popularity with international development agencies, local authorities, planners, and corporate strategists, as a means of achieving greater competitiveness and economic growth. A considerable body of work has rendered strong theoretical and empirical support to the cluster approach and governments have poured in enormous amounts of funds to promote and facilitate cluster strategies. Yet, not all clusters are sustainable. This paper pulls together insights from knowledge management, strategic management as well as social network, social identity, and social exchange theories to provide a comprehensive understanding of the socio-political dynamics of clusters. Specifically, it is argued that the competitiveness of regional clusters can be compromised by the development of a homogeneous macroculture, social identity discrepant, power imbalance, market rationalization, lack of untraded interdependencies and overwhelming negative externalities.

Introduction

Regional clusters have been touted as a way of achieving growth through increased operational efficiency, faster innovations and more successful entrepreneurial startups (Krugman, 1991; Scott, 1998; Martin & Sunley, 1998; Porter 1998). Many case studies show that clustering enhances competitiveness because of collective efficiency and cohesive network relationships that develop (Bartelman, Caballero & Lyons, 1994; Martin & Ottaviano, 2001; Nadri & Schmitz, 1999; Rabellotti, 1999; Schmitz, 1995). The agglomeration literature generally underscores positive cluster dynamics that generate positive self-reinforcing feedback loops, leading to further growth and higher profitability. As such, many governments try to promote the development of regional

clusters by offering tax benefits, financial incentives, and infrastructural facilities to encourage foreign multinational corporations and entrepreneurial firms to relocate in favor of their clusters (Schmitz, 2000; World Bank, 2000).

Spatial competitiveness is the ability of a regional economy to not only attract and keep viable business enterprises with stable or increasing market shares, but also to sustain or enhance the living standards of its residents (Storper, 1995; Begg, 1999). Regional economies compete among themselves based on their competitive advantages such as superior technology, state-of the-art infrastructure and institutional capital, or comparative advantages such as wage flexibility and exchange rate favorability (Camagni, 2002). As such, the competitiveness of regional economies may change over time (Gardiner, Martin & Tyler, 2004).

To ensure sustainable inflow of resources, clusters compete with one another to attract finance, entrepreneurial talent and managerial capabilities by developing cluster-specific knowledge assets, creating superior market value, offering promising innovative capability, and providing up-to-date infrastructure. Clusters do not stand in splendid isolation. Rather, they are pitched against one another by dynamic competitive forces in an ongoing battle for scarce resources. Regional economies that face competitive or comparative disadvantages may become trapped in "spirals of relative decline" when their firms find it increasingly hard to access export markets (Greene, Tracey & Cowling, 2007, p. 5).

We know empirically about the decline of two well-known clusters: viz., the minicomputer cluster at Route 128 in Boston, Massachusetts and the mainframes cluster in Minneapolis, Minnesota. They painfully illustrate how rapid decline and economic devastation may follow on the heels of phenomenal growth (Pouder & John, 1996). In Europe, the cluster of closely-linked specialized Swiss watch producers and that of iron and steel producers in the Ruhr region of Germany, also adapted poorly to external technological changes and overlooked new market opportunities (Grabher, 1993; Glasmieir, 1994).

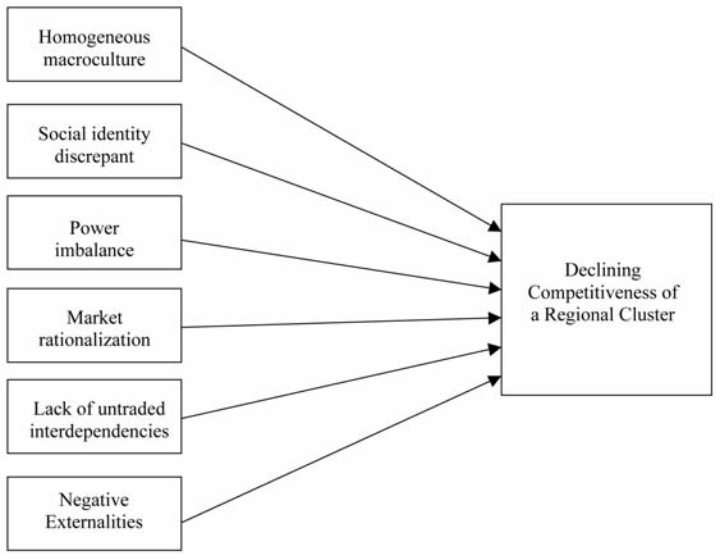
While most studies emphasize how positive intracluster dynamics enhance the competitiveness of firms located therein (Bennett, Graham & Bratton, 1999; Håkanson, 2005; Martin & Ottaviano, 2001; Porter, 1998; Smith & Ibrahim, 2006), not enough attention has been given to dysfunctional cluster dynamics which may jeopardize cluster competitiveness (Martin & Tyler, 2003; Staber, 2007). That is, much of the literature tends to "ignore broader, non-output related modalities of regional competition which may tend to have rather more negative than positive connotations" (Bristow, 2005, p. 300). I attempt to fill this void by examining the forces at work that could negatively impact the competitiveness of clusters.

I suggest a theoretical framework in which six negative forces generate self-reinforcing feedback loops which may lead to declining competitiveness. The six forces are: (1) a homogeneous macroculture, (2) a negative identity discrepant, (3) an intracluster power imbalance, (4) the introduction of new market rationalities, (5) the lack of untraded interdependencies, and (6) the presence of negative externalities.

I define the key concepts used below as follows: first, homogeneous macroculture is the existence of common mental models, shared pools of knowledge, and accepted sets of competitive behavioral norms that bind cluster firms together as a collective

entity. Second, social identity discrepant is the undesirable gap between a cluster's identity when it is seen as being less attractive and that of competing clusters. Third, power imbalance is a state of unequal resource dependence. Fourth, market rationalization occurs when novel market rationalities generate new competitive dynamics by changing the rules of competition or even by transforming a market's organizing logic. Fifth, untraded interdependencies are informal exchanges of information in the form of knowledge or technological spillovers that are not regulated by contracts signed or transactions negotiated. Finally, negative externalities are the adverse impacts of congestion, under-concentration and lack of intracluster rivalry.

Figure 1: *A Theoretical Framework on the Threats to Cluster Competitiveness*



This paper is organized into three major sections. Section 2 provides a quick overview of the literature on regional clusters, focusing on the positive forces of clustering. Section 3 discusses the conceptual framework presented in Figure 1 and argues that six negative forces may counter the positive forces leading to declining competitiveness of clusters. In the final section, I will explore the practical and research implications of the six negative forces.

Cluster Competitiveness

Positive Forces of Clustering

The agglomeration of firms in a geographical locality has been variously described in the literature as regional clusters (Porter, 2000), industrial districts (Storper, 1995; Amin, 2000), neo-Marshallian nodes (Amin & Thrift, 1992), and innovative systems (Niosi & Zhegu, 2005; Zhou & Xin, 2003). There are also different definitions of clusters (Martin & Sunley, 2003). For example, Porter (2000) defined regional cluster

as a group of colocated, interconnected firms and associations that are bound by commonalities and complementarities. Becattini provided a slightly broader definition to an industrial district, a concept popular among economic geographers, as "a socio-geographical entity characterized by the active presence of both a community of people and a population of firms in one naturally and historically bounded area" (1990, p. 39).

Regardless of terminology, most researchers acknowledge that intracluster firms gain higher competitiveness from a confluence of several positive forces. According to the industrial district tradition and based on Alfred Marshall's studies, an agglomeration of small and medium-sized companies in the same or related industries can benefit from three externalities. These are the economies of specialization of suppliers, of labor markets and of shared knowledge (Niosi & Zhegu, 2005; Meardon, 2001). Krugman (1986) highlighted external scale economies and low transportation costs as those that make clustering flourish.

According to Porter (1998), regional clusters create value and enhance their competitiveness by benefitting from linkages established horizontally and vertically with colocated firms and associated institutions. Such linkages facilitate the creation of tightly linked input-output systems. This comes from integrating suppliers of raw materials and of parts and components with some dominant industry players, as well as drawing venture capitalists closer to promising entrepreneurs. This tight integration of firms and institutions facilitates interfirm coordination as to their various supply chain roles.

The development of specialized clusters like high-technology and biotechnology clusters in the late 1980s questioned the need for colocation of value chain-related firms. Unlike traditional clusters, these firms did not colocate to fulfill upstream or downstream production requirements. Rather, they did so to capture knowledge externalities flowing from public and private research institutions and laboratories. Technologically complex pharmaceutical, aerospace, and telecommunication products were being designed, developed, and manufactured at different specialized clusters situated in different geographical regions around the world (Taggart & McDermott, 2001). The aerospace industry, for instance, is made up of numerous specialized agglomerations such as engine clusters, civil aircraft assembly clusters, and commercial aircraft clusters (Niosi & Zhegu, 2005).

To understand the competitive dynamics of these new clusters, researchers began to focus attention on the capture of knowledge externalities through strategic tie-ups and collaborations, knowledge spillover from universities, research institutes and laboratories, interfirm knowledge transfer, and the movement of managerial and technical personnel among firms and institutions (Tallman et al., 2004). Some chose to investigate accepted cluster norms and practices that facilitate systematic and interactive learning among firms (Storper, 1995; Asheim, 1999).

In examining Silicon Valleys-type clusters located in different parts of the world, Bresnahan, Gambardella and Saxenian (2001) found that different sets of forces accounted for cluster success at different stages of development. At the initial stage of cluster formation, four determinants were critical. These were: founding and growth

of new enterprises, ready availability of managerial skills, abundant supply of skilled labor, and connection to major external markets. Once a cluster had successfully taken off, the development of positive feedback dynamics became important not only in sustaining growth, but also in enhancing its competitiveness. This helped to sustain the interest and attention of venture capitalists, entrepreneurs, and skilled labor. Positive feedback dynamics can facilitate the exchange of strategic technical information and market knowledge among collaborative firms, hastening the accumulation of agglomeration benefits, and generating network synergies.

Many published journal articles on clusters, whether case studies or empirical analyses, lent strong support to the idea that spatial agglomeration improves economic performance and employment growth (Fingleton, Igliori & Moore, 2004). However, whether agglomeration also promoted innovation as postulated by Porter (1998) and Krugman (1991), remains an unsettled research question (Baptista & Swann, 1998; Suarez-Villa & Walrod, 1997). Moreover, agglomeration does not assure sustainable wealth generation as there are instances of cluster decline and loss of competitiveness. In the following sections, drawing insights from knowledge management, strategic management, social network, social identity and social exchange theories, I describe how various sociopolitical dynamics in the cluster environment may negatively impact the relative competitiveness of clusters.

Negative Forces of Clustering

I suggest that six negative forces may lead to declining cluster competitiveness. The six forces are: a homogeneous macroculture, a negative identity discrepant, an intracluster power imbalance, the introduction of new market rationalities, the lack of untraded interdependencies and finally, the presence of negative externalities.

Homogeneous Macroculture

Macrocultures are characterized by shared metaphors or world views (Huff, 1982), the homogeneous application of constructs (Spender, 1989), the presence of a common pool of knowledge specific to a group of people (Hambrick, 1982), the sharing of idiosyncratic beliefs among senior managers of a related set of organizations (Abrahamson & Fombrun, 1994), and industry-based shared assumptions, values and behavioral patterns (Jones, Hesterly & Borgatti, 1997). In clusters, interlinked value-adding networks among firms and institutions can set in motion a dynamic that may lead to the development of a homogeneous macroculture that stabilizes the exchange structure within the cluster.

However, when a homogeneous macroculture develops within a regional cluster, its competitiveness may decline for several reasons. This is because clusters are not completely isolated. Rather, clusters have a certain degree of openness and of closure to the external environment. Openness denotes the degree to which intracluster firms have significant ties with extra-cluster firms; closure denotes the degree to which intracluster firms have significant bonds with one another. How open a cluster is depends on how thick the linkages among intracluster firms and extracluster firms are. Thick internal bonds encourage norms of trustworthiness to emerge that engender the proliferation of obligations and expectations (Coleman, 1988).

Thick internal bonds mean a greater embeddedness of firms within a cluster. This, in turn, promotes economies of time as trust that helps to displace the need for excessive monitoring and protracted negotiations for collective action (Granovetter, 1985). Cluster-specific architectural knowledge also speeds up the flow of knowledge within a cluster and enhances the learning and absorptive capacity of cluster firms (Belussi & Pilotti, 2002; Gertler, 2003; Pinch et al., 2003). Fine grain information exchange speeds up decision making, and real-time joint problem solving arrangements come about more easily (Uzzi, 1997). Meanwhile, intracluster movement of people across firms speeds up the transfer of tacit technical and managerial knowledge (Almeida & Kogut, 1999).

However, too much embededness may occur when firms within a cluster fail to achieve a suitable degree of openness to extracluster ties. Overly thick internal bonds can promote an excessive tendency toward looking inward. This can lock out extracluster firms from participating in intracluster social networks, resulting in thin extracluster ties. Over-embedded firms may just resort to a "deep" search for ideas inside the cluster instead of a "broad" search for ideas outside. Pouder and St. John (2006) argued that geographical clustering of firms may lead to the development of a deep structure (i.e., a basic configuration of interdependence among firms within the cluster), which holds specific mental models and competitive behavioral patterns. This development of a homogeneous macroculture may create an unhealthy paranoia about internal competition, desensitize the cluster from threats in the larger competitive environment, and cause it to engage in unproductive efforts to innovate. Isolated clusters can get stuck with certain path-dependent technological trajectories and become constrained by the limitations of their own worldviews. This may transform their collective competencies into competitive disadvantages and strategic inertia (Abrahamson & Fombrun, 1994). Such clusters could become more vulnerable to environmental jolts because of resource diseconomies, insular competitive practices, ineffective and infrequent innovation (Pouder & St. John, 1996).

The development of corporate atherosclerosis and blind spots can impact the absorptive capacity of firms within a cluster. Through intracluster socialization, firms develop sets of criteria for evaluating the efficiency and effectiveness of alternative means of reaching their goals. These may differ significantly from those adopted by extracluster firms. For example, intra and extracluster evaluations of the costs and benefits of a new business arrangement may differ greatly because of differences in cost-benefit calculations, cost projections, and value commitments (Rueschemeyer, 1977). Overly strong intracluster relationships may cause complacency by promoting conformity to norms which discourage innovation, blinding firms to external challenges and hindering the integration of extracluster firms into the social network.

These arguments find empirical support in Florida, Cushing and Gates' (2002) study of metropolitan areas in the United States. Comparing the levels of social capital with the levels of innovation (based on technological intensity and the number of patents filed), they found that areas with low levels of innovation were associated with high scores on social capital. Conversely, areas with high levels of innovation were associated with below-average levels of social capital. This study showed that overly strong intracluster ties could be detrimental to innovativeness.

Given the theoretical argument and empirical support discussed above, one could argue that deeply embedded clusters are especially vulnerable to radical technological change. While homogeneous macroculture facilitates interfirm interactions, interactive learning, and incremental improvement, it is less likely for such a cluster to promote or endorse revolutionary technological change since technological development is path dependent (Bathelt & Boggs, 2003). If shared knowledge holds a cluster of firms together, then radical changes in the technological regime could loosen exchange ties within cluster. Firms may then find it necessary to relocate to other clusters where knowledge of alternative technological trajectories and paradigms reside. Therefore,

> *Proposition 1:* Cluster competitiveness may be jeopardized when intracluster firms become so deeply embedded within a homogeneous macroculture, that they are constrained by embedded logics or rationalities to fully appreciate threatening extracluster developments.

Social Identity Discrepant

Social identity is about one's sense of belonging to a social group. Social identity theory emphasizes social categorization, identification and construction of self-image. Social categories are distinct perceptual classes that confer meanings on constituents by emphasizing similarities within groups and differences between groups (Tajfel & Turner, 1986). Where there is social mobility, members of a social category may change their social identities by moving to other social categories. Thus, the social identity conferred by one's group membership can be a major reason for defection when the status of one's original group is perceived to have fallen relative to a competing social group.

Likewise, the social identities of organizations are arguably also derived from their membership in formal groups. Organizations want to maintain and sustain a positive social identity. Where there is mobility, organizations seeking to enhance their social identities may choose to move to more socially desirable groups (Rao, Davis & Ward, 2000). Thus, defections by a critical mass of firms of a regional cluster may undermine the social identity of non-defecting firms. Cluster sustainability would thus be threatened when identity discrepant cues accumulate with increasing defections. Since social identity is affirmed by social comparison, defections of important cluster firms to other clusters may confuse the remaining firms (Rao, Davis & Ward, 2000). In sum, the competitiveness of a regional cluster is compromised when a large number of firms defect elsewhere in the search of higher cluster status.

External ties may well prevent parochial mindsets from developing, but social identity theory suggests that the more external ties firms in a cluster have, the weaker their social identities derived from their membership in that cluster. There would then be a bigger likelihood of defecting. However, the concept of superordinate social identity may explain otherwise. A superordinate group may take the form of virtual communities, discussion groups, industry associations or professional societies. Superordinate social identity is a shared social identity that people develop when they perceive themselves to be members of a higher-level category encompasses various

groups. Research affirms that shared superordinate identity helps to reduce intergroup bias (Allport, 1954; Sherif, 1966) and ingroup favoritism (Gaertner & Dovidio, 2000). Thus, it can help create more positive attitudes towards outgroups that are brought in under the same umbrella (Gaertner, Dovidio & Bachman 1996). This can increase the likelihood of intergroup knowledge transfer (Kane, Argote & Levine, 2005).

Extending this rationale to firms in a cluster, the development of a superordinate social identity may arguably promote cluster survivability, not only by reducing intracluster parochialism, but also by increasing knowledge sharing across clusters. Conversely, a failure to develop a superordinate social identity may predispose to cluster decline as firms could defect to other clusters in an attempt to enhance their individual social identities. Hence,

> *Proposition 2:* Cluster competitiveness may be threatened if the social identity firms derive from its membership is perceived to be less desirable than that conferred by a competing cluster unless firms also develop superordinate social identities that lower the perceptual differentials.

Power Imbalance

Clustering is not just about geography. It also involves dynamic sociopolitical processes, specific structures of dependencies, institutions and individuals. Firms and institutions are dependent on each other for the exchange of valued resources. Dependence is a source of power for those on whom others are dependent (Emerson, 1972). There are two determinants of that dependence: resource value and resource availability (Emerson, 1962). The more valuable one's resources are to others and the fewer the alternative sources for them, the more power one has over their dependants. As such, a person, firm or institution's position within networks of dependencies will determine its relative power. Network theory posits that the more centrally located one is within a social network, the more power one has. Thus, centrally located firms are more influential because they wield greater control over the flow of resources and information (Cook & Emerson, 1978; Cook & Gilmore, 1984). Conversely, peripheral firms have less power because of their dependence on centrally located ones for resources and information given their lack of alternative sources of resources.

Power asymmetries result from unequal resource dependence relations among participating producers, suppliers and customers (Molm, Takahashi & Peterson, 2000). For example, Nokia dominates the telecommunications cluster in Helsinki to the extent that it employs more than half of Helsinki's technical university graduates and serves as the major client for most firms in the cluster (Van den Berg, Braun & Van Winden, 2001).

That power asymmetry may manifest in two forms of imbalances: (a) relational imbalance within an exchange relationship and (b) structural power imbalance within the exchange network (Cook, 1990; Cook & Emerson, 1978; Emerson, 1981; Molm, 1989). Either form of power imbalance may lead to cluster instability as powerful firms may decide unilaterally to undermine other firms in the cluster when it profits them to do so. For example, if centrally-located firms relocate, this may cause

dependent firms to suffer and the cluster to become less competitive.

Such power asymmetries are seen in many regional clusters found within developing economies where clusters are developed around production plants of multinational companies (MNCs) attracted by tax concession, grants, and low labor costs (Clancy et al., 2001; Zhou & Xin, 2003). Within such clusters, the relationships between MNCs and local firms tend to be hierarchical. To reduce power asymmetry, less powerful local firms may try to innovate to create value. For example, while MNCs are important sources of new technology at Zhongguancun high-technology cluster in Beijing, local firms there try to create value by acting as important sources of local market knowledge and fulfilling subsidiary needs along the value chain. There, while MNCs are involved in product development at the high end and local firms at the low-end, the latter are also involved in system integration.

The Zhongguancun cluster remains attractive by keeping up with the latest technological advances and, more importantly, by pioneering new technologies through its indigenous R&D base, diversity of firms, skilled labor force, and entrepreneurial culture (Zhou & Xin, 2003). Likewise, in Singapore, local small and medium-sized firms are able to reduce power differentials and create a perception of interdependence, rather than create dependence by enabling a reverse flow of technology through complementary innovations in its hard disk cluster around Seagate (Chew & Yeung, 2001).

In sum, cluster competitiveness may be threatened by power asymmetries as dominant firms may choose to exit. This could lead to an exodus of dependent firms, thereby disrupting social networks in the cluster and leading to declining expectations of reciprocity. Hence,

> *Proposition 3:* Cluster competitiveness may be threatened by disproportionate power assymetries among firms if dependant firms are unable to counter such imbalances with incremental and complementary value-creating innovations.

Market Rationalization

The global marketplace is in a constant state of flux as competitors look out for the next big thing. New entrants unencumbered by past practices, mental models, or legacy technologies are incentivized to introduce new business models that can radically transform the competitive dynamics among clusters. The introduction of new market rationalities in this manner may destabilize a cluster as new cost profiles or new technological imperatives can potentially trump those existing ones, rendering them obsolete and less competitive (Uzzi, 1997).

In regard to cost rationality, the product life cycle theory postulates that firms tend to move from high-wage regions to low-wage regions. These regions do so in order to compete on the basis of price when process technology becomes more standardized and also to act as new markets for the emergence of mature products (Vernon, 1966). Thus, declining cost competitiveness may lead firms to relocate to another competing cluster in order to remain competitive. A case in point is the Bingo garment cluster in Japan which started out as a garment center for the production of factory uniforms and a special fabric. Some garment producers chose to relocate their production base to

northwestern Kyushu in the 1970s in order to reduce their labor costs by 20 to 30%. They then moved to China in the 1990s to reduce their wage cost by 92%. Bingo could not have survived as a garment cluster if it had not innovated by moving on to the design and marketing of high-quality fashionable products or developed new markets (Yamamura, Sonobe & Otsuka, 2003).

In regard to technological rationality, advancements may introduce new technology-based rationalities by altering the minimum efficient scales of operation and input requirements. These can upset the prevailing competitive dynamics of clusters by lowering entry barriers and encouraging new entrants (Henley, 1994). Since firms situated within an existing cluster generally operate under similar cost structures and draw resources from the same labor pool, suppliers, and stocks of knowledge, they will be at a disadvantage should the embedded organizing logic become inferior to the emerging logic of a competing cluster.

In terms of technological development, clustering need not be consistently positive through the life cycle of a cluster. The development of a strong homogeneous macroculture is an advantage in the early phase of cluster growth as it promotes collective efficiency and speeds up the development of a chosen technology regime through incremental innovations. However, once the chosen technology developmental path becomes entrenched within a cluster, further development will entail achieving higher efficiencies at the cost of innovation (Abernathy & Utterback, 1978). If this happens, the cluster will be constrained by legacy technology choices. Its ability to respond to radical technological innovations going on outside the cluster becomes curtailed.

The development of a disruptive technology can cause much market disequilibrium when it overrides the existing dominant technology, transforms the way firms compete in the marketplace, and rewrites the rules of the game. When a disruptive technology's organizing logic begins to reconfigure competitive dynamics among clusters, firms located in "weakening clusters" will be incentivized to relocate. A rapid declustering of firms can disrupt the industrial base of an existing agglomeration dramatically (Fingleton et al., 2004; Fingleton, Igliori & Moore, 2005; Suarez-Villa & Walrod, 1997). Studies in Brazil, Korea and Japan have documented industries and workers moving en masse within two to three years to nearby satellite towns, suburban areas, or hinterlands (Chun & Lee, 1985; Henderson, Lee & Lee, 1999; Townroe, 1981). With globalization, this can even proceed across borders and continents, which can lead to the declining competitiveness of existing clusters. Therefore,

> *Proposition 4:* Cluster competitiveness may be threatened when its organizing logic becomes inferior to a new one emerging in competing clusters.

The Lack of Untraded Interdependencies

Porter (1990) argued that the twin forces of proximity and affinity are critical in enabling the flow of information and knowledge among buyers, suppliers and associated institutions. While proximity does provide ample opportunity for face-to-face human interaction, it is affinity developed through shared experiences in school,

clubs, professional associations and other enduring social relationships that establish channels for interpersonal communication. Thus, clusters promote the development of mutual relationships and interdependencies only if both forces of proximity and affinity prevail.

This came about after a study comparing California's Silicon Valley to Route 128 outside Boston. Saxenian (1994) found that the entrepreneurial success of the former was attributable to its tradition of interorganizational knowledge sharing, while the latter's entrepreneurial activity was stifled by a tradition of secrecy. The technical and business communities in Silicon Valley were able to respond to changes in technologies and market conditions through their strong professional linkages with the academic communities of Stanford University and the University of California at Berkeley, as well as the venture capitalist community.

For Storper (1995), "untraded interdependencies" described technological spillovers and informal exchange of strategic insights, knowledge, and interpretations. Tallman et al. (2004, p. 258) called it "knowledge exchanged informally and without explicit compensation." According to Storper (1995), untraded interdependencies which cannot be captured by input-output transactions or contract exchanges explain the spatial patterns of regional clusters. He asserts that the Silicon Valley shows no sign of weakening as a cluster because "geographically-constrained untraded interdependencies outlive geographically-constrained input-output linkages," the former emphasizing informal or tacit ties, the latter formal contracts and relationships (Storper, 1995, p. 209).

Untraded interdependencies emerge from networks of conventions, rules, common understandings, and shared language. Below the surface of local industrial cultures is an ethos of innovation through informal, collective interactions (Bellandi, 1989; Antonelli, 2000). This close link is perceived to exist in industrial districts of north-east and central Italy where firms share equipment and technical information, take on larger orders cooperatively, subcontract jobs to competitors who lose out on orders and also refrain from wage competition.

In such cultures, there is collective learning and the poaching of workers is frowned upon (Brusco & Sabel, 1981; Lorenz, 1992; Sabel & Zeitlin, 1985). In the development of a shared knowledge base among people, colocated geographically can help reduce dynamic uncertainty. It facilitates the coordination of actions and problem solving (Camagni, 1991). Collective learning takes place through informal interaction among people and organizations as well as the mobility of skilled labor and managers within the cluster.

Thus, if untraded interdependencies fail to emerge in a locality, then linkages among firms will be weak, and the larger industrial culture will be less than supportive. If linkages are weak, collective learning and the shared knowledge base will be also. According to Bell and Albu (1999), the mere existence of a cluster of production systems does not imply dynamic knowledge flows among cluster firms are necessarily present. They argue that production systems and knowledge systems are not identical because they tend to involve different sets of people. For example, input-output linkages facilitate transactional exchanges but do not to promote the generation or diffusion of knowledge.

A study by Hansen (1988) on the sharing of knowledge across organization subunits revealed that weak interunit ties hindered the transfer of complex knowledge. This concurred with Appleyard's (1996) finding that interfirm knowledge sharing must occur in private and public channels in order to sustain business vitality and economic growth. Many studies have highlighted the immobility (Attewell, 1992), inertness (Kogut & Zander, 1992), and stickiness (Szulanski, 1996; Grant, 1996) of knowledge. If so, the transfer of complex and ambiguous knowledge across firms within a cluster could be difficult when weak intracluster ties are prevalent. Without a shared knowledge base, a regional cluster will have difficulties sustaining its competitiveness. Hence,

> *Proposition 5:* Cluster competitiveness may be jeopardized when it fails to generate untraded externalities that promote collective learning and the development of a shared knowledge base.

The Presence of Negative Externalities

Clusters can generate both positive and negative externalities. Positive cluster externalities confer benefits of spatial proximity while negative cluster externalities confer liabilities. The nature and kinds of cluster externalities may vary as the geographical density of firms vary over time. As clusters grow and mature, over-concentration can lead to congestion as negative externalities emerge. On the supply side, congestion effects can lead to rising labor and real estates costs, and skill shortages (Bennett et al., 1999). On the demand side, external diseconomies may mean thinning profit margins as firms overcompete, which may lead to declining investments in R&D and, thereafter, downtrends in innovations.

Congestion effects can overwhelm positive externalities when cluster intensity transcends an upper threshold that is determined by location-specific characteristics (Fingleton et al., 2005).

In the Norwegian salmon aquaculture cluster, an increase in regional farm density was associated negatively with productivity, even though density correlated positively with technical efficiency. This finding implies that at some point, negative congestion externalities that had to do with fish illnesses might have overwhelmed the benefits of positive externalities related to knowledge spillovers and the use of specialized inputs (Tveteras & Battese, 2006).

Clusters may also fail to take off. Under-concentration and inadequate density can be a liability with regard to creativity and innovation if a critical mass of innovative firms is absent. Studying the impact of agglomeration on the generation of new knowledge, Varga (1998) correlated 4,000 product innovations to annual research expenditures of U.S. universities and research institutes of private companies. The level of innovative output was found to be influenced by the density and size of a cluster. Similar results were obtained by Andersson, Quigley and Wilhelmsson (2005) in a study of commercial patents granted in Sweden. Higher patent activity was positively correlated with higher workforce diversity and labor force density. In another study on the impact of clustering on innovation in Italy and United Kingdom, it was found that clustering might not be conducive to higher innovative performance.

Rather, the innovativeness of cluster firms was contingent on the presence of other innovative firms (Beaudry & Breschi, 2003). Thus, firms in clusters that are densely populated with innovative firms are more likely to innovate. Conversely, firms in clusters with mainly noninnovative firms are less likely to innovate.

Clustering does not automatically confer higher technological competitiveness. In fact, the absence of intense intracluster rivalry may negatively impact the technological sophistication of cluster firms. A study on machinery producers in Sweden found that locally embedded technology relations correlated negatively with firm technological development. However, large firms facing intense internal rivalry tended to have higher technological levels (Larsson & Malmberg, 1999). This study highlights the importance of rivalry and a competitive environment in stimulating cluster firms to achieve higher levels of technological development (Barnett, 1997; Barnett & Hansen, 1996). In sum, the absence of a critical mass of innovative activities and the presence of weak intracluster competition can be disadvantageous to cluster well-being. Hence,

> *Proposition 6:* Cluster competitiveness may be threatened when its negative externalities outweigh its positive ones.

Discussion and Conclusion

Many countries compete to attract dominant firms to spearhead the development of economic clusters within their borders. Some have succeeded in influencing the location and spatial distribution of economic activities to their benefit through a variety of policy instruments such as subsidies and the provision of free trade zones, industrial estates, and transshipment facilities. But such conventional incentives may no longer suffice. New sets of expectations associated with the emergence of new market rationalities can influence location decisions. Novel considerations may include the protection from terrorist threats, protection of intellectual property rights, the local capacity to innovate, and even clean air.

I have argued that six negative forces can be at work to threaten the competitiveness of regional clusters. If clustering leads to insular competitive practices that reduce the capability of firms to respond swiftly to global technological challenges, the cluster can become less attractive as a destination for future agglomeration. In fact, if other clusters become more attractive, this will cause an accumulation of identity discrepant cues that are large enough to trigger a relocation by cluster firms. Worse still, rapid disintegration may occur when powerful anchor firms choose to relocate.

Not all firms benefit from agglomeration. Mere spatial proximity is not sufficient for generating untraded interdependencies. Instead, the overconcentration of firms and the absence of innovative and competitive cluster dynamics may negatively impact the economic and technological performance of cluster firms. The introduction of new business models and organizing logics can destabilize existing clusters. New cluster configurations may even be critical for firms to remain competitive.

Government policy makers must understand and manage cluster dynamics

throughout the life cycle to mitigate these six forces to forestall cluster disintegration and decline. Clearly, there is no one-size-fits-all approach that will ensure cluster survival. Different clusters have different network structures, interfirm power dynamics, organizing principles, and development trajectories (Markusen, 1996; Altenburg & Meyer-Stamer, 1999). As such, different policy instruments should be created to address different cluster-specific weaknesses.

While the chances of survival increase with the accumulation of positive knowledge and scale externalities in the cluster, there may be counteracting forces from overcrowding and from technologies locking in path dependencies. To avoid these traps, governments may help conduct extracluster surveillance to monitor the development of new knowledge in foreign clusters. They may also help to strengthen intercluster ties to enable the transfer of strategic knowledge. Governments should consider subsidizing investments in emerging alternate technologies and facilitate the diversification of the bases of firms. If there are steps they can take to mitigate the undesirable impacts of negative externalities, governments must also help out in this regard.

Governments may encourage greater intracluster cooperation by facilitating the formation of horizontal and vertical linkages for joint action and collective efficiency (Rabellotti, 1999). Since complex, ambiguous knowledge is difficult to transfer by weak intracluster ties, policymakers may need to facilitate and promote greater formal and informal knowledge exchange among cluster firms. This will also stimulate the emergence of a shared knowledge that can be attractive enough to discourage defection.

Attaining collective efficiency has been shown to be crucial for manufacturing-based and natural resources-based clusters but less so for complex products or technology clusters (Giuliani, Pietrobelli & Rabellotti, 2005). In the latter case, accessing idiosyncratic resources such as technological discoveries, entrepreneurial talent and experiences are more critical (St. John & Pouder, 2006). Moreover, the social dynamics of clusters, especially technology clusters, may include intense rivalry which may raise the sense of alertness and urgency that can help generate further improvements through more intensive innovative activities (Staber, 2007b). But they may also evoke predatory sentiments instead of cooperation, support and trust when proximity to one's rivals provides valuable opportunity to observe their competitive strategies up close.

A homogeneous macroculture that blinds cluster firms to extracluster developments would be a big negative. In this regard, there are valuable lessons to be learned from the mobile telecommunication equipment cluster at Xingwang Industrial Park in Beijing. The Nokia-Capitel, the dominant firm, and 30 major suppliers are located there. The relatively homogeneous nature of this cluster made the development of homogeneous macroculture highly probable. Recognizing the importance of external linkages in keeping suppliers up to speed with latest developments elsewhere, Nokia-Capitel requested its suppliers to have up to 60% of their net sales to external customers over a reasonable period of time. That policy has not only prevented the over-dependence of suppliers on Nokia-Capitel but has also ensured constant surveillance of extra-cluster competition and access to extracluster knowledge (Yeung, Liu & Dicken, 2005).

There is also a concern about radical market shifts or disruptive technological developments. Thus, clusters must set in place a self-renewal process to ensure timely and successful adaptation. Two cases illustrate that the adverse impact of path-dependent strategies and how external agents may trigger profound changes in clusters (Meyer-Stamer, 1998). First, the woolen knitwear cluster in Ludhiana, India survived a crisis in 1991 when its primary export market collapsed. It then set out to improve product quality through upgrading technical skills and reorganizing work processes to meet the more sophisticated demands of new markets (Tewari, 1999). Second, at the apparel cluster in Torreon, Mexico, the arrival of new and large U.S. buyers led to an upgrading in the range of production at cluster level and heightened competitiveness at firm level (Bair & Gereffi, 2001). This affirms the importance of extracluster links in transforming dysfunctional cluster dynamics.

Overall, policy makers must be mindful of the distinction between practices at the firm, network, and cluster level because decisions made at firm level may benefit the firm concerned but could jeopardize the cluster's overall competitiveness (Staber, 2007). Policy makers also need to decipher whether the level of firm concentration in a cluster is below the critical threshold level needed to enjoy efficiency gains or above the threshold where negative returns set in. Incentives could be designed to promote agglomeration at a specific site or encourage dispersion to alternate sites. Of course, the crucial question is how to identify these thresholds. Unfortunately, despite many studies on regional agglomeration, not enough has been learned about clusters at their different stages of development to answer this question. A lot more work needs to be done.

There is also a need to study empirically how competition impacts cluster composition, how roles played by different firms and institutions impact cluster sustainability, and how intracluster variability impacts its adaptability and competitiveness. Mathematical modeling could provide greater quantitative precision in delineating the dynamic interplay of various positive and negative forces at different life cycle stages. The task may be arduous, but the rewards will be bountiful.

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Everything is Relative, but Relative to What? Defining and Identifying Reference Points

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Reference points are an integral part of many organizational practices and theories. In spite of their widespread use, there has been very little theory development on reference points themselves. We investigate and propose a general theory of reference points. First, we develop a definition of reference points. We then identify reference point dimensions and how they contribute to reference point selection. Lastly, we propose a model of reference point selection and suggest how several moderators may affect the process.

"Put your hand on a stove for a minute and it seems like an hour. Sit with that special girl for an hour and it seems like a minute. That's relativity." —Albert Einstein

Einstein's theory of relativity gave birth to the axiom, "everything is relative." Management theory and practice has certainly embraced this concept through the use of reference points. A reference point is something we use to compare new stimuli against in order to make sense of that stimuli. Using reference points is part of the perceptual process from which we describe, evaluate, and/or make decisions about things, people, and events. For example, a manager may compare this week's performance to last week's (reference point) and determine that it is substandard.

Employee A may compare her salary to employee B's (reference point) and decide she is paid fairly. Or, a human resources manager may determine that an employee's dress is inappropriate for the times. Everything is relative to some reference point.

A discussion of reference points is incorporated in many business research areas such as marketing (Shoham & Fiegenbaum, 1999; Van Auken & Adams, 1998), economics (Brown, 1995), and the management fields of strategy (Fiegenbaum, Hart & Schendel, 1996; Fershtman, 1996), decision-making (Tversky & Kahneman, 1991), negotiations (Blount, Thomas-Hunt & Neale, 1996; Kristensen & Gärling, 1997a, 1997b; White et al., 1994), compensation (Blau, 1994), ethics (Boyle, Dahlstrom & Kellaris, 1998), and risk (Kahneman & Tversky, 1979). Reference points are a central component of numerous management theories and practices including prospect theory, equity theory, performance evaluations, benchmarking, and stock market analyses.

In spite of their ubiquitous use in descriptions, evaluation, and decision-making, the question of what determines the choice of reference points remains relatively unexplored in management literature. For example, Kahneman and Tversky (1979) developed two well-known theories on decision-making (the prospect theory and the reference-dependent model), which posit that decisions are dependent on how an individual frames the decision in comparison to a reference point. But neither theory attempts to explain how or why a particular reference point is chosen other than to acknowledge that the status quo is a frequently used reference point. One area that has received considerable attention is that of establishing referent others (Goodman, 1974; Kulick & Ambrose, 1992; O'Neill & Mone, 2005). This research is limited to comparisons between individuals and has not been extended to the broader context of reference points. Some researchers have sought to identify which reference points are selected in various situations (Gooding, Goel & Wiseman, 1996; Kristensen & Garling, 1997a), but no attempt has been made to identify the dimensions of reference points or the processes involved in their selection. In fact, researchers have yet to provide a clear and consistent definition of reference points.

This is a critical oversight in the research literature. Defining reference points, understanding their dimensions, and modeling the process by which reference points are selected can provide vital insights into individual perceptions and decision-making processes. For example, it is well documented that framing effects are dependent upon reference point selection (Kahneman & Tversky, 1991). Understanding which reference point an individual will choose and why is crucial to better understanding the framing process and the resulting decision. Practically speaking, if managers understand how and why employees choose their reference points, they may be able to influence that process, thereby influencing their judgments and decision-making. Knowing what referent another individual is likely to choose may give us the insights necessary to influence job satisfaction and to predict and prevent such behaviors as job turnover (Dittrich & Carrell, 1979; Kulik & Ambrose, 1992). Drawing from the existing management and psychology literature, we propose a definition of reference points and their dimensions, as well as a model of reference point selection.

Definition

While the basic concept of reference points is relatively clear, few formal definitions have been offered and those that have been are not consistent. Lim (1995, p. 8) defined reference points as "an expectation level," but he notes that this definition is intentionally narrow to fit his specific topic. Many researchers discuss using anchoring points more interchangeably with reference points (Holyoak & Gordon, 1983; Rosch, 1975; Smith, Cooney & McCord, 1986), but Kahneman (1992) draws a distinction. Still, he refers to reference points as something against which outcomes are coded and evaluated.

One general definition for the word "reference" is something that serves as a source of information. The central concept of reference points is that they act as a point of comparison from which we learn about a new stimulus. For any stimulus to act as a reference point, it must possess known characteristics (Kahneman, 1992; Rosch, 1975). We must be familiar with at least some attribute of the reference point if we are to use it as a standard against which we can compare something else (Holyoak & Gordon, 1983).

In addition, there must be something about the new stimulus which is unknown (Kahneman, 1992; Rosch, 1975). If we know all there is to know about something, we have no need to compare it with something else. The act of comparing it with the reference point is designed to help us gather information about an unknown feature relative to a known domain (Brown, 1995; Kahneman, 1992; Rosch, 1975).

And finally, the unknown feature of the new stimulus must share a perceived connection with a known feature of the reference point (Goodman, 1974; Holyoak & Gordon, 1983; Kahneman, 1992; Rosch, 1975; Smith et al., 1986; Wisniewski & Bassok, 1999). While humans are capable of making many types of associations between objects or ideas (e.g. analogies, thematic connections, categorical connections) (Wisniewski & Bassok, 1999), researchers have noted that reference points require a categorical connection (Fiegenbaum et al., 1996; Kahneman, 1992; Rosch, 1975). Other types of associations such as the thematic connection made between key and car, do not facilitate comparison. Categorical connections allow comparisons on the basis of the shared category. Goodman (1974) refers to this as referent relevance. Cars and boats can be compared because they both belong to the category of modes of transportation. Nevertheless, categorical connections can be very broad in nature since we are capable of categorizing individual stimuli in multiple categories. These concepts allow us to form a working definition of reference points.

> *Definition:* Reference points are stimuli of known attributes that act as standards against which other categorically similar stimuli of unknown attributes are compared in order to gain information.

Dimensions

This research proposes that reference points have at least five dimensions: familiarity, connectivity, similarity, temporal, and locus. The first two of these are

implicit from the proposed definition while the others present themselves from previous research. Understanding these is important as each dimension will have an impact on the selection process. Each dimension becomes a possible criterion for sorting and selecting among potential reference points. The following section describes each dimension and how it interacts with the selection process in general. As we will show, the saliency of each dimension may change depending upon the circumstances.

Familiarity

By definition, we must be familiar with some aspect of a stimulus in order to use it as a reference point. Familiarity is crucial to the notion of reference points. It is not necessary though to know everything there is to know about it. Instead, we only need to know specific characteristics about it. These characteristics must be those for which we are seeking information for our initiating stimulus.

The need for familiarity has been recognized by other researchers (Holyoak & Mah, 1982; Rosch, 1975; Stapel & Koomen, 1998). Holyoak and Mah (1982) proposed that reference points may possess different levels of familiarity. When we are very familiar with a stimulus, we use it as a habitual reference point. Stimuli with which we are less familiar may be used as transient reference points when a better reference is not available. Holyoak and Gordon (1983) found that we use the self as a habitual reference point in similarity comparisons with our friends but not in comparisons with others.

Rosch (1975) demonstrated that we tend to use prototypes, clearest cases, and best examples as preferred reference points. These categories all denote items with which we tend to be most familiar.

> *Proposition 1*: The more familiar we are with a stimulus, the more likely we are to use it as a reference point.

Connectivity

The second proposed dimension is that of connectivity. This means that the reference point must share a common attribute with the new stimulus (Holyoak, 1978; Rosch, 1975). Again, this is an implicit assumption contained in the definition. As has been previously noted, researchers have posited that this must be a categorical connection and the shared attribute must be a known attribute in the reference point and also an unknown or uncertain attribute in the new stimulus. Such a shared connection is necessary for any significant comparative learning or analysis to occur (Frederick & Loewenstein, 1999; Holyoak, 1978; Rosch, 1975).

Psychology researchers have developed several theories about how humans categorize stimuli including spatial models (Nosofsky, 1986; Shepard, 1962), feature-based models (Tversky, 1977), and prototypes or exemplar models (Reed, 1972). A complete understanding of categorization processes is beyond the scope of this article (see Ashby and Maddox, 2005), but a few points are important to consider. First, humans have demonstrated a wide range of categorization skills. We are capable of categorizing a single stimulus into multiple domains using various dimensions or

properties. For example, an apple can be categorized by size, shape, color, or food category (i.e. fruit). Furthermore, we are able to distinguish between these multiple categorizations based on context (Poitrenaud, Richard & Tijus, 2005). Second, some stimuli appear to be better representations of a category than others (Markman & Gentner, 2001). Apples are generally considered a better representation of a fruit than tomatoes.

> *Proposition 2*: The likelihood of a stimulus being chosen as a reference point will increase the more categorically similar it is to the characteristic of interest in the novel stimulus.

Similarity

Beyond the categorical connection between a potential reference point and a novel stimulus, the two may also share other similar features. For example, within the category of birds, sparrows are more closely associated with wrens than with ostriches. This closeness is based upon other categorizations shared by the stimuli (e.g. size, color, location, etc.). While these may or may not be directly related to the aspect being compared, further similarities will probably increase the perceived appropriateness of the reference point (Stapel & Koomen, 1998; Tversky, 1977). If we want to know the size of a particular company, we might compare it to any other company of known size. However, the comparison may seem more meaningful or appropriate if the two companies are in the same industry, are similar in age, geographically near each other, and so forth.

> *Proposition 3*: The more similarities a known stimulus shares with an unknown stimulus, the more likely that it will serve as a reference point.

Temporal

The idea that reference points contain a temporal dimension has been suggested by several researchers (Bell & Bucklin, 1999; Fiegenbaum et al., 1996; Kahneman, 1992, 1999; Loewenstein, 1988). The temporal dimension refers to whether the reference point is based on past, present, or future criteria. For example, a business attempting to assess its performance could use past, present, or a future performance goal as a reference point (Fiegenbaum & Thomas, 1988; Gooding et al., 1996; Heath, Larrick & Wu, 1999; Lee, 1997).

Loewenstein (1988) emphasized this temporal dimension when he showed that purchasing behavior is dependent on whether the buyer compares the price of a product against a previous sale price, the present price of similar goods, or an expected future price (e.g. an expected price increase). Although Fiegenbaum and her colleagues (Bamberger & Fiegenbaum, 1996; Fiegenbaum et al., 1996) divided the temporal dimension into only two categories (past and future), Loewenstein's analysis shows that reference points can exist in the present as well.

In fact, it can be argued that the present state is the most likely one to be chosen for a reference point (Kahneman & Tversky, 1979; Knetsch, 1989; Samuelson & Zeckhauser, 1988; Tversky & Kahneman, 1991). We tend to be more familiar with

current conditions than with either past or future conditions. In addition, current conditions may be more salient. A temporally current reference point is also likely to be perceived as evolving or existing in a similar set of conditions or environment and thus, more similar to the novel stimulus being investigated. While past conditions may also be high in familiarity, they will probably have less connectivity to the current stimulus, though this is not necessarily so. If the present status contains significant unfamiliarity or uncertainty, then a past state may be preferred as the reference point. And finally, a future state is least likely to serve as a reference point because the future often contains significant uncertainty and may lack connectivity to the present stimulus. There is some evidence though that at least one type of future based reference point, goals or aspirations, can be rather influential and persistent (Heath et al., 1999).

Proposition 4: Present criteria are more likely to be used as reference point than are future or past criteria.

Proposition 5: Past temporal states are more likely to serve as reference points than future states.

Locus

The last dimension considered here is locus, or the internal vs. external dimension. Fiegenbaum et al. (1996) considered these as separate dimensions, but use the terms in referring both to the reference point itself and to environmental forces that influence reference point selection. While we agree with them that there are both internal and external forces which impact the reference point selection process, the reference point itself cannot be both internal and external simultaneously.

The locus dimension refers to the originating source of the reference point. Internal reference points come from personal experience or personal ownership (Holyoak & Gordon, 1983). External reference points come from outside the self.

The distinction between internal and external reference points has been considered in negotiations, marketing, and sociology literatures. Negotiations researchers have noted that negotiators use both internal (e.g. reservation price) and external (e.g. market price) reference points (Blount, Thomas-Hunt & Neale, 1996; Kristensen & Gärlinga, 1997a, 1997b; White et al., 1994). Internal and external reference points have been linked to purchasing decisions (Bell & Bucklin, 1999). Some sociologists argue that the self is the primary internal reference point used in analyzing social situations (Holyoak & Gordon, 1983; Rogers, Kuiper & Kirker, 1977; Rogers, Kuiper & Rogers, 1979). Others have noted that social norms often serve as external reference points (Boles & Messick, 1995; Kahneman, 1999; Kahneman & Miller, 1986).

The locus concept can be extended to other levels of analysis as well. An internal organizational reference point comes from within the organization, while an external organizational reference point comes from outside the organization. Organizations evaluating their performance can use internal reference points such as their own previous performance, or they can use external reference points such as industry means or a specific competitor's performance (Fiegenbaum & Thomas, 1988; Gooding et al., 1996).

We propose that internal stimuli are more likely than external stimuli to be selected as a reference point. We tend to be more familiar with and knowledgeable about our characteristics or the characteristics of our organization than with those of others. Internal characteristics also require less cognitive effort to recall and comprehend. For these reasons, internal reference points are particularly likely to be used when complex or difficult characteristics are being investigated. For example, we would typically compare another person's ethical standards or personal integrity with our own rather than with someone else's.

Under some conditions external reference points are needed. We may not share a categorical connection with the novel stimulus such as when we want to know about the fuel efficiency of an automobile. Sometimes the information we seek is about ourselves. For example, the fairness of our pay is most often understood when compared with an external reference point.

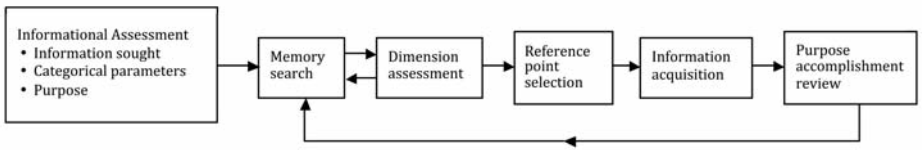
Proposition 6: Internal reference points will be used more often than external reference points.

Reference Point Selection

Although business researchers have widely acknowledged the importance of reference points and their impact, very little work has been done to determine how and why a particular stimulus is chosen to serve as a reference point. At first glance, reference point selection would seem to be automatic or intuitive. A closer examination however, reveals that the process is deliberative and cognitive. Psychology research on categorization and comparisons provides some help in understanding the process. We begin by looking at the general steps to reference point selection. Then we consider moderating factors that will affect the process.

The first step in reference point selection is to determine what aspect of the new stimulus is unknown (See Figure 1). This is a crucial step since it sets the parameters for the reference point search. These parameters include the category of information being sought and most likely, the purpose of the information. This step is often characterized by the formulation of question. A simple example will help demonstrate the process.

Figure 1: *Reference Point Selection Model*



Suppose a hospital is trying to determine if its heart attack survival rate is acceptable. They may formulate a simple question, "How good is our survival rate for heart attacks?" which typifies this step. While it may seem that the question could best be answered by a numerical report of survival rates, such numbers often lack context. Reference points provide context. Notice that the question identifies the specific performance metric that we are interested in learning more about. This automatically establishes the categorical domain that will be considered when we search for an appropriate reference point. It eliminates other aspects of hospital performance (e.g. nurse-to-patient ratio, patient satisfaction rates, timeliness with paperwork, etc.) from consideration. It is, of course, possible to formulate a broader question (e.g. "How good is our patient care?") which would include these other aspects of the hospital's performance in the categorical domain to be searched. The narrower the scope of information sought, the narrower the search parameters.

Implicit behind the formation of the question is the purpose for seeking the information. Understanding the purpose of the information is important since it is likely to affect the level of attention given to reference point selection. Existing research suggests that the information gathered can be used for at least three different purposes: description (Helson, 1964), evaluation (Thibaut & Kelley, 1959), and decision-making (Tversky & Kahneman, 1991) (Ashby & Maddox, 2005; Markman & Ross, 2003). Information used for evaluation is more important than that used for basic descriptive purposes, and information used for decision-making is more important than that used for evaluation. Thus, reference point selection is most important when the information will be used for decision-making. It is expected that more cognitive energy will be devoted to reference point selection when the information is to be used for important purposes.

The second step in the process is to search our memory for stimuli that share a categorical connection with the unknown aspect of the new stimulus. Our ability to locate and identify categorically similar items is dependent upon our categorization skills, experience, memory, and effort expended. Stimuli that do not share a perceived categorical connection, or are not available in memory, cannot be used as a reference point. Continuing the above example, the identified category is patient survival rate. Thus, we would quickly turn to other survival rate statistics.

Next, stimuli identified in the categorical search are checked using the other dimensions of reference points. We review a stimulus to see if it meets acceptable levels of familiarity, connectivity and similarity. These three dimensions are applicable to all reference point selections and are likely to be the most critical to the selection process. The other dimensions (temporal and locus), may not always be relevant and may have more limited application. Nevertheless, when they are relevant to the selection, they will also be considered.

The categorical search and dimensional assessment steps are potentially iterative. If the first identified potential reference point fails to meet an acceptable level of comparability in all the relevant dimensions, it will be discarded and we will return to the search stage to identify another possibility. In doing so, we are likely to narrow the search parameters to avoid selecting another unacceptable option.

In our current example, our initial search might have produced survival rates

among cancer patients in our hospital as a likely reference point. We check cancer survival rates on the relative dimensions to see if it is an appropriate reference point. We are familiar with that rate (familiarity) and it shares an appropriate categorical connection (connectivity) with heart attack survival rates. In some ways the two rates are similar (e.g. they are both in our hospital and occurred during the same time frame), but they are also very different (e.g. different diseases). We must determine if any existing differences make cancer survival rates an inappropriate reference point. In this case, the difference in diseases violates the similarity requirement and causes us to return to the search stage. We therefore narrow our search parameters specifically to heart attack survival rates. We may consider heart attack survival rates in our hospital from previous years (internal locus) or we may consider rates from other hospitals (external locus). We assess both options on the relative dimensions and determine that rates in other hospitals are most relevant given changes in medical technology which have improved patient care significantly (temporal). Having reached acceptable levels on the relative dimensions, other hospitals' heart attack survival rates are then selected as the reference point.

Selection of a reference point occurs when a stimulus meets acceptable levels on all applicable dimensions. In the current example, we may determine that we need to be even more specific with our selection limiting it to other hospitals of similar size, type, geographic location, or services. Note that when a stimulus is chosen as a reference point, we cease the searching process. Following the principle of satisficing, we do not search other potential stimuli to see if a better reference point can be found.

The next step involves obtaining the desired information by comparing the unknown aspect of the new stimulus to the reference point. In the current example, our survival rates will be viewed in comparison to other similar hospitals' rates. In the last step, we review the information to see if it accomplishes the original purpose. If we are seeking evaluative information and our survival rates are higher than theirs, we would conclude that we are doing well. If we are using the information for decision-making purposes, can we make a decision based on the information obtained? For example, if our survival rates are lower, we may need to improve nurse-to-patient ratios. If the purpose is fulfilled, the process is complete. If not, we may return to the search stage and repeat the process or we may seek to use some other way of gathering the desired information.

Moderators

There are a number of moderators that can influence the reference point selection process. Note that reference point selection is a cognitive process involving the unknown and is thus susceptible to many previously identified cognitive biases and heuristics (Tversky & Kahneman, 1974). An identification of all potential moderators is beyond the limitations of this paper, but some examples are identified here to illustrate the impact that they may have.

The general reference point selection process is likely to be moderated by environmental factors such as time constraints and the importance of the information

sought. Given its cognitive nature, an exhaustive search for the best reference point might not be feasible or warranted. If time is a factor, individuals may choose to use a reference point that they have used previously. Commonly used reference points, or habitual reference points, are familiar and require less time for cognitive processing. Karylowski (1990) found that the use of self as a habitual reference point decreased time spent in making social judgments. When the information sought is not critical, individuals may satisfice rather than do a complete search for the best reference point.

While time and importance may curtail the search process, other factors such as personal motives or outcome salience may actually overextend the process (Kühberger, 1998). A person may begin with the end in mind and therefore seek a reference point which will confirm preheld suppositions. For example, union leaders negotiating wages will likely seek to use a reference point which helps them obtain the largest raise for their constituents. If their company's management team received 10% raises the previous year while other union workers within the industry only received 3%, they will naturally be inclined to want to use management raises as the reference point for negotiations. They may argue that company management is more similar to their union workers than workers in other companies since they work for the same company, and draw upon the same resource pool. While this ignores the dissimilarities in their responsibilities and skills, it might better serve their end goal. This suggests that individuals unhappy with the evaluation drawn from one reference point may switch reference points in a form of self-fulfilling prophecy. Such effects have been noted in research on happiness and hedonic adaptation (Frederick & Loewenstein, 1999; Kahneman, 1999).

Additional moderators may impact individual steps in the selection process. The initial step of identifying the information needed may be moderated by the novelty of the situation and an individual's experiences. Novel situations may make identification of the information needed difficult. Likewise, an individual's lack of experience may limit his/her ability to identify required information or it may color the interpretation of the current situation.

The searching phase involves several cognitive processes including categorization, memory storage and memory searching, which are highly susceptible to moderator influence. Categorization skills are influenced by individual attentiveness to detail, mental and creative ability. This will influence how stimuli are categorized and therefore, which ones are perceived to be categorically similar. Memory storage is affected by cognitive ability. Memory searching is subject to numerous cognitive biases such as familiarity, vividness, recency, and the availability for recall. These will affect one's ability to find the largest possible set of potential reference points.

The ability to evaluate the dimensions of a potential reference point may be affected by our experience and familiarity with the stimulus as well as our cognitive ability to recognize similarities and dissimilarities. It is also important to recognize which dimensions are most relevant to the selection process. Personality traits such as conscientiousness and need for cognition may impact this area also (Boyle et al., 1998). These may change the amount of effort expended in the search and evaluation of potential reference points.

Research Implications

This research has highlighted how reference point selection is important to understanding how information is gathered and used. Reference point selection has a direct impact on how information is evaluated and decisions are made. This research has sought to provide much needed clarity to the definition and dimensions of reference points. In addition, the proposed model provides a possible framework for understanding how reference points are selected.

The proposed model needs to be tested empirically to validate its accuracy. More work remains to be done to clarify the steps. For example, it has been proposed that the various dimensions are checked for their suitability and that they may vary depending on the situation. Variables need to be identified that will help clarify which dimension is most salient and to determine their relative weighting.

A number of potential moderators have been suggested. Those proposed here represent but a few of the potential moderators which may impact the selection process. Others need to be identified. The model provides a framework for understanding when such moderators may be most likely to occur.

Research is needed to investigate how individual differences affect the reference point selection process. Work has been done to see if such differences influence framing effects when reference points are provided (Fischoff, 1983; LeBoeuf & Shafir, 2003) but what if no reference point is given? Fischoff (1983) provided subjects with three potential ways to describe the same scenario to see how subjects choose the frame for making a decision. His findings were unable to predict individual behavior based upon the frame selected. Perhaps an investigation into the reference point underlying the frame would produce better predictions. The current research provides a framework for such an investigation.

Considerable research is needed on the potential moderating influence of individual differences on the selection process. How do personality traits such as need for cognition or conscientiousness impact the effort expended? Does mood play a role? Do some individuals such as those with high negative affectivity naturally choose reference points that negatively skew information evaluation? These are but a few of the possibilities which readily present themselves for additional research.

Another area of needed research is to see how the model might fit with the concept of multiple reference points. One debate is whether multiple reference points are integrated into a single reference point or are considered separately (Barkan et al., 2005; Ordonez, Connelly & Coughlan, 2000). Integration of multiple reference points may be possible through the creation of a fictional stimulus which more closely resembles the stimulus in question than any existing stimulus. Segregation may be used to compare closely related but different aspects of the stimulus such as fairness and satisfaction in pay levels (Ordonez et al., 2000).

Modeling the reference selection process may also help to encourage the use of multiple reference points to avoid ensuing framing problems. Whyte (1991) suggests that such an approach may improve the overall quality of decisions. The use of multiple reference points may be accomplished by asking individuals to search for other stimuli that share similar characteristics or by varying other dimensions such as

seeking potential past, present and future reference points.

This research may also provide a framework for investigation into why one reference point is chosen when multiple reference points are presented (Boles & Messick, 1995; Ordonez et al., 2000; Sullivan & Kida, 1995). The reference point chosen may truly be a better representation of the stimulus under consideration or cognitive biases may have simply made it appear to be so.

The current model may also shed light on how and why individuals change reference points (Fredrick & Loewenstein, 1999). This may occur when new information becomes available that questions the current reference point's appropriateness and thus, a new one is sought. It may occur to allow a "reinterpretation" of the resulting evaluation if the current one is unpleasant. It might be used to retrospectively justify one's behaviors (Levine & Moreland, 1987).

Conclusion

Reference points are an integral part of many organizational practices and theories. Understanding their nature and how they are selected is critical to future research. This research provides much needed clarity on reference points by developing a concise definition and by describing their dimensions. Furthermore, it identifies the different purposes for which they are used. And finally, it provides a model describing how reference points are selected, including potential moderators. It is hoped that this research will act as a catalyst for further research in this important area.

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