

AUTOPOIESIS: THE CONCEPTION OF JOINT LEARNING

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ABSTRACT

The literature on the intent, content, and balance of knowledge transfer within and across firms is vast. Yet we conceptually develop a model of two different types of knowledge generation informed by research on mental maps. The first archetype which we call absorption is related to the traditional view of knowledge generation as a transfer between individuals, units, or organizations. The second archetype, autopoiesis, defines a joint creation of new knowledge across persons embodying a higher level of interpersonal, organizational, or interorganizational learning. Autopoiesis concerns collective learning procedures in which partners jointly develop new insights and solutions that can hardly be redirected to specific individuals. The autopoietic knowledge generation achieves a win-win situation of involved actors or organizations. It as such is highly relevant for alliances, where firms otherwise face the risk of losing competitive advantages through unintended knowledge spill-overs. Thus this paper presents the two conceptualizations, absorption and autopoiesis, in the context of alliances.

Keywords: *Knowledge, Alliances, Mental Maps*

1. INTRODUCTION

Firms generate knowledge internally but also by exposing themselves acquire external knowledge, especially from alliances (Mowery, Oxley, & Silverman, 1996). Alliance research has strongly addressed learning and the transfer of knowledge (Dussage, Garette, & Mitchell, 2000). The associated challenges were modelled in studies on risks of asymmetric learning (Kale, Singh, & Perlmutter, 2000), on learning races, on the protection of knowledge (Inkpen, 2000), and on control (Inkpen & Currall, 2004).

However, studies concentrated on the knowledge transfer. Studies assumed that the goal of alliances to acquire (existent or latent) knowledge of other participants in the alliance (Grant & Baden-Fuller, 2004). So far, the joint generation, where the involved parties achieve a win-win

situation is ill-researched. We argue that alliances can learn by the transfer respectively the absorption of knowledge but have a great potential for a joint generation of new knowledge.

This autopoietic generation, directs processes in which knowledge is not only transferred but also synergistically combined to allow the involved parties achieving mutual gains. A fraction of these is known as ‘common benefits’ incorporated in alliance procedures (Khanna, Gulati, & Nohria, 1998). The synergetic combination will drive fourth the generation of innovative products. Still, there is little known about this joint generation of knowledge, particularly in alliances.

This paper aims to introduce absorption and the new idea of autopoiesis to the theory of learning, specifically to alliance learning. Thus the new concept is discussed in the context of in alliances.

2. WORKING THE WAY TOWARDS ABSORPTION AND AUTOPOIESIS

2.1 Alliances

We understand alliances as voluntary arrangements between two or more independent firms that are neither pure hierarchy nor pure market and are negotiated on an ongoing basis (Lawrence & Phillips, 2002). Learning alliances have been understood as an important class of inter-firm alliances (Hamel, 1991). The use of innovation alliances that are established to develop and commercialize new products, services, or technologies (Gulati, 1998), particularly bases upon transferring and creating new knowledge between partners. Prior studies have delivered empirical evidence that alliances improve the rate of patenting (Shan, Walker, & Kogut, 1994) and product innovation (George, Zahra, & Wood, 2002, Kelley & Rice, 2002). As such learning is a most important issue in alliances.

2.2 Individual and Organizational Knowledge

Grant (1996) referred to knowledge as simple as “that which is known” (p. 110) to cope with the ambiguities of knowledge in defining. Nonaka & Tagueuchi, 1995 understand knowledge as

beliefs that are justified. Porter and Liebeskind (1996) define knowledge as information that has been proofed. Fiol and Lyles (1985) differentiate different forms; they argue that learning - knowledge generation - is different to adoption. Learning is concerned with the development of insights, knowledge, and associations between past actions, the effectiveness of those actions, and future actions (Fiol & Lyles, 1985). Knowledge generated can be understood “as a set of beliefs held by an individual about causal relationships among phenomena” (Sanchez & Heene, 1996, p. 9).

Beyond individual knowledge, there is a strong tradition of organizational respectively collectively held knowledge. This view strongly builds upon the notion that knowledge is embedded in interpretation systems (Daft & Weick, 1984). On an organizational level, firms learn when the knowledge (e. g. rules and standard operating procedures) alters knowledge configurations (Argyris, 1990). Organizational routines representing repetitive modes of acting and operating procedures have been conceptualized as such collective knowledge (March & Olsen, 1975; Nelson & Winter, 1982).

2.3 Sharing and Integration of Learning in Alliances

Learning is a multi-facet phenomenon. It includes diverse archetypes at different levels which might be existent in alliances. Learning can occur on a genuine inter-firm – relational – archetype in alliances. Grant & Baden-Fuller (2004) refer to alliances “as vehicles of *learning* in which each member uses the alliance to transfer and to absorb the partners’ knowledge base” (p. 64). Okhuysen & Eisenhardt, 2002 (2002) differentiate knowledge sharing and integration. Herewith they understand alliance as a system of knowledge production. Sharing defines the process by which individuals identify information and communicate; integration occurs when several individuals combine their information to create new knowledge (Okhuysen & Eisenhardt, 2002).

We argue that learning covers both: the knowledge transfer across firms and the generation of shared knowledge between participants. Only few studies discussed shared knowledge of allying firms e. g. as common benefits (Khanna, 1998; Lafferty & Goldsmith, 2005) or joint rules and procedures (Holmqvist, 1999). Existing studies have two shortcomings: they ignore the

collective level as unit of analysis (Holmqvist, 1999) and potential outcomes of the joint generation. We assume instead that gains from a joint birth of knowledge which we refer to as autopoiesis are great.

2.4 Mental Models and Learning in Alliances

Studies on shared mental models research and describe how individuals and collective entities process knowledge (Kim, 1993). Mental models are interpretations of a cognitive system or a network of associations between concepts in an individual mind (Ward & Reingen, 1990). Human beings constantly develop and use mental models (Johnson-Laird, 1983). Individuals continuously interpret and unconsciously apply knowledge. Becoming aware of new information actors recognize and filter the knowledge being either elements or relations between them. Still, only a specific amount of information will be re-used and integrated in the system of existing elements and relationships. In each moment, individuals operate upon a continuously altered system.

The level of overlap of different mental models illustrate the degree of shared knowledge (Cannon-Bowers & Salas, 2001). Such overlap subsists about routines etc. in a firm or within a context, e. g. group, firm, or alliance. The overlap, the collective issue, of organizational knowledge has more coherence than a simple aggregation of interpretations of individuals (Walsh & Ungson, 1991). Shared models, as well as individual cognitive models, contain systems of concepts and relations (Laukkanen, 1996; Taylor & Lerner, 1996). Overlap can comprise items themselves or relationships between them. For example, relationships between concepts include causal effects between items. In this view, collective knowledge is rooted in elements and relationships of tacit and explicit knowledge structures. These are located in the brain of the organizational members as well as in their routines and behaviour, e. g. use of artificial memories, documentations.

There are diverse mental models among team members (task/technology, of “response routines”, and of team work (Cannon-Bowers, Salas, & Converse, 1993, p. 432) that can be shared and not shared. Shared mental models help team members to understand phenomena and to develop

conclusions about (1) task-related features situation (understanding the technology and tasks), and (2) team-related aspects of the situation (understanding of the members characteristics, roles, pattern of interaction, and location of information) (Mathieu, Goodwin, Heffner, Salas, & Cannon-Bowers, 2000).

Wegner (1985) stresses the need to develop organizational learning through interrelationships. Heedful interaction is a attentive, conscientious, and considerate mode of interaction. The collective cognitive cognition “mind” is located in the web of connections between individuals (Weick & Roberts, 1993).

3. CONCEPTUAL MODEL

3.1 Absorption

Actors, units, and organizations can transfer knowledge and learn from the newly found associations between cognitive items, building up a new system. We call this absorption. In alliances absorption is the combination of knowledge across partners. The combination is coupled with interpretation processes. These tie the novel knowledge into the existing mental structure. Individuals, especially with unequal cognitive structures, process information differently: a particular stimulus, processing procedures, and the decision strategies followed can be at variance (Mohammed, Klimoski, & Rentsch, 2000). Absorption does not refer to the combination of discrete pieces of knowledge (Okhuysen & Eisenhardt, 2002). It builds on the subjective processing and merging of knowledge. When considering different lenses for viewing knowledge in the group, members can create new knowledge from the same information. Knowledge can be increased through alternative combinations that are produced through different ways and articulations of knowing. Thus, learning by absorption is context dependent.

Actors of the allying firms may learn from each other by exchanging and interpretation components of their mental maps. Then the added acquired knowledge is included into the existing mental map. The initial – ex-ante – knowledge structure of the recipient in the other firm is a major determinant to successful inter-organizational learning processes. In this regard,

“absorptive capacity” is defined as “the ability of a firm to recognise the value of new, external information, assimilate it, and apply it to commercial ends.” (Cohen and Levinthal, 1990: 128).

3.2 Autopoiesis

We regard to autopoiesis as the joint birth of knowledge across actors of the system ‘alliance’. Autopoiesis being beyond the focus on cognition at the individual level is informed by group cognition. Conventional wisdom suggested group-level cognitive processes analogous to those at individual level (Sandelands & Stablein, 1987). Yet, empirical studies have shown an inconsistency to this (Hutchins & Klausen, 1996; Gibson, 1999). Groups can be seen as collective actors with a specific set of mental models that lead to organizational learning (Kim, 1993).

The roots of autopoiesis base on a living (biological) system as a model of self-production (Varela, Maturana, & Uribe, 1974; Varela, 1979; Maturana & Varela, 1980). Autopoiesis was introduced into the social sciences and organization theory by German sociologist Luhmann (1984, 1986) and Morgan's (1986) collection of metaphors of organizations. Luhman interpreted autopoiesis as a form of system-building (Luhmann, 1995). In the constitution of their elements and operations, systems refer to themselves, self-referentially closed. Morgan (1986) pictures autopoietic organizations of autonomy, circularity, and self-reference. Yet, self-production has the potential to be interpreted through many different ways.

This paper uses autopoiesis to describe how knowledge is socially constructed. Autopoiesis is beyond cognition at the individual level. The self-referential knowledge creation evolves as individual and group experiences are interpreted and renewed (Mohammed et al., 2000). The collective birth resides in higher-order themes and generalizations. These resemble a “magical transformation” from individual to group mind (Wegner, Guiliano, & Hertel, 1985: 268). The magical transformation experiments with labels and usages of existent or newly created technologies. These jointly constructed interpretation systems were not existent in the single actors in before. They represent new and mutual knowledge. This influences behavior and coordination (Cannon-Bowers et al., 1993; Weick & Roberts, 1993). As such, the joint

generation of knowledge, the autopoiesis, emerges from knowledge that is attributed to a specific context (e. g. a technology, group, firm, or alliance). The location of the collective knowledge in autopoiesis differs to absorption, in which actors learn from each other by exchanging parts of their mental maps storing them within the firm. Autopoiesis instead covers the collective birth store of knowledge across firms. Autopoiesis is manifested by a web of upstream, downstream, and horizontal exchanges and interactions. It requires under co-location of individuals that interactively produce mental models. We define three components of our knowledge: content, intent and balance of learning.

3.3 Components of the Model

Content

With respect to its content, learning by absorption typically concentrates on technical aspects of knowledge. It includes both know-why and know-how. The content of absorption can be a combination including tacit-laden skill-learning and explicit-laden technical learning. Social processes of interaction act supporting within problem-solving exchange of knowledge. Yet, they are not required for the learning by itself. In contrast, the autopoietic creation among partners builds upon complex social interrelations. Autopoiesis is developed and manifested by a web of exchanges and interactions between individuals and groups.

Intent

Learning intent directs the learning type in the alliance: It can either follow clear or unspecific goals. Absorption and autopoiesis refer to both types of March and Simon's (1991) concept of exploitation and exploration to alliances (Koza & Lewin, 1998, Rothaermel, 2001). Absorption covers to exploitation mode as it includes the refinement and extension of existing competencies, technologies and paradigms. March and Simon (1991) define exploration as the experimentation with new alternatives that have returns uncertain and even often negative. This relates to the uncertain outcomes of autopoiesis. While goal orientation is possible in exploitation & absorption, exploration & autopoiesis requires autonomy and flexibility to unforeseen events.

Balance

In absorption, a learning balance can be attained through the reciprocal exchange of knowledge elements. This reciprocal balance, often by sequential exchange, ensures partners' ongoing engagement. Autopoiesis instead is a powerful means of relational rents by its own (Dyer & Singh, 1998). The simultaneous mutual learning across partners that builds knowledge not held before in the involved actors. This will motivate ongoing and increased learning.

Effects

Learning by absorption is based upon an exploitation of partners' specialization. This increases targeted innovation and firms' performance. Learning by absorption will allow lower cost and more effective alliance processes and outcomes. The lower cost will in turn motivate participants to proceed with the collaboration and therefore more firms will operate on future alliance projects. This constitutes the basis for a re-enforcing loop of learning alliance formation.

Autopoiesis as joint birth implies alterations of the individual and organizational cognitive system. Some of the outcomes are visible in behavioural changes and tangible outcomes. Autopoiesis promotes new ideas by newly combined facts, procedures newly pooled, or new relations between concepts found. A joint birth of knowledge will deliver new processes and structures, e. g. routines or products. This stresses its effectiveness on innovation outcomes. Furthermore, alliances will also experience few risks by unintended knowledge spillovers as the synergetic production allows to jointly produce new levels of knowledge. The outcomes of autopoiesis may cause a positive re-enforcing learning loop. Interdependence among team members achieve advantages from heedful interrelating that leads to increased individual responsibility and team effectiveness. In sum, the improved processes will further enhance the effectiveness of alliance.

4. DISCUSSION AND CONCLUSION

This paper delivers new insights that differ from existing. It models with respect to autopoiesis mutual relational knowledge generation. Our study provides an extension to the findings of (2000), who differentiate scale and scope alliances. Similar to the open learning in scope

alliances, we find relational learning that benefits from more emergent learning. However, this paper goes beyond the study by Dussage et al., 2000 as it explores a new sphere of learning – the autopoietic. Our results extend the ideas of Scarbrough (2004a; Scarbrough et al., 2004b) who propose two major processes of project-based learning (PBL): 'learning-by-absorption' and 'learning-by-reflection' to the inter-firm and collective level. Our study extends the findings on exploration and exploitation (March & Simon, 1991). We clarify that autopoiesis is a form of exploration as two firms are enabled to mutually generate new knowledge. We assume that mutual learning emerges through the interactions and joint interpretations by partners. Risks of opportunism are low in autopoiesis that has mutual benefits. Also, the autopoietic can be useful for the development of novel products by the synergistic emergence of competences. To explore this inter-firm joint knowledge creation that occurs in a social arena, and to address a new line of alliance research this study transfers a social-cognitive view of knowledge creation (Cannon-Bowers et al., 1993; Cooke, Salas, Cannon-Bowers, & Stout, 2000; Klimoski & Mohammed, 1994; Mohammed & Dumville, 2001) to the relational sphere of social interactions between alliance partners.

The topic of this paper is important as there is increasing recognition that effective collaboration in the use of knowledge is a principal source of inter-organizational rents and competitive advantage (Spender, 1996; Dyer & Singh, 1998; Lorenzoni & Lipparini, 1999).

Still, the explanation of a joint birth of new knowledge across partners in innovation alliances requires to analyze the antecedents of those in further studies. Therefore, we recommend subsequent empirical research on the managerial antecedents and governance forms of absorption and autopoiesis in alliances.

REFERENCES

- Argyris, C. 1990. *Overcoming Organisational Defences: Facilitating Organisational Learning*. Boston.
- Cannon-Bowers, J. A., Salas, E., & Converse, S. 1993. Shared mental models in team decision making. In J. N. Castellan (Ed.), *Individual and Group Decision Making*, Vol. 22: 221-246. Hillsdale, New Jersey: Lawrence Erlbaum Associates.
- Cannon-Bowers, J. A. & Salas, E. 2001. Reflections on shared cognition. *Journal of Organizational Behavior*, 22(2): 195-202.
- Cooke, N. J., Salas, E., Cannon-Bowers, J. A., & Stout, R. J. 2000. Measuring Teams Knowledge. *Human Factors*, 42: 151-173.
- Daft, R. L. & Weick, K. E. 1984. Toward a model of organizations as interpretation systems. *Academy of Management Review*, 9(2): 284-295.
- Dussage, P., Garette, B., & Mitchell, W. 2000. Learning from competing partners: Outcomes and durations of scale and link alliances in Europe, North America and Asia. *Strategic Management Journal*, 21(2): 99-126.
- Dyer, J. H. & Singh, H. 1998. The relational view: Cooperative strategy and source of interorganizational competitive advantage. *Academy of Management Review*, 23: 660-679.
- Fiol, C. M. & Lyles, M. A. 1985. Organizational Learning. *Academy of Management Review*, 10: 803-813.
- George, G., Zahra, S. A., & Wood, D. R. 2002. The effects of business-university alliances on innovative output and financial performance: a study of publicly traded biotechnology companies. *Journal of Business Venturing*, 17(6): 577-609.
- Gibson, C. B. 1999. Do They Do What They Believe They Can? Group Efficacy and Group Effectiveness Across Tasks and Cultures. *Academy of Management Journal*, 42(2): 138-152.
- Grant, M. 1996. Toward a Knowledge-based Theory of the Firm. *Strategic Management Journal*, 17(Winter Special Issue): 109-122.
- Grant, R. M. & Baden-Fuller, C. 2004. A Knowledge Accessing Theory of Strategic Alliances. *Journal of Management Studies*, 41(1): 61-84.

- Gulati, R. 1998. Alliances and networks. *Strategic Management Journal*, 19(4): 293-317.
- Hamel, G. 1991. Competition for Competence and Interpartner Learning within International Strategic Alliances. *Strategic Management Journal*, 12(Special Summer Issue): 83-103.
- Holmqvist, M. 1999. Learning in imaginary organizations: Creating interorganizational knowledge. *Journal of Organizational Change Management*, 12(5): 419-438.
- Hutchins, E. & Klausen, T. 1996. Distributed Cognition in an Airline Cockpit. In Y. Engeström & D. Middleton (Eds.), *Cognition and Communication at Work*: 15-34. Cambridge: Cambridge University Press.
- Inkpen, A. C. 2000. A Note on the dynamics of learning alliances: Competition, cooperation, and relative Scope. *Strategic Management Journal*, 21(7): 775-779.
- Inkpen, A. C. & Currall, S. C. 2004. The coevolution of trust, control, and learning in joint ventures. *Organization Science*, 15(5): 586-599.
- Johnson-Laird, P. 1983. *Mental Models*. Cambridge, MA.: Harvard University Press.
- Kale, P., Singh, H., & Perlmutter, H. 2000. Learning and protection of proprietary assets in strategic alliances: building relational capital. *Strategic Management Journal*, 21(3): 217-237.
- Kelley, D. J. & Rice, M. P. 2002. Advantage beyond founding - The strategic use of technologies. *Journal of Business Venturing*, 17(1): 41-57.
- Khanna, T. 1998. The scope of alliances. *Organization Science*, 9(3): 340-355.
- Khanna, T., Gulati, R., & Nohria, N. 1998. The dynamics of learning alliances: competition, cooperation, and relative scope. *Strategic Management Journal*, 19(3): 193-210.
- Kim, D. H. 1993. The Link between Individual and Organizational Learning. *Sloan Management Review*, 35(1): 37-50.
- Klimoski, R. & Mohammed, S. 1994. Team mental model: Construct or metaphor? *Journal of Management*, 20: 403-437.
- Koza, M. P. & Lewin, A. Y. 1998. The Co-evolution of Strategic Alliances. *Organization Science*, 9(3): 255-264.
- Lafferty, B. A. & Goldsmith, R. E. 2005. Cause-brand alliances: does the cause help the brand or does the brand help the cause? *Journal of Business Research*, 58(4): 423-429.

- Laukkanen, M. 1996. Comparative cause mapping of organizational cognitions. In J. R. Meindl & C. Stubbart & J. F. Porac (Eds.), *Cognition Within and Between Organizations*,: 3-44. Thousand Oaks et al.: Sage.
- Lawrence, T. & Phillips, N. 2002. Institutional Effects of Interorganizational Collaboration: The Emergence of Proto-Institutions. *Academy of Management Journal*, 45(1): 281-290.
- Lorenzoni, G. & Lipparini, A. 1999. The leveraging of interfirm relationships as a distinctive organizational capability: A longitudinal study. *Strategic Management Journal*, 20: 317-338.
- Luhmann, N. 1995. *Social Systems*. Stanford.
- March, J. G. & Olsen, J. P. 1975. The Uncertainty of the Past: Organizational Learning under Ambiguity. *European Journal of Political Research*(3): 147-171.
- March, J. G. & Simon, H. A. 1991. Exploration and Exploitation in Organizational Learning. *Organizational Science*, 2(1): 81-87.
- Mathieu, J. E., Goodwin, G. F., Heffner, T., S., Salas, E., & Cannon-Bowers, J. A. 2000. The influence of shared mental models on team process and performance. *Journal of Applied Psychology*, 85(2): 273-283.
- Maturana, H. & Varela, F. 1980. *Autopoiesis and Cognition: The Realization of the Living*. Dordrecht D. Reidel Publishing Co.
- Mohammed, S., Klimoski, R., & Rentsch, J. R. 2000. The Measurement of Team Mental Models: We Have No Shared Schema. *Organizational Research Methods*, 3(2): 123-165.
- Mohammed, S. & Dumville, B. C. 2001. Team mental models in a team knowledge framework: Expanding theory and measurement across disciplinary boundaries. *Journal of Organizational Behavior*, 22(2): 89-106.
- Mowery, D. C., Oxley, J. E., & Silverman, B. S. 1996. Strategic alliances and interfirm knowledge transfer. *Strategic Management Journal*, 17(Winter Special Issue): 77-91.
- Nelson, R. & Winter, S. 1982. *An Evolutionary Theory of Economic Change*. Cambridge, Mass., London: Belknap Press of Harvard University Press.
- Nonaka, I. & Takeuchi, H. 1995. *The Knowledge-Creating Company*. New York: Oxford University Press.
- Okhuysen, G. A. & Eisenhardt, K. M. 2002. Integrating Knowledge in Groups: How Formal Interventions Enable Flexibility. *Organization Science*, 13(4): 370-386.

- Porter-Liebesskind, J. 1996. Knowledge, Strategy, and the Theory of the Firm. *Strategic Management Journal*, 17(Special Issue): 93-107.
- Rothaermel, F. T. 2001. Incumbent's advantage through exploiting complementary assets via interfirm cooperation. *Strategic Management Journal*, 22: 687-699.
- Sanchez, R. & Heene, A. 1996. Competence Perspectives on Strategic Learning and Knowledge Management. In A. Heene & R. Sanchez (Eds.), *Strategic Learning and Knowledge Management*. Chichester usw.: Wiley & Sons.
- Sandelands, L. E. & Stablein, R. E. 1987. The Concept of Organization Mind. In S. Bacharach & N. DiTomaso (Eds.), *Research in the Sociology of Organization*, Vol. 5: 135-162. Greenwich.
- Scarborough, H., Bresnen, M., Edelman, L. F., Laurent, S., Newell, S., & Swan, J. 2004a. The processes of project-based learning - An exploratory study. *Management Learning*, 35(4): 491-506.
- Scarborough, H., Swan, J., Laurent, S., Bresnen, M., Edelman, L., & Newell, S. 2004b. Project-based learning and the role of learning boundaries. *Organization Studies*, 25(9): 1579-1600.
- Shan, W., Walker, G., & Kogut, B. 1994. Interfirm cooperation and start-up innovation in the biotechnology Industry. *Strategic Management Journal*, 25: 387-394.
- Spender, J.-C. 1996. Making knowledge the basis of a dynamic theory of the firm. *Strategic Management Journal*, 17(Winter Special Issue): 45-62.
- Taylor, J. R. & Lerner, L. 1996. Making sense of sensemaking: How managers construct their organization through their talk. *Studies in Cultures, Organizations and Societies*, 2(2): 257-286.
- Varela, F., Maturana, H., & Uribe, R. 1974. Autopoiesis: The Organization of Living Systems, Its Characterization and a Model. *Biosystems*, 5 187-196.
- Varela, F. 1979. *Principles of Biological Autonomy*. New York: Elsevier (North Holland).
- Walsh, J. P. & Ungson, G. R. 1991. Organizational Memory. *The Academy of Management Review*, 16: 57-91.
- Ward, J. C. & Reingen, P. H. 1990. Sociocognitive Analysis of Group Decision Making Among Consumers. *Journal of Consumer Research*, 17: 245-262.

- Wegner, D. M., Giuliano, T., & Hertel, P. T. 1985. Cognitive Interdependence in Close Relationships. In W. Ickes (Ed.), *Compatible and Incompatible Relationships*: 253-276. New York: Springer.
- Weick, K. E. & Roberts, K. H. 1993. Collective Minds in Organizations: Heedful Interrelating on Flight Decks. *Administrative Science Quarterly*, 38(3): 357-381.