The Forming of Shared Cognition in Business Ecosystems: Collective Sensemaking and its Influence on Mental Models

Abstract

Mental models tend to converge within organizations and this hinders cooperation across organizations. For a business ecosystem to be effective, it is therefore crucial to build shared cognition between the partnering organizations. Collective sensemaking has been suggested to play an important role in the forming of shared cognition, but how does collective sensemaking in business ecosystems come about and what is its influence on mental models? To answer that question, we follow 96 managers from the Dutch energy sector that engage in group model building workshops aimed at making sense of the ongoing 'energy transition'. Mental model measurements before and after the workshops provide evidence for the resulting change in shared cognition.

Introduction

Organizations rely for their success more and more on participating in cooperative networks, or business ecosystems (Moore, 1993). From organizational cognition literature, we know that effective cooperation depends on shared cognition (Narayanan, Zane, & Kemmerer, 2011; Mohammed, Ferzandi, & Hamilton, 2010). Organizations vary widely in the cues in the environment they deem important for developing strategies, as well as in the meaning they ascribe to these cues (Daft & Weick, 1984; Weick, 1995). How then do organizations within business ecosystems build a shared frame of reference? Collective sensemaking processes in various kinds of strategy workshops are suggested to play an important role (Hodgkinson, Whittington, Johson, & Schwarz, 2006). A tool that seems specifically useful for such a purpose is 'group model building' (Vennix, 1996). In group model building workshops, participants collaboratively make sense of ongoing issues by identifying the causal relationships that together provide an endogenous explanation for the perceived trends and developments (Forrester, 1961; Sterman, 2000).

In this study, we follow 96 managers from of the Dutch energy sector that engage in group model building workshops aimed at increasing shared cognition. These managers belong to a business ecosystem that seeks to facilitate the ongoing energy transition: the transition towards a more sustainable energy system (Kern & Smith, 2008). Following earlier studies on shared cognition (Hodgkinson, 2002; Markoczy & Goldberg, 1995), we develop a questionnaire to measure the mental models of the managers. The managers answer the questionnaire both before and after the workshops, providing us with evidence about the change in shared cognition. Video recordings of the workshops allow for an analysis of "interpretation and meaning systems, and the process whereby those systems are altered" (Gioia & Chittipeddi, 1991). Doing so we provide an explanation of how cognitive processes affect behavior among organizations (Powell, Lovallo, & Fox, 2011).

Background

Mental Models

Managers have to rely on their simplified understanding of the organization's environment, or mental model (Narayanan et al., 2011). This simplification is functional because the environment is extremely complex and ambiguous (Walsh, 1995), while individuals have limited data processing capabilities (Simon, 1947). Besides, managers do not need a full understanding of the

environment to formulate a strategy that is 'good enough' (Cyert & March, 1963). Mental models as such save time and prevent managers to suffer from information overload (Hodgkinson & Sparrow, 2002). Despite these important functions in strategizing, mental models may become dysfunctional when these simplifications are no longer accurate (Barr, Stimpert, & Huff, 1992). Especially after changing circumstances, mental model renewal becomes crucial (Reger & Palmer, 1996). The relevance of accurate mental models is well described in studies on *cognitive inertia,* the phenomenon where managers neglect renewing their mental model even though circumstances have changed. Several studies showed how mental models remained the same, even in drastically changing environments, resulting in poor performance (Porac, Thomas, & Baden-Fuller, 1989; Hodgkinson, 1997; Tripsas & Gavetti, 2000).

Shared Cognition
An important process explaining similarities in mental models is the social influencing process consisting of both formal and informal communication between managers. Because of this process, their mental models become more similar over time (DiMaggio & Powell, 1983; Chattopadhyay, Glick, Miller, & Huber, 1999). This process takes place in teams, organizations, and industries as a whole (Spender, 1989). Through communication the manager's mental models influence each other (Salancik & Pfeffer, 1978), leading to a certain level of *shared cognition* (Mohammed, Ferzandi, & Hamilton, 2010). When working together within a business ecosystem, it is problematic if the mental model of the manager of one organization is different from the mental model of the manager of the other. How a manager develops a strategy depends on his or her mental model, and if managers cannot agree about what cues are important and what importance they have, it is not likely that they can agree on identifying a strategy for the business ecosystem as a whole. Within team mental model literature, a positive relation between the sharedness of mental models and team performance is well established in a wide variety of contexts (Mohammed et al., 2010: p. 891). While this literature studies mental models of teams working within an organization, we do not expect this relation to be much different for the mental models of managers from different organizations working together within a business ecosystem. We do expect however, that for managers from different organizations it is *harder* to reach shared cognition than for managers within an organization. Because these managers are from different organizations that fulfill complementing roles in a business ecosystem, it is likely that they have different backgrounds, potentially more different than for team members with different backgrounds *within* an organization.

Collective Sensemaking
So, how do these managers from different organizations make sure that they find enough common ground to successfully define a strategy for the ecosystem as a whole? Collective sensemaking is suggested to play an important role in forming shared cognition (Weick, 1995). In a process of collective sensemaking, managers discuss which trends are important and what meaning they should attach to these trends (Weick, 1995). Managers try to 'sell their issues', they try to convince other managers of their interpretation of the environment (Dutton & Ashford, 1993; Dutton, Ashford, Wierba, O'Neill, & Hayes, 1997). With visionary storytelling they try to impose their interpretation in a process of *sensegiving* (Gioia & Chittipeddi, 1991). Managers work on building their identity to give legitimacy to this process of sensegiving (Patriotta & Spedale, 2009). This study explores a process of collective sensemaking in a business ecosystem

and identifies the role of patterns in collective sensemaking in the change of mental models and the resulting shared cognition.

Method

Case description: The Dutch energy transition

In this study, we follow a business ecosystem in the Dutch energy sector. This sector is experiencing turbulent times. The fossil industry is well presented in the Netherlands (Kern & Smith, 2008). There is a large natural gas industry in which both private and public parties profit from exploiting the largest gas reservoir in Europe (Verbong & Geels, 2007). Besides, the international fossil industry has a considerable representation in the Netherlands with the headquarters of the Anglo-Dutch multinational oil and gas company Royal Dutch Shell (Kemp, Rotmans, & Loorbach, 2007). Following European regulation, the Dutch government recently set new goals for energy conservation and renewable energy production as a part of its 2012 coalition agreement (Cabinet Rutte-Asscher, 2012). The goals imply considerable changes, with a goal for renewable energy production of 16% in 2020, compared to 4,7% in 2013 (PBL, 2012). Moreover, the shift towards renewable energy production conflicts with the current interests of the fossil industry (Kemp, Rotmans, & Loorbach, 2007). The term *energy transition* has been used to indicate the required 'structural change towards a sustainable energy system' (Kemp, 2010).

In this study we follow a business ecosystem around one of the organizations that strives to play a leading role in facilitating the Dutch energy transition, the distribution system operator Alliander. In its recent annual report, they state that "Alliander wants to facilitate the transition to a more sustainable energy system" (Alliander, 2012). However, "while the contours of the future energy system are already visible, the exact shape of things to come is still unknown" (Alliander, 2012). Therefore, "by working closely with customers, partners and government agencies, [they] are trying to anticipate trends and developments, wherever possible, in a responsible manner" (Alliander, 2012). We follow how Alliander and its partners, together forming a business ecosystem, engage in group model building workshops to support the forming of a shared understanding of trends and developments.

Group model building workshops

In this study we use group model building workshops to facilitate collective sensemaking. Group model building workshops consist of collaboratively drawing causal maps. Numerous studies show how mental model renewal may be aided with causal mapping, the drawing of cause-effect relations between variables (Axelrod, 1976; Eden & Ackermann, 1998; Huff, 1990; Markoczy & Goldberg, 1995; Narayanan & Fahey, 1990; Nicolini, 1999). The mere act of drawing causal relations has been shown to reduce reliance on existing frames, because it requires the manager to reflect on his or her patterns of thought (Hodgkinson, Bown, Maule, Glaister, & Pearman, 1999). Causal mapping in group model building workshops is supported by facilitators that help participants in following the procedures (Andersen & Richardson, 1997; Rouwette, Korzilius, Vennix, & Jacobs, 2011; Rouwette, Vennix, & Mullekom, 2002; Vennix, 1996, 1999). The modeling process allows participants to persuade each other on what cues to attend to, and what meaning to attach to these cues (Rouwette et al., 2011). The model that the participants build takes the form of a causal loop diagram: a diagram showing the relevant variables and the causal relations that link them (Vennix, 1996). Group model building workshops as such act as a catalyst for collective sensemaking (Daft & Weick, 1984; Weick, 1995).

In a timeframe of two months we organized eight group model building workshops. On the one hand we wanted to make sure that the workshops were small enough to provide enough opportunity for interaction, since it is this interaction that might lead to managers convincing each other of what cues to attend and what meaning to attach to them. On the other hand we wanted enough managers in our workshops to be able to infer conclusions. Therefore, we organized eight workshops for small groups of managers. The workshops had exactly the same design, the only difference being the participants that attended the workshops. The number of participants per workshop varied from eight to fifteen, with a total of 96 participants over all eight workshops. In each workshop two facilitators with expertise in the procedure of collaboratively drawing maps helped the groups with drawing them. The workshops took about five hours each.

Measure: shared cognition

To measure shared cognition, we measured mental models of all 96 participants both before and after they engaged in the group model building workshops. To measure the mental models, we adapted the method as put forward by Markoczy and Goldberg (1995) and by Hodgkinson (2002). First, we analyzed 162 articles in 5 large Dutch newspapers that mentioned the energy transition between 2003 and 2013. This analysis, based on the procedures as put forward in grounded theory (Glaser & Strauss, 1967), resulted in the finding of 47 means and ends related to the energy transition mentioned in the newspaper articles. For each of these 47 constructs, we ask the managers participating in our study how important that construct is to them in the energy transition. The answers to these 47 questions together form what we consider as their mental model of the energy transition. Then, following Knight et al. (1999), we measure shared cognition by summing up, for each workshop separately, the standard deviations of the answers on each of the 47 constructs. This provides us with a measure of *dissensus,* the higher the number, the more *disagreement* there is on the importance of aspects in the energy transition.

Preliminary results

Each of the eight group model building workshops resulted in a model, in the form of a causal loop diagram of what the managers participating in the workshop saw as a description of the energy system that explains the development of the energy transition. Figure 1 provides an illustration of what such a model looks like. The model in Figure 1 is an integration of the eight individual models that resulted from the workshops.

Table 1 shows the shared cognition before and after the workshops, based on 86 out of the 96 managers that filled out a complete pre and post questionnaire. Moreover, a student t-test is used to see whether the shared cognition is significantly higher after the workshops, compared to before. While all of the eight workshops show an increase in shared cognition, six of the eight workshops result in a significant increase.

Video recordings of the eight workshops allow for analysis of the process of collective sensemaking. Several patterns emerge in this analysis. Some parts of the workshops are characterized by one manager trying to 'sell' his interpretation to the others with 'visionary storytelling'. Other parts are characterized by several managers opposing each other's interpretation by presenting conflicting stories. Preliminary analysis of the recordings suggests that these conflicts have an important role in building shared cognition, more important than 'explanations' and 'envisioning'.

Figure 1: Aggregated model illustrating the results of eight group model building workshops
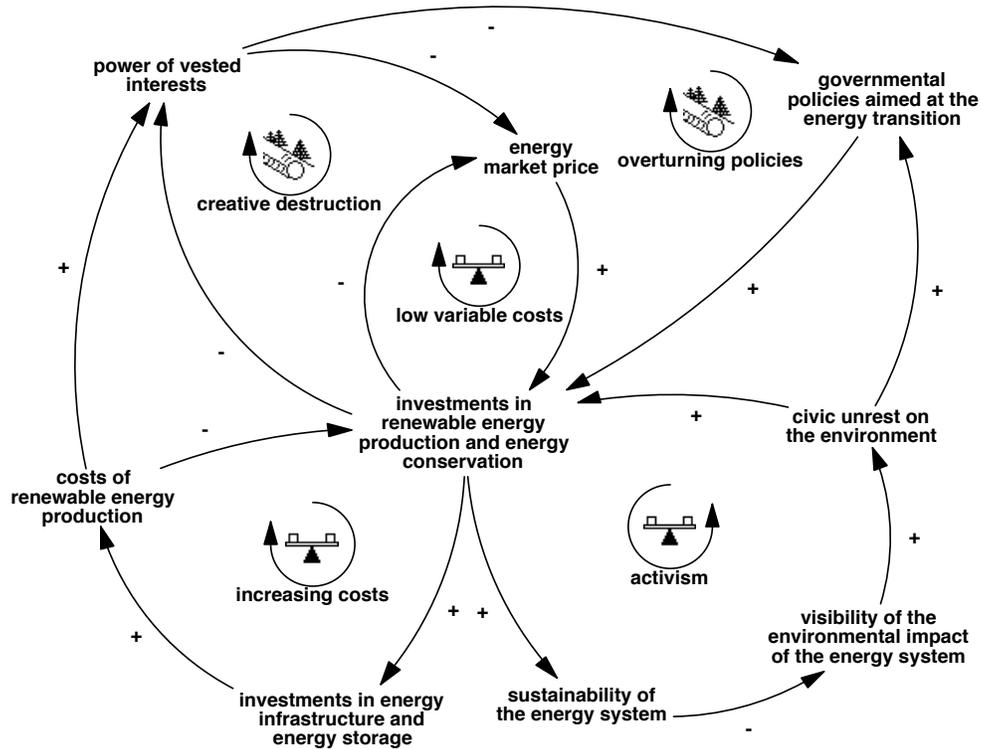
Table 1: Increased shared cognition after participating in a group model building workshop

Workshop	Participants	Dissensus pre	Dissensus post	Increase in shared cognition
1	10	49,5	42,8	6,7***
2	9	55,7	48,0	7,7**
3	10	54,3	46,2	8,0***
4	9	49,2	46,0	3,2
5	14	55,5	52,3	3,2*
6	12	50,8	49,7	1,0
7	8	57,6	54,0	3,7*
8	14	56,0	52,1	3,9*

$* p < .05$, $** p < .01$, $*** p < .001$

Discussion

The results of this study are relevant for both the business ecosystem literature and the managerial and organizational cognition literature. We know that effective cooperation depends on shared cognition (Narayanan, Zane, & Kemmerer, 2011; Mohammed, Ferzandi, & Hamilton, 2010). Building shared cognition may be a substantial challenge, especially in business ecosystems with managers from organizations with widely varying backgrounds. This study shows an example of how cognitive aspects influence the effectiveness of business ecosystem. Managers may be persistent in how they understand their environment, they are prone to cognitive inertia. Effective coordination requires that managers build a shared understanding of their environment, which makes it unavoidable that at least some of the managers adapt their mental model. This study shows under what conditions managers build shared cognition, and what this process looks like.

5

References

Alliander. (2012). *Annual report*.

Andersen, D. F., & Richardson, G. P. (1997). Scripts for group model building. *System Dynamics Review*, *13*(2), 107–129.

Axelrod, R. M. (1976). *Structure of decision: The cognitive maps of political elites*. Princeton, NJ: Princeton University Press.

Barr, P. S., Stimpert, J. L., & Huff, A. S. (1992). Cognitive change, strategic action, and organizational renewal. *Strategic Management Journal*, *13*(S1), 15–36.

Cabinet Rutte-Asscher. (2012). *Coalition agreement "Building bridges."*

Chattopadhyay, P., Glick, W. H., Miller, C. C., & Huber, G. P. (1999). Determinants of executive beliefs: comparing functional conditioning and social influence. *Strategic Management Journal*, *20*(8), 763–790.

Cyert, R., & March, J. (1963). *A behavioral theory of the firm*. Englewood Cliffs, NJ: Prentice-Hall.

Daft, R. L., & Weick, K. E. (1984). Toward a Model of Organizations as Interpretation Systems. *Academy of Management Review*, *9*(2), 284–295.

DiMaggio, P. J., & Powell, W. W. (1983). The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields. *American Sociological Review*, *48*(2), 147–160.

Dutton, J. E., & Ashford, S. J. (1993). Selling issues to top management. *Academy of Management Review*, *18*(3), 397–428.

Dutton, J. E., Ashford, S. J., O'Neill, R. M., Hayes, E., & Wierba, E. E. (1997). Reading the wind: how middle managers assess the context for selling issues to top managers. *Strategic Management Journal*, *18*(5), 407–423.

Eden, C., & Ackermann, F. (1998). *Making Strategy: The Journey of Strategic Management* (p. 507). SAGE.

Forrester, J. W. (1961). *Industrial Dynamics*. Cambridge (MA): M.I.T. Press.

Gioia, D. A., & Chittipeddi, K. (1991). Sensemaking and sensegiving in strategic change initiation. *Strategic Management Journal*, *12*(6), 433–448.

Glaser, B. G., & Strauss, A. L. (1967). *The Discovery of Grounded Theory: Strategies for Qualitative Research* (p. 271). Transaction Publishers.

Hodgkinson, G. P. (1997). Cognitive Inertia in a Turbulent Market: the Case of UK Residential Estate Agents. *Journal of Management Studies*, *34*(6), 921–945.

Hodgkinson, G. P. (2002). Comparing Managers' Mental Models of Competition: Why Self-report Measures of Belief Similarity Won't Do. *Organization Studies*, *23*(1), 63–72.

Hodgkinson, G. P., Bown, N. J., Maule, A. J., Glaister, K. W., & Pearman, A. D. (1999). Breaking the frame: an analysis of strategic cognition and decision making under uncertainty. *Strategic Management Journal*, *20*(10), 977–985.

Hodgkinson, G. P., & Sparrow, P. (2002). *The competent organization*. New York (NY): Open University Press.

Hodgkinson, G. P., Whittington, R., Johnson, G., & Schwarz, M. (2006). The Role of Strategy Workshops in Strategy Development Processes: Formality, Communication, Co-ordination and Inclusion. *Long Range Planning*, *39*(5), 479–496.

Huff, A. S., & Schwenk, C. (1990). Bias and sensemaking in good times and bad. In A. S. Huff (Ed.), *Mapping strategic thought* (pp. 89–108). Chichester, England: John Wiley.

Kemp, R. (2010). The Dutch energy transition approach. *International Economics and Economic Policy*, *7*(2-3), 291–316.

Kemp, R., Rotmans, J., & Loorbach, D. (2007). Assessing the Dutch Energy Transition Policy: How Does it Deal with Dilemmas of Managing Transitions? *Journal of Environmental Policy & Planning*, *9*(3-4), 315–331.

Kern, F., & Smith, A. (2008). Restructuring energy systems for sustainability? Energy transition policy in the Netherlands. *Energy Policy*, *36*(11), 4093–4103.

Knight, D., Pearce, C. L., Smith, K. G., Olian, J. D., Sims, H. P., Smith, K. A., & Flood, P. (1999). Top management team diversity, group process, and strategic consensus. *Strategic Management Journal*, *20*(5), 445–465.

Markoczy, L., & Goldberg, J. (1995). A Method for Eliciting and Comparing Causal Maps. *Journal of Management*, *21*(2), 305–333.

Mohammed, S., Ferzandi, L., & Hamilton, K. (2010). Metaphor No More: A 15-Year Review of the Team Mental Model Construct. *Journal of Management*, *36*(4), 876–910.

Moore, J. F. (1993). Predators and prey: a new ecology of competition. *Harvard Business Review*, *71*(3), 75–86.

Narayanan, V. K., & Fahey, L. (1990). Evolution of revealed causal maps during decline: A case study of admiral. In A. S. Huff (Ed.), *Mapping strategic thought* (pp. 109–134). Chichester, England: John Wiley.

Narayanan, V. K., Zane, L. J., & Kemmerer, B. (2011). The Cognitive Perspective in Strategy: An Integrative Review. *Journal of Management*, *37*(1), 305–351.

Nicolini, D. (1999). Comparing Methods for Mapping Organizational Cognition. *Organization Studies*, *20*(5), 833–860.

Patriotta, G., & Spedale, S. (2009). Making Sense Through Face: Identity and Social Interaction in a Consultancy Task Force. *Organization Studies*, *30*(11), 1227–1248.

PBL. (2012). *Climate and energy roadmaps towards 2050 in north-western Europe*. The Hague/Bilthoven, the Netherlands.

Porac, J. F., Thomas, H., & Baden-Fuller, C. (1989). Competitive groups as cognitive communities: The case of scottish knitwear manufacturers. *Journal of Management Studies*, *26*(4), 397–416.

Powell, T. C., Lovallo, D., & Fox, C. R. (2011). Behavioral strategy. *Strategic Management Journal*, *32*(13), 1369–1386.

Reger, R. K., & Palmer, T. B. (1996). Managerial Categorization of Competitors: Using Old Maps to Navigate New Environments. *Organization Science*, *7*(1), 22–39.

Rouwette, E. A. J. A., Korzilius, H., Vennix, J. A. M., & Jacobs, E. (2011). Modeling as persuasion: the impact of group model building on attitudes and behavior. *System Dynamics Review*, *27*(1), 1–21.

Rouwette, E. A. J. A., Vennix, J. A. M., & Mullekom, T. van. (2002). Group model building effectiveness: a review of assessment studies. *System Dynamics Review*, *18*(1), 5–45.

Salancik, G. R., & Pfeffer, J. (1978). A Social Information Processing Approach to Job Attitudes and Task Design. *Administrative Science Quarterly*, *23*(2), 224–253.

Simon, H. (1947). *Administrative Behavior*. New York (NY): Macmillan.

Spender, J.-C. (1989). *Industry Recipes; An Enquiry into the Nature and Sources of Managerial Judgement*. Oxford, UK: Basil Blackwell.

Sterman, J. D. (2000). *Business dynamics: Systems thinking and modeling for a complex world*. Boston (MA): Irwin McGraw-Hill.

Tripsas, M., & Gavetti, G. (2000). Capabilities, cognition, and inertia: evidence from digital imaging. *Strategic Management Journal*, *21*(10-11), 1147–1161.

Vennix, J. A. M. (1996). *Group model building: facilitating team learning using system dynamics* (p. 312). John Wiley & Sons, Inc.

Vennix, J. A. M. (1999). Group model-building: tackling messy problems. *System Dynamics Review*, *15*(4), 379–402.

Verbong, G., & Geels, F. (2007). The ongoing energy transition: Lessons from a socio-technical, multi-level analysis of the Dutch electricity system (1960–2004). *Energy Policy*, *35*(2), 1025–1037.

Walsh, J. P. (1995). Managerial and Organizational Cognition: Notes from a Trip Down Memory Lane. *Organization Science*, *6*(3), 280–321.

Weick, K. (1995). *Sensemaking in organizations*. Thousand Oaks (CA): SAGE Publications.