

Effect of Knowledge on Organizational Change

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Abstract — Knowledge is nowadays considered to be the main source of competitiveness in many companies. Knowledge may also be the facilitator of organizational change, and thereby, contribute indirectly to the competitiveness. Organizational change is, however, a broad concept and it is examined from many perspectives in multiple disciplines. Therefore, the aim of this theoretical paper is to analyze and categorize concepts, theories and models of organizational change. This paper also provides some preliminary views of what is the role of knowledge for changes in organizations. Based on a literature review, change is categorized based on the theory (selection, adaptation, or co-evolution), intentionality (planned or emergent), and the type or magnitude of change. Knowledge forms and processes are proposed to be seen as a facilitator of incremental and radical changes.

Keywords — Organizational change, Incremental change, Radical change, Knowledge.

I. INTRODUCTION

Knowledge may affect an organization's ability to change and improve its competitiveness. Studies of learning organizations and continuous innovations have underlined the importance of knowledge, but it is yet, however, unclear how knowledge and change are related in a bigger picture. For example, does an organization that has a great amount of organizational knowledge change more efficiently than one that does not have much knowledge? So, the question is, in what way may knowledge facilitate changes in an organization, or has it any influence on change at all? These questions are relevant for organizations operating in dynamic environments, especially if their business activities are largely based on the use and production of knowledge. In order to sustain competitiveness, they should also be able to change when needed.

Organizational change is, however, a broad concept and it is examined from various perspectives in multiple disciplines. For example, learning and innovation in organizations are popular topics nowadays, but change is conceptualized in different ways in them. Therefore, this paper has two objectives. First, it aims at analyzing and categorizing concepts, theories and models of organizational change, in order to have better understanding about change. Secondly, to examine the role of knowledge, this paper provides some preliminary views of the question *what is the role of knowledge as a*

facilitator for organizational changes. Although the main focus is in theories and types of change, the issues of maintenance and decline are also shortly discussed.

This study is a conceptual analysis, and it is based on a literature review. Thus, the paper is theoretical and it aims at describing and categorizing the phenomena and the concepts of the issue. Literature review was carried out in the fall 2005. The material for this study has been gathered through library databases of Tampere University of Technology. The research material consists of books, journals and doctoral dissertations. The value of this paper is that it combines both knowledge management and change theories in general, and offers help to both practitioners and researchers in understanding the area.

This paper is organized as follows. In the beginning, a brief review of organizational change is presented, including several theories and models of organizational change. After that, forms and processes of organizational knowledge are presented, as well as some conclusions about how knowledge may generate change in organizations are provided. Finally, the summary is presented.

II. TYPOLOGIES OF ORGANIZATIONAL CHANGE

Organizational change has its theoretical roots in sociology, business economics and strategy, and organization theory. Many concepts and theories for organizational change are also borrowed from other disciplines, such as child development and evolutionary biology and therefore, theoretical approaches and concepts are multiple [1]. For example, concepts of 'development', 'renewal', 'transition', 'transformation', 'learning', 'innovation', and 'decline' all explain changes but in various ways. These terms can be considered as synonyms or sub-concepts of organizational change. Change can refer to continuous renewal of existing condition or to a transformation to entirely new condition. As a concept, the term 'change' is neutral: it can describe change in both good (improvement) and bad (decline).

According to Van de Ven and Poole [1], the term 'change' refers to an observed "difference in form, quality, or state over time in an organizational entity," such as an individual's job, a work group, strategy, a product, or the overall organization. Also Hildén [2] emphasizes that organizational change is "the realized difference in one or more sub-systems, such as structures, processes, information systems, culture, social capital, or competence." These definitions view change from the outcome point of view. However, organizational change

can also be seen as a process where an organization changes from a current state to a wanted future state in order to increase, for example, its competitiveness or flexibility. With the goals of change, an organization usually aims at new or improved ways of using its resources and competences. This approach to planned change usually describes multiple stages of how change is being executed in organizations and what actions and roles are involved (see, e.g., [3]; [4]).

In addition to outcome and process views of change, organizational change can be examined from several dimensions, such as the content, magnitude, or tempo of change (see, e.g., [5]). Changes can also occur in different grades in organization, i.e., change may take place within an organization which itself remains unchanged (first-order change) or change involves a variation whose occurrence changes an organization itself (second-order change) [3].

To gain better understanding about the why and how of organizational change, this paper aims at describing several theories and models. These are presented next.

A. Theories explaining organizational change

Theories explaining changes in organizations may be usually regarded as *selective* or *adaptive* [6]. According to Volberda et al. [7], from the selection perspective, change is "highly restricted by resource scarcity, convergence to industry norms, and structural inertia" (p. 160). Theories that are mainly based on selection are, for example, population ecology [8], evolutionary theory [9], and resource-based theory ([10]; [11]) [6]. On the contrary, Volberda et al. [7] argue, from the adaptation perspective, that companies can and do change, overcoming their rigidities: successful companies learn to behave differently and they seek for new competencies. Such theories of adaptation include, for example, dynamic capability theory ([12]) and learning theories ([13]) [6].

In the last few years the concept of '*co-evolution*' has gained ground in the literature alongside with selection and adaptation (see e.g., [6]; [7]; [14]; [15]). Instead of being purely selection or adaptation, co-evolutionary approach views change as interrelated process of both of them [7]. For example, Lewin and Volberda [6] define co-evolution as "the joint outcome of managerial intentionality, environment, and institutional effects." Thus, change occurs continuously when units at the different levels of the organization develop in co-evolution with each others and also with the environment. As Mitleton-Kelly [15] emphasizes, it is relevant to point out the difference between adaptation and co-evolution. In adaptation it is assumed that only the organization changes, but in co-evolution the organization changes with the environment and changes within the organization also affects the environment. Co-evolutionary influences can be observed also inside the organization, between units and between organizations.

B. Intentionality of change

In general, change can be either internally produced *endogenous change* or *exogenous change* that is caused by

external environment [16]. For example, management can produce change from top to down by changing strategy, size of the organization, management practices, or introducing new technology. These changes are considered to be proactive, "in anticipation of external events that may occur" [17]. By contrast, external environment may and do change increasingly fast and changes can not be controlled or selected by organization. These changes are considered to be spontaneous from the organization's point of view and are just reacted and adopted in best possible manner. [16]

As described above, there seems to be two views of understanding the intentionality of organizational change: change can be planned or emergent. Planned change is usually referred to as managed or controlled change. They are usually strategic, episodic changes that aim to transform the whole organization (or a selected function, etc.). Emergent changes refer to unintentional actions and spontaneous changes that are continuously happening while organization naturally grows and develops. When an organization and its management are functioning quite passively, change in its environment may affect the whole organization, and the environment may select companies that will survive.

In addition to exogenous changes, emergent changes may also be internally produced, occurring from bottom to up, when employees and units communicate with each others. These changes are usually emergent from the management point of view. In this way, the concept of 'emergence' is widely used in complexity studies. According to McMillan [18], emergence means "a phenomenon of the process of evolving, of adapting and transforming spontaneously and intuitively to changing circumstances and finding new ways of being." An emergent process can include, for example, the creation of new knowledge and innovative ideas in group work, because new knowledge can be considered as something totally new and unexpected, and not only as a sum of existing ideas.

C. Models and types of change

In the literature, many models have been developed to describe the nature of organizational change. Up to the late 1970s, the *incremental model* of change dominated and after that, researchers began to draw attention to two other perspectives: the *punctuated equilibrium model* and the *continuous transformation model* [19].

Incremental change model views change as a process whereby individual parts of an organization deal incrementally and separately with one problem and one goal at a time. When managers respond to pressures in their local internal and external environments, in this way, over time, their organizations become transformed (see, for example, [17]).

Contrary to previous view, punctuated equilibrium model views the change evolving through "long periods of small, incremental change that are interrupted by brief periods of discontinuous, radical change" [20]. Radical change is seen as a large-scale process that deals with the whole

organization in short time.

Change can also be seen as continuous: it is neither incremental nor radical and thus, does not belong to the previously discussed models [20]. Weick and Quinn [5] combine all ongoing, evolving, and cumulative organizational changes under the term 'continuous change'. They suggest that substantial change can be cumulated and created with small continuous, simultaneous, and interdependent adjustments. Advocates of the continuous transformation model disagree with both the incremental change and the punctuated equilibrium models and claim that an organization should develop its ability to change continuously in order to survive [19]. This has led to the ideas of 'learning organizations' and continuous innovation.

Typologies of organizational change and their descriptions are collected in Table 1.

TABLE 1
TYPOLOGIES OF ORGANIZATIONAL CHANGE

Frameworks	Concepts	Descriptions
Theories	Selection	Change occurs through competitive or management's intentional selection.
	Adaptation	Changing by adapting to existing internal or external conditions.
	Co-evolution	Parts that are in contact with each other change together and are dependent on one another.
Models	Incremental change	"Changes that focus on individual components, with the goal of maintaining or regaining congruence" (p. 196) [17].
	Punctuated equilibrium	"Change through relatively long period of stability (equilibrium periods) that is punctuated by relatively short burst of fundamental change (revolutionary periods)" (p. 1141) [22].
	Continuous change	Uninterrupted and growing change occurs simultaneously in the whole organization.
Types	Incremental change	For example, first-order change [3], and organizational development [24].
	Radical change	For example, second-order change [3], and organizational transformation [24].
Intentionality	Planned	Internally planned, managed, and controlled change [3].
	Emergent	Change that is emergent, spontaneous and surprising, caused by internal or external forces [19].

Debate about the efficiency of incremental change model and punctuated equilibrium model has been an ongoing issue in the literature in the 1990s. According to Romanelli and Tushman [22], small changes do not accumulate over longer periods to accomplish fundamental transformation of organization's systems, strategies, and structures, but this could be attained only through revolutionary, episodic, and radical change. Therefore, they speak rather about the state of organizational equilibrium than about incremental change. As Brown and Eisenhardt [20] note, the focus of the punctuated equilibrium model is in radical change, although incremental change is assumed to occur. In contrast, Dean et al. [23] claim that companies are adopting radical change only when the attempt to change

incrementally fails. They suggest that incremental change is an equally valid response to major environmental change than a more risky punctuated change.

It could be assumed that all these changes occur in organizations in different phases of their life cycle. The concepts and models of organizational change depend on the view of how an organization and its environment are seen. At the same time when conceptions of organizations are changed from traditional and mechanical to dynamic and more complex, also views of organizational change are renewed. For example, according to McMillan [18], traditional and classic views of change are: 'linear,' 'disruptive,' 'cause and effect,' 'incremental,' 'an event,' and 'controllable,' whereas modern and dynamic views are: 'full of opportunities,' 'revolutionary and incremental,' 'continuous,' 'about learning,' 'non-linear,' 'uncontrollable,' and 'creative.'

Now that theories, models and types of organizational change are presented, it is time to analyze how knowledge in organization may affect these previously identified changes. Instead of focusing in one specific model, this paper further investigates two types of change, namely incremental and radical change. For example, how are organizational knowledge and change related and in what way can knowledge generate change in the whole organization? These issues are discussed next.

III. HOW DOES KNOWLEDGE AFFECT ORGANIZATIONAL CHANGES?

To sustain and increase its competitiveness and to function efficiently in dynamic environment, an organization should be able to produce change and to develop itself. To understand what knowledge may facilitate changes in organizations, it is important to examine different forms and processes of knowledge. These issues are discussed in the next section.

A. Knowledge forms in organizations

Typically, organizational knowledge is categorized by different forms, for example, knowledge can be explicit or tacit. Data and information are examples of explicit knowledge, and they can be stored in the organization's information systems. According to Kogut and Zander [25], organizational information includes "facts, axiomatic propositions, and symbols" (p. 386). Tacit knowledge is usually considered as individuals' skills and experiences, although it can also be organizational. For example, Kogut and Zander [25] refer to organizational know-how as "higher-order organizing principles of how to coordinate groups and transfer knowledge" (p. 388). Furthermore, Spender [26] uses the term "collective knowledge," a social type of knowledge that is "embedded in the firm's routines, norms and culture" (p. 52). Tacit organizational knowledge is therefore embedded in structures and actions. A third form of knowledge is "potential knowledge," as suggested by Stähle and Grönroos [27]. It refers to new knowledge that is not yet available to the organization but may exist in intuition and weak signals.

As we can see, organizational knowledge is not the same as the sum of the employees' knowledge. Organizational knowledge is more like knowledge collectively stored, shared, and experienced. Although experts working in organizations have much knowledge in their heads, it does not mean that the whole organization is knowledgeable. Therefore, employees' knowledge should be transformed to organizational level in order for this knowledge to facilitate and improve change in the organization.

Different forms and sources of knowledge have facilitative effect on changes. From the selection perspective, it can be argued that the most essential form of organizational knowledge is explicit. In selection, especially in external selection, organizations usually have strong bias towards exploitation, and therefore, knowledge that effects mostly on change comes from the market [7]. For example, Volberda et al. [7] use March's idea of exploitation and exploration in organizational learning when they identify four renewal processes for organizations. Exploitation refers, for example, to efficiency, selection, and choice, where as exploration includes such terms as variation, risk, experimentation, discovery, and innovation [28].

If an organization has been capable to create a balance between exploitation and exploration, the essential form of knowledge could be considered as tacit. Adaptation and co-evolution require learning and incremental development among entities, such as management and employees. On the other hand, if exploitation and exploration are not in balance but fluctuates from one to another, potential knowledge may facilitate changes that may emerge spontaneously and can also be radical. This phenomenon is typical in the punctuated equilibrium model and these radical changes, or discontinuous changes, are usually considered as innovations (see, e.g., [29]).

B. Knowledge processes facilitating changes

To make change easier and through that to increase their ability to adapt and be successful, organizations should improve their knowledge processes [30]. The impact of knowledge processes on organizational change may vary, and may result in incremental or radical changes.

Probably the most cited knowledge process is the knowledge creation process of Nonaka and Takeuchi ([31]; [32]), which is based on four interaction patterns between tacit and explicit knowledge, namely, socialization, externalization, combination, and internalization. These interaction processes represent how to convert individuals' existing knowledge into new knowledge. However, at the organizational level, knowledge creation can also mean searching knowledge from external sources. For example, according to Maula's ([30]; [33]) model of living composition, organization can interact with its environment and also coordinate itself continually with the changing environment through a specific knowledge flow that is termed 'organizational senses.' This knowledge flow enables organization to collect weak signals, triggers, and new ideas from the environment. By doing this, organization is more capable to adapt environmental

changes and also to develop its own renewal processes also in a radical way if needed [30].

In addition to knowledge creation, the key knowledge processes in organizations include knowledge sharing and integration [34]. According to Pöyhönen [35], continuous use, sharing, and development of organizational knowledge generate incremental change. In contrast, she also argues that gathering and creation of entirely new knowledge and innovations may generate radical change.

To fully understand organizational change, we should note that change is only one side of the coin. To be effective, the organization requires some degree of stability. By stability we do not refer to stagnation or decline but maintenance or exploitation that was discussed earlier. Maintenance consists of effective standardization and replication of the existing organizational-level information and tacit knowledge across the firm; "it implies changes only in individual skills and knowledge" [35]. According to Maula [30], this organizational efficiency is based on internal knowledge flow that she terms as 'organizational memory function'. This function aims at maintaining daily operations by exploiting existing information and previous experiences.

C. Challenges for Organizations

The impact of knowledge on the capability to change can also be seen as negative. For example, existing organizational knowledge can prevent from realizing the need for change, hinder change forces for activating change processes, or some other way slow down change processes. However, knowledge can still be considered as the enabler and facilitator of changes, even if the effect and the direction of change are negative. Then, change can be referred as decline when existing organizational structures, routines and culture do not maintain organizational activities efficiently and they even prevent anything new to be created [36].

It is not, however, certain that knowledge codification, sharing, or creation generate changes in organization at all. Knowledge has insignificant role for changes when existing knowledge is not used efficiently to produce change. Although an organization has a lot of knowledge and knowledge is brought mainly to the organization by recruiting new employees, through customers and research, this knowledge may still not produce the needed change. Pfeffer and Sutton [37] refer this phenomenon with the term 'knowing-doing gap'. They claim that typical knowledge management practices make this gap even worse, because they concentrate still too much on technologies and the transfer and storage of codified knowledge instead of transformation of tacit individual knowledge to organizational knowledge.

Based on the literature it is not evident if knowledge has any effect on change or not. Therefore much more research is required. For example, within the emergent approach on organizational change it could be studied whether the amount, form, or process of knowledge affects change.

IV. SUMMARY AND CONCLUSIONS

Based on a literature review, this paper examined concepts, theories and models of organizational change. Organizational change is conceptualized in the literature from both output and process point of view. Diverse concepts indicate, for example, the magnitude of the change_or why and how the process unfolds. In the literature, there are three theories explaining why the organizational change occurs: selection, adaptation, and co-evolution. Further, three models explain the type and nature of change: first the incremental change model which means a gradual step-by-step development, secondly the punctuated equilibrium model which means alternating from incremental to radical change, and thirdly a continuous change where change is neither incremental nor radical. Change can also be classified as planned or emergent, based on the source of knowledge that facilitates change processes.

When the organization is to conduct changes, it is relevant to analyze the role of knowledge as a facilitator of change, not as an output of that change. Knowledge can also be seen as a process that generates the actual change processes. Change in an organization is therefore highly dependent on how knowledge in its different forms is used in both internal and external knowledge processes of the organization. In order to change itself efficiently, the organization should recognize its existing knowledge bases, and balance both internal and external knowledge codification, sharing, and creation. Furthermore, the change may be incremental or radical. Incremental change was seen as the balance between exploitation and exploration, whereas unbalance between these actions was considered to lead to radical change. The use of knowledge in explicit form effects mostly on maintaining the efficiency in organizations. Incremental change can be facilitated by sharing and developing existing knowledge, by transforming explicit knowledge into organizational structures and practices as well as by developing tacit knowledge at the organizational level. Finally, tacit knowledge at the organizational level can generate radical change in creation of new knowledge together with the environment.

Future research work could include deeper analyze and development of a model for how different forms and processes of knowledge may produce changes in organization. Through that model, it would be easier for managers to identify strengths and weaknesses of their organizations' knowledge processes and develop them further in order to generate desired changes within an organization.

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REFERENCES

- [1] A.H. Van de Ven & M.S. Poole, "Explaining Development and Change in Organizations" *Academic Management Review*, vol. 20, no 3, 1995. pp. 510-540.
- [2] S. Hildén, *Does Organizational Change Improve Organizational Functionality? Intentions and Experiences in a Frequently Changing Organization*. 2004. Doctoral dissertation, Tampere University of Technology.
- [3] A. Levy, "Second-order planned change: Definition and conceptualization" *Organizational Dynamics*, vol. 15, no. 1, 1986. pp. 5-20.
- [4] A.A. Armenakis, & A.G. Bedeian, "Organizational Change: A Review of Theory and Research in the 1990s" *Journal of management*, vol. 25, no. 3, 1999. pp. 293-315.
- [5] K.E. Weick, & R.E. Quinn, "Organizational Change and Development" *Annual Review of Psychology*, vol. 50., 1999. pp. 361-386.
- [6] A.Y. Lewin, & H.W. Volberda, "Prolegomena on Coevolution: a Framework for Research on Strategy and New Organizational Forms" *Organization Science*, vol. 10, no. 5, 1999. pp. 519-534.
- [7] H.W. Volberda, C. Baden-Fuller, & F.A.J. van den Bosch, "Mastering Strategic Renewal: Mobilising Renewal Journeys in Multi-unit Firms" *Long Range Planning*, vol. 34, no. 2, 2001. pp. 159-178.
- [8] M.T. Hannan & J. Freeman, "The Population Ecology of Organizations" *The American Journal of Sociology*, vol. 82, no. 5, 1977. pp. 929-963.
- [9] R.R. Nelson & S.G. Winter, *An Evolutionary Theory of Economic Change*, 1982, Cambridge: Belknap.
- [10] E.G. Penrose, *The Theory of the Growth of the Firm*, 1959, New York: Wiley.
- [11] B. Wernerfelt, "A Resource-Based view of the Firm", *Strategic Management Journal*, vol. 5, no. 2, 1984. pp. 171-180.
- [12] D.J. Teece, G. Pisano, & A. Shuen, "Dynamic Capabilities and Strategic Management" *Strategic Management Journal*, vol. 18, no. 7, 1997. pp. 509-533.
- [13] C. Argyris & D.A. Schön, *Organizational learning: a theory of action perspective*, 1978. Addison-Wesley.
- [14] H.W. Volberda & A.Y. Lewin, "Co-evolutionary Dynamics within and between Firms: from Evolution to Co-evolution" *Journal of Management Studies*, vol. 40, no. 8, 2003. pp. 2111-2380.
- [15] E. Mitleton-Kelly, *Complex systems and evolutionary perspectives on organisations: the application of complex theory to organisations*, 2003, Pergamon, Amsterdam.
- [16] R.M. Burton, & B. Obel, *Strategic Organizational Diagnosis and Design: The Dynamics of Fit*, 2004. Kluwer Academic Publishers.
- [17] D.A. Nadler & M.L. Tushman, "Organizational Frame Bending: Principles for Managing Reorientation" *The Academy of Management Executive*, vol. 3, no. 3, 1989. pp. 194-204.
- [18] E. McMillan, *Complexity, Organizations and Change*, 2004, London, Routledge.
- [19] B. Burnes, "Emergent Change and Planned Change – Competitors or Allies? The Case of XYZ Construction. International " *Journal of Operations and Production Management*, vol. 24, no. 9, 2004. pp. 886-902.
- [20] S.L. Brown & K.M. Eisenhardt, "The Art of Continuous Change: Linking Complexity Theory and Time Paced Evolution in Relentlessly Shifting Organizations" *Administrative Science Quarterly*, vol. 42, 1997. pp. 1-34.

- [21] M. Tushman & P. Anderson, "Technological Discontinuities and Organizational Environments" *Administrative Science Quarterly*, vol. 31, no. 3, 1986. pp. 439-465.
- [22] E. Romanelli & M.L. Tushman, "Organizational Transformation as Punctuated Equilibrium: An empirical test" *Academy of Management Journal*, vol. 37, no. 5, 1994. pp. 1141-1166.
- [23] A. Dean, Y. Carlisle & C. Baden-Fuller, "Punctuated and Continuous Change: The UK water industry" *British Journal of Management*, vol. 10, 1999. pp. 3-18.
- [24] J.I. Porras & R.C. Silvers, "Organization development and transformation" *Annual Review of Psychology*, vol. 42, 1991. pp. 51-78.
- [25] B. Kogut & U. Zander, "Knowledge of the firm, combinative capabilities, and the replication of technology" *Organization Science*, vol. 3, no. 3, 1992. pp. 383-397.
- [26] J.-C. Spender, "Making Knowledge the Basis of a Dynamic Theory of the Firm" *Strategic Management Journal*, vol. 17, 1996. pp. 45-62.
- [27] P. Stähle, & M. Grönroos, *Dynamic Intellectual Capital: Knowledge Management in Theory and Practice*. 2000. WSOY. Helsinki.
- [28] J.G. March, "Exploration and exploitation in organizational learning" *Organization Science*, vol. 2, no. 1, 1991. pp. 72-87.
- [29] M. Toivonen, T. Tuominen, & Brax S. "Innovation process interlinked with the process of service delivery - a management challenge in KIBS" *Innovation in Services Conference*, Manchester, 15-17 June 2006.
- [30] M. Maula, *Organizations as Learning Systems. 'Living Composition' as an Enabling Infrastructure*, 2006. Elsevier Science, Advanced Series in Management. London: Elsevier.
- [31] I. Nonaka, "A Dynamic Theory of Organizational Knowledge Creation" *Organization Science*, vol. 5, no. 1, 1994. pp. 14-37.
- [32] I. Nonaka, & H. Takeuchi, *The Knowledge-Creating Company*, 1995. New York: Oxford University Press.
- [33] M. Maula, "The Senses and Memory of a Firm – Implications of Autopoiesis Theory" *Journal of Knowledge Management*, vol. 4, no. 2, 2000. pp. 157-161.
- [34] D. Hislop, *Knowledge Management in Organizations: A Critical Introduction*, 2005, Oxford University Press.
- [35] A. Pöyhönen, *Modeling and measuring organizational renewal capability*. Doctoral dissertation. Lappeenranta, Lappeenranta University of Technology, 2004.
- [36] D. Leonard-Barton, "Core Capabilities and Core Rigidities: A Paradox in Managing New Product Development" *Strategic Management Journal*, vol. 13, 1992. pp. 111-125.
- [37] J. Pfeffer & R.I. Sutton, *The Knowing-Doing Gap: How smart companies turn knowledge into action*, 1999, Harvard business school press, Boston, Massachusetts.