Qualitative mapping for understanding the collective judgment building process: a study of the Federal Open Market Committee

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QUALITATIVE MAPPING FOR UNDERSTANDING THE COLLECTIVE JUDGMENT BUILDING PROCESS:
A STUDY OF THE FEDERAL OPEN MARKET COMMITTEE

by

Hyunjung Kim

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THE COLLECTIVE JUDGMENT BUILDING PROCESS:
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ABSTRACT

This study develops a mapping method for studying a collective judgment building process in a decision-making group. Environmental uncertainties and a lack of information require a decision maker to make judgments about various issues relevant to the decision task. In a group setting, the members together weave their structural model of the system with available information to build a collective judgment for the decision task.

The method detailed in this study generates a map that describes the collective model of the system structure that is verbally expressed during a decision-making meeting. Based on the assumption that the decision emerges from the group process, the map is then used as a narrative tool to explain how the group preferred one decision over other alternatives.

The Federal Open Market Committee (FOMC)’s monetary policymaking process is used as a case for this study. Verbatim transcripts from the FOMC meetings are used as the data. Integrating coding methods from grounded theory and mapping languages from system dynamics, the study systematically elicits a map from the qualitative data. The detailed account of the mapping process allows one to follow how the relevant data segments are sifted, coded, and transformed into a visual representation. The study also describes how the researcher’s subjectivity is embedded in the interpretive process of the mapping and how it is recognized explicitly. The map is then used to explain how the FOMC reached a policy decision through a process of building collective judgment about the state of the economy.
This study attempts to make contributions to existing literature primarily by developing a new mapping method for studying the collective judgment building process. However, the study also intends to demonstrate the benefits of interdisciplinary communication between those who practice qualitative mapping and modeling and those who use ethnographic research methods. More specifically, the study attempts to suggest a way to systematically generate system dynamics maps and models from qualitative data through the use of coding practice. In addition, this study intends to contribute to those interested in understanding the FOMC’s monetary policymaking in practice.
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CHAPTER 1

INTRODUCTION

1.1 RESEARCH MOTIVATION

This study started with an inquiry about how social science describes cognitive and social processes of decision making. Diverse methods exist to collect data about different aspects of decision-making processes and to organize and represent the data in meaningful ways. Various theoretical frameworks are developed to explain decision-making processes, and some provide normative recommendations for improved decision performance. More specifically, this study is interested in describing a structure of a system collectively perceived by a decision-making group. The structural model is then used to explain the decision group’s process of building collective judgment leading to a decision. In order to do so, it incorporates coding and mapping practices from two different disciplines: grounded theory and system dynamics.

In system dynamics, qualitative maps are used to describe system structure perceived by decision makers, and computer simulation models are used to operationalize the qualitative maps and integrate the maps with empirical data. These maps and models are used as learning tools to improve decision making, and it is not difficult to imagine that their success as normative instruments are highly dependent on the quality of the maps and models. While much has been documented about formulation of mathematical representation of the perceived system structure using computer simulation models, the
process of transforming raw data into qualitative maps has been barely explored. This phase of modeling is often considered as a part of model conceptualization, and what is captured in these qualitative maps and how well the maps represent the object of interests are thought to be in the realm of skills and experience of the modelers.

This study attempts to develop a systematic way to elicit qualitative maps from raw data. It draws insight from the grounded theory approach in ethnography. As in grounded theory where theories emerge from raw data through the process of coding (Strauss and Corbin 1998), qualitative maps of this study describing decision makers’ collective model of system structure emerge from data through a systematic coding process.

To demonstrate a systematic way to derive qualitative maps from raw data, the study uses data similar to those acquired in ethnographic research. The data come from the Federal Reserve’s monetary policymaking process. This study examines the verbatim transcript generated from the policymakers meetings, and creates a qualitative map that describes the decision-making group’s structural understanding of the system. The elicited map is then used to explain the cognitive and social processes of decision making during the particular meetings studied.

The mapping method described in this study has methodological implications for the system dynamics and grounded theory communities. For the system dynamics community, grounding qualitative maps solidly on data presents a way to enhance the degree of confidence in the modeling process. Validity of a model built on qualitative data can be tested rigorously by tracing back to the source data. Furthermore, it redefines the status of qualitative maps in the modeling community. Rather than regarded as an
interview technique, a group facilitation tool, or a pre-modeling process of problem conceptualization, qualitative maps can be used as an analytical tool to systematically explain the cognitive and social processes of decision making. For the grounded theory community, the study presents a new way to code and diagram the data. The mapping language from system dynamics can be a useful way for ethnographers to visually organize and conceptualize rich textual data.

This study has multiple audiences in mind. First, the coding and mapping method developed in this study will be of interest to those who use qualitative maps for modeling and management purposes. This method may also be of interest to qualitative researchers looking for a new coding and diagramming language. A broader audience will be for those interested in decision groups’ collective perception of system structure and the process of generating a group decision. Finally, those interested in the Federal Reserve’s decision-making process in practice will also be another target audience for this study.

1.2 RESEARCH QUESTIONS

The main objective of this study is to develop a systematic coding method to sort out decision makers’ perception of system structure from qualitative data and represent it in a meaningful way. The relevant research question would be “How do we systematically elicit qualitative maps from raw data?” To answer this question, it is necessary to discuss what qualitative maps are and what these maps are intended to portray. It is also necessary to identify what a perceived system structure is in a decision-
making context, and what part of the structure is accessible via ethnographic data. In other words, the initial methodological question must be preceded by a theoretical reflection of the relationships between data, the decision-making process, and the subject of the maps. This will be fully discussed in Chapter 2. For now, “qualitative maps” will be briefly limited to words-and-arrow diagrams used to describe single or multiple decision makers’ understanding of how a system works. The “system” will be limited to those pertinent to a decision problem. The “raw data” can be in any form, both qualitative and quantitative. The data are rich and detailed, yet they require sorting and filtering to tell meaningful stories about the decision problem or a decision-making process.

In addition to the methodological contribution, this study attempts to demonstrate how the maps generated from ethnographic data can be used to promote our understanding of decision-making process in organizations. This study is especially interested in the group level process where social dynamics are intermingled with individual cognitive processes. In a complex system, a sophisticated decision maker develops a set of information cues that allows him or her to form a judgment about the state of the system and to make a decision based on the judgment. Information selection is influenced both by information availability and the decision maker’s perceived structure or model of the decision environment. Various personal and social factors are embedded in one’s mental model. When a decision is made in a group, there are additional dynamics of sharing and merging one’s knowledge and judgment. No one individual has a perfect knowledge of the system, and this deficiency and environmental uncertainty leaves room for adjustment and compromise. A map derived from this social process is inherently different from a map derived from an individual.
The study also presents how the mapping method can be applied to different policy environments to enhance our substantive understanding of policy decisions. In this study, the Federal Reserve’s monetary policy decision is used as a case. The elicited map reveals a part of the system that plays a critical role in forming the group’s collective judgment pertinent to the policy decision. The map highlights how the group resolves major disagreements and comes to a collective decision. The map explains how monetary policies are made in practice and what kind of discussions lead the group to pick one policy over other alternatives.

The goal of this study is to contribute to existing literature in three different ways. Methodologically, it presents a systematic tool to sort out from raw ethnographic data a decision-making group’s shared perception of the system and represent it as a map. Theoretically, it presents a way to enhance our understanding of group decision-making processes. Substantively, it contributes to our understanding of Federal Reserve’s monetary policymaking in practice. This attempts to answer following research questions:

1. How do we systematically elicit qualitative maps from raw data?
2. How do we use these maps to understand group decision-making processes?
3. How do we use these maps to understand monetary policymaking in practice?
1.3 DATA

The data used for this study are verbatim transcripts of a Federal Open Market Committee (FOMC)’s policymaking meeting. The FOMC is the main monetary decision-making body of the Federal Reserve. Verbatim transcripts are not ethnographic data per se, but they allow researchers to indirectly access and experience the scenes. Unlike ethnographic studies, verbatim transcripts do not allow researchers to visually observe non-verbal cues or the surrounding environment. Neither can they interview the subjects or immerse themselves in culture. However, verbatim transcripts preserve every verbal statement in its original form undistorted by the researcher or the method of data collection. When a decision is made behind closed doors, as in the case of many high-profile, elite decision-making processes, verbatim transcripts may be the only way for the researcher to access these decision-making meetings.

The verbatim transcripts of the FOMC’s monetary policymaking meetings describe rich group dynamics taking place inside the meetings. From the transcripts, it is possible to visualize the policymakers’ serious discussions, collective reflections, negotiations, and the process of cooperation. The transcripts sometimes convey their emotions such as frustration, tension, and excitement. More importantly, these transcripts give us access to these closed-door meetings of monetary policymakers. Such opportunities are rarely available to the public. In this regard, the Federal Reserve’s meeting transcripts can serve as excellent data for academics and practitioners interested in decision-making processes of elite policy groups and monetary policymaking in practice.
There are several challenges to studying the Federal Reserve’s verbatim transcripts. First, the data are not collected for this study. The data are so rich that various group processes and policy issues are complexly intermingled in the data. As a result, there must be a way to sort out and organize themes and constructs in the data. Second, researcher’s subjectivity influences the interpretation of the data. This can be minimized by the use of systematic coding, but the temporal, spatial, and cultural gap between the policymakers and the researcher can limit the researcher’s ability to correctly infer the decision makers’ meaning system. However, this may be a problem with any type of verbal communication.

1.4 RESEARCH METHOD

One of main goals of this study is to develop a systematic tool to sort out and represent the monetary policymakers’ collectively perceived system structure from verbatim transcripts of their policy meetings. A full discussion of the method used in this study is presented in Chapters 4 and 5. This section has a brief introduction to the methodology.

First, using Strauss and Corbin (1998)’s coding methods, patterns in the data were systematically analyzed and conceptualized in an inductive manner. This requires the data to be broken down into discrete parts, closely examined, and compared for similarities and differences. The data pieces are then reassembled in categories for discovery of patterns and themes. An initial analysis of the selected meeting transcripts
suggested that there are two major factors influencing the decision of changing money supply. First is the policy group’s collective assessment of the current and the future state of the economy and the monetary system. Second is the policy group’s mental simulation of how the public would react to different policy scenarios. The distinction between these two judgment formation processes is not always clear because the economy and the public behaviors are parts of one system. However, it is useful to make the distinction in order to separate the discussion of the policy action necessary at a specific meeting period from the discussion of the framing of the policy action for the public announcement. This study narrowed its focus to how the group collectively analyzes the current and future state of the economy, and relevant data segments were sifted for further analysis.

Second, causal arguments and information cues used by the policymakers were coded from the selected data set. Causal argument is a statement that indicates the speaker’s perception of a causal relationship between two variables in the system. Information cues indicate observed or expected values of variables in the system, and they can also suggest strength or direction of the causal relationships in the system.

Third, the codes collected from the second stage were merged into a composite map representing a part of the system structure that the FOMC as a group highlighted and discussed in the meeting. The concept of “stock” and “flow” were introduced at this phase to represent delays and accumulations of information and materials in the system. In the simulation modeling community, this composite map would be a prior step for building a mathematically formulated model. The process of building a composite map introduced in this study demonstrates to the modeling community how qualitative maps can be systematically grounded in data.
Rather than developing a formal simulation model from the composite map, this study takes a different direction by exploring the analytical value of the map. It uses the map to deepen our understanding of the group decision-making process and monetary policymaking in practice.

1.5 ORGANIZATION OF FOLLOWING CHAPTERS

The dissertation is organized as follows. Chapter 2 will lay out the theoretical background of this research. It clarifies the difference between the true object of interests a map is trying to portray and the substance actually represented in the map. In other words, it defines “the map” and “the territory” that it represents (Weick 1990). The first part of Chapter 2 will survey how different fields define “the territory” differently. The second part will survey different “maps” intended to study “the territory.” The discussions in Chapter 2 lead to an insight that there is a need to develop a way to systematically link these maps to their territory via rigorous coding. Chapter 3 introduces the data of this study. The Federal Open Market Committee (FOMC)’s institutional structure, decision-making process, and its decision-making environment will be discussed. The chapter also includes a short review of literature of the FOMC decision-making process. Chapter 4 introduces a general coding system developed for this study. Elicitation, representation, and analysis methods used for this study are described, and major coding issues are discussed. Chapter 5 applies the coding system described in Chapter 4 to the data. A composite map is elicited from a policy meeting of the FOMC,
and the process is documented in detail. Chapter 6 uses the map elicited in Chapter 5 to understand the monetary policymaking process in practice. The usefulness of the map as an analytical tool will be presented. Chapter 7 is a conclusion and discussion of this study.
CHAPTER 2
THEORETICAL FRAMEWORK

This chapter lays out a theoretical framework for the coding method that will be developed in the following chapters. The proposed output of this study—a map elicited from qualitative data of a group decision-making process—must be defined in terms of what it intends to represent and what the representation itself means. In the introduction, it was described that the map of this study intends to portray a decision maker’s perception or the model of system structure pertinent to a decision task. However, the theoretical discussion provided in this chapter argues that it is not always easy to define what it means by the perception of system structure or what role it plays in the decision-making process. Furthermore, the issue becomes even more complex when the process involves multiple decision makers, as in the case of this study.

For the discussion of this chapter, it is useful to identify the difference between a “map” and its “territory.” Weick (1990) points out how both are often confused in social science. While a map itself is a representation of a territory, it is not the territory itself. This may sound obvious, but when the territory is an intangible thing or an abstract concept, the distinction between the two becomes quite blurry. For example, a map used to represent a mental model is mistakenly referred to as the mental model. This is an important distinction for this study.

The first part of Chapter 2 describes the map and the territory of this study. It will discuss the part of the FOMC decision-making process that is the subject of the map
generated in this study. The second section surveys definitions found in the literature to describe the phenomena similar to the subject of this study. The literature review is motivated by two questions: Are there studies interested in the territory similar to that of this study? If so, how do these studies define the territory? The goal of the literature review is to embed this study within the existing paradigms of research and to gain insights in terms of research methodology. The third section will survey different methods used in different fields to observe and represent the territory similar to this study.

Chapter 2 concludes by finding out that there needs to be more effort to systematically link qualitative maps to what they represent. For example, simulation modeling and strategic management communities have used qualitative data for modeling and planning, but not much attention has been paid to the process of transforming raw data into maps. This may be the reason why maps were only regarded as a supplementary tool for modeling. As will be presented in Chapter 4, this study proposes a way to address this problem by adopting a coding method from ethnography.

2.1 A MAP AND WHAT IT REPRESENTS

A decision-making process can be simplified as a processor that receives decision inputs and generate decision outputs (Figure 1). In this study, the black box is referred to as the decision processor, and it may include various cognitive and social processes generating a decision. For the Federal Reserve’s monetary policymaking process, the decision processor will be a cognitive and social process taking place in the Federal Open
Market Committee (FOMC) meetings. An implicit assumption here is that the actual monetary policy decisions are made during these FOMC meetings.

Figure 1. Decision Processor

What constitutes the decision processor can be different depending on the form of decision-making process. For example, the processor of an individual decision maker will be different from that of a decision-making group. In this study, the decision processor will be discussed at the group level, and when expanded, a typical group decision-making process looks like Figure 2.

Decision making requires human judgment because it involves environmental uncertainty and limited information (Hammond 1996). Group decision making differs from individual decision making because judgment is collectively made by a group.

Before group members start communicating about a decision task, the members have shared experiences, knowledge, and information. The degree and extent of this sharedness would be influenced by a variety of factors such as forms and frequency of the group interaction and work processes, duration of stay as a group, and similarities in the members’ background. In the FOMC case, the members share career backgrounds as financial or economic experts, and with service terms lasting 14 years or longer, the majority share the experience of collectively implementing monetary policy. In addition,
prior to each FOMC meeting, the committee members are provided with economic data and analysis from the Federal Reserve’s economic staff.

**Figure 2. Group Decision-making process**

![Diagram of Group Decision-making process]

In addition to shared experiences, knowledge, and information, each group member has his or her own set of experiences, knowledge, and collection of information. Based on these decision inputs, each decision maker makes personal judgment about the
state of the system and preferred course of action. At this stage, the decision processor operates at the individual level. One’s mental models or schema play a critical role in selecting and organizing information and creating judgment (Richardson et al. 1994).

Once the meeting starts, the group discusses the decision task. The members interact and communicate. The group members share their exclusively-owned experiences, knowledge, and information. The members also draw the group’s attention to their shared experiences, knowledge, and information. As the meeting progresses, the members’ diverse judgment and positions begin to merge and a collective judgment is created to fill in the information void and the environmental uncertainties. This decision processor at the group level results in the group’s shared understanding of the system from which collective decisions are generated.

Two assumptions are made here. First, collective judgment is assumed to be a product of the shared understanding of the system. Building collective judgment requires verbal communication. Therefore, collective judgment is often observable. On the other hand, shared understanding of the system evolves slowly from the group process and is rarely observable. It exists in the deeper level of the mind. Second, ideally speaking, collective judgment is agreed by every member in the group. However, when the group fails to reach a consensus, the majority judgment is regarded as the collective judgment with an assumption that it is the majority judgment that shapes the group’s decision output.

The linear process described in Figure 2 may vary depending on the decision-making context. In some cases, the individual level process and the group level process may not have a clear boundary. There may be other types of decision inputs not depicted
in Figure 2. However, the theoretical discussion of this study is based on the simplification of the group decision-making process described in Figure 2.

It is also important to recognize that only the observable and explicit part of the group decision-making process is represented in the map of this study. It is because a map can only be elicited from the verbal statements made during the meetings. As briefly described in the previous chapter and will be further detailed in the following chapters, the map generated in this study captures causal arguments stated by decision makers during a policymaking meeting. This map is an artifact of social interactions. It describes information, system structure, and judgment that are shared, negotiated, and merged during the social process. In addition to that, the map inevitably includes interpretation of the coder who creates the map (Scheper and Faber 1994; Doyle 1997). The coder must interpret meaning from conversation, fill in missing pieces, and infer what is implied. A systematic coding can reduce coder bias, but because the map is elicited from the textual data, it cannot entirely eliminate researcher interpretation and judgment.

What is the use of the map created from an observation of social interactions? If what is going on inside the meeting is not irrelevant to the group’s shared understanding of the system and the collective decision output—in other words, if we assume actual decisions emerge from the group process—what is captured in the map should reveal, to some degree, why the group reached its decision among many alternatives. The map is an indirect method to study the unobservable decision processor which is a combination of information and models that individual members bring in to the meeting and the collective understanding of the system developed during the meeting.
In sum, the territory of the map proposed in this study is a decision processor of a policy group. The data used to access the territory are verbatim transcripts from the decision-making meeting. The map represents the territory by capturing the system structure and information discussed in the meeting. The map assumes that decision makers’ verbal statements reflect their understanding of the system and that the policy decision is based on the collective judgment generated from their shared understanding of the system. Two lenses filter the territory before it is captured in the map (Figure 3). The first is the method of data elicitation. In this study, the data were collected by recording and transcribing the policy meeting. The second lens is the method of data representation. In this study, the transcribed data are coded and represented in a qualitative words-and-arrow map.

**Figure 3. Two Lenses Filtering Object of Interest**
2.2 DEFINING THE PROCESSOR AT THE GROUP LEVEL: A LITERATURE REVIEW*

This section is a literature review of studies interested in the territory similar to this study. At this stage, it is loosely called a group decision processor that receives information and generates a decision. Many researchers from different disciplines have been interested in defining and analyzing the decision processor. They use different terms and definitions for the decision processor. As a result, their methods for studying the territory also differ. The goal of this section is to review literature from different disciplines that share interests in the decision processor and position this research within the existing literature.

2.2.1 Who Studies the Processor and Why?

Researchers from different disciplines are interested in the concept similar to the group decision processor. The disciplines include cognitive psychology, organizational behavior, sociology, artificial intelligence, and decision sciences. Their research topics involve perception, interpretation, attention, memory, knowledge representation, learning, problem-solving, and social cognition (Huff 1990).

While they all share a common interest in the territory similar to this study, their research is stimulated by different research motivations. Simon’s (1947/1997) bounded rationality argument has been one of the major motivations for research focused on

* A part of this literature review is published in: Kim, Hyunjung. (Forthcoming). In Search of a Mental Model-like Concept for Group Level Modeling. System Dynamics Review.
information processing. Simon’s work led to a recognition that different individuals or organizations may come to different decisions in a given environment. Growing interest in what drives these differences motivated researchers to focus on selection and interpretation of information in organizations (Lant 2002). In psychology, a group of researchers (for example, Cannon-Bowers and Salas 2001) studied shared mental model in an effort to improve team performance. They assumed that shared knowledge among team members leads to better team performance, and their research has been devoted to identifying and measuring shared knowledge. The recent growth in the knowledge industry was another reason for the stream of research on information processing and knowledge management in organizations (Gibson 2001). A growing interest in decision-making group in organization was another driving force for the research. Important decisions in organizations are rarely left for individuals to decide. Rather, a group of expert decision makers are involved in the process. Klimoski and Mohammed (1994) said “increasingly, organizational research is reflecting the fact that teams are the cornerstone of American modern society (p.406).” Levine et al. (1993) also noticed that while cognition is frequently collaborative in reality, too many experiments and academic studies focus on individual cognition. Seeing the limitations in application of individual level analysis to understanding of group or organizational level phenomenon, researchers started to pay more attention to the development of group level theories. Finally, there are those motivated by decision support. System dynamics researchers and practitioners belong to this category. System dynamicists attempt to understand how decisions are made in order to improve future decision performances. They believe that mental models
are inherently limited, and that by using various decision support tools, one can substantially improve the decision-making capacity (Forrester 1961; Sterman 1994).

Despite the common interest in defining and analyzing the concepts similar to group decision processor, there has been little effort toward cross-fertilization among these disciplines. Klimoski and Mohammed (1994) found that researchers from different fields rarely cite one another. Nicolini (1999) later found increasing numbers of interdisciplinary collaboration, especially in terms of sharing different research methods, but there still remains barriers to their efforts. One barrier for interdisciplinary communication is the use of different terms to describe the concept of interest. Researchers are interested in the black box that lies between somewhat observable information inputs and decision outputs, but they use different names for the black box.

In order to further define the group decision processor and ground it in the established literature, it is necessary to explore various terms and definitions used in the literature to describe the black box. For analytical convenience, the black box will be called “the processor” in this study. The processor includes all aspects of cognition, information processing, and judgment building in a group. The processor generates one or more decisions or actions in a group. It does not refer to physiological constructs, such as brain or neurons. Rather, it encompasses all the mental representations and social processes that transform information inputs into decision outputs.

Two questions will guide the literature review. First, what are the conceptual differences among various terms used to describe the processor? Second, based on the differences identified, where in the literature does the processor studied in this FOMC project fall into?
2.2.2 A Plethora of Names for the Processor

Schneider and Angelmar (1993), Klimoski and Mohammed (1994), and Walsh (1995) formulated lists that give a good overview of the terms used to describe processor. Schneider and Angelmar collected over 65 processor terms used for “research on organizational cognition (p.350).” Klimoski and Mohammed listed over 30 terms in their study of “variations on a theme: application of the team mental model concept (p. 408-409).” Walsh listed over 75 terms for “cognition in organization: the language of management theory (p.284-285).” Together, these three studies list over 200 variations in the terms used. Table 1 shows some of the words used by researchers to formulate a descriptor for the processor. Frequently, a qualifier describing a group-ness of the phenomenon is combined with one or two words describing the processor. Sometimes, a qualifier that emphasizes special attributes of the processor is used with a descriptor for the processor. If one reviews the previous research on the processor, he or she is likely to come across many of the combinations of these listed words. The definitions of these terms vary even more.

Having diverse terms and definitions has its benefits. It demonstrates the fact that researchers have explored various attributes of the processor and shows that what they are discussing is in fact not one concept, but different concepts with possible overlaps among them. The problem is that there has been little effort to identify how these concepts differ from one another. When cross-referencing occurs, do the authors mean the same thing? Without clarifying assumptions underlying the definitions, inter/intrdisciplinary discussions can only create confusion. For example, there are cases
of circular definition in the literature, where a processor term is defined by using another processor term. If one defines “collective mental model” as a “knowledge structure shared by a group,” what does it mean by the knowledge structure? There are also cases of using the same term with different meanings. Some use the term “shared” to mean “aggregated,” while other use the term to mean “commonly-held” or “communicated.”

Table 1. Examples of Words Used to Formulate a Descriptor for the Processor

<table>
<thead>
<tr>
<th>Qualifiers for group-ness:</th>
<th>Name for the processor:</th>
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<tr>
<td>Shared</td>
<td>Knowledge Structure</td>
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<tr>
<td>Team</td>
<td>Cognitive Structure/System/Framework</td>
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<tr>
<td>Social</td>
<td>Cognition</td>
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<tr>
<td>Collective</td>
<td>Memory</td>
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<td>Group</td>
<td>Mental Model</td>
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<tr>
<td>Organizational</td>
<td>Schema</td>
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<td>Negotiated</td>
<td>Culture</td>
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<td></td>
<td>Minds</td>
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<td></td>
<td>Representation</td>
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<td></td>
<td>Interpretation System</td>
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<td></td>
<td>Belief Structure/System</td>
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<tr>
<td>Qualifiers emphasizing other attributes of the processor:</td>
<td></td>
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<tr>
<td>Managerial</td>
<td>Social Order</td>
</tr>
<tr>
<td>Situated</td>
<td>Perceptual Filters</td>
</tr>
<tr>
<td>Transactive</td>
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</table>

A more serious problem is confusion in the level of analysis. Schneider and Angelmar (1993) pointed out that studies based on assumptions and methods from cognitive psychology tend to focus on the individual level of analysis while those based on sociology and anthropology focus on the group or organization level of analysis. These differences lead to a problem when interdisciplinary integration results in use of the same term to describe a cognitive phenomenon at the different levels of analysis. Another source of confusion involves forms of the processor. The forms of the processor
can range from knowledge and memory to social interaction and communication. Depending on the definition of the processor form, selection of measurement and analysis methods will vary.

The most extensive work on the classification of processor concepts can be found in Schneider and Angelmar (1993) and Walsh (1995). The former categorizes previous studies by the level of analysis (individual-group-organization) and the form of cognition (structure-process-style). The latter uses the level of analysis (individual-group-organization-industry) and the content and structure of knowledge structure (representation-development-use). Their works provide a useful framework for organizing previous studies. However, two issues require further clarification. First, some studies cannot be clearly categorized by the level of analysis, especially when they are interested in the group or organization level processor. For example, if cognition occurs at the individual level but sharing occurs at the group level, what should be the level of analysis? The answer is closely related to the second issue: Is the content of study cognition at the individual level or sharing at the group level? What if neither one cannot be studied without looking at the other? In other words, because the phenomena at different levels interact and influence one another, it is not always possible to identify one study with one level of analysis. To address these issues, this paper proposes a modified framework for organizing processor concepts in the literature.
2.2.3 Location-Form Framework

The framework proposed in this study is based on the idea of a continuum (Figure 4). The continuum recognizes that it is not always easy to identify different terms and definitions with clear-cut categories.

**Figure 4. Framework of Location-Form Continuum**

One dimension of the continuum is the *location of the processor*. At one extreme, the entire processor could be located at the level of an individual. Thinking is done at the individual level only, and even in a group setting the locus of study is on the individual mind process. At the other extreme, the entire processor could be located at the collective level. The collectivity may refer to a group, an organization, or even an industry. When the processor is located at the collective level, it is a collectivity that receives and processes information and generates action. A similar criterion is briefly mentioned by Lant (2002) when she explains the “locus of organizational cognition “ (p. 355). It must be noted that the location of the processor is different from the level of analysis. While
the former is about where the processing takes place, the latter is about where the processor is observed. The location of the processor explicates the researcher’s assumptions about the nature of the processor, while the level of analysis is relevant to the research design. The second dimension of the proposed continuum is the form of the processor. At one extreme, researchers are interested in the static product form, such as memory and knowledge. At the other extreme, researchers are interested in the process that changes in the course of group dynamics. Examples would be communication and interaction. There are studies that define the processor in terms of both products and processes. Therefore, the continuum idea will be useful to deal with such problems.

2.2.4 Positioning Studies on the Continuum

In this section, different processor terms used in literature will be positioned in the two-dimensional space described in Figure 4. The positioning involves a close study of definitions of the processor terms in order to identify assumptions made in relation to the processor’s location and form.

Cognitive psychologists have been inclined to use the term mental model or cognition. In general, mental model refers to a representation of reality that allows one to make sense of the world and anticipate its future path. For a more formal definition, many scholars including Doyle and Ford (1998), refer back to Johnson-Laird’s book Mental Models (1983). The work is founded on Craik’s (1943) proposition that “thinking is manipulation of internal representation of the world” (Cited in Johnson-Laird 1983: p.10 in Prologue), and Johnson-Laird attempted to study mental representations by
analyzing language and discourse. He regarded *mental model* as a processor that translates external information into internal symbols and retranslates such symbols into external actions. When used in a group setting, a mental model is often referred to as a *shared mental model* or a *team mental model* (Cannon-Bowers et al. 1993). Salas and Cannon-Bowers (2001) define a shared mental model as “knowledge held by a team member that is either compatible, complementary, and/or overlapping with teammates” (p.87). Similarly, Klimoski and Mohammed (1994) define a team mental model as “what is being shared and operating among team members as a collectivity” (p. 414). In the same study, they use the term *shared cognition* interchangeably with *team mental model*, and emphasized that a team mental model or shared cognition is one’s knowledge about his or her team members’ knowledge and is different from unarticulated subconscious knowledge. In other words, their definition of team mental model is narrower than that of Salas and Cannon-Bowers, because to qualify as a team mental model, knowledge has to be shared between team members, and must also be known to all members that the knowledge itself is being shared. In both studies, the processor is in product form (i.e., knowledge) and the location of the processor is within the individuals. In sum, these studies are focused on the part of individual knowledge that is shared among the team members. Therefore, the position of their definitions in the continuum framework is at the individual-product end (Figure 5).

In contrast to the above definitions, *shared mental model* defined by Levesque et al. (2001) moves slightly towards the collectivity-process end of the continuum. Their interest is in overlapping cognition which they associate with enhancement in team performance. Since overlapping can only occur though coordination and communication,
they study interactions leading to convergence of mental models over time. In other words, while mental models are primarily located in individuals, the process of sharing modifies the mental models of the individuals.

**Figure 5. Positions of the Terms Used in the Literature to Describe the Processor**

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>Product</th>
<th>Process</th>
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<tbody>
<tr>
<td>Collectivity</td>
<td>Organizational Memory&lt;sup&gt;15&lt;/sup&gt;</td>
<td>Organizational Cognition&lt;sup&gt;6&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Collective Cognitions&lt;sup&gt;8&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Organizational Mind&lt;sup&gt;10&lt;/sup&gt;</td>
</tr>
<tr>
<td>Individual</td>
<td>Shared Mental Model&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Organizational Interpretative System&lt;sup&gt;11&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Team Mental Model&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Organizational Sensemaking&lt;sup&gt;12&lt;/sup&gt;</td>
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<tr>
<td></td>
<td>Schema&lt;sup&gt;4&lt;/sup&gt;</td>
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<tr>
<td></td>
<td>Knowledge Structure&lt;sup&gt;5&lt;/sup&gt;</td>
<td></td>
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<tr>
<td></td>
<td>Organizational Cognition&lt;sup&gt;7&lt;/sup&gt;</td>
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</table>

2. Klimoski and Mohammed, 1994
3. Levesque, et al., 2001
4. Fiske and Taylor, 1984; Elsbach, et al., 2005
5. Walsh, 1995
6. Nicolini, 1999
7. Tegarden and Sheetz, 2003
8. Gibson, 2001
9. Weick and Roberts, 1993
10. Sandelands and Stablein, 1987
12. Walsh and Fahey, 1986
13. Daft and Weick, 1984
14. Weick, 1995
15. Levitt and March, 1988

When the location of the processor is at the individual end of the continuum, the same concept may be used to describe a phenomenon at both the individual and group
level. One example would be the concept of a *schema*. Schemas are defined as cognitive templates or simplified representations of knowledge that are used to identify elements of a situation and relationships between these elements (Fiske and Taylor 1984; Walsh 1995; Elsbach et al. 2005). Because schemas are individually held, relatively stable, and seldom observed, schema discussions rarely differentiate between the individual and group/organizational level processes. A concept similar to schema is *knowledge structure*. According to Walsh (1995)’s definition, “a knowledge structure is a mental template that individuals impose on an information environment to give it form and meaning” (p. 281). If positioned in the location-form framework in Figure 5, schema and knowledge structure would be located at the individual-product end of the continuum.

In contrast to these individual level perspectives, there is a group of researchers who use the term “cognition” at the collective level. Nicolini (1999) identifies *organizational cognition* as a “social process of cognition and thinking at organizational level” and differentiates it from “cognitive process at individual level in organizational setting” (p.834). He makes it clear that organizational cognition is a social process and the locus of the processor is at the collectivity. However, Tegarden and Sheetz (2003) use the same term to mean “shared understanding that managers have in common with each other” (p.114). Compared to Nicolini’s perspective, Tegarden and Sheetz’s organizational cognition closely resembles the shared mental model defined by Salas and Cannon-Bowers (2001). There are others who prefer to use the terms *collective cognition*. Gibson (2001) defines collective cognition as the four phases of accumulation, interaction, examination, and accommodation that takes place at the group level. With the exception
of Tegarden and Sheetz’s, the definitions of organizational or collective cognition can be positioned near the collectivity-process ends of the continuum in Figure 5.

Weick and Roberts (1993) called the processor *collective mind* or *group mind*. They defined a *collective* as individuals in a group who inter-relate their actions with care, and *mind* as an activity as opposed to an entity. They explained that collective mind is located in the process of “heedful interrelating” (p.361), and their definition can be interpreted as individually located processors which operate during an interrelating process among the individuals. This definition thus falls on the individual-process side of the continuum in Figure 5. A similar term used is *organizational mind*. Sandelands and Stablein (1987) defined organizational mind as an ideational process that is carried out by organizational behavior. They contrast their view with others who regard mind as “a substance or static pattern of relationships” (p.138), and emphasized that complex interaction of ideas is at the heart of the organizational mind. According to Sandelands and Stablein, organization *is* mind, and the criteria for it to qualify as mind should be different from that of the human mind. Their definition of organizational mind is clearly on the collectivity-process end of the continuum. As a theory of group mind, Wegner (1986) proposed the idea of *transactive memory*. He defined it as “a set of individual memory systems in combination with the communication that takes place between individuals” (p.186). It is cognitive interdependence among team members; a way that individuals use other people’s memory as an external memory. In organizations, transactive memory is a “shared system for encoding, storing, and retrieving information” (Wegner et al. 1991: p.923) and Wegner explains that it is neither memory of individuals nor the process of interaction among these individuals, but a combination of the two.
Therefore, the position of transactive memory would be somewhere in the middle of the product-process and the individual-collectivity continuum in Figure 5.

Walsh and Fahey (1986) and Walsh et al. (1988) focused more on the political process within a group. They posited that what is represented in a group’s collective knowledge structure is influenced by individual power differences in the group. They called the aggregated model a *negotiated belief structure*. The position of the negotiated belief structure in the continuum framework is somewhat less clear. Although the negotiated belief structure is a knowledge structure, i.e. a product, what generates the product is a political process of negotiation and influence. The location of the processor is also a combination of individual and collectivity. While negotiation takes place in the collectivity, there is a substantial influence in creating negotiated belief structures by powerful individuals.

There is a group of researchers who emphasize the interpretation and meaning-creation aspects of the processor. Daft and Weick (1984) called the processor *organizational interpretation systems*, and defined it as “the process of translating events and developing shared understanding and conceptual schemes among key managers” (p.286). They explained that organizations differ in their attitudes towards interpretation, and these attitudes are determined by the managers’ assumptions about the environment, and by the organization’s intrusiveness into the environment. A similar term used is *organizational sensemaking* (Weick 1995). Sensemaking is a process of creating meaning from selected information, and is influenced by one’s previous experiences. Organizational interpretation systems and sensemaking are both process-oriented concepts. In terms of the location of the processor, these concepts assume interpretation
at both the individual and collective level, and recognize that a powerful individual can influence interpretation at the collective level. Therefore, these terms are positioned in the middle of the location continuum as illustrated in Figure 5.

Levitt and March (1988) used the term organizational memory to describe the organizational learning process. It is defined as routines, rules, and procedures in organizations where organizational members’ experience and knowledge are accumulated and maintained. This organizational memory is an artifact of organizational behaviors and is separate from members of the organization. Therefore, organizational memory may be positioned at the product-collective end of the continuum in Figure 5.

2.2.5 Finding a Common Ground: The Processor of this Study

The literature review in this section explored various terms and definitions describing the processor using its location and the form. The motivation for the research was a need to identify subtle differences among the terms used in the literature to describe processor and to position the subject of this study within the existing literature.

The processor of this study is a group decision-making process at the Federal Reserve. The group process integrates decision inputs such as individual members’ experiences, knowledge, and the collection of information, and turns them into a collective decision. During the process, the group generates a series of collective judgment to overcome various environmental uncertainties and information deficiencies. The shared perception of the system is also created. This process is not separate from the group’s power relationships and other social factors. How collective judgment and
collective understanding of reality is related is beyond the scope of this study. If this group decision processor is positioned in the continuum introduced in this study, it will be located the middle of the location continuum and closer to the process end of the form continuum. This is the territory of the map proposed in this study.

The main finding from the survey is that different terms used to describe the processor have subtle differences in their assumptions about the location and the form of the processor. There is no definition used in the literature exactly matching the processor concept developed in this study. In other words, the subject of this study cannot be named as collective minds, organizational cognitions, shared mental models, or other terms discussed. But the literature review in this section shows that the processor studied in this FOMC project adds another dimension to the various attributes of the processor identified in the existing literature.

The assumptions underlying the processor concept have important implications in terms of selecting appropriate research methods. As it will be discussed in the next section, there are many research tools developed to study the processor, and it is important to make sure that the selected methods study the intended aspects of the processor. For example, if one is interested in the processor as a social process of creating a collective understanding of the policy system, using a method that collects data from individual group members would be less helpful, because the processor as a social process assumes that the phenomenon at the collective level is inherently different from the sum of the individuals’ knowledge.

The location-form continuum framework proposed in this study has some limitations. Because it uses the concept of a continuum, determining relative positions of
different terms requires subjective interpretation of the definitions given in the literature. While some definitions include a clear statement of location and form of the processor, there are definitions that are conceptually vague about these factors. If this is the case, a more in-depth study of the literature should be carried out for clarification. The scope of literature reviewed in this paper may pose another problem—there are terms and definitions relevant to the processor not included in this study. However, with such a limitation, this study demonstrates the diversity of terms used to describe the processor, highlights the subtle differences among these terms, and proposes a way to organize them.

2.3 METHODS FOR STUDYING THE PROCESSOR: A LITERATURE REVIEW

Methods used to study processor can be categorized into three types: (1) elicitation methods, (2) representation method, and (3) analysis methods. Elicitation of methods collect tangible and operationalized form of data about the processor, since the processor is often implicit, less observable, and sometimes subconscious. Representation methods organize the elicited data in a way that can be communicated to others. Finally, analysis methods allow close examination of the elicited and represented product and draw implications from it. There can be an overlap between these three categories of methods, because one method can meet more than one of these three goals. It must be also noted that selection of different methods relies heavily on how processor is defined and what assumptions are implicit in the definition.
2.3.1 Elicitation Methods

Survey and interview are the most widely used types of elicitation methods. They directly elicit data from the subject’s account. The benefit of survey and interview is that they allow researchers to collect the data in a format that is convenient for his or her research design. But survey and interview have several limitations. First, it is less useful when the processor is located at the collective level, because the data are collected from individuals. Second, the content of elicited data is highly influenced by the questions asked. Finally, data collected from the subject’s direct account may not represent the real processor the researcher is interested in. Many studies in cognitive psychology suggest that people are in general not very good at recognizing or explaining one’s own behavior or thoughts (for example, Berry and Broadbent 1984).

Self-Q Interviews (Bougon et al. 1990) minimize researcher influence in the elicitation process by having subjects interview themselves. An assumption behind this technique is that it is subjects who know the best about their personal knowledge which guides their behaviors. In Self-Q Interviews, interviewees question themselves to expose concepts relevant to the system that is being investigated and identify importance of these concepts as well as relationships among them. Self-Q Interview is useful when the processor is defined as a product located at the individual level. For example, it is an appropriate tool to study commonly held knowledge among a group of individuals.

Card sorting (Smith-Jentsch et al. 2001) is another method to elicit knowledge from individuals. For a particular knowledge structure investigated, different components of behaviors related to the knowledge structure are identified. Examples of effective and
ineffective behaviors for each component are then recorded in index cards, and subjects are asked to sort the cards into categories and label the categories in a way that is meaningful to them. These categories and labels are then compared across the individuals.

For studying a processor at the group level, elicitation methods frequently involve a group process. Group model building (Richardson and Andersen 1995; Vennix 1996; Andersen and Richardson 1997; Luna-Reyes et al. 2006) is an example of group level elicitation method. In a group model building session, key stakeholders are brought together to define a problem, discuss observed and expected system behaviors, and explore the system structures relevant to the behaviors. During this process, researchers play an active role as a facilitator and a modeler. Data are not only elicited from individuals, but the data are shaped during the interaction and communication of the group.

Ford and Sterman’s knowledge elicitation method (1998) is a comprehensive approach that involves both individual level knowledge elicitation and group level reflection. Ford and Sterman suggest that separation of individual and group level processes can minimize group think (Janis 1971) and parameter convergence.

Content analysis is another elicitation method commonly used. A benefit of content analysis is that the researcher does not influence content of data that is being collected. A drawback is that elicitation requires inference from documents, which can be difficult if the meaning of the data is not clear. In this case, it is hard to clarify the meaning unless the data source is available for further interview.
2.3.2 Representation Methods

What has been elicited can be analyzed as it is, but in some cases, the elicited data need to be represented visually for further analysis. Different mapping techniques are used for representation purpose.

Huff (1990) used the term mental maps as a general label for representation methods for capturing the content and process of strategic thinking. She categorized mental maps into five types depending on the purpose: maps for assessing attention, association, and importance; maps for showing categories and hierarchies among concepts; maps for describing causal reasoning; maps for strategic argument; and maps for schemas, frames and linguistic codes. Her book Mapping Strategic Thought introduces a collection of different mapping methods that can serve as a useful tool kit for those interested in mapping techniques.

Axelrod (1976) is one of the early founders of mapping methods. He developed a cognitive mapping approach with influence from psycho-logic, causal inference, graph theory, evaluative assertion analysis and decision theory. Axelrod’s cognitive mapping is a causal mapping: it represents what people say about causal relationships. From individual’s causal assertions, structural relationships among a set of assertions are derived. Each concept is represented with a word or a phrase, and the relationships between concepts are specified with an arrow with either positive or negative polarity to show the nature of the relationship. A cognitive map can be derived for the individual decision maker or a decision-making group. If the latter is the case, the map can be an
aggregation of individually derived cognitive maps, or the map can be derived directly from a group discussion.

Eden and his colleagues’ cognitive mapping (Eden et al. 1992) is a flexible way of representing an individual or group’s cognitive model. The map specifies how strategic statements are linked. Similar to Axelrod’s cognitive maps, Eden’s cognitive maps have words/phrases/sentences (i.e. nodes) and arrows that connect the nodes. But Eden’s arrows do not have polarity, because arrows can either represent causal effects or sequence of events.

Bougon (1992) proposed congregate cognitive map as a way to represent a continuously enacted and negotiated cognitive structure. Bougon differentiated between labels people use and meanings people assigned to these labels. He emphasized that the nodes in the maps are labels to which individuals assign different meanings. Individual maps are first created, and then congregate maps are generated by linking the individual maps by the common labels.

The system dynamics community uses causal loop diagrams or stock-and-flow diagrams as a representation method. Causal loop diagram attempts to represent subject’s perceived structure of the system. Each node in the diagram is labeled like a variable in the system, and arrows linking the nodes represent the causal relationship between these nodes. The direction of relationship is specified using a polarity sign, and when linkages create a circular relationship, it is called a loop. There are two types of loops: negative or balancing loop, and positive or reinforcing loop. A stock-and-flow diagram is a more developed form of a causal loop diagram. It identifies accumulations in the system—called stocks—and flows that increases or decreases the stocks. Stocks and flows are
important concepts, because they capture delays in the system. While causal loop diagrams and stock-and-flow diagrams are used as conceptualization tools for building formal simulation models, Senge (1990) and other systems thinkers use the diagramming technique to promote organizational learning. This study uses the stock-and-flow diagramming technique as the representation method.

### 2.3.3 Analysis Methods

Analysis can take place simultaneously with elicitation or representation. In some studies, computer based tools or quantitative techniques are used solely for analytical purposes. Examples include proximity analysis and filtering (Carley 1997), matrix method (Nozicka et al. 1976), and hierarchical decomposition (Ramaprasad and Poon 1985).

In analyzing cognitive maps, Eden, Ackermann et al (1992) use a ratio of links to constructs as a measure of cognitive complexity. To isolate core constructs, they recommend domain analysis which calculates the total number of in- and out-arrows from each node. They developed software, Decision Explorer, which performs various analyses of cognitive maps.

In System Dynamics, computer simulation models are used to analyze elicited mental models. Simulation models can test relationships between a system’s structure and its behaviors by exploring dynamic behaviors generated from the virtual system. The computer software packages developed for the modeling purpose also incorporate robust
analytical tools that allow users to experiment with various policy scenarios with different parameter values and discover counterintuitive insights.

2.3.4 Contributions of this Study

The survey in this section only includes a partial list of research methods for eliciting, representing, and analyzing the processor. The methods for studying the processor are developed in various disciplines, but interdisciplinary collaborations are rare among the methods. Selecting appropriate methods for studying the processor is determined much by how the processor is defined in terms of its location and form. The survey in this section reveals that the methods for studying the processor are mostly geared toward the product form, and there are not many methods developed for studying the process form. As discussed in the second section of this chapter, many researchers regard organizational cognition or group decision making as the process of interaction and communication among the group members. Lant (2002) has noted that “methods for tracing social interaction as a source of social cognition and social structure have not yet met with success (p.358).”

This study contributes to the existing literature by paying special attention to the methods developed and used in system dynamics. In system dynamics, qualitative data have been recognized as an important data source for studying the decision processor. Forrester, the founder of the field, emphasized that numerical database constitutes only a small portion of the data available, and much more information can be gained from written and mental databases (1994). Luna-Reyes and Andersen (2003) said, “although
system dynamics models are mathematical representations of problems and policy alternatives, it is recognized that most of the information available to the modeler is not numerical in nature, but qualitative (p.271).” While the field has accumulated research and documentation in model formulation and validation—the methods for analysis—there has not been much study done in terms of how to systematically elicit maps and models from qualitative data. In other words, while there is much research done in moving from the representation phase to the analytical phase, there is still work to be done in documenting the transition from the elicitation phase to the representation phase. Systematic effort to tie maps to what they represent can address some of the validity issues around the models based on qualitative data. The Chapters 4 and 5 present this effort to build a tighter link between the processor, elicited data, and the map representation.

2.4 SUMMARY

This chapter surveyed the existing literature to lay out the theoretical framework for this project. The territory of the map this study intends to portray was defined, and previous research interested in the similar territory was reviewed. The methods for studying the similar territory were also reviewed. The discussions in this chapter led to an insight that the methods for studying group processes can be improved further, and in system dynamics, this can be done by systematically transforming qualitative data to the maps used for model conceptualization.
Another interesting point observed in the literature is that some studies did not explicitly recognize the difference between the product generated in the representation phase and the concepts that they were trying to represent. In other words, they regarded their “map” as “territory,” when maps are only a representation of the territory. For example, some used a phrase “cognitive map” to refer to both cognitive models and the maps generated during the representation process. Others called what they have elicited as “mental model.” It must be noted that the processor and a representation of the processor are not equivalent entities.

Although the map is not the territory it represents, in a socially constructed world, the map itself can create a territory (Weick 1990). Are we interested in maps or are we interested in what underlies the maps? Does a map itself have a value apart from what it intends to represent? Bougon (1992) and Eden (1992) argue, in a socially constructed reality, the cognitive map itself is a social reality, because its construction and evolution is a social phenomenon. And therefore, the maps have its own value separate from what it intended to represent.

This social constructionist perspective is useful for explaining the purpose of using a mapping technique to study the FOMC’s decision-making process. Although the map created from the FOMC meeting transcripts may not represent any one member’s mental model or the sum of the committee members’ mental models, the map itself has value as an artifact of the meeting where social construction takes place.
CHAPTER 3

THE FEDERAL OPEN MARKET COMMITTEE (FOMC)

The data of this study are verbatim transcripts from a Federal Reserve’s monetary policymaking meeting. Chapter 3 explains the data source to provide the context for this study. This chapter describes the Federal Open Market Committee (FOMC)’s institutional structure and its decision-making procedures. It also includes a brief review of the previous research on the FOMC’s decision-making process.

3.1 STRUCTURE

“The Federal Open Market Committee (FOMC) is the most important monetary policymaking body of the Federal Reserve System. It is responsible for formulation of a policy designed to promote economic growth, full employment, stable prices, and a sustainable pattern of international trade and payments.” (From the Federal Reserve Board website)

The current structure of the Federal Reserve Board System was established based on the Banking Act of 1935, which granted greater independence to the Federal Reserve. The Board of Governors of the Federal Reserve is made up of seven members appointed by the President and confirmed by the Senate, and serve for fourteen years. Unless they are completing an unexpired portion of a term, they cannot be reappointed. Among the seven members, two members are appointed by the President as the Chairman and the
Vice Chairman. Their term lasts for four years, but they can be reappointed. Regionally there are twelve Federal Reserve Banks. Each bank has a president and a board of directors, and they oversee regional depository institutions and provide financial services for the institutions.

The FOMC is composed of twelve voting members: seven from the Board of Governors and five from the regional Reserve Banks. The five Reserve Bank presidents serve in the FOMC on one-year rotating bases, except the president of Reserve Bank of New York who serves in the FOMC full time. The seven non-voting Reserve Bank presidents fully participate in the FOMC meetings and voice their opinions like any other voting members, although they do not get to vote on policy decisions. The Chairman of the Board of Governors serves as the chairman of the FOMC, and the president of Reserve Bank of New York serves as the vice chairman of the FOMC (Figure 6).

**Figure 6. Members of the FOMC**

The Federal Reserve has three tools for monetary policy: open-market operations, discount rates, and reserve requirements. The FOMC is mainly responsible for the open-market operations, which involves the buying and selling of U.S. government securities.
The Board of Governors is responsible for the adjustment of the discount rate—the interest rate charged to depository institutions on loans from the Reserve Banks—and the reserve requirement—the fund depository institutions must hold in reserve to a ratio of their deposit liabilities. However, in practice, overall monetary goals are discussed during the FOMC meetings, and operational guidelines for implementing the open-market operations, the discount rate, and the reserve requirement are adjusted based on their discussions.

The FOMC holds eight regular meetings each year, but the committee can hold additional meetings or conference calls whenever a situation requires urgent attention.

3.2 DECISION-MAKING PROCESS

Before a FOMC meeting, the committee members receive three books prepared by Federal Reserve staff economists. The Beige Book has the Reserve Bank staff’s regional economic assessment and outlook. The Green Book presents the national economic data, including historical data and the staff’s future forecasts. The Blue Book lists possible policy alternatives selected by the staff.

Diverse agenda relevant to monetary policy are discussed in the FOMC meetings. A typical meeting starts with a report on the open market operations since the previous meeting and is followed by a staff briefing on the economic and financial developments and prospects. When the briefing is over, FOMC members ask various questions to the staff. During this process, the group collectively modifies the staff’s assessment and the forecast of the economy and financial environment.
Once the staff briefings are over, the group commences go-around surveys of each member’s assessment of the economic and financial situation. During this process, the members share regional and industry specific information. Much of this shared information are anecdotes and informal surveys. Anecdotes play an important role in the meeting, because it is the most up-to-date form of information about the current state of economy. The group freely discusses various issues emerging during the survey sessions, and it collectively builds judgment to deal with uncertainties and information deficiencies in the decision-making environment.

Based on the go-around survey results, the committee discusses appropriate policy alternatives. Each member takes a turn and states his or her policy preference. The Blue Book alternatives serve as the base point for the discussion, but often the committee creates a new policy alternative not mentioned in the Blue Book. When the committee reaches a certain degree of consensus, voting takes place. Majority rule applies in the voting.

The last part of the meeting is devoted to the formulation of a policy directive that will be publicly released. The policy directive describes the monetary decision made at the meeting with a brief explanation for why the decision was made. Because the directive has a substantial signaling effect to the public, the committee carefully selects words and sentences to be used for the directive. The final decision is framed in a carefully selected language designed to minimize unintended public interpretation of the FOMC policy.

With a five-year lag, the FOMC is required to release the verbatim transcripts of its meetings. Unlike policy directives, these transcripts provide rich qualitative data of the
FOMC decision-making processes and the collective perception of the decision-making environment that led to the policy decision. Therefore, this study uses a verbatim transcript of a FOMC meeting as the data to elicit a map describing the group’s collectively perceived system structure from which the decision emerged.

The Federal Reserve Chairman Alan Greenspan, once said;

“I must say that before I attended FOMC meetings, I had a different view of what constitutes the nature of policy, because I used to read the directives and I couldn’t for the life of me figure out what in the world they were talking about. But now, given the few FOMC meetings I’ve attended, I am realizing what it is.” (FOMC 1988b: p.35)

The transcripts offer researchers the closest view of the inside meetings of the monetary policymakers, and despite the lack of non-verbal cues, the transcripts allow researchers to experience some of what Greenspan has figured out by attending these meetings.

3.3 DECISION-MAKING ENVIRONMENT

It must be noted that the environment in which the FOMC operates is highly uncertain and complex. Time delays in the system make it hard for the policymakers to discern whether their intervention policy is having an effect or not. Causal structure of the system is complicated enough to further confuse FOMC policymakers. The system is subject to random noise and probabilistic variations. Furthermore, the particular decision
task involves conflicting goals and high decision consequences. The following section discusses the decision-making environment of the FOMC in detail.

3.3.1 Time Delays

Time delays are one of the most significant aspects of the monetary decision-making environment. Delays refer to the time lag between initiation of action and its effect. Since adjustment of macroeconomic variables takes months, if not years, long delays exist between the time a monetary policy is implemented and the time the effect of the policy is fully realized.

Time delays create difficulties for the FOMC decision makers. In the May 1988 meeting, the committee members argued over whether to take another tightening move after the previous contraction policy in March. The problem was that they were not sure whether the economy had "absorbed" the increased money growth from the March expansion or the effect of the intervention was delayed in the system and was still about to happen. In the May transcript, the frustration is expressed as the following:

"The markets probably are vulnerable if we move too far too fast. On the other hand, they're vulnerable if we delay too long. I don't know what the precise, perfect timing for this kind of action is." (FOMC 1988c: p.4)

"I don't think we know at this stage what has happened on the money growth that would be anticipated from the moves we have made." (FOMC 1988c: p.7)

"We have had these two tightening moves in very recent weeks and I'm not sure that the markets have fully digested those moves. I'd be very surprised if the real
economy has taken them into account or if the monetary aggregates have begun to
reflect them.” (FOMC 1988c: p.8)

If the effect of the last policy decision has not fully played itself in the economy, any further intervention has a risk of overreaction. However, time delays in the system require them to make decisions in a proactive manner putting the decision makers in a difficult position.

Influence of time delays on decision making has been studied by many. According to Sterman (1989; 1994), delays in the system have a negative influence on task performance, because they slow the learning loop and reduce learning gained in each cycle. If a decision maker is unaware of delays in the system, he or she can implement a policy that is either an overly-aggressive correction or a counter-correction, and both of these may create instability in the system. Paich and Sterman (1993) found in a simulation experiment involving delays and feedback that decision makers not only failed to manage the system, but frequently made the situation worse by their own actions. Brehmer (1990) showed in an experiment involving dispatching decisions of fire-fighting units that the subjects performed worse when a delay was introduced to the task. He found that his subjects were able to detect the delay, but being unable to figure out how to deal with it, they ignored it and acted as if there was no delay. Brehmer and Allard (1991) elaborated the fire-fighting experiment to show delays inhibit learning and adaptation. In his later experiment, Brehmer (1995) found that decision makers may discover the correct nature of time delays, but they are likely to fail to develop strategies consistent with their findings. These studies generally found a negative association between decision performance and time delays for the following reasons: decision makers fail to
learn; they fail to perceive delays and overreact to the problem; when delays are perceived, decision makers either ignore them or fail to develop appropriate strategies.

The FOMC decision makers are aware of the fact that the economy is a system with long time delays. To cope with the decision environment, the FOMC members mentally explore many possibilities of delays before deciding upon a monetary policy. Much of the meeting time is spent on discussing major time delays in the system and ways to “soft-land” the economy by minimizing over-intervention but at the same time by being proactive. The following quotes from the FOMC meetings in 1988 show:

“One thing we have learned from the 1970s experience is that if we are going to stabilize the economy and prevent inflation from blowing up again, we have to be willing to act before it is clear that inflationary pressures are here. If we wait until we see wages escalating or prices escalating on a broad scale, we will have a momentum that is going to be very difficult to turn around.” (FOMC 1988b: p.51)

“If you tighten up against a relative price shock, then you’re going to potentially overshoot; as that filters through the economy, then it’s going to create an overreaction on the downside at some point, and then you’re going to be trying to work it back up.” (FOMC 1988c: p.27)

3.3.2 Limited Information

Another characteristic of the monetary policy environment is that information available for decision making is very limited. More than two hundred economists at the Federal Reserve collect and analyze large amounts of data. They make assessments of
current economic and financial systems, and make forecasts into the future using
econometric models. But even with the luxury of the quality information and models that
the Federal Reserve has, the FOMC decision makers must face the fact that the most
critical piece of information for their policymaking is likely to be unavailable. Systematic
data collected by the economists require time, and the most up-to-date data the FOMC
can obtain are usually several weeks old if not months. Past data are helpful in estimating
the current and future state of the system, but only in a limited way. What the decision
makers really need is knowledge about the current state of the system and an accurate
forecast into the future.

There are problems with the estimation from the past data. First, the estimation
can be very wrong when there is a shift in the trend. For example, estimated GDP can be
very different from the actual GDP if the economy is at the peak or at the bottom of the
economic cycle and is about to experience a shift in the trend. The trend can also be
disrupted by various exogenous factors such as changes in politics and foreign policy.
The discrepancy between the actual state and the estimated state leads to difficulty in
decision making and generates feelings of anxiety among the decision makers. The
second problem is that very different policies may be needed within a margin of error of
the estimates. For example, estimates can have the margin of error between positive and
negative values, and the error on the positive side may lead to an expansion policy while
the error on the negative side may lead to a contraction policy. The following quotes from
the FOMC transcripts demonstrate the difficulty expressed by the committee members
about the lack of information:
“Steve McNees reminded me yesterday that the average miss in GNP forecasts made in the first quarter is plus or minus 1-1/2 percent. It seems to me that if we miss on the upside this time, we could have some really serious problems with price pressures in manufacturing.” (FOMC 1988b: p.38)

“I would hate for us to make an assumption and start crying wolf, and then stop crying wolf at the point where the whole thing blows up on us.” (FOMC 1988b: p.41)

Limited information is characteristic of systems with time delays. Döner and Wearing (1995) emphasized that in a dynamic system, future prediction and advance action is necessary but is a difficult task. Döner and Wearing found that when people are faced with a situation where they lack sufficient information to make a good judgment, they focus on information that they believe to be important without knowing what critical information for a given state is. They also found that some decision makers get obsessed with data collection, wasting time without really knowing whether it is worth it to spend the time. Sterman (1994) also suggested that when not enough information is given, decision makers fail to perceive the feedback in the system correctly, and they blind themselves by selectively looking at information that is neither important nor consistent with their mental model.

In order to cope with information deficiency, the FOMC decision makers participate in an intensive discussion to identify missing information critical for the decision task at hand. Economic estimates and analysis provided by the Federal Reserve’s staff researchers serve as an anchoring point (Abolafia 2005), and the FOMC decision makers discuss how the real economy may deviate from the estimates by sharing various anecdotes. The members come to the meeting with anecdotes gathered from
various sources like regional bankers, factory owners, and managers in a firm. Although anecdotes are far from science, the FOMC members fill the information gap with these anecdotes and get a sense of how the economy is doing at that moment. The following quotes show how the members bring in informal information to the discussion and decision making:

“We have been hearing for some months now about the improvement in the machine tools business form various people in the district. Earlier this week we saw some articles on the improvement that is taking place in that industry.” (FOMC 1988b: p.42)

“We have several firms, primarily in metals, that have reported that they are at capacity levels: they simply can’t produce anything else. One of those firms is considering some kind of expansion at this point.” (FOMC 1988b: p.46)

In addition to its reliance on anecdotes, the FOMC develops a set of cues that can complement the lacking information. These information cues are indirect indicators of macroeconomic variables the FOMC is interested in, but the data on those indirect indicators are more readily available than macroeconomic variables such as GDP or the Consumer Price Index. An example of such indicator is inventory accumulation, as Chairman Greenspan mentions in the following quote:

“The thing we have to be a little careful about is that we recognize that at some point, whenever you get a situation which is as uniformly positive as this, it turns. It’s only a question of when it turns. The thing that’s bothering me slightly about the outlook as I look at it – not in the negative sense but in the confirmation sense – is that, at this particular stage in the cycle, if we are running into the type of acceleration and
inflationary process which is at the forefront of our concerns, I think we should now begin to get some significant inventory accumulation. We have all the forces in place for it: namely, intermediate prices beginning to move and general awareness of aggregate demand. Yet we are not seeing either.” (FOMC 1988c: p.1)

Since inventory information can be accessed with a shorter time lag but is at the same time closely related to the production and the consumption trends in the economy, the level of inventory receives much attention during the FOMC discussions. Sometimes the data on delivery time or order backlog serve as an indirect indicator. Over time, the FOMC accumulates a set of information cues that they trust. When an indicator loses its tie to the macroeconomic variable the FOMC is interested in, the committee discards the indicator and looks for a new one.

3.3.3 Complex Causal Structures

In addition to time delays and information deficiencies, the decision environment of the FOMC is composed of complex causal structures. The system the FOMC deals is a huge one. It encompasses domestic and international economy, financial market, politics and welfare. It is complex in terms of the number of variables in the system as well as the feedback relationships among them. An abundance of feedback loops and confounding relationships makes it difficult for the decision makers to understand the nature of the economy and to design policies for intervention.

Sterman (1994) describes the problem as one where “the number of variables that might affect the system vastly overwhelms the data available to rule out alternative theories and competing interpretations (p.302).” The complexity that arises from the
existence of confounding variables also poses a problem, because it requires a mental simulation that exceeds the decision maker’s capability. Berry and Broadbent (1987) found in their experiment that people are not very good at dealing with implicit system structures. They found decision makers focus on salient structures and fail to learn about non-salient structures. Therefore, it can be inferred from their research that when decision environments are complex with many non-salient relationships, decision makers would perform far from optimal. Ashby (1956) and Brewer (1975) also suggested that complexity of a system is a negative factor for decision performance.

One of the greatest confounding variables in the FOMC’s policymaking is “market psychology (Abolafia 2005).” The FOMC is not the only decision maker in the system. Like the FOMC, the market looks at changes in the economy, attempts to understand the forces behind the changes, and takes appropriate actions. Market psychology is so powerful that it can shape and move the economy. Therefore, it is very important for the FOMC to identify whether a problem in the economy stems from the economic fundamentals or from the market psychology as they may require different intervention approaches. The following quotes illustrate how the FOMC members try to separate the market psychology from the economy’s fundamental movement and their policy implications:

“Sterilizing intervention can have only a short effect and would be meaningful only to the extent that you can alter the psychology of the portfolio adjustment process. And with the huge stock of assets out there, psychology is not an irrelevant consideration because you can get very substantial moves for [unintelligible] period of time with no change in fundamentals.” (FOMC 1988b: p.7)
“I don’t think we – I was around this place in the 1970’s – sufficiently understood that the inflation psychology had become so strong in this country that small moves in interest rates were shrugged off. Moves in interest rates that previously would have had a big impact on the market had no discernable impact at all. We were very slow to recognize that.” (FOMC 1988b: p.15)

Market psychology confuses the policymakers even more, because it reacts to the FOMC policy. Whenever the FOMC announces a policy change, the market participants strive hard to figure out the FOMC’s intention behind the policy. By doing so, the market gets an idea of the future economy that the FOMC is attempting to shape, and based on the analysis, the market participants strive to make an early movement. This market reaction has a significant power to amplify or offset the intended policy effect. Therefore, when the FOMC designs a policy, it needs to predict how the market will interpret the policy intention and include that into the policy function. The problem is that it is not always easy to predict market psychology, and misjudging it in the policy design can add instability to the system. Market psychology is one major source of “counterintuitive behavior of social systems (Forrester 1971)” or “policy resistance (Meadows 1982).” That is why the FOMC devotes itself to creating policy directives that send out clear signals to the market.

3.3.4 Competing Goals and High Consequences

A societal decision maker is a person who makes risky decisions the outcome of which will be felt by others (Lichtenstein et al. 1990). Decision-making environments of
societal decision makers are often characterized by multiple and conflicting goals and high consequences for the decisions.

Monetary policy influences various economic actors in the society with different goals. However, despite different stakeholder interests, the FOMC remains relatively neutral. The decision makers at the FOMC focus more on the overarching goals of economic prosperity and stability, and there is not much evidence in the data that members seek their own or specific groups’ interests in policymaking. Even the regional presidents of the Federal Reserve Banks put the overall performance of the economy on top of their own regional benefit. Independence of the Federal Reserve guaranteed by the law also seems to foster such a culture. However, even when the FOMC decision makers look at the big picture, the committee members must pursue inherently conflicting goals of monetary intervention: to promote economic growth and to stabilize price levels. The former is usually achieved by the expansion policy while the latter is related to a contraction policy. When the economy is clearly overheating or is in a recession, selecting one goal over the other is not so difficult. However, when the position of the economy in the business cycle is not clear, the priority of the conflicting goals become questionable.

In March and May 1988, price stability received more attention than economic growth, but the consensus on the goal priority was achieved after a long debate. The conflicting goal structure leads to the FOMC’s frequent discussion on its priority in policymaking. The following quotes from May 1988 meeting show how ambiguous the goal priority is to the FOMC members:
“I don’t know how this Committee would vote on that, but I remember several years ago Chairman Volcker asked us what we thought the objective was and half of us voted for price stability alone; half voted the other way; and he didn’t vote and didn’t break the tie. But I think that (price stability) is the ultimate objective, and I hear more and more people around here saying that.” (FOMC 1988c: p.24)

“If our objective is price stability, then we ought to begin to pursue that objective aggressively.” (FOMC 1988c: p.5)

In addition to the competing goal structure, the FOMC faces decisions that involve high consequences. Monetary policy affects the wealth of individuals and the nation. Throughout the FOMC meetings, the members frequently express their belief in monetary policy and its impact on the economy. The scope and the depth of influence of monetary policy create feelings of responsibility in the decision makers and put a psychological burden on the members. In the following quotes, the FOMC members exhibit their anxiety and caution over the policymaking:

“It is a question that there is no obvious or easy answer to; but it seems to me that we have to ask it rather than continue intervening willy-nilly and hoping that will solve the problem. I’m not against the intervention – it just seems to me that we have to think the thing through a little more carefully than to just say “well, let’s intervene and see what happens.” (FOMC 1988b: p.6)

“I think that tells me that we’re sort of on a knife edge, policy-wise. We can make a mistake on the downside or the upside here. But we have to take some risk. My personal view is that there may be more upside risk, in terms of the beginnings of some pressures indicated by conditions in the financial markets and in the other real economic data. But I think we ought to be very cautious at this point, because there
are downside risks, as has been pointed out. I think the stock market is very uneasy about the situation.” (FOMC 1988b: p.52)

For the FOMC decision makers, consensus building and majority voting are effective ways to deal with uncertainty and consequences involved in their decisions. The process generates confidence in the collective judgments, and shifts the burden from the individuals to the group.

Uncertainty and complexity of the FOMC’s decision-making environment requires the group to build collective judgments in order to come to a monetary policy decision. Building collective judgment is a process where individual minds are exposed, negotiated, and integrated. The mapping method developed in this study will capture the artifact of this process.

3.4 LITERATURE ON THE FOMC DECISION-MAKING PROCESS

Monetary policy implemented by the FOMC draws close public attention. The press reports FOMC decisions with a detailed analysis scrutinizing every word and sentence used in FOMC directives. Financial markets and industries show reaction to FOMC decisions.

The FOMC decision-making process has also been a subject of interest to academics. For example, in economics, theories were developed to explain the relationship between monetary policy, economic performance, and inflation. Monetary theories developed and elaborated in economics influence various policy models used in
the FOMC. The majority of the members are renowned economists themselves. Economists have made contributions in answering what would be the better monetary policy and what impacts monetary policies have on the economy. The vast number of economic literature on monetary policy will not be discussed in this section. In this review, the focus will be on the descriptive studies of monetary policymaking in practice. Researchers from various disciplines have studied the behavioral and institutional aspects of the Federal Reserve’s decision-making process.

Blinder, who served as the Vice Chairman of Board of Governors during 1994 to 1996, emphasized that academics, especially monetary theorists, need to pay more attention to the nature of decision making by the committee (Blinder 1998). Based on his experience at the FOMC, Blinder explains that the real policymaking behaviors of the central bankers differ substantially from theories and models. The reason partly comes from the fact that there is no consensus regarding what the right model is. Complications due to policy lags and institutional structure are other factors that explain why monetary policymaking in practice is different from economic theories.

A number of economists have been interested in the relationship between FOMC’s policy preferences and its decision-making process. Rogoff (1987) studied how the central banker’s concern for its credibility and reputation constrain its policy preferences. Faust (1996) examined how the institutional structure of the FOMC affect its preference towards inflation policy. Bell-Kelton (2006) examined the FOMC verbatim transcripts to observe the forces behind the FOMC’s deviation from conventional monetary theories. Her work suggests that the deviation is a result of the FOMC’s perception of the changing economic structure entering a new technology era and its
concern for credibility and transparency. Several researchers carried out comparative analysis of the FOMC’s policymaking behavior with other central banks (Blinder et al. 2001; Fontana 2006).

Political influences on the FOMC decision making and the chair’s role has been more closely studied in political science and political economy. An extensive account of the FOMC decision-making process can be found in Chappell, McGregor et al. (2005). They studied the FOMC meeting memoranda and transcripts to extract data about individual members’ policy preferences, and attempted to link individual preferences to collective policy decisions. Their findings include influence of political partisanship on the committee members’ individual policy preference, and substantial but not a dictator-like influence of the FOMC chairman on the committee decision. Detailed reviews of literature on FOMC decision-making process in political context can be found in Chappell, McGregor et al. (2005), Drazen (2000), and Persson and Tabellini (2000).

The aforementioned studies were interested in the FOMC decision-making processes, because they wanted to better understand the monetary policy formulated by the committee. In contrast, there are studies interested more in the nature of FOMC decision-making process. Karamouzis and Lombra (1989) and Lombra and Moran (1980) observed that the FOMC members make monetary policy in an ad hoc fashion rather being completely rational actors. Abolafia (2004; 2005) studied FOMC decision-making behaviors with an interpretative framework. Drawing empirical data from FOMC verbatim transcripts, he explained how the committee members’ attempt to influence each other’s interpretation of the information. In his earlier paper (Abolafia 2004), he showed how a series of “framing moves” evolves during the policymaking process, and
concluded that the framing skills of individual actors play a substantial role in shaping the committee decision. In his later work (Abolafia 2005), he explained that FOMC decision makers move from one model to another in order to make sense of the situation that they are in. Abolafia called this mode of behavior a culture of “continuous inductive exploration (p.208).”

Karamouzis and Lombra (1989), Lombra and Moran (1980), and Abloafia (2004; 2005) all describe FOMC decision makers as those who have to wade through an uncertain environment with less than perfect knowledge and information. Their studies share a similar perspective. They assume that collective judgment, interpretation about the environment, and strategies emerge from the group process. Economic theories and models do not always give clear guidelines for the FOMC policymaking, and the decision makers must develop ways to deal with ambiguity and uncertainty in the environment with limited information. These studies pay special attention to the policymakers’ use of formal and anecdotal information and how they put this information and their theories about the system structure together to build a collective judgment about the state of economy.

With the availability of rich data from the Federal Reserve, the process of making monetary policy is an area of ample research opportunity. The FOMC verbatim transcripts are valuable data that give an access to the closed-door meetings of the elite decision-making process. This study attempts to contribute to the collective effort to understand the Federal Reserve’s monetary policymaking in practice by systematically analyzing the FOMC data and generating a map of the group’s model of system structure.
3.5 SUMMARY

In Chapter 3, the data source of this study was described. The description of the FOMC’s institutional structure, its decision-making process, and decision-making environment presents a background context for the verbatim transcript of a FOMC decision-making meeting. Uncertainty and complexity of the FOMC’s decision-making environment requires the group to build collective judgments, and the structure of the FOMC and its decision-making process reflects the need. In the FOMC meetings, individual minds are exposed, negotiated, and integrated. The map developed in this study captures the artifact of this process.

Building on the existing literature of monetary policy in practice, the mapping method developed in this study attempts to make contributions by showing the policymakers’ use of formal and anecdotal information and how they put together the selected information with their model of the system structure. The map is then used to explain the process of building collective judgment about the state of economy.
CHAPTER 4
ELICITING A MAP FROM QUALITATIVE DATA

The main objective of this study is to develop a systematic method to elicit a map from raw data. The map intends to describe a structure of a system collectively perceived by a decision-making group and to explain the process of building collective judgment in the decision-making group. It was briefly proposed in the previous chapters that the map will be created by coding verbal statements made in the decision-making meeting. Chapter 2 explained the nature of the map generated in this way by clarifying the territory of the map and by relating the map to existing literature. Chapter 3 explained the data that will be used to demonstrate the coding. This study uses verbatim transcripts from the Federal Open Market Committee (FOMC) meetings. The map elicited from the transcript attempts to contribute to a better understanding of monetary policymaking in practice.

In this chapter, the process of generating the map will be detailed. The method incorporates the coding practice from grounded theory and the mapping language from system dynamics. Qualitative maps are frequently used in system dynamics to describe the decision maker’s mental model of the system structure. This makes the system dynamics qualitative maps an appropriate method for representing the FOMC’s decision processor. However, compared to a typical system dynamics qualitative map, the map of this study builds more explicit and systematic links with the source data by employing coding methods used in grounded theory.

The use of language and techniques from system dynamics and grounded theory implies that the researcher is looking into the data with a specific methodological lens.
Each field has its own epistemological and ontological stance, and by using the methods developed in grounded theory and system dynamics, theoretical assumptions of these fields become a part of this study. In grounded theory, having such a lens is regarded as useful. It makes one theoretically sensitive, meaning that one has theoretical insights into the data (Glaser and Strauss 1967). When used properly, it enriches one’s understanding of the data. However, because these assumptions are implicit, unstated, and often remain subconscious, and because they influence the content and the shape of the research, it is important to explain them explicitly (Meadows 1980).

Therefore, the first section of this chapter will be devoted to the introduction of grounded theory and system dynamics and the explanation of their underlying assumptions. The rest of the chapter will describe the general process of eliciting a map from raw data and the coding issues that emerge during the process.

4.1 METHODOLOGICAL LENS

4.1.1 Grounded Theory

The method proposed in this study uses coding practice in grounded theory. Grounded theory is a qualitative research method developed in sociology in the 1960’s by Barney Glaser and Anselm Strauss (Glaser and Strauss 1967). The primary goal of grounded theory is theory generation. Unlike typical research designs where a hypothesis is deduced from existing theories and tested, grounded theory generates a theory
inductively from raw qualitative data (Charmaz 2006). Verification of existing theory is useful to the extent that it serves new theory generation (Glaser and Strauss 1967). Although the main goal of using the method is to build a theory, the method can be used for organizing concepts or doing description (Strauss and Corbin 1998), or as a general way of thinking (Glaser and Strauss 1967).

Unless the purpose of research is an elaboration of existing theory, the researcher begins analyzing the data without specifying a theoretical framework. This inductive approach does not mean that the researcher studies the data with “an empty head” as opposed to “an open mind” (Dey 1993, referenced in Strauss and Corbin 1998). Glaser (1978) emphasizes that the researcher must remain theoretically sensitive in order to recognize emerging concepts and categories.

An interpretative perspective underlies grounded theory. Strauss and Corbin (1998) differentiate grounded theory from other so-called qualitative researches which collect qualitative data and quantify the data for analysis. Grounded theory not only uses qualitative data, but it also analyzes the data in the qualitative process of interpretation. The process involves discovering concepts and their relationships from raw data and allowing theories to emerge from the data.

In the 1990’s, the original idea of grounded theory developed by Glaser and Strauss (1967) diverge into two streams. Goulding (1998) summarizes the theoretical and methodological divergence in terms of two factors. First, Strauss (1987) began to focus more on the development and documentation of systematic coding method, and this was criticized by Glaser (1992) as a quantification of the method. Second, Glaser argued that a theory should be case specific, but Strauss was seeking a more general theory.
This study follows the coding practice developed over three editions of *Basics of Qualitative Research* (Strauss and Corbin 1990; Strauss and Corbin 1998; Corbin and Strauss 2008). Their method suggests a flexible, yet systematic approach to analyze data. There are different types of coding process, and each plays different role in separating and organizing concepts from data. Charmaz (2006) explains that, “we attach labels to segments of data that depict what each segment is about. Coding distills data, sorts them, and gives us a handle for making comparison with other segments of data” (p. 3). In this study, open coding and axial coding are used. While the former breaks down the data into concepts and labels them in categories, the latter reassembles the pieces by defining the relationship between the categories. In addition to open coding and axial coding, there is a process of selective coding. Although it was not fully explored in this study, selective coding is used to integrate categories to generate a theory.

Corbin and Strauss (2008) describe the epistemological and ontological assumptions underlying grounded theory. They list sixteen assumptions of grounded theory that have strong root in pragmatism (Dewey 1925; Mead and Morris 1934) and symbolic interactionism (Blumer 1969). The following quote summarizes the worldview held by the Corbin and Strauss:

“Important to us are the great varieties of human action, interaction, and emotional responses that people have to the events and problems they encounter. The nature of human responses creates conditions that impact upon, restrict, limit, and contribute toward restructuring the variety of action/interaction that can be noted in societies. In turn, humans also shape their institutions; they create and change the world around them through action/interaction.” (Corbin and Strauss 2008: p. 6)
This study also shares the perspective in that a decision or an action emerges from systems of meanings which is shared, aligned, and negotiated during the course of interaction. In the case of the FOMC, the monetary decision is an action that emerges from the system of meanings assigned to its decision environment. This system of meanings is shaped during the group’s interaction, and the map elicited in this study captures a snapshot of this “fluid” meanings system.

4.1.2 System Dynamics

System dynamics is a discipline founded by Jay W. Forrester in the 1950’s. In his book *Industrial Dynamics* (1961), he laid out philosophical perspectives and methodological foundations for studying complex systems. System dynamics attempts to understand dynamic behavior of a complex system by analyzing the structure that generates the behavior. A problematic behavior is thought to be endogenously generated by the system structure (Richardson and Pugh 1989). The structure of a complex system is characterized by feedback loops, delays, and nonlinear relationships, and due to these factors, an effort to intervene the system often ends up without fruit or creates unintended consequences. This intellectual tradition of system dynamics can be traced back to servomechanism in social science and cybernetics in engineering (Richardson 1999).

System dynamics assumes the existence of objective reality, but it also recognizes that actions intended to change the reality is generated by actors each of whom owns subjective perception of the reality. The misalignment between the objective reality and the subjective reality (often called “mental model” in system dynamics) is the source of
ineffective decisions, and system dynamics attempts to aid decision making by enhancing the mental model.

These assumptions have methodological implications in system dynamics. The field developed languages and methods to (1) describe structural complexity of a system embedded with feedback loops, delays, and nonlinear relationships, (2) examine the relationship between the structure and behavior of a system, (3) communicate differences in mental models held by individuals, and (4) align the mental models with the objective reality. The field has interpretive perspectives as much as it has positivistic attitudes (Lane 2001).

In the interpretive realm, qualitative maps are used. Causal-loop diagrams and stock-and-flow diagrams are the main representation tools used in system dynamics to depict hypothesized causal structures of the system being analyzed. It describes a theory of how different parts of the system are causally related for the system to generate behaviors of interests. This structure-behavior relationship is called dynamic hypothesis in system dynamics.

The maps are then transformed into mathematically defined computer simulation models. Empirical data are integrated into the models, and the structure-behavior relationships are tested by simulating the models. As the modeling process progress, it moves toward the world of positivists.

In this study, only the interpretive tools of system dynamics are used. Causal-loop diagrams and stock-and-flow diagrams will be used to describe how the group of decision makers at the FOMC perceives their system. Therefore, much of the content of the maps will come from the “talk” about the system.
4.2 DISCOVERING CODES IN THE DATA

The very first stage of the mapping in this study begins with open coding developed by Strauss and Corbin (1998). Open coding requires data to be broken down into discrete parts: words, phrases, sentences, and paragraphs. These segments are closely examined for similarities and differences, and phenomenon is labeled. During this process, concepts are discovered. The coding “opens up to the text and expose the thoughts, ideas, and meanings contained therein” (p. 102).

4.2.1 Defining Research Perimeters

Open coding was used in this study for two purposes. First, it was used to derive research questions. Preliminary data analysis was carried out without pre-existing codes to look for. From repeated micro-analysis of the text, constructs were elicited from multiple FOMC meeting transcripts. As they started to form patterns, research questions emerged. At that stage, it was noticeable that the monetary policymaking required the FOMC to collectively make judgments on various issues. Two main themes, or decision factors, stood out from the rest. The first theme evolved around the committee’s “assessment of the state of the economy.” The second is the “possible public reactions to the policy.” The two themes are inseparable in reality, because the public is a part of the economy. However, in this study, the codes were separated so that the discussion of the policy action necessary at the specific meeting period is differentiated from the discussion of the framing of the policy to achieve the intended effect. If the former is
about the real policy need for the economy, the latter is about manipulation of the market psychology.

After the initial open coding of multiple transcripts, the focus of this study was narrowed down. Unlike research questions in quantitative research, qualitative research questions are broad and less structured. They define the topic and its perimeters, but they do not have preidentified concepts as they will emerge from the data as the research progresses (Corbin and Strauss 2008). The perimeter of this study was limited to the issue of the FOMC’s assessment of the state of the economy. Accordingly, the research questions to guide the further coding process were formulated. What is the committee’s collectively assessment of the state of the economy? What are the judgment tasks facing the committee? How does the committee build collective judgment? What is the collectively perceived system structure based on which the judgment is generated? What is the information shared in the process?

4.2.2 Identifying Variables and Causal Relationships

After the first stage of open coding, the data segments relevant to the research questions are sifted for further analysis. The second stage of open coding is more focused on the research questions. Sentences are microanalyzed further, and codes are identified using the coding chart shown in Table 2.

The following describes the sequence of open coding process using the chart in Table 2:
First, the segments of the data relevant to the study are identified. In this case, from the selected FOMC meeting transcript, the FOMC members’ statements relevant to their assessment of the state of the economy are identified.

Second, the data segments are broken down further so that each segment contains only one argument or judgment about the state of economy. One argument/judgment and its supporting rationales become the unit of analysis. The segment can be as short as a sentence or as long as one or two paragraphs.

Third, for each data segment, the spokesperson’s name and the location of the data in the transcript are recorded. For more specific location of the data, Conversation Identification Numbers (CIN) are assigned to every paragraph in the transcript, and it is recorded in the cording chart.

Table 2. Coding Chart

<table>
<thead>
<tr>
<th>Speaker Name:</th>
<th>Transcript Page:</th>
<th>CIN:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main Argument or Judgment:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Statement about Causal Structure</strong></td>
<td><strong>Cause Variable:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Effect Variable:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Relationship</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Direction:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Strength:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Information Shared</strong></td>
<td><strong>Cause Variable Value/Trend/Outlook:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Effect Variable Value/Trend/Outlook:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Relationship Attributes:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Information Source</strong></td>
<td><strong>Formal:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Informal:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Notes:</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Fourth, the speaker’s main argument or judgment about the state of economy is recorded.

Fifth, the speaker’s rationales supporting the argument or judgment are recorded. These rationales can be a statement about causal relationships between system variables or the value or behavior of the variables. In the FOMC case, an argument or judgment about the state of economy can be supported by a causal relationship among economic variables or an observation of the variable behaviors. The data segments are analyzed, and variables and causal relationships are identified. From this stage, the coding process starts to show influence from system dynamics.

System structure in system dynamics is defined in terms of the causal relationships among the variables. The structure is associated with behaviors of the system variables. To conceptualize a problem and define the system boundary, system dynamics modelers begin their modeling process by examining the data looking for important variables, relationship among the variables, and observed/expected behaviors of the variables (Richardson and Pugh 1989; Andersen and Richardson 1997). In this study, a similar approach is taken, but with the use of systematic coding. The data are coded for variables, causal relationships between variables, and behavioral information about the variables. But what is a variable?

By definition, a variable is “something that varies or is prone to variation,” and in mathematics, it is “a quantity capable of assuming any a set of values” (The American Heritage® Dictionary of the English Language, Fourth Edition. Houghton Mifflin Company, 2004.) Variable is rather loosely defined in system dynamics. According to
Richardson and Pugh (1989), “variables in causal-loop diagrams are quantities that can rise or fall, grow or decline, or be up or down” (p. 28).

Variables are conceptual units of the system, and the causal relationships between variables represent the structure of the system. How to identify a variable is largely determined by the research question, the definition of the system, and the degree of conceptual aggregation. For example, the main research question guiding the coding process is how the committee collectively assesses the state of the economy. The system is defined as the economy, and the variables are conceptual units used by the committee members to describe the economy.

According to Strauss and Corbin (1998), names of categories—or in this case, variables—come from three sources. They can be discovered from data, borrowed from existing theories and literature, or picked up from the native terms. In this study, all three methods were used. Economic literature was especially helpful in identifying variables. The majority, if not all, of the FOMC members have extensive educational and professional background in economics and finance, and they frequently incorporate various economic concepts from the literature into their language. Likewise, various units of economic data collection—that is, economic indicators—are frequently used as the main conceptualizing units in the FOMC discussions. Concepts such as capital, production, shipment, interest rates, and labor would be a few examples of economic variables. The sub-categories of variables are often discovered from the native terms. For example, one person may talk about “car manufacturing plant” as a specific sub-category of “capital.” The coder must make a decision to what level the sub-categories are disaggregated to be represented in the map. The more detailed the map is, the more
explicit is its tie to the data source. However, the complexity of the map can obstruct the analytical effectiveness of the map. The aggregation process is described more in the Section 4.4.

_Sixth,_ if the rationale for the argument/judgment is in the form of causal relationships, the cause variables, the effect variables, and the nature of relationships are identified and coded respectively.

_Seventh,_ if the rationale for the argument/judgment is about observed or expected behavior of the variables, the content of information is identified and coded. The information may be about a value of a variable at a specific time point, a behavioral trend of a variable, or a future outlook of a variable. The information may also be about the direction or the strength of the stated causal relationships.

_Eighth,_ the source of information is recorded. _“Formal information”_ refers to data systematically collected by government agencies and research organizations. Major economic indicators such as employment data or Gross National Product (GNP) fall into this category. _“Informal information”_ refers to anecdotes with informal sources.

Finally, the Note section is used to record any additional information or memos.

The process of generating one coding chart for one argument/judgment was continued until one full transcript was analyzed. Variables and causal relationships identified during the process are then carefully linked into a map. This is described in the next section.
4.3 LINKING CODES TO BUILD A MAP

4.3.1 Axial Coding

The next phase of coding is similar to axial coding described by Strauss and Corbin (1998). While open coding is about the breaking down of the data to discover codes and grouping them into categories, axial coding is about finding the relationship among the categories of codes. It “reassembles data that was fractured during open coding” (p. 124). While open coding and axial coding are not sequential steps, open coding usually precedes axial coding. It is because the relationships between categories become clear with the progress of open coding. The effort to define relationships among the categories is an important step of conceptualization that can lead to a discovery of a theory. Strauss and Corbin introduce the paradigm method as a way to carry out axial coding, but they also encourage other methods to be developed and used.

In this study, the codes developed during the open coding process are linked and represented as one qualitative map. Influence of system dynamics lens becomes even greater than the open coding stage, because the map uses the language of system dynamics.

4.3.2 System Dynamics Language

Qualitative mapping technique of system dynamics is quite simple, yet there are specific mapping rules and language the community follow rather faithfully (Sterman...
The basic building blocks of causal-loop diagrams are shown in Figure 7. Each node in the diagram represents a variable in the system. Two variables are connected by an arrow showing their cause-effect relationship. The variable at the end of the arrow is the independent variable (or the cause variable), and the variable at the head of the arrow is the dependent variable (or the effect variable). The polarity sign by the arrow represents whether the variables have a direct relationship or an inverse relationship. The positive sign implies a relationship in which an increase in the independent variable causes the dependent variable to increase, or in which a decrease in the independent variable causes the dependent variable to decrease. The negative sign implies a relationship in which an increase in the independent variable causes the dependent variable to decrease, or in which a decrease in the independent variable causes the dependent variable to increase.

A series of causal relationships can create a feedback loop as shown in Figure 8. In system dynamics, the concept of feedback loops play a fundamental role in understanding dynamic complexity (Richardson 1999). A reinforcing loop in a system...
creates an accelerating or destabilizing behavior. Once a reinforcing loop is triggered, it will keep reinforce itself until some exogenous limit is imposed on the behavior. Underneath a typical pattern of exponential growth or decay exists a reinforcing loop. On the other hand, a balancing loop results in a stabilizing system. It creates equilibrium seeking behaviors.

**Figure 8. Feedback Loops**

Reinforcing Loops (Positive Feedback Loops):
- Even number of negative relationships in a loop
- Create accelerating, self-reinforcing, amplifying, destabilizing dynamics

Balancing Loops (Negative Feedback Loops):
- Odd number of negative relationships in a loop
- Create stabilizing, goal-seeking, compensating, balancing dynamics

When a causal-loop diagram recognizes stocks and flows in the system, it is called a stock-and-flow diagram. In system dynamics, systems are viewed as continuous and fluid-like processes (Richardson and Pugh 1989). A stock is where fluid of tangible or non-tangible material accumulates, and flows show the rate at which the material flows in and out of the stock. Stocks are represented by rectangles, and flows are represented by pipes (Figure 9). A pipe has a valve that controls the rate of flow. Clouds represent flow
sources or sinks that are outside the model boundary. Stocks are important for several reasons. According to Sterman (2000), stocks characterize the state of the system and represent systems with inertia and memory. They are sources of delays and disequilibrium dynamics.

Figure 9 shows a basic stock-and-flow structure. The exact same structure can be represented as a causal-loop diagram. It must be noted that an outflow is depicted as a negative relationship, because an increase in the outflow (the cause variable) decreases the level of the stock (the effect variable). In the stock-and-flow diagram shown in Figure 9, the outflow is a function of the stock. It is often so, because in many situations the rate of outflow is limited by the level of the stock. In such a structure, if the level of stock decreases, the rate of outflow decreases accordingly. This relationship is a positive one, because a change in the stock (the cause variable) causes a change in the flow (the effect variable) in the same direction. Together, the two causal relationships between the stock and the outflow create a balancing loop.

**Figure 9. Stock and Flow Diagram**
Using these basic mapping language and techniques from system dynamics, the variables and their relationships identified during the open coding process is transformed into a map. The process is described in the following section.

4.3.3 Generating the Structural Map of the System

To create a qualitative map from the FOMC transcript, the codes elicited from the open coding process are transformed into a stock-and-flow diagram. This process reassembles the data by finding the relationship between categories of data identified as variables. In this sense, it can be considered as a type of axial coding. The process is described in below:

From the previous open coding process, data segments relevant to this study are identified. Each identified segment has one argument or judgment about the state of the economy and its supporting rationales. Each segment should have its own coding chart. The chart breaks down the supporting rationales into a cause variable, an effect variable, and their relationship. The supporting rationales may describe the observed or expected behavior of the variables or the strength of the causal relationship among the variables.

First, each causal statement identified in the chart is represented in a words-and-arrow diagram. For example, the statement;

“If you were to reduce the discount rate, presumably that would take funds down with it.” (FOMC 1988a: p. 53),
can be broken down into Discount Rate (the cause variable), Funds (the effect variable), and a positive relationship between the two. The statement can be represented as “Discount Rate $\rightarrow^+\text{Funds}$.” A more complex example would be the statement;

“We have seen, as people have pointed out, in the last few days some periods in which the fund rate has been fairly close to the discount rate. Often that gives rise to an expectation that the discount rate is going to be reduced.” (FOMC 1988a: p. 53)

In this statement, the effect variable is clear: the expectation of discount rate reduction. However, the cause variable requires a little closer look. What changes the effect variable is the fact that the fund rate is reaching the discount rate. In other words, the cause variable is the difference between the fund rate and the discount rate. For the coding purpose, this can be represented as “[the discount rate – the funds rate] $\rightarrow^+$ Expectation of the discount rate reduction.” From the data, it is clear that the funds rate is smaller the discount rate, and as the gap between the two narrows the expectation increases. Thus this is a positive relationship. The statement can be also represented as Figure 10.

**Figure 10. Transforming Raw Data into Words-and-arrow Forms**

![Diagram](image.png)
Second, once all the causal statements relevant to the state of economy are represented in words and arrows, similar variables are grouped together. This requires the coder to take a closer look at the data and identify the meaning of the words in the context. In the two examples given above, the context suggests that the variables “the funds” and “the funds rate” all refer to the same concept: the Federal Funds Rate. They should be grouped together. Once all the variables referring to the same concepts are grouped, one common variable name is assigned to each group. For example, “the funds” and “the funds rate” were grouped with other similar terms under the name “Federal Funds Rate.” This process will be further explored in the section 4.4.4 Merging Conceptually Similar Variables.

Third, idiosyncratic variable names used in the first step are replaced with the group names developed in the second step. The first example would be restated as “Discount Rate $\rightarrow^+ \text{ Federal Funds Rate}.”

Fourth, the statements represented in the word-and-arrow forms are collected and linked together to create a composite map. The linkage is created via common variables. For example, the two data pieces in the above examples can be collected and linked as Figure 11.

**Figure 11. Creating a Composite Map**
Each causal arrow in the map is tagged with a conversation identification number (CIN) in the coding chart to specify its data source. If a causal link in the map is mentioned multiple times during the meeting, it may be associated with multiple conversation identification numbers. For example, if conversation identification number (#1) and (#2) are assigned respectively to the texts quoted in above examples, the causal links in the map would be tagged with the identification numbers as shown in Figure 11.

In this study, all the causal statements made in one meeting are captured in one map. However, depending on the analytical purpose, it is also possible to create one map over multiple meetings or to create multiple maps in one meeting.

Fifth, while creating a composite map, stocks and flows are identified. This may be a challenging step if one is not used to the concept of stocks and flows. In mathematics, the identification is less complicated, because stocks are represented in integrals and flows in derivatives (Sterman 2000). When linking the causal arguments together, it becomes more apparent that some variables are associated with the states of the system. They are stocks. There are variables that get to be added to the stocks or that deplete the stocks. They are flows. The following quote may be a good example:

“From our local contacts we’re getting confirmation of things that we are seeing nationally—that is, we have reports of heavy inventory accumulation, particularly at the retail level. There are some indicators that wholesalers of consumer goods are starting to use incentives and promotions to generate greater retail orders. On the other hand, some of the manufacturers that we talk to report that they’re adding to inventories strictly as a precautionary measure, as delivery times lengthen and capacity pressures intensify in their industries.” (FOMC 1988a: p. 16)
It is interesting to observe that two factors are associated with the inventory level. First, a high inventory level leads to sales promotions. Second, manufacturers add goods to their inventory. In other words, there is an effort to reduce the inventory level and there is an effort to increase the inventory. Inventory represents a state of the system. It is a stock. Production adds goods to inventory, while sales removes goods from inventory. The production and the sales are the inflow and the outflow respectively. The level of inventory changes only when the rate of inflow is greater than the rate of outflow or vice versa. If the inflow and the outflow change in the same direction at the same rate, the level of stock will remain the same. When represented in a stock-and-flow diagram, the above quote looks like Figure 12.

**Figure 12. A Stock-and-Flow Representation of Inventory Dynamics**

Here is another quote that implies the inventory is a stock:

“The more general question is (...) whether one saw some effort to accumulate inventories in the manufacturing sector. There was accumulation. It wasn’t any faster: in fact, it was slower, than the increase in output. And it’s not inconceivable that there
could still be some significant desire to build up inventories further. We do have some moderate accumulation of manufacturers’ stocks.” (FOMC 1988a: p. 2)

The statements were made while the speaker was suggesting that the sales in the economy look strong. To support the argument, the speaker mentions that that the rate of accumulation in the inventory was slower than the rate of increase in the output. The context implies the output refers to the production output. The speaker’s logic makes sense when the inventory is interpreted as a stock, and the production rate and the sales rate are the inflow and the outflow respectively. The rate of change in the level of inventory is the difference between the production rate and the sales rate. The production rate has been increasing. If the sales rate has remained the constant, the rate of change in the inventory accumulation would increase at the same rate as the increase in the production. However, the quote says, the increase in the inventory level has been slower than the rate of increase in the production. This implies that the rate of sales also has been increasing although the growth has not been as substantial as the production increase.

Another example of a stock is capacity. The capacity investment and the capacity depreciation are the inflow and the outflow of the stock. For intangible variables, stocks are often associated with memory or delay. The perception of inflation is a stock, because the perception is an accumulation of the past experience with the inflation. When real inflation is higher than the perception of the inflation, the difference becomes a part of the memory and eventually adds to the perception of the inflation.

Sixth, for each statement containing information about a variable’s value, trend, or future outlook, its conversation identification number is specified in the map next to the relevant variable. Conversation identification numbers link the variables in the map with
their original data source as they do for the causal arrows in the map. For example, if above inventory quote is assigned with conversation identification number 23, then (#23) be recorded in the map next to the variables production, precaution, sales incentives and promotions, and inventory.

Finally, to show the parts of the map that receive more attention during the meeting, the thickness of causal arrows and the font size of variables are adjusted proportionally to the frequency of the relationships or the variables mentioned in the meeting. This is not typically done in the causal-loop diagramming in system dynamics.

4.4 DEALING WITH VARIOUS CODING AND MAPPING ISSUES

There are a few coding and mapping issues that should be addressed. The issues include dealing with implicit structures, filling in for missing structures, dealing with structural disagreement, and merging multiple terms with similar meaning.

4.4.1 Implicit and Explicit Structures

Each individual in a decision-making group has one’s own mental model of the system. As a group, these individual mental models may share common structures, especially when members of the group share a set of experiences or knowledge (Mohammed and Dumville 2001). Sometimes, these common structures become so obvious to the members that they no longer verbally describe the structures in the
meetings. Sometimes, causal statements made in the meetings are simplified for convenience and brevity.

For example, a statement may appear as “X causes Z” but what it really means may be “X causes Y, and Y causes Z.” When a relationship is represented with one or more intermediate variables that are not explicitly stated in the transcript, it is called an implicit structure in this study. The assumption of implicit structure is quite useful when it comes to creating a composite map. It allows the coder to merge multiple expressions into one structure and generate a simpler version of the map. For example, Person 1 mentions the relationship between X and Z during the decision-making meeting. In the same meeting, Person 2 mentions the relationship between X and Z but Y linking the two variables. Their statements can be either treated as one structure or two different structures. In Figure 13, two representational alternatives are shown. In the first case, the statements are regarded as separate causal arguments and represented by two different arrow-paths between X and Z. In the second case, the statements are regarded as equivalent. An assumption is made that the Person 1’s statement includes an implicit structure of Y. The relationship is expressed with one arrow-path between X and Z but with a thicker arrow to show that the path has been mentioned more than once.

Not many people describe a structure with the exact same causal argument. Without the assumption of implicit structures, the composite map can get quite messy. If the map is visually too complex, it loses its value as a representation tool.

One pitfall of assuming an implicit structure is that it can lead to coder bias. The coder needs to make an interpretation of causal arguments to determine its intermediate variables. It is possible that the coder’s interpretation may not accurately capture the true
meaning of the statement. For example, if the data say “X causes Z,” the coder could interpret it as “X causes T, and T causes Z,” when the actual meaning in the data is “X causes Y, and Y causes Z.” The possibility of misrepresenting a statement by assuming an implicit structure questions the validity of the composite map.

Figure 13. Representation of Implicit Structures

Person 1: “X causes Z,”
Person 2: “X causes Y that causes Z”

Option 1
Both statements have explicit structures.

Option 2
Statement 1 has an implicit structure, and Statement 2 has an explicit structure.

In order to avoid the bias and to achieve simple representation, the context of a statement must be carefully studied. Examining causal arguments made prior to, or after the statement can be helpful. When a series of dialogues refers to a specific part of the system structure, a statement appearing in the same context is likely to refer to the same part of the structure. It is also helpful to ask probing questions to the data sources. Directly questioning the speaker about the true meaning of his or her statement can reduce coder bias. However, probing does not completely eliminate bias. It is possible that the speaker does not remember the exact meaning of his or her own statement. It is
also possible that the speaker may not be so open about the true meaning if the statement involves controversial issues when equivocality was intended. In the case of the FOMC project, this probing was not possible due to the nature of the decision-making group and the timing of the data collection.

It is also a good idea to use different representation for implicit and explicit structures. For example, implicit structures may be coded with a different form of the conversation identification numbers (CIN). They can be color-coded or written in a different font. If the thickness of the arrows is used to represent the frequency of a causal argument appearing in the data, different weights may be assigned to explicit and implicit structures.

4.4.2 Filling In

In some cases, an implicit structure has no explicit counterpart. In other words, a causal statement made by a group member has an obvious implicit structure, but its intermediate variables are never mentioned in the meeting. There is no explicit structure that can serve as a representation of this implicit structure. Such an implicit structure exists when the structure is well known to all members of the group and the structure is taken for granted.

For the purpose of building a composite map, it is sometimes useful to identify the implicit structure and represent it in the diagram. In such cases, the coder can fill in the missing variables. Filling in must be done with care, because bias can be introduced if the coder misinterprets an implicit structure and represents it in a way different from its
original meaning. It must be also noted in the map that the specific part of the map is assumed by the coder.

4.4.3 Disagreement on the Structure

If a map is created by merging all the causal statements articulated during a decision-making meeting, there must a way to deal with disagreements in the decision-making process. It is always possible that the members disagree on the system structure. For example, Person 1 made an argument based on the rationale that an increase in X leads to an increase in Y (a positive relationship). Person 2 may refute the statement by saying an increase in X is more likely to decrease Y (a negative relationship). What polarity sign should the coder assign to the arrow between X and Y?

To resolve the issue, it is helpful to identify the source of disagreement. Are Person 1 and Person 2 talking about two mutually exclusive relationships? In other words, do two people believe that there is only one kind of relationship between X and Y? In this case, the disagreement comes from defining the polarity of the relationship. This would be Case 1 in Figure 14. On the contrary, Person 1 and Person 2 may be focusing on different implicit structures between X and Y. If the latter is the case, the disagreement is likely to come from the relative weights the two members assign to the different implicit relationships. This is shown as Case 2 in Figure 14. Person 1 may see a causal path linking X, a, and Y as the dominant path between X and Y, while Person 2 may believe a causal path linking X, b, and Y as the dominant path.
The source of disagreement has implications for the mapping practice. In the second case, where the disagreement comes from the relative weights on the causal paths, the composite map needs to capture both. It is because the both paths exist in the collectively perceived system structure. On the other hand, if one refutes another person’s argument because the causal relationship mentioned in the argument does not exist or is simply wrong (as in the Case 1), it is necessary to examine the validity of the causal argument. It must be noted that the validity is checked not against the real system structure but against the decision-making group’s collectively perceived system structure. The composite map represents only the causal relationship supported by the group. Depending on the group’s social attributes and decision agenda, such direct dismissal of one’s argument occurs at varying rates. It is very rare in the FOMC group process. One reason may be that the monetary policy system is so huge and complex that no one can claim absolute knowledge of the system structure. In many formal meetings, it is also regarded as socially inadequate to discount one’s argument as incorrect.

**Figure 14. Two Types of Structural Disagreement**

<table>
<thead>
<tr>
<th>Case 1</th>
<th>Case 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disagreement on the polarity of the relationship</td>
<td>Disagreement on the relative weights on the causal paths</td>
</tr>
</tbody>
</table>

- Positive Relationship between $X$ and $Y$
- Negative Relationship between $X$ and $Y$

X → $\pm$? → Y

X → + → Y

X → + → Y

X → + → Y

X → + → Y

X → + → Y
4.4.4 Merging Conceptually Similar Variables

For convenience of representation, it is necessary to merge conceptually similar variables into one variable. People often use different terms or labels for a variable. Sometimes they use a specific category of a variable. Language use is idiosyncratic. It is rich and detailed, but messy and unorganized. For analytical purposes, it is necessary to find a pattern among the words used and to group similar variables. This process concerns two coding issues: the level of aggregation, and the interpretation of labels. The following is an example from the FOMC transcript:

“I have two questions. Mr. Chairman. One, the part of the forecast I have a problem with is business fixed investment. [Given] sustained strength in the manufacturing sector, except maybe in automobiles, the staff is showing the manufacturing industry operating at higher levels of capacity. That is going to produce, unfortunately I think, some price strains as the year goes on. The staff projection shows a deceleration in business fixed investment against last year. Now, I find that hard to reconcile not only with normal cyclical patterns but also with the orders figures for the past four months. The projection has real plant and equipment spending up at a 2.9 percent annual rate and non-defense capital goods up at a 3.5 percent annual rate. These are unusually strong increases: it would lead me to conclude that I should discount the plant and equipment surveys as being a bit out of date and [not] factor in a bigger increase in fixed investment this year.” (FOMC 1988a: p. 2)

Variable names or indicator labels used in the quote are highlighted in bold. They are business fixed investment, levels of capacity, price strains, orders, real plant and equipment spending, non-defense capital goods, and fixed investment. If the list of labels
comes from one member’s short comment, it is possible to imagine the list of labels that would be generated from one or two days of a FOMC meeting. If these different labels are treated as separate variables, it is also possible to imagine how quickly the composite will evolve into incomprehensible complexity. Therefore, the coder must aggregate different variable names into one general term. Here is an example of aggregation from the quoted data:

Capital Investment (an effort to increase production capacity)

Business fixed investment

Real plant and equipment spending

Non-defense capital goods

Fixed investment

Capacity (a stock generated by capital investment)

Level of capacity

Price pressure (a pressure in the system that can trigger inflation)

Price strains

In determining the higher category, the context where each label is used plays an important role. For example, “non-defense capital goods” is categorized under capital investment, because the context tells us that the speaker meant “non-defense capital goods spending.” Depending on the context, the same label may be categorized under different variable names. For example, “orders” in the quoted text could mean “orders for equipment” or “orders for product.” If the former is the case, “orders” is categorized under capital investment. If the latter is the case, it is categorized under customer orders. From the text, it is not clear what the speaker meant by “orders.” All we can infer is that
it was mentioned in the context where capital investment is stressed. The variables with unclear meanings can be categorized separately.

The coder’s interpretation plays an important role in organizing and merging concepts and labels. It requires the coder to pay careful attention to the context. The coder makes another decision as to what level of aggregation should be represented by the composite map. In the example above, should the map depict the group “capital investment” as one variable or should it include all the variables in the sub-category? Aggregation has a benefit of parsimony, but it requires a greater degree of the coder influence and results in the loss of reality gained from the data.

4.4.5 Importance of Local Knowledge

The coding and mapping issues discussed above requires the coder’s close examination of the context and interpretation of the deeper levels of meaning shared by the decision group. The transcribed data capture the verbally expressed statements from the decision-making meeting. The meaning of the statements is embedded in the cultural and situational context shared by the group. In order to fully understand the meaning, one needs to share the context. The coding and mapping issues emerge, because the coder is outside the cultural and situational context. The coder attempts to infer the meaning system shared by the group, but a statement clearly understood by the decision group may leave the coder puzzled. This is a typical problem with any ethnographers. As an observer, the ethnographer attempts to understand the meaning of a culture that he or she is not a part of.
A deeper understanding of a culture requires “local knowledge” (Geertz 1983). In order to understand the meaning system in the native perspective, the researcher must become familiar with the local context as much as possible. In order to do so, ethnographers immerse themselves in the native culture. In this study, the coder is temporally and spatially separated from the scene where the data are collected. The coder cannot experience the culture as an ethnographer would do. However, the coder can enhance understanding of the native meaning system by familiarizing oneself with the FOMC language, institution, members, and history. The more one gains about the local knowledge, the interpretation of the data will be closer to the native meaning system.

4.5 USING THE MAP AS AN ANALYTICAL TOOL

In system dynamics, qualitative maps have a limited role as an analytical tool. Although causal-loop diagrams or stock-and-flow diagrams are useful tools for representing a system structure, it has limitations as an analytical tool. First, causal relationship can have various functional forms and strength, but they are not represented in these qualitative diagrams. Second, dominance among feedback loops can change over time, but this information is lost in these diagrams. Third, it is possible to hypothesize a system structure responsible for the system behaviors under study, but there is no way to test the hypothesis. In order to overcome these limitations, causal-loop diagrams or stock-and-flow diagrams must be mathematically formalized using computer simulation models. The map elicited in this study shares the same problems with the causal-loop diagrams or
stock-and-flow diagrams in system dynamics. However, this study suggests that the map could be used as an analytical tool in a different way.

Computer simulation models are analytical tools for exploring mental models and aiding decision making. The main purpose of using computer models is to overcome the cognitive limitations of our mental simulation which tends to be inconsistent and inaccurate (Sterman 1994). In contrast, the goal of this study is not to improve the decision makers’ mental models or to recommend a better policy decision. The goal is to describe a decision-making process. The map elicited from raw data of the group decision-making process can serve as an analytical tool for studying the group’s process of building collective judgment. While the map may lack normative use, it can be effectively used as a descriptive tool. But how can a map that captures an artifact of a process describe the process itself?

Generating judgment and decisions involves simulation of mental models. Without help of computer simulation models, what happens in our everyday decision making is a mental simulation. We simulate our mental models to see what might happen in different environmental scenarios with different decision alternatives. But because our cognitive ability is limited, we cannot simulate our mental models all at once. We separate our perceived system structure into manageable pieces and focus on a certain part of the models for mental simulation.

This behavioral pattern is also observed in the FOMC meeting. The FOMC policymakers may have access to computer simulation models outside the meeting. But once they are inside the meeting, their discussion relies on mental simulations. This collective effort to mentally simulate their perceived system structure makes them focus
on specific parts of the system. And from this mental simulation of selective parts of the system, the group’s collective judgment and decisions emerge. Therefore, to describe the FOMC decision-making process, this study moves from one part of the map to another part showing a series of mental simulations that take place inside the meeting.

The technique is similar to “unfolding maps” in system dynamics. Often system dynamics modelers unfold their complex maps and models in a manageable sequence when they present to clients or audiences. Starting from a blank page, a small part of the diagram is revealed with a description of what it represents. Then, another part is revealed with an explanation. This revealing process is strategically planned to communicate the content of the maps and models in the most effective way. The unfolding process continues until the whole content is revealed. This technique enhances the modeler-client communication by guiding the laypersons through the visual and technical complexities of maps and models.

The technique is used in this study for another purpose. It is used to show how the decision-making discussions evolve over time. As the map unfolds, it shows how the collective judgment and decisions emerge from the group dynamics of information sharing, collective interpretation, negotiation, and learning. The unfolding process is carried out as follows:

First, a question that the group collectively strives to answer is specified. This should become clear as the open coding and the stock-and-flow diagramming progress. In the FOMC case, the central question is the decision-making group’s assessment of the state of the economy.
Second, for each argument or judgment coded, the part of the map associated with
the argument is revealed. The revealed part of the map should represent the rationales
supporting the argument.

Third, folding and unfolding is repeated as the discussion progresses. For each
folding and unfolding exercise, narrative documentation is created.

Finally, a strategic sequence of the unfolding is determined. The goal is to
represent the evolvement of arguments leading to the group’s collective conclusion on the
issue discussed. For the case of this study, the goal is to represent the evolvement of
arguments leading to the group’s collective assessment of the state of the economy.

Chapter 6 demonstrates how these analysis steps are taken in practice.

4.6 UNDERSTANDING THE NATURE OF THE MAP

The process of coding and mapping described in the previous sections results in a
qualitative map systematically derived from the raw data. The map is generated by
integrating two different methods—grounded theory and system dynamics. As a result,
the map is quite different from the typical qualitative maps in system dynamics, and the
coding process is also somewhat different from the typical grounded theory approach.
The following sections explore the characteristics of the composite map of the system
produced in this study in relation to its disciplinary origin.
4.6.1 Relationship to Qualitative Maps in System Dynamics

The map developed in this study uses the language of system dynamics—words and arrows, polarity signs, and the notations for stocks and flows. However, the map differs from the causal-loop diagrams or stock-and-flow diagrams of system dynamics in several ways.

First, every part of the map developed in this study is explicitly linked to its data source. For that purpose, this study adopts a coding practice from ethnography. Codes are labels applied to each segment of the data, and they are used to categorize and sort the data into patterns (Lofland and Lofland 1995). The map of this study is tied to the data via codes. Qualitative maps in system dynamics are also rigorously data-driven, but they are more of conceptual sketches of feedback theories emerging from the data. Luna-Reyes and Andersen (2003) point out that system dynamics lack “an integrated set of procedures to obtain and analyze qualitative information” and this leads to a problem of linking “the observations of reality and the assumptions or formulations in the model” (p. 272). This loose connection between a system dynamics model and its qualitative data often leads to the questioning of model validity. Having a coding process in between the data elicitation phase and the representation phase as proposed in this study may be one solution to this problem.

Second, it is the coding scheme that determines what is selected from the data and included in the map. In system dynamics, what is included in maps and models is determined by the modeler and the clients’ definition of a problem and its system boundary. After interviewing clients or examining the data, the modeler shapes what
should be included in the map and how it is represented. By having a coding process, the content of the map in this study is less influenced by the researcher. As a result, the map may appear less refined and not as succinct as causal-loop diagrams or stock-and-flow diagrams in system dynamics. The map may have broken loops, logical inconsistencies, and digressions from the topic. However, the map remains closer to the data, and this makes the map better as a descriptive tool than as a normative tool.

Third, the map has its own analytical value. In system dynamics, qualitative maps are regarded only as a representation of causal hypotheses that is to be tested using formal simulation models (Sterman 2000). Causal-loop diagrams and stock-and-flow diagrams are used as conceptualizing tools for building a formal simulation model. However, the map developed in this study can serve as a tool to analyze a decision-making process. The coding allows the map to be solidly tied to its data source, and it opens up a possibility of using the map as an analytical tool.

4.6.2 Comparison to Grounded Theory

In grounded theory, the goal of coding data is to discover a theory. Diagramming is sometimes used in ethnography to visualize relationships among categories of concepts (Lofland and Lofland 1995; Strauss and Corbin 1998), but the diagram as a product is not the goal itself. On the other hand, the coding in this study is carried out to elicit a map. In other words, the map is more than a tool of organization or visualization. The map represents a group’s collective model of system structure that is exposed during the group interaction. The map is a theory in itself.
The map is a case-specific theory. While Strauss and Corbin (1998) recommend the use of selective coding to move toward more general theory, Glaser (1992) argues that the theory should be case specific. Such difference in the perspective can be also found in the larger realm of ethnography (Sanday 1979). Some ethnographers shy away from generalization across cases (Boas 1948; Geertz 1973), while others seek a general theory from the study of parts (Goodenough 1971). Whether the theory in ethnographic studies should be general or specific is outside the boundaries of this study. While the theory-building effort in this study is limited to one specific case of decision meeting, there are possibilities of building a general theory by creating a map from multiple meetings of various decision agenda.

One of the distinct characteristics of grounded theory is its sampling method, called theoretical sampling. Glaser and Strauss (1967) defines theoretical sampling as “the process of data collection for generating theory whereby the analyst jointly collects, codes, and analyzes his data and decides what data to collect next and where to find them, in order to develop his theory as it emerges. This process of data collection is controlled by the emerging theory, whether substantive or formal.” (p. 45) Theoretical sampling continues until the categories saturate, meaning no new categories of concepts emerge from data. This sampling technique is not possible for this study due to the characteristics of the data being used. The map of this study is derived from one FOMC meeting transcript, and the duration of the mapping process is controlled by the transcribed data. The implication is that the map generated in this study does not include the full model of system structure collectively perceived by the decision-making group. It only includes
fragments of the group’s collective model of the system structure. Only the verbally described structure during the specific meeting period is captured in the map.

Another difference is that the open coding carried out in this study is not as “open” as in grounded theory. Unlike the first stage of open coding where the research question is identified, the second stage of open coding is more structured to look for system variables and their causal relationships. It collects materials for the qualitative mapping in the next stage. This is a focused effort to sift relevant data for the mapping purpose has a danger of neglecting rich phenomena taking place in the decision meeting. To avoid this, it is important to frequently step back from the microanalysis and take a broader view. The Note section in the coding chart can be used to memo various concepts and categories that are not in the form of variables or causal relationships.

4.7 SUMMARY

Chapter 4 explained the mapping method developed in this study to describe a group decision processor. The method uses approaches from two distinct fields: grounded theory and system dynamics. Learning from the coding practices in ethnography, this study attempts to elicit a map that is systematically grounded in the data. The method also uses mapping techniques from system dynamics to represent the structure of the system collectively perceived by the decision-making group. The chapter also discusses various coding and mapping issues emerged during the process and how these issues were addressed in this study.
While the method outlined in this chapter is intended to generate a map for studying a group decision-making process, it also opens a possibility for an interdisciplinary collaboration between ethnography and system dynamics. System dynamics modelers can enhance their use of qualitative data by adopting ethnographic coding practices, while ethnographers can use system dynamics mapping methods as a diagramming tool.

The method described in this chapter will be applied to the FOMC data in Chapter 5. The process of eliciting a composite map from a FOMC verbatim transcript will be detailed. In Chapter 6, the map generated in Chapter 5 will be used to explain the decision outcome of the FOMC meeting.
CHAPTER 5

THE FOMC’S THE STRUCTURAL MODEL OF THE ECONOMY

In this chapter, the coding and mapping method introduced in the previous chapter is further explored. The method is applied to the data collected from a decision-making meeting of the Federal Open Market Committee (FOMC) to build a map describing the group’s decision processor. As explained in Chapter 2, depending on the methods used, a map will study different aspects of the group decision processor. The map elicited in this study captures the decision-making group’s collective understanding of the economic system. It describes the part of the group’s structural model of the economy exposed during the decision-making meeting. Later, the map will be used to explain the process of building a series of collective judgment which is a critical part of making a group decision.

In Chapter 4, the coding and mapping method was described in three phases: (1) Open coding of discussion themes and meeting agenda, (2) Coding of causal arguments using the coding chart, (3) Transformation of the coded arguments into a stock-and-flow diagram. The research questions and the research boundaries emerged from the first phase. In the second stage, the relevant data segments are broken down into system variables and causal structures. In the third stage, the data pieces are visually transformed and reassembled into a map.
5.1 DEFINING THE BOUNDARIES OF THE STUDY

An inductive approach is used to determine the boundaries of this study. Research questions and themes emerge from the initial open coding of the data.

The very first stage of the coding involves finding concepts in the data and naming them. The data is analyzed in units of words, sentences, and paragraphs, and codes are assigned to phenomena discovered in the data. Strauss and Corbin suggest that codes are answers to “what is going on here?” (1998: p.114). Here is an example of how open coding is carried out in the beginning of this research. The following is a quote from March 1988 meeting, and the codes are recorded in parentheses:

“When we look at capacity (information cue: capacity)—and the Fed is the official source of these data (information source)—capacity is a very dubious concept. You really don’t know whether or not you have run into capacity until you have some objective measures of the inability to meet customer orders (information cue: customer orders, dubious nature of information). That is really what it’s all about (defining the current situation). And the lead times on the deliveries on materials—with the exception of steel, [unintelligible] metals products paper and the like—haven’t really expanded all that much (information cues: delivery lead times, anecdotes). In other words, the system is producing to demand, and even though the backlogs go up, there is no evident pressure (linking information to explain the situation, sensemaking). So, while I think we are getting close, and I think the issues we are raising are the correct ones (judgment about the current situation), let’s stay with the numbers (relying on objective data). And the numbers at this stage are still telling us that there is some flexibility there yet (conservative intervention). There may not be much, but I don’t see it (judgment), and I guess you don’t either (inducing support). It’s conceivable that the NAIRU may be lower or that excess capacity in terms of current
costs may be still larger in general (risk factors). I would hate for us to make an assumption and start crying wolf, and then stop crying wolf at the point where the whole thing blows up on us (crying wolf: the fear of giving a false alarm, conservative intervention). I think we may have some flexibility here, but not an awful lot. As I see it, the facts don’t show anything else (interpretation of available information). Do you disagree with that view? (inducing support, opening a discussion) (Memo: The speaker is against a hasty intervention for the tightening policy. The current data does not fully support the need for a tightening move.)” (FOMC 1988b: p.41)

The codes identify and classify various phenomena in the data. There are codes for group dynamics (for example, “inducing support” or “opening a discussion”) and policy attitudes (for example, “conservative intervention” or “crying wolf”). There are codes relevant to specific use of information (for example, “interpretation of available information” or “information cues”).

The codes come from various sources. Depending on research perspectives, phenomena are defined differently. Therefore, the codes are determined primarily by the research context (Strauss and Corbin 1998). Some codes use the native terms as in the case of “crying wolf” in the example. These codes are called in vivo codes. Some codes are picked up from literature. For example, the code “sensemaking” is picked up from Weick (1995) and Abolafia (2005). The coding allows one to organize and categorize various phenomena observed in the data.

Memoing is widely used during the open coding process. Strauss and Corbin define memo as “the products of analysis or directions for the analyst” (1998: p.217). They say the memo can be about the codes, theoretical perspectives, or operational notes. In the example, the memo was used to summarize the points made by the speaker.
The first stage of the open coding is carried out using multiple FOMC transcripts. The coding continues until several dominant patterns are observed in the data, and the researcher is ready to narrow down the research area.

Open coding of multiple FOMC transcripts reveals that there are common agenda discussed in every meeting. These agenda include an assessment of the state of the economy, procedural matters, the operational targets, and language to be used in the directives. These agenda can be organized into multiple layers as in Figure 15. The broad agenda shared by all FOMC meetings is how to adjust the money supply in the economy. Should they increase, decrease, or maintain the level of money supply in the economy? In order to make a policy decision, the FOMC needs to consider many different factors relevant to the policy.

**Figure 15. Multiple Layers of FOMC’s Common Meeting Agenda**

<table>
<thead>
<tr>
<th>Policy Decision</th>
<th>Decision Factor 1</th>
<th>Decision Factor 2</th>
<th>...</th>
<th>Decision Factor N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Should we increase, decrease, or maintain the level of money supply in the economy?</td>
<td>What is the state of the current economy and its future prospects?</td>
<td>How would the market react to our policy?</td>
<td>...</td>
<td></td>
</tr>
</tbody>
</table>

- Examples of Meeting Specific Agenda
  - Did the stock market crash in Oct. 1987 lower aggregate demand? (Dec. 1987)
  - What is the meaning of rising inventory? (Feb. 1988)
  - Is there price pressure building up in the economy? (Mar. 1988)
  - Is our previous tightening move showing up in the economy? (May 1988)
One of these factors is the current and the future state of the economy. Another major factor is the market’s reaction to policies. While these two factors are highly related to one another, the former involves the discussion of the policy action necessary at the specific meeting period while the latter involves the discussion of the framing of the policy to achieve the intended effect. There may be as many as \( N \) factors for determining the level of money supply in the economy. For this study, the boundaries of the research will be limited to the issue of the group’s assessment of the current state of the economy and its future prospects.

Answering the question “What is the current and the future state of the economy?” requires the group to make a collective judgment on various issues. Judgment has to be made, because the decision makers are bounded by the complexities and uncertainties of the economic environment. With a constantly changing economic environment, the source of these complexities and uncertainties in the system change over time. Therefore, in defining the current and the future state of the economy, the FOMC is faced with different judgment tasks in each and every meeting. At one meeting, the group’s attention may be focused mainly on the relationship between the stock market and the aggregate demand. At another meeting, the focus is shifted to whether the inventory building up in the economy is a sign of weakness. Yet at another meeting, the group needs to make judgment about the extent of price pressure building up in the economy.

These meeting-specific issues emerge from one economic system. Depending on the economic environment, the part of the system that is critical for the policy decision changes. In each meeting, the group tends to focus its discussion on the part of the system
that requires collective judgment building. This partial system structure is captured in the map elicited from the data.

In this study, a map is elicited from one FOMC meeting transcript. The February 1988 meeting is selected to demonstrate how a map is generated from the data and to show how the map can be used to describe the collective judgment building process of the FOMC during a specific meeting. February 1988 is when there was great uncertainty regarding the meaning of the rising inventory level in the economy. This study could have used the FOMC transcripts from other time periods. However, this specific meeting was selected because it was a time period when a degree of uncertainty regarding the current and the future state of the economy had increased due to the stock market crash of 1987. As a result, the FOMC devoted a large portion of its meeting building collective judgment about the state of the economy.

5.2 BUILDING A MAP FROM THE FOMC TRANSCRIPT

5.2.1 Selecting Relevant Data Segments

In the first phase of open coding, the focus of the study is narrowed to the collective judgment building process of the FOMC regarding the current and future state of the economy. Once the research questions and the boundaries are defined in the first phase of open coding, the relevant data segments for the study can be separated for the
second phase of coding. The February 1988 meeting includes the discussion agenda as listed in Table 4.

Table 4. Agenda for February 1988 FOMC Meeting

1. Approval of minutes of two previous FOMC meetings

2. Economic situation -----------------------------------------------(Page 1~28)
   A. Staff report on economic situation
      • Domestic aspects (by Prell)
      • International development (by Truman)
   B. Committee discussion
   C. Survey of regional economy

3. Longer-run ranges for monetary aggregates -----------------------(Page 29~45)
   A. Staff comments (by Kohn)
   B. Committee discussion and action on ranges for 1988

4. Foreign currency operations ----------------------------------------(Page 45)
   A. Report on operations since the last meeting (by Cross)
   B. Action to ratify transactions since the December meeting

5. Domestic open market operations -----------------------------------(Page 45~51)
   A. Report on operations since the last meeting (by Sternlight)
   B. Action to ratify transactions since the December meeting

6. Current monetary policy and domestic policy directive -----------(Page 51~74)
   A. Staff comments (by Kohn)
   B. Committee discussion
   C. Action to adopt directive

7. Confirmation of date for next meeting

(Modified from the agenda published at the Federal Reserve’s website)

The discussion relevant to the current and future state of the economy appears everywhere in the meeting, but it is more frequently observed when the committee is talking about the economic situation, the long-run ranges of monetary aggregates, and the monetary policy directives. Here is an example of shifting relevant causal arguments:

“Well, I do think that monetary growth targets are important, and I would like to have them even if the law didn’t require them (strongly advocating the monetary growth
target). There are conditions that exist or occur during a year that are unforeseen that may warrant from time to time accepting growth outside the target ranges. But I think the advantages of target is that they do, in a sense, hold us accountable for those deviations—that is, whenever we have faster growth than the targets, if it turns out to be a policy mistake, it seems to me we have to bear that responsibility (the role of target: accountability). And there isn’t any question that we are somewhat on the line right now because M2 has grown outside the target ranges. Our year-over-year growth rate bottomed out for M2 at 3 percent—that is before the revisions. The numbers showed 3 percent in the week of January 11th: and 3 percent is quite a way below the 5 percent (Hard data on M2). It seems to me that it is important, as we go through this period of adjustment of exchange rates—which we know brings pressure on import prices (current economic situation)—to make it clear to everyone that our long-run objective is to get the price level stability (policy objective). We know that we couldn’t keep the rate of inflation at a long-run desired level while going through that adjustment (current economic situation and its implication on the inflation rate). But it seems to me that we should have these target ranges, and the Chairman’s testimony concerning them should make clear our long-run objective of price stability. (policy suggestion, signaling effect)” (FOMC 1988a: p. 32-33)

The quote appears when the group is discussing the adjustment of long-term target range for monetary aggregates. At the time of the meeting, the target range was set to the M2 growth rate of 5 to 8 percent. The speaker makes a point that they have recently missed the target on the downside. The M2 growth rate was 3 percent. In a normal situation, this would mean the M2 has been growing at a slower rate than expected, and the committee should ease the money supply to bring the rate within the target range. However, the speaker feels that easing is not an appropriate policy. The
depreciation of the dollar—which he refers to as “this period of adjustment of exchange rates” and the meaning of the statement can be inferred from the context—would increase the import price and lead to inflation. In such case, should they ignore the target range and tighten the money supply in anticipation of inflation? Or should they ease the money supply to meet the target? The speaker objects to the former by emphasizing the role of monetary target as a tool to check the soundness of the monetary policy. Instead, the speaker suggests the committee to explicitly express its will to control inflation. This argument is related to the market reaction and signaling effect. (Later in the discussion, he suggests to the committee to change the target range so that the target stays close to the current M2 growth rate.) It must be noted, the meaning of a statement must be interpreted within the context. Conversation flows and people reference one another. It is not possible to analyze the meaning of a sentence when it is separated from the rest of the dialogue.

The short paragraph quoted above is loaded with arguments and supporting rationales. Which ones are relevant to this study? Which part of his statements describes the state of the economy? According to his assessment, the economy is under inflation pressure. It comes from a rise in the import price due to dollar depreciation. This causal structure and behavior of the three variables (i.e. inflation, import price, and dollar exchange rate) are sifted for the study. The rest of the data is less relevant, because the speaker talks about importance of monetary target range and what the committee should do to achieve intended policy effect. It is more about how to implement a policy, rather than what policy is needed in the current economic situation. Therefore, only the data
segments relevant to the current state of the economy—underlined in the quote—were selected from the transcript for the next phase of the coding.

5.2.2 Identifying Arguments and Variables

The second phase of the coding uses the coding chart introduced in Chapter 4 (Table 2). The first step is to break down the data into main arguments or judgments about the state of the economy and their supporting rationales. The supporting rationales can be in the form of a statement about causal relationships among the system variables or information about observed or expected behavior of variables. The rationales can be also in the form of statements about direction or strength of the causal relationships. Argument/judgment and their supporting rationales are all intermingled in the data. It was discussed in the previous chapter how the variables and the causal relationships are discovered from the data. Variables are conceptual units used by the FOMC to describe the state of the economic system. They are found mostly from native terms, but they are found from economics and finance literature.

The FOMC decision makers rarely make statements in a form easily transferable to the coding chart. It is the role of the coder to separate the data and categorize them into the coding system developed. The following quote is in the form of an argument supported by implicit causal relationship and anecdotal information:

“However, there is some optimism it seems to me, given [developments in] two or three primary sectors of our economy. (…) The farmers have recovered from a very low level of activity and they’re feeling very good, even in the middle of the winter with cold
weather. I think an important observation is that there are some real paybacks to the agricultural banks.” (FOMC 1988a: p. 20)

The main argument is that the economy has an optimistic outlook. In the quote, causal structures are not explicitly mentioned. However, if interpreted based on the context, it can be inferred that the farmers’ level of activity is positively associated with the optimistic economic outlook. It is not clear from the data which one is the cause variable and which one is the effect variable. Nevertheless, causal relationship is implied. The increasing level of farmers’ activity is supported by two indicators: the farmers’ good feelings and their payback trends. These indicators are based on anecdotes collected from different sources. They are shared in the meeting, because the speaker believes they are important pieces of information that should contribute to the group’s collective judgment building process. The quote and codes recorded in the coding chart are shown in Table 5.

Table 5. Coding Example I

<table>
<thead>
<tr>
<th>Speaker Name:</th>
<th>Mr. Guffey</th>
<th>Transcript Page: 20</th>
<th>CIN: 20-04</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Argument or Judgment:</td>
<td>There is some optimism (in the economy).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Statement about Causal Structure</td>
<td>Cause Variable: Optimistic economy/farmers’ activity</td>
<td>Effect Variable: Farmers’ activity/optimistic economy</td>
<td>Relationship Direction: Positive</td>
</tr>
<tr>
<td>Information Shared</td>
<td>Cause Variable: Farmers level of activity is recovering: Farmers’ are feeling good. Farmers are making real paybacks to the agricultural banks.</td>
<td>Effect Variable:</td>
<td>Relationship Attributes:</td>
</tr>
<tr>
<td>Information Source</td>
<td>Formal:</td>
<td>Unidentified</td>
<td>Informal:</td>
</tr>
<tr>
<td>Notes:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

113
Here is another example. This is a quote made during the assessment of the mid-
Atlantic economy by President Boehne:

“I have several comments on the regional economy as well as the national economy. As far as the regional economy goes, the Mid-Atlantic area is still operating at very high levels of economic activity. But, if one could measure GNP at the regional level I think one would see a slowdown in growth. Interestingly enough, it’s more because of supply constraints than it is because of demand constraints. Labor markets are very tight. I hear comments, particularly in manufacturing, about slower delivery times for materials. People tell me that the steel industry is not as friendly as it once was: they don’t answer their phone as readily: the shipments from steel companies are slower: and in some cases, they aren’t filling orders completely. So it does seem to me that there’s some slowing, but not for demand reasons, more for supply reasons. I do not sense any excessive concern about inventory buildup.” (FOMC 1988a: p. 12-13)

Three main arguments are made in the above quote: (1) the Mid-Atlantic economy is highly active, but (2) growth is slowing down, and (3) it is due to supply constraints. The meaning of “supply constraints” can be inferred from the rest of the statements. It is a situation where the resource for production is reaching its limit and the production cannot grow any further. The third argument about the supply constraint provides a causal explanation for the first two arguments. Using one’s mental model of the system, Boehne relates the observed behavior of economic activity with the existence of supply constraints. To support the argument, he shares six information cues with the group. They are labor markets, material delivery times, friendliness of the industry, shipment rate, unfilled orders, and concern about inventory buildup. The coding from the transcript is shown in Table 6.
Table 6. Coding Example II

<table>
<thead>
<tr>
<th>Speaker Name:</th>
<th>Mr. Boehne</th>
<th>Transcript Page: 12-13</th>
<th>CIN: 12-06</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Argument or Judgment:</td>
<td>There is a slow down in economic growth due to supply constraints.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Statement about Causal Structure</th>
<th>Cause variable:</th>
<th>Effect variable:</th>
<th>Relationship Attributes:</th>
<th>Attributes:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Labor Market</td>
<td>Production (Inventory)</td>
<td>Delivery times</td>
<td>Positive</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Production (Inventory)</td>
<td>Industry friendliness</td>
<td>Negative</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Production (Inventory)</td>
<td>Shipment</td>
<td>Positive</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Production (Inventory)</td>
<td>Unfilled Orders</td>
<td>Negative</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Inventory)</td>
<td>Concern about inventory buildup</td>
<td>Positive</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Information Shared</th>
<th>Cause Variable:</th>
<th>Effect Variable:</th>
<th>Relationship Attributes:</th>
<th>Attributes:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tight</td>
<td>Slower growth</td>
<td>Slower growth</td>
<td>Slower growth</td>
</tr>
<tr>
<td></td>
<td>Slower growth</td>
<td>Slower</td>
<td>Not as friendly</td>
<td>Slower</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Some cases</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No excessive concern</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Information Source</th>
<th>Formal:</th>
<th>Informal:</th>
<th>Comments heard from manufacturing and steel industry</th>
</tr>
</thead>
</table>

Notes:

"Inventory" concept is implicit, thus shown in parentheses.
"Economic activities" are interpreted as "production" after examining the context.

Each statement related to the six indicators is represented in a column. The first column is the rationale for judging that there is a supply constraint. A tight labor market suggests a supply constraint, and it is negatively associated with the economic activities. As explained in the Notes section of the coding chart, “economic activities” is paraphrased as “production,” because the context implies that the slowing economic activities are taking place in the production sector. The rest of the columns are about ramifications of the supply constraint. Boehne shares five anecdotes he gathered from manufacturing sector and steel industry. They all assume an implicit structure of the inventory. Inventory is a stock adjusted by production and shipment rates. Five
indicators—delivery time, friendliness of the industry, unfilled order, shipment, and concern about inventory buildup—are influenced by the level of inventory. The anecdotes suggest that there is a need for greater production, but with limited resources—as indicated by the tight labor market—the production growth is slowing.

Here is another coding example. This is a statement by President Forrestal:

“A lot of these manufacturers are also reporting that their uncertainty about the dollar is causing them to hold back on some business fixed investment or capital expenditures. They got burned at the time that the dollar was very high and they’re reluctant to go into a lot of expensive business fixed investment at the moment. A lot of the manufacturers are also reporting backlogs of up to six to seven weeks in orders. As for prices, we get spotty information about them, but in general I would say that there’s a tendency for price increases to be coming into the marketplace.” (FOMC 1988a: p. 16)

The codes are available in Table 7. Forresetal’s main argument is that there seems to be a risk of inflation in the economy. To support the argument, three pieces of anecdotal information are shared. First, manufacturers had a bad experience with the dollar appreciation in the past. Second, there seems to be an unwillingness to make capital investment. Third, there are reports of order backlogs. The causal structure linking these three pieces of information with the tendency for price increases remains mostly implicit.

As shown in the first column, the first causal relationship is a negative one between the dollar value and the willingness to make capital investment. From the context, it is hard to infer what intermediate variables link the cause and the effect. The second column is about the order backlog. It is a concept related to the inventory.
production rate cannot keep up with the sales rate, order backlogs will be created. Inventory is an implicit structure. Inventory also explains why the speaker mentioned manufacturers’ unwillingness to make capital investment. A lack of capital investment will slow down the production as the rate of capital utilization reaches its limit. It will lower the inventory level and increase the order backlogs. Order backlogs will eventually trigger the price to increase, which is the classic supply-demand relationship.

For each argument made during the February 1988 meeting, a similar coding table is created. When the coding is completed, the tables are collected and grouped by arguments. Relationships between these groups of arguments are then identified. Grouping the arguments has several benefits. First, when the meaning of an argument is

<table>
<thead>
<tr>
<th>Table 7. Coding Example III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speaker Name: Mr. Forrestal</td>
</tr>
<tr>
<td>Main Argument or Judgment: Price increases are coming into the marketplace.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Statement about Causal Structure</th>
<th>Cause variable:</th>
<th>Effect variable:</th>
<th>Relationship Direction:</th>
<th>Strength:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$ Value (?)</td>
<td>Capital investment</td>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Inventory)</td>
<td>Order backlog</td>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Order Backlog)</td>
<td>Price</td>
<td>Positive</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Information Shared</th>
<th>Cause Variable:</th>
<th>Effect Variable:</th>
<th>Relationship Attributes:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Uncertain.</td>
<td>Held back</td>
<td>6-7 weeks</td>
</tr>
<tr>
<td></td>
<td>May appreciate.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spotty cases of price increase</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Information Source</th>
<th>Formal:</th>
<th>Manufacturer reports</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Informal:</td>
<td></td>
</tr>
</tbody>
</table>

Notes: (?) represents an unidentified implicit structure.
unclear, it can be inferred from the similar arguments in the group. Second, when an argument assumes an implicit system structure, the structure may be inferred by analyzing other arguments in the group. Finally, the grouping of arguments provides an overview of the collective judgment building process. Table 8 summarizes the main argument groups identified in the February 1988 transcript.

Table 8. Organization of Arguments from the February 1988 Meeting

<table>
<thead>
<tr>
<th>Arguments for Tightening Policy</th>
<th>Arguments for Easing Policy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main Arguments</strong></td>
<td><strong>Sub-Arguments</strong></td>
</tr>
</tbody>
</table>
| There is risk of inflation.     | • Capacity for production is limited.  
                               | • Capacity utilization is high.   
                               | • Labor market is tight.          
                               | • There is a wage pressure       
                               | • Demand is greater than supply.  |
| Economic growth has an optimistic outlook. | • There is a high export demand.  
                                       | • Inventory build-up is voluntary. 
                                       | • Consumer spending is strong.     
                                       | • Stock market crash had insubstantial effect on the economy. |
| Inflation is unlikely.          | • Inflation is unlikely.       |
| Economic growth is at risk.     | • Dollar appreciation can reduce export.  
                               | • There are unwanted inventory build-ups. 
                               | • Consumer spending is weak.       |

5.2.3 Pre-mapping Transformations

Once the data are organized into causal statements as described in the previous section, they can be transformed into words-and-arrow diagrams. These words-and-arrow diagrams are then collected and integrated into a composite map. The map will show an overall picture of the system structure discussed in the meeting, and it identifies where the group’s attention is most focused and how the collective judgment emerges from the
structure. In this section, mapping causal arguments is demonstrated using examples.

Following is the President Boehne’s quote used in the previous section as an example:

“I have several comments on the regional economy as well as the national economy. As far as the regional economy goes, the Mid-Atlantic area is still operating at very high levels of economic activity. But, if one could measure GNP at the regional level I think one would see a slowdown in growth. Interestingly enough, it’s more because of supply constraints than it is because of demand constraints. Labor markets are very tight. I hear comments, particularly in manufacturing, about slower delivery times for materials. People tell me that the steel industry is not as friendly as it once was: they don’t answer their phone as readily: the shipments from steel companies are slower: and in some cases. They aren’t filling orders completely. So it does seem to me that there’s some slowing, but not for demand reasons, more for supply reasons. I do not sense any excessive concern about inventory buildup.” (FOMC 1988a: p. 12-13)

Table 6 summarizes the six causal structures elicited from the data. It was explained in the previous section that there is an implicit structure of inventory. In addition to inventory, “unfilled orders” is also a stock. They both represent accumulations in the system. While the former is a physical accumulation of goods produced in the economy, the latter is an accumulation of intangible order requests. The structures are described in simple words-and-arrow diagrams as Table 9. When the words-and-arrow pieces are put together, they look more like Figure 18.

In order to create the visual representation in Figure 18, the stock-and-flow relationships between inventory, production, and shipment are represented in a typical stock-and-flow diagram. Then, the rest of the causal relationships are added in. The linkage is created using common variables: production and inventory. Each of the six
causal arguments in Table 9 is assigned with an identification number. The identification numbers are recorded next to the relevant causal path in Figure 18 to show how each statement is represented in the map. Compared to the word-and-arrow representations in Table 5, the connected map in Figure 18 provides a visually more succinct depiction of the system structures.

Table 9. Words-and-arrow Representation of Causal Arguments

<table>
<thead>
<tr>
<th>Cause</th>
<th>Effect</th>
<th>*</th>
<th>Words-and-arrow Representation</th>
<th>#</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labor</td>
<td>Production</td>
<td>+</td>
<td><img src="image" alt="Diagram" /> Labor + Production</td>
<td>1</td>
</tr>
<tr>
<td>Production (Inventory)</td>
<td>Delivery Time</td>
<td>-</td>
<td><img src="image" alt="Diagram" /> Production + Inventory - Delivery Time</td>
<td>2</td>
</tr>
<tr>
<td>Production (Inventory)</td>
<td>Friendliness of Industry</td>
<td>+</td>
<td><img src="image" alt="Diagram" /> Production + Inventory + Friendliness of Industry</td>
<td>3</td>
</tr>
<tr>
<td>Production (Inventory)</td>
<td>Shipment</td>
<td>+</td>
<td><img src="image" alt="Diagram" /> Production + Inventory + Shipment</td>
<td>4</td>
</tr>
<tr>
<td>Production (Inventory)</td>
<td>Unfilled Orders</td>
<td>-</td>
<td><img src="image" alt="Diagram" /> Production + Inventory - Unfilled Orders</td>
<td>5</td>
</tr>
<tr>
<td>(Inventory)</td>
<td>Concern for Inventory Buildup</td>
<td>+</td>
<td><img src="image" alt="Diagram" /> Inventory + Concern for Inventory Buildup</td>
<td>6</td>
</tr>
</tbody>
</table>

The structural representation in Figure 18 resembles the raw data closer to their original form. The causal relationships in the data are represented with very little change: variable names are picked up from the data, and the representation of implicit structures is kept to a minimum. Comparing the data and the figure side by side, it is not difficult to follow how the structure is generated from the data. For each coding chart, the words-
and-arrow structure similar to Figure 18 is created. These maps are then merged together to create one composite map of the system structure.

**Figure 18. Connecting Words-and-Arrows**

A problem with using the structural representations such as Figure 18 to create a composite map is its lack of generalizability. They reflect the FOMC members’ idiosyncratic language use. One causal structure can be expressed in many different ways. People may use different variables names. They may talk about a variable using different examples. They may describe a structure with different intermediate variables emphasized. They may not explicitly mention the cause or the effect variables if they are obvious to the group. While they may be true to the data, the structures like Figure 18 lose their meaning when detached from the data. With low level of conceptualization, they have little analytical value. Furthermore, the idiosyncratic nature of the words-and-arrow pieces makes it difficult to combine multiple structures into one composite map. Two structures are integrated when they have a common variable. Unless idiosyncratic variable names are generalized, finding a common variable can be very difficult.
5.2.4 Generalizing the Structural Representation

The next step is to generalize the structural representation so that idiosyncratic description of the system structure can be collapsed into one composite map. Figure 19 shows a generalized version of Figure 18. It is a big leap in conceptualization: the structures identified in Boehne’s quote appear as part of a bigger map that integrates structures collected from other members’ statements. For example, the structures relevant to capacity utilization or new orders are elicited from other members’ statements in the transcript. The following describes the process of creating a general map like Figure 19.

First, variables identified in the coding charts are examined so that similar variables can be grouped and assigned with a common variable name. For example,
“unfilled orders” (p.12, Boehne), “backlogs of orders” (p.16, Forrestal), and “order books” (p.43 Greenspan) are all grouped under the stock “orders.” “Shipments data” (p.7, Prell), “retail sales” (p.17, Stern), and “sales performance” (p.17, Melzer) are all grouped under “shipment.” Likewise, variable names used in Figure 18 are replaced with more general terms such as “service quality” (i.e. friendliness of industry), “producer’s anxiety over excess inventory” (i.e. concern about inventory buildup), and “delivery delay” (i.e. delivery times). This grouping process was discussed in Chapter 4. Generalizing idiosyncratic variable names allows different words-and-arrow structures to be integrated if they have a common variable.

Second, causal relationships are decomposed further by identifying implicit structures. For example, a causal relationship A→C may be decomposed and coded as A→B→C. This way, the relationship A→C can overlap with structures A→B or A→B→C. For example, the “Labor→Production” relationship mentioned in Beohne’s quote in the previous example is decomposed and coded as “Labor→Production Capacity→Production.” This way, the structure can be merged with other structures containing the “Production Capacity→Production” relationship. For example, the following quote shares the “Production Capacity→Production” part of the structure with Beohne’s statement:

“I’ve been in Frank Morris’ camp in thinking that expenditures on plant and equipment, along with net exports of goods and services, would be the real driving force in the economy.” (FOMC 1988a: p. 6)

The “expenditure on plant and equipment” is an investment that increases the stock of “Capital” described in Figure 19. The “driving force in the economy” is
interpreted as “production” after studying the context in which the statement is made. With a couple of implicit variables identified, the relationship path may be represented as “Capital Investment → Capital → Production Capacity → Production.” This structure has a partial overlap with the structure elicited from Boehne’s statement.

Third, in describing the structure of the system, generic structural representation in system dynamics is adopted if found useful. In system dynamics, a map or a model is built to address case-specific problems (Richardson and Pugh 1989). Sometimes, these case-specific models turn out to be applicable to more general groups of problems. These generic structures have substantial theoretical value, but they also serve as an important learning tool for young modelers. Over time, the field has accumulated a catalogue of general structures that can be used as building blocks for modeling, and the catalogue has been recommended as a pedagogical tool (Andersen and Richardson 1980). These structures can be easily found in system dynamics textbooks (for example, Richardson and Pugh 1989; Sterman 2000). In addition to using system dynamics language and mapping techniques, this study takes advantage of the catalogue of structures to organize and integrate the causal relationships identified in the FOMC transcript.

Here are examples of general structure used in Figure 19. Figure 20 shows a general “goal-gap” structure used in system dynamics. The state of the system is compared to the desired state of the system (goal). If there is a discrepancy (gap) between the two, then the inflow rate is changed to close the gap. If the state of the system is less than the desired state, the inflow will be increased to bring the state of the system closer to the desired state. If the state of the system is greater than the desired state, the inflow
will be negative. The adjustment time represents how quickly the correction is made. When applied to the inventory situation, the structure looks like Figure 21.

**Figure 20. General Goal-Gap Structure**

**Figure 21. Application of the Goal-Gap Structure for Inventory Correction**

The general structure used in the composite map of this study as shown in Figure 22. The variables and the causal relationships in the Figure are coded from the statements made by different FOMC members in the data. Some talk about how manufactures worry about the excess level of inventory. Some talk about the shortage of inventory. Some—
like Boehne in the previous example—talk about how such concern about the inventory level leads to an adjustment in the production rate. A few relevant quotes are shown below:

“And that is some of the accumulations in retail inventories was planned—was desired in effect—to beat higher prices for imports.” (FOMC 1988a: p. 1)

“Inventories would begin to build up and we’d see some adjustment of production in this process.” (FOMC 1988a: p. 8)

“I guess my main difference with the staff forecast involves the inventory situation. Because I am more pessimistic about whether or not the current levels are considered excessive or right on, that makes me have a different point of view about what’s going to happen to them. I think that there’s going to be a lot more worked off in the first quarter, and also some in the second quarter, so I have a significantly weaker first half.” (FOMC 1988a: p. 20-21)

**Figure 22. Use of the Goal-Gap Structure to Create a Composite Map**
Above quotes all talk about the current level of inventory in comparison to the desired level. The gap either encourages manufacturers to produce more or to slow down the production. The goal-gap structure is a useful framework for organizing and integrating the variables and the causal relationships collected from different statements in the data.

Another example of general structure used in Figure 19 is “Residence Time.” Residence time stands for the length of time a unit stays in the stock (Sterman 2000). The structure is described in Figure 23. The structure is best explained mathematically: Residence Time = Stock / Outflow. This structure is useful in describing delivery delay. Delivery delay is the time it takes for an order to be fulfilled. Figure 24 shows how the general structure is applied to represent the delivery delay concept.

In addition to the examples given above, this study frequently adopted general structures widely used in system dynamics to create the composite map.
5.2.5 Tracing the Previous Example in the Map

Compared to Figure 18, the generalized structure in Figure 19 looks less like the raw data. However, it is still possible to trace each part of the structure back to the causal arguments in the data. The following describes how Boehne’s statement previously quoted as an example is represented in the general version of the composite map.

Boehne’s argument related to the tight labor market and its effect on the production growth is described in the map as shown in the bolded part of Figure 25. Labor and capital are two types of production capacity mentioned in the February 1988 meeting transcript. The quoted data only talk about the labor aspect of the production capacity. The capital side of the production capacity comes from other members’ statements such as the one by President Black quoted before:

“Mr. Chairman, I’ve been in Frank Morris’ camp in thinking that expenditures on plant and equipment, along with net exports of goods and services, would be the real driving force in the economy.” (FOMC 1988a: p. 6)

“Plant and equipment” are capital goods positively associated with the economy—or more specifically, with production. Capital goods are used as the means of production. Along with other capital goods mentioned in the transcript, plants and equipments are grouped under the common variable name “capital.” A careful analysis of the text informs that Black is talking about an inflow of a stock. “Expenditures” is an inflow that increases the capital stock. In other parts of the transcript, the inflow is described as capital investment or construction.
From Beohne’s speech, it is not clear whether he perceives labor as a stock. However, it is more explicitly described as a stock by other members, as in the following example:

“As I’ve indicated before, we have had a downtrend in manufacturing employment in New England since December 1984, reflecting a mini-recession in our computer industry. That downtrend has ended. October-November show the first increases in manufacturing employment in New England in our computer industry since the end of ’84. Given that our unemployment rate is 3 percent, I think the only question is: Where are they going to find the labor to generate a further increase in employment? I had thought for a while that perhaps a slowdown in defense contracting might spin off some skilled labor that the high-tech industry could use; but I’ve been disabused of this notion by our defense industry people who point out that what’s happening in the
Pentagon now is that they’re focusing on slowing down the increase in the number of what they call, in Pantagonese, platforms—ships, aircraft, and so on—and focusing on increasing the electronic capabilities of existing platform.” (FOMC 1988a: p 23)

In the quoted data, the speaker differentiates employment (rate) from labor (stock). The employment concerns the rate of hiring and the rate of quitting/firing. It is a function of available jobs and available labor. On the other hand, labor is a stock of workable people in the economy. To merge all labor-related structures into one map, “labor” in Boehne’s statement was assumed as a stock.

As discussed in the previous section, the variable “production capacity” is assumed as an implicit structure in Boehne’s statements. A tight labor market means limited production capacity, which leads to a lower level of production. Boehne only mentioned the relationship between the labor market and the level of production, but production capacity is specified in the map as an intermediate variable. Production capacity was identified as a part of the FOMC’s perceived system structure when the group was discussing capacity utilization. For example;

“With regard to the District, our growth characteristics are now very much in parallel with the national numbers. (…) Even the beleaguered equipment manufacturers—and this has really been a very tough industry—are showing signs of light. I’m hearing the first good news out of that group that I’ve heard for a good many years. We talked about machine tools a little earlier, but one of our directors operates a very large machine tool company and they are operating at an 80 percent rate; they are enjoying the best quarter that they have had since 1982.” (FOMC 1988a: p. 15)
The quote above positively associates a high rate of capacity utilization (i.e. “operating at an 80 percent rate”) with a positive economic outlook. By definition, capacity utilization is the percentage of production capacity used for production. It is determined by desired level of production and available production capacity. If mathematically expressed,

\[ \text{Capacity Utilization} = f(\text{Desired Production} / \text{Production Capacity}); \text{ and} \]

\[ \text{Production} = \text{Capacity Utilization} \times \text{Production Capacity}. \]

Since capacity utilization is frequently addressed during the FOMC meeting, and since the definition of capacity utilization always accompanies the concept of production capacity, production capacity is explicitly described in the map.

Assuming intermediate variables such as production capacity simplifies the diagram. Unless there is a substantial risk of distorting the meaning of a statement, identifying implicit structures also help clarify the deeper meaning of the statement.

The bold part of Figure 26 represents the relationships between production, inventory, shipping, and delivery delay. Inventory as a stock captures the gap between the production rate and the shipping (sales) rate. When the rate of shipping is greater than the rate of production, inventory level falls. The shipping rate is a function of order (demand) and inventory. Shipping is made only when there are enough goods in the inventory to fill that order. If the inventory level is not sufficient, the shipping and the order fulfillment rate is restricted, and thus delivery delay becomes longer.
The bold part of Figure 27 describes the relationship between production, inventory, producer’s concern for the inventory level, and friendliness of the industry. If the current level of inventory is greater than the desired inventory, the gap leads to the producer’s concern for excessive inventory buildup. If the desired level is greater than the current inventory level, the producers worry about the shortage of inventory, and according to Boehne, they become less friendly to the customers.

The bold part of Figure 28 describes the relationship between inventory and unfilled order. Unless the orders are fulfilled by shipping goods from the inventory, the orders accumulate as backlogs.
Figure 27. Structure for Production, Inventory, Concern for the Inventory Level, and Friendliness of Industry
5.3 THE FINAL MAP ELICITED FROM THE FEBRUARY 1988 FOMC MEETING

Coding words-and-arrow relationships from raw data and linking the pieces together requires a careful analysis of meaning of words used by the decision makers. As described in the previous sections, the process can be summarized as follows: First, relevant data segments are sifted. From the selected data, all the statements are broken down into their main arguments and supporting rationales. The rationales are then again broken down into the cause-effect variables and the information about the variable values or trends. Similar arguments and variables are categorized into groups, and the variable groups are labeled with representative variable names. The cause-effect relationships are transformed into simple words-and-arrow diagrams using the group variable names. Stocks and flows are identified at this stage. Finally, the words-and-arrow pieces are collected, linked, and overlaid to create one composite map.

The process of eliciting causal structures from the raw data and merging the pieces into the composite map is continued until the full transcript is analyzed. The composite map gained from the February 1988 FOMC meeting is shown in Figure 29. For visual convenience, the map does not show polarity signs. The map looks like a model of the economic system. It represents the part of the perceived economic system revealed during the collective judgment building process of the FOMC. It represents the FOMC’s collective model of system structure based on which the group’s policy decision is generated.
The map in Figure 30 is a variation of Figure 29. It shows how many times a causal link or a variable appears in the data using the thickness of the arrows and the font size of the variables. The frequency of appearance in the data is proportional to the arrow thickness and the font size. For example, the thickest arrow suggests the causal relationship is mentioned more than ten times in the transcript. The thinnest line is used for relationships mentioned only once in the transcript. The dotted line is used to represent a relationship implied in the data but never explicitly stated. These causal relationships are filled in by the coder. Likewise, the font size of the variables increases in proportion to their appearance in the data. The biggest font—for example, the one used for “Inventory,” suggests that the variable was mentioned more than twenty times in the data including the implicit references. The second biggest font, like the one used for “willingness to increase capacity,” suggests the variable was mentioned more than ten times but less than twenty times. In this study, implicit and explicit structures are weighted equally, but could be adjusted with different weights if necessary. The frequency of all the variables and the causal links in the map can be found in Appendix.

The map gives an overview of the system structure collectively perceived by the decision-making group. Furthermore, the map shows what parts of the system receive more attention during the decision-making meeting. They are more likely to be a critical structure for building the group’s collective judgment about the state of the system. The map effectively describes that some parts of the system are discussed more than other parts during the meeting. In the February 1988 meeting, the discussion evolved around the issues of consumer demand, production, and inventory.
The elicited map may have different appearances depending on the coder’s degree of structural aggregation, selection of variable names, or style of conceptual representation. However, the substantive contents and the arguments captured in the map should be fairly consistent if the map is derived from the same transcript using a systematic coding method.
Figure 29. The Map Elicited from February 1988 FOMC Meeting
Figure 30. Frequency of References in the Data
5.4 LINKING THE MAP WITH THE DATA

Further along the coding process, it becomes harder to trace the raw data in the visual representation. The data are reduced and simplified into a map that can be used as an analytical tool, but the map can easily become somewhat disconnected from its original data source. To avoid separation of the map and the data, a rigorous effort to link the two is needed.

As explained in Chapter 4, this study tied the map with the data by using Conversation Identification Numbers (CIN). The CIN is assigned to a small segment of data to show its location in the transcript. In this study, the numbers are created in “page number—paragraph number” format. For example, President Boehne’s statement cited in the previous section is assigned with the CIN 12-06. “12” shows the page number in the transcript, and “06” shows the paragraph number in the page.

For each causal link or variable in the map, the data source is logged using CIN. For example, all the causal relationships mentioned in the Boehne’s statement are tagged with the CIN 12-06 in Figure 31. Likewise, all the variables relevant to the Boehne’s statement are tagged with the CIN 12-06 in Figure 32.

To find out the data segments relevant to the labor-production relationship represented in Figure 31, one can refer to the CIN 12-06 and be directed to Boehn’s quoted statements in the transcript on page 12, paragraph 6. Likewise, to find out the data segments relevant to the variable “service quality” in Figure 32, one can also be directed to Boehn’s quoted statements referred via CIN 12-06. One causal link or variable can be associated with multiple CINs if it appears in the data multiple times.
Figure 31. Linking Causal Relationships with the Data Source

Figure 32. Linking Variables with the Data Source
As shown in Figures 31 and 32, two types of parenthesis are used with the CINs. If the causal relationship is explicitly mentioned in the data, it is noted in [CIN] format. If the relationship is implicit in the data, it is noted in (CIN) format.

In practice, the distinction between the explicit and the implicit statements is not always clear. For example, the “labor \(\rightarrow\) production” relationship is mentioned explicitly in Boehne’s statement. In the map, the relationship is represented with an intermediate variable “production capacity.” In other words, the structure “labor \(\rightarrow\) production” is broken down into the “labor \(\rightarrow\) production capacity” relationship and the “production capacity \(\rightarrow\) production” relationship. The structure is replicated in Figure 31, and each causal relationship is labeled as CR1, CR1-1, and CR1-2. The dilemma is that while CR1 is an explicit structure, it is expressed in the map as CR1-1 and CR1-2, and neither of them has been mentioned explicitly by Boehne. If CR1-1 and CR1-2 are regarded as implicit structures and referenced with (12-06), the map fails to recognize the explicit statement about CR1 made by Boehne in the data. In such situations, CR1-1 and CR1-2 are regarded as part of the explicit structure CR1 and referenced with [12-06]. Only the implicit aspect of the structure is the variable “production capacity,” because it was not mentioned in Boehne’s statement. Therefore, the notation (12-09) is used to link production capacity to the data source. The result is summarized in the last part of Figure 33.

As the map gains complexity, the notation method shown in Figures 31 and 32 can become visually confusing. One causal link or a variable can be associated with multiple data sources, and over the course of the coding process, the CINs for data references fills the map. To avoid this, it is useful to create data reference tables.
For data referencing purpose, two types of Map Identification Numbers (MIN) are created in addition to the conversation identification numbers. The first type of MIN is assigned to every causal link in the composite map (MINC), and the second type of MIN is assigned to every variable in the map (MINV). Then in a table, the conversation identification numbers are matched with map identification numbers for causal relationships and variables. For example, Figure 34 shows a partial view of the composite map used in the previous examples. For each causal link and variable, a unique map identification number is assigned. The map identification numbers for variables (MINV) are shaded in grey to separate them from the map identification numbers for causal links (MINC).
Table 10 shows how the conversation identification numbers and the map identification numbers are matched. To trace the source data from the map, one can look up the relevant MINC or MINV in the table and find the matching CINs. Using the CINs, it is possible to locate all the data segments in the transcript where the structure is derived. The table can be also used to track how specific data segments are described in the map. Each data segment should have its own CIN. By looking up the CIN in the table, one can find the matching MINCs and MINVs. In sum, the table can be used to trace the data source for a specific map structure. The table can be also used to study how a specific data segment is represented in the map.

In the Appendix, a full map with the complete map identification numbers is shown. Also, the complete table matching the source data with the map structure is attached. By using these, one can trace how this study interpreted the FOMC data and elicited the composite map from the data.

**Figure 34. Map Identification Numbers**
Linking the map tightly with the data source has many benefits. First, it forces the mapping process to be more systematic. Second, it explains how the coder interprets the data. This allows the coder’s interpretation to be examined and modified as the coder gains deeper understanding of the data. It also allows others to examine the mapping process and build confidence in the map generated. Third, it provides a handle to use the map as an analytical tool as it will be shown in the next chapter.

### 5.5 SUMMARY

In Chapter 5, the coding method developed in Chapter 4 was applied to the FOMC data. The detailed process of eliciting a composite map of the group’s collectively
perceived system structure was described. The coding process began with setting the boundaries of the study and sifting the data segments relevant to the defined boundaries. The open coding method from grounded theory was primarily used for this purpose. The selected data were then broken down into arguments, cause-and-effect relationships, and variable information. The coded data were then categorized and generalized, and they were transformed into a map using the diagramming language adopted from system dynamics. The study attempted to link the map to its data source by using referencing codes and tables.

The generated map describes the collectively perceived system structure that is exposed during the decision-making meeting. The map portrays the system structure that is more frequently discussed during the group process. The map is an artifact of the collective judgment building process in which the group makes an effort to assess the current and future state of the economy.

In Chapter 6, the elicited map will be used to generate insights about the February 1988 FOMC meeting. If the map in Chapter 5 served as a representation tool, the map in Chapter 6 will be used as an explanatory tool for analysis.
CHAPTER 6
UNDERSTANDING THE COLLECTIVE JUDGMENT BUILDING PROCESS OF THE FOMC

The map generated in Chapter 5 describes the structure of a system collectively perceived by the Federal Open Market Committee (FOMC). The map was elicited from the verbatim transcript of the committee’s February 1988 meeting. The coding and mapping process described in Chapter 5 shows how the map is systematically grounded in the data. It also shows that the method has influence from grounded theory and system dynamics.

The map is an artifact of the collective judgment building process. The map represents part of the economic system discussed during the process of making collective judgments about the state of the economy. In every FOMC meeting, the committee makes an assessment of the state of the economy in order to generate a policy decision. The system structure captured in the map received the group’s attention while the group was making the assessment.

In this chapter, the value of the map as an analytical tool will be explored. The structural model, or the map generated in Chapter 4, is used to explain the process of building collective judgment in the decision-making group. What is the decision outcome of the February 1988 meeting? Does the map explain the group judgment building process leading to the decision?
There is an assumption underlying the analysis presented in this chapter. As discussed in the literature review in Chapter 2 and in the open coding process in Chapter 4, there are multiple factors influencing the FOMC’s decision choice. Institutional factors, cultural factors, or political factors may influence the group’s decision. However, the assumption made here is that the group’s assessment of the economy also plays a critical role in the group’s policy decision. The study attempts to explain the policy decision by looking at the group’s structural model of the system and their assessment of the system variables.

In Chapter 4, it was proposed that a technique similar to “unfolding maps” in system dynamics will be used for the analytical purposes. The following sections will demonstrate how various parts of the composite map are covered and disclosed in a sequence to show the evolvement of decision-making discussion over time.

6.1 GENERAL ECONOMIC ENVIRONMENT IN FEBRUARY 1988

In October 1987, the U. S. economy experienced a major stock market crash. The extent of the market collapse is shown in Figure 35.

Although the stock market started to recover towards the end of 1987, there was an uncertainty regarding its effect on the economy. In February 1988, the FOMC’s monetary policy decision rested on how the committee would assess the current and the future state of the economy after the stock market crash. Would the economy fall into a recession? Would the economy recover to its pre-October growth rate? If the former was
the case, an expansion of money supply would be preferred in order to stimulate the economy. If the latter was the case, the committee had to watch out for the inflation risk accompanying rapid economic growth. An incorrect assessment of the economy could throw the economy into a greater recession or overheat.

**Figure 35. The Stock Market Crash of 1987**

![Graph showing the S&P 500 Composite Index and Dow Jones Industrial Average from 1/7/80 to 1/7/90, with a notable drop on 1/7/87.]()  

In the previous meeting held in December 1987, the FOMC made a judgment that the economy was not severely hurt by the stock market crash. The committee examined the aggregate demand pattern, and it concluded that both domestic and foreign demands were strong. Based on the assessment, the committee collectively decided that it would
be wise to wait and see how the economy performs rather than taking an immediate monetary action.

The same committee met again in February 1988. Despite the committee’s hope, the uncertainty regarding the effect of the stock market crash was not eliminated, and a sharp rise in the economy’s inventory level caught the committee’s attention. During the meeting, the committee questioned the factors responsible for the rise in the inventory level. The committee had to answer the following questions: Is this a signal that the economy is slowing down due to the stock market crash? Does it mean that the aggregate demand is not as sound as it was expected in the previous meeting? Or does the inventory level signal something optimistic?

6.1.1 Staff Analysis

In each meeting, the Federal Reserve’s staff economists generate an economic analysis that serves as an anchor for the FOMC discussion. Although the verbatim transcript includes the staff presentation in the Appendix, the staff analysis was not coded for this study. While the analysis is rich with structural and numerical information, the analysis is generated outside the FOMC meeting and it is not a part of the group process. However, it plays an important role in setting the scene for further discussion, and therefore, the staff analysis is briefly summarized in Table 11. In the February 1988 meeting, associate economists Prell and Truman made a presentation with special attention paid to the level of inventory in the economy (FOMC 1988a, Appendix).

Different variables in the system serve as indicators for studying the current and future state of the economy. Staff economists at the Federal Reserve select a set of
important economic data and distribute the information to the FOMC before the meeting. This information is called the “Beige Book.” During their presentations in the FOMC meeting, the staff economists once again bring the committee’s attention to some of the important economic indicators. They talk about the behavioral trend of these variables, their expected path in the future, and their implications in the economy. As shown in Table 3, the associate economists Prell and Truman pay attention to the trends of economic variables like production, exchange rate, employment, and government spending.

The observed behaviors of these indicators are knit together with the staff’s mental models of the economic system. The staff economists create causal explanations for what is going on in the economy and what needs to be done for the future. Here is an example:

“While the stock market drop may have played a role, we are inclined to think that the December story for single-family houses is partly one of lagged response to the earlier rise in mortgage rates and partly statistical noise. Recent field reports suggest that the decline in mortgage rates since last fall has revived buyer interest and builder optimism. (…) We expect a near-term bounceback in single-family starts to the 1.1million vicinity. (FOMC 1988a: Appendix, FOMC Chart Show--Domestic Aspects, by Prell, p. 6)
Table 11. Summary of Staff Outlook

<table>
<thead>
<tr>
<th>Variable</th>
<th>Observed/Expected Behavior</th>
<th>Economic Implications</th>
<th>Policy Implications</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>• Expects a slowdown in the annual GNP growth rate to 1.5% in the first half of 1998</td>
<td>• Inventory adjustment slows down the growth temporarily.</td>
<td>Expansion</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>• Expects the GNP growth rate to run about 2.75% after that</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dollar Exchange Rate</td>
<td>• Expects a depreciation</td>
<td>• Export will rise.</td>
<td>Contraction</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Price of imported goods will rise.</td>
<td>Contraction</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Domestic price level will rise.</td>
<td>Contraction</td>
<td></td>
</tr>
<tr>
<td>Employment</td>
<td>• A slowing growth in the last year</td>
<td>• Reduced output level in this quarter</td>
<td>Expansion</td>
<td>3, 9-10</td>
</tr>
<tr>
<td></td>
<td>• Expects a decline in the unemployment rate to 5.75 in 1989</td>
<td>• Possible pressure on wage</td>
<td>Contraction</td>
<td></td>
</tr>
<tr>
<td>Inventory</td>
<td>• A big increase in the last quarter</td>
<td>• May lead to a slow down in production in the first quarter</td>
<td>Expansion</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Accumulation may be due to expected growth in consumer spending and export</td>
<td>Contraction</td>
<td></td>
</tr>
<tr>
<td>Consumer Spending</td>
<td>• Expects 1.5~2% increase in 1988 and 1989</td>
<td>• Reflects a negative effect from the stock market crash, but consumer confidence remains still strong</td>
<td>Contraction</td>
<td>5</td>
</tr>
<tr>
<td>Income</td>
<td>• A deceleration in real income in the last year due to dollar depreciation</td>
<td>• Will restrain consumer spending</td>
<td>Expansion</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Possible pressure building on wage</td>
<td>Contraction</td>
<td></td>
</tr>
<tr>
<td>Housing</td>
<td>• A decline in building and sales since last year, and expects to remain low</td>
<td>• Reflects a lagged effect of a rise in mortgage rate, but will rebound with the recent decline of mortgage rates</td>
<td>Contraction</td>
<td>5-6</td>
</tr>
<tr>
<td></td>
<td>• High vacancy rates for rental, but will rebound slowly</td>
<td>• Reflects less attractive tax environment</td>
<td>Expansion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Construction dropped, but will rebound</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Business Fixed Investment</td>
<td>• A small growth</td>
<td>• Will have a positive effect on GNP growth</td>
<td>Contraction</td>
<td>6-7</td>
</tr>
<tr>
<td></td>
<td>• High capacity utilization rate</td>
<td>• Reflects enhanced international competitiveness</td>
<td>Contraction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• New plant construction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government Spending</td>
<td>• A slower growth at the state and the local level</td>
<td>• Reflects deterioration in the financial position</td>
<td>Expansion</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>• A drop at the federal level</td>
<td>• Reflects a lagged effect of earlier decrease in appropriations</td>
<td>Expansion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Decline in the defense procurement</td>
<td>• Will hold down borrowing in business and household sector</td>
<td>Expansion</td>
<td></td>
</tr>
<tr>
<td>Price</td>
<td>• Expects an inflation</td>
<td>• Due to lower unemployment and wage pressure</td>
<td>Contraction</td>
<td>3, 9-11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Rising capacity utilization</td>
<td>Contraction</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dollar depreciation</td>
<td>Contraction</td>
<td></td>
</tr>
</tbody>
</table>

The observed slow down in the housing sector is attributed to a rise in the mortgage rate. A causal relationship between the housing sector and the mortgage rate is implied in the analysis. It is also implied that there is a time delay in the cause-effect
relationship. By substituting the data on the mortgage rate with more recent data (i.e. “the decline since the last fall”), the causal structure generates a future prospect for the housing market. With the declining mortgage rate, the housing market is expected to recover, and this economic implication leads to a policy implication. The segment of staff analysis on the housing sector suggests that the committee should not implement an expansionary monetary policy. For simplification, it is noted as “contraction” in Table 3, meaning it adds to a pool of arguments supporting a contraction policy or disfavoring an expansionary policy. The final column of the Table 11 notes the location of relevant staff statements in the transcript. This allows a quick reference to the original data source when needed.

Knitting the behaviors of economic indicators with causal structures, the staff economists create a story about the current and the future state of the economy. In the February 1988 meeting, the staff outlook and the policy recommendation can be summarized as follows: Economic growth has been slowed down due to inventory accumulation since late 1987. The inventory accumulation is likely to be a temporary phenomenon, because it is intended by producers who expect an increase in sales. With strong consumer spending and better terms of trade due to the dollar depreciation, economic growth will speed up towards late 1988 and 1989. There is an inflation risk due to high rate of capacity utilization, shifting of resources to export, and an increasing import price. Based on the analysis, the staff recommended a neutral to tightening monetary policy.
6.1.2 The Committee’s Collective Judgment Task

Figure 36 summarizes main economic data available to the committee prior to the meeting. They are inferred from the verbatim transcript of the staff briefing. Other than the dollar exchange rate, all of the data available to the committee are delayed information. The $t^*$ represents the time of the FOMC meeting, which is February 1988. At time $t^*$, the committee does not have sufficient information about the current and the future behavior of the listed variables. The committee must make judgment to fill in the void information. By using data about the past, sharing anecdotes, and knitting the pieces together using mental models, the committee collectively creates a story about the current and future state of the economy.

**Figure 36. Judgment Tasks Facing the FOMC**

- **AGNP**
- **ΔConsumer confidence**
- **Export**
- **Inventory**
- **Business Fixed Investment**
- **Sales**
- **Unemployment**
- **$ Value**

$t^*$: Time of the FOMC meeting
The staff analysis serves as an anchor for the FOMC discussion. The FOMC members often initiate their own assessment of the state of the economy by questioning the staff analysis. During the meeting, the members share their own collection of information and compare their own analysis to that of the staff’s. During this process, the group merges individual mental models and starts to build collective judgment on various issues to manage uncertainty and complexity for the monetary decision making.

In the February 1988 meeting, the main judgment task centers on the level of inventory. In order to correctly assess the state of the economy, the members feel that they need to find out the driving cause for the rising level of inventory. Immediately after the presentation by the staff economists, a committee member raises a question on the inventory issue:

“Mike, the pattern of inventories is pretty critical for the forecast and I think you’ve made an effective case that we are not going to go through what is considered a drastic inventory cycle. But the thing that strikes me is that, really, this is almost the best of all possible worlds in non-farm inventories where there is basically no cycle. And I wonder if it’s more likely that you would have a greater reaction in terms of production than what you’ve shown, in which case we might have somewhat weaker growth in the first half.” (FOMC 1988a: p. 1)

This quote well summarizes the main issues that need to be resolved in this meeting. Would the committee agree with the staff economists that the rising inventory level is not a reflection of slowing production? The group needs to make a collective judgment about the meaning of the inventory at that specific point in time. It is the key
judgment task facing the committee in order to assess the state of the economy and thus generate a monetary decision based on the assessment.

6.2 PROCESS OF BUILDING COLLECTIVE JUDGMENT

Making a decision with one voice is important to the FOMC. The voice inside the meeting may be not so unitary, but to the public, the FOMC wants to portray their perspective with consistency. Each FOMC member comes to the meeting with one’s own assessment of the economy. The assessment is often more focused on one’s local district, supported by rich anecdotes collected at the regional level. During the meeting, the members share these individual assessments, regional data, and anecdotes. In the process, the FOMC as a group generalizes the assessment to the national level and shapes its policy position preferably with a consensus.

However, the FOMC’s discussion does not progress in a clear sequence of convergence. The members share a wide variety of information—almost in a brainstorming fashion—that can help with the group’s collective judgment tasks. Rather than carefully selecting information that only supports one’s policy preference, the FOMC members share information and structural hypotheses that may argue against one’s own policy position. They eagerly play the role of devil’s advocate to find weaknesses in their collective assessment of the economy.

Rather than showing the progression of the discussion in the time sequence, the judgment building process is organized by the sectors of the economy that the group
discusses. The division of economic sectors used in this study is more like a grouping of discussion themes, and it may not be consistent with the economic sector concepts in economics.

6.2.1 Inventory Sector

The stock-and-flow dynamics of inventory is introduced in Chapters 4 and 5. What concerned the committee in the February 1988 meeting was the unusually high level of inventory in the economy. In Figure 37, it is represented as the level of the inventory stock. The level of stock increases when the rate of inflow is greater than the rate of outflow. In this case, the level of inventory increases because the rate of production is greater than the rate of shipment. The main judgment task facing the committee is to decide whether the inventory accumulation is mainly due to the increasing rate of production, or the slowing rate of shipment, or both.

![Figure 37. Possible Causes of Inventory Accumulation](image)

It is interesting to note the inventory accumulation due to the increasing production rate is associated with a prospering economy, while the inventory
accumulation due to the decreasing shipment rate is associated with a downturn in the economy. The former situation is referred to as a “planned” inventory (FOMC 1988a: p.1), and the latter is referred to as an “inventory overhang” (FOMC 1988a: p.1, 43) or an “inventory recession” (FOMC 1988a: p.43).

The first step in identifying whether the current situation is a planned inventory or an inventory overhang is to look at the order pattern. Greenspan says, “Every inventory recession that I’ve ever experienced—and I’ve seen an awful lot of them—was signaled first in the order books before anything else” (FOMC 1988a p.43). Order is a stock with an inflow of new orders and an outflow of order fulfillments. When an order is placed, the shipment is made, and the order is fulfilled. The relationship is shown in Figure 38.

**Figure 38. Orders and Inventory**

![Orders and Inventory Diagram](image)

The order represents the economy’s demand side. It is important, because it signals to the producers how much they should produce. This is represented in Figure 39
as “desired inventory.” The producers adjust their desired inventory level according to the orders they receive. If the desired level is higher than the current inventory level, the producers slow down the production rate (i.e. the Path 1 in Figure 39). If the desired level is lower than the current inventory level, the producers speed up the production rate (i.e. the Path 2 in Figure 39). This goal-gap structure, especially the former situation with the unwanted inventory, is frequently referred to as “inventory correction” or “inventory cycle” in the data.

The inventory correction seems to be happening in both ways. Some argue that there is an excess level of inventory in the economy and the inventory correction is likely to slow down the production. For example:

“MR. STERN. As far as the national economy is concerned, I guess my own view is a little less optimistic than the staff’s, mainly because I think the first half is going to be
a bit weaker. My intuition is that the inventory correction might be more significant than they’re predicting.” (FOMC 1988a: p.17)

“MS. SEGER. I guess my main difference with the staff forecast involves the inventory situation. Because I am more pessimistic about whether or not the current levels are considered excessive or right on, that makes me have a different point of view about what’s going to happen to them.” (FOMC 1988a: p.20)

Their judgment is that the Path 1 in Figure 39 is dominant over the Path 2. However, there are others who argue against the dominance of the Path 1. They believe the inventory problem is not as severe. For example:

“MR. BOEHNE. I do not sense any excessive concern about inventory buildup.” (FOMC 1988a: p.13)

“MR. MELZER. I don’t get the sense of an inventory problem in terms of general merchandise. Where I pick that up is more in talking to people in areas like furniture, consumer durables, appliances. I sense that this is not a problem yet that has spilled back into the production cycle. People have not changed production plans based on this, partly because of order backlogs and the like.” (FOMC 1988a: p.17)

“MR. BLACK. Several people have indicated that they think the weakness in the first half, as a result of the inventory correction, may be greater than the staff is projecting. Most of my colleagues at Richmond share that feeling. My feeling is that the staff has it about right.” (FOMC 1988a: p.18)

“MR. JOHNSON. You don’t see the kind of forces at work right now, it seems to me, that would lead to the kind of classic inventory correction that some people get hysterical about.” (FOMC 1988a: p.27)
“CHAIRMAN GREENSPAN. In my mind, when I look at this particular outlook, as I sort of indicated in my views yesterday, it’s very difficult to find the inventory weakness, or inventory recession, out there.” (FOMC 1988a: p.43)

Yet, other members provide anecdotes supporting the producer’s anxiety over the inventory shortage. They suggest the Path 2 may be active in the economy. For example:

“Mr. Parry. We conducted surveys of retailers about inventory levels and it was a bit surprising to us that they were generally satisfied with their inventory levels: and as many indicated that they had shortages as indicated that they had excessive levels of inventories. In the auto area, there’s no question that at year-end auto dealers had high inventories. But a more recent check at the end of January indicated that that was pretty well rectified. Based upon what we’ve seen there are few signs, if any, that the Twelfth District had weak consumer spending or excessive inventories. However, there’s no question that the numbers for the national level indicated excessive inventories in the fourth quarter.” (FOMC 1988a: p.14)

“Mr. Black. Some of the manufacturers that we talk to report that they’re adding to inventories strictly as a precautionary measure, as delivery times lengthen and capacity pressures intensify in their industries. That’s particularly true for paper and textiles, and this of course reflects the improvement in the tradeable goods area.” (FOMC 1988a: p16)

Overall, the committee’s judgment on the causes of inventory accumulation is quite mixed. While the committee found the evidences for both planned inventories and inventory overhangs, there seems to be more support for the voluntary buildup of inventories. In order to get a better sense of the inventory situation, the committee’s
discussion moves over to other relevant parts of the economy associated with the inventory.

6.2.2 Domestic Demand Sector

Like Greenspan, a number of members pay close attention to the order and sales trends in the economy. These indicators represent the demand side of the economy. They inform the committee whether the economy has strength to deal with the inventory overhang or if it is heated enough to induce the producers to stock up the inventory. The anecdotes that the members bring generally support strong demand in the economy. For example:

“MR. PARRY. Currently available information indicates that retailers experienced a 5 percent growth in nominal sales in the final three months of the year versus the same period in 1986.” (FOMC 1988a: p.14)

“MR. STERN. I think retail sales, in general out our way, have been better than expected.” (FOMC 1988a: p.17)

“MR. FORRESTAL. A lot of the manufacturers are also reporting backlogs of up to six to seven weeks in orders.” (FOMC 1988a: p.16)

“MR. MORRIS. I looked at those new orders figures for December, and not only were they exceptionally strong, but the fact that they were that strong two months after the stock market crash suggests to me that our manufacturing sector is really going to be on a roll in the first half of this year.” (FOMC 1988a: p.35)
Few other related variables are discussed in the meeting (See Figure 40). One is delivery delay. As explained in Chapter 5, the delivery delay variable captures the gap between the orders and the available inventory. If there are more orders than that can be fulfilled, then it would take longer for the orders to be filled. Another related variable is service quality. If the producers are selling out their products, they are less concerned about their service quality. For example:

“MR. BOEHNE. People tell me that the steel industry is not as friendly as it once was: they don’t answer their phone as readily: the shipments from steel companies are slower: and in some cases, they aren’t filling orders completely.” (FOMC 1988a: p.13)

“MR. KEEHN. In the steel industry, I think there has been almost a spectacular turnaround, with the industries—certainly in our area—operating at very, very high levels. Delivery schedules are being lengthened out, and we are hearing increasing comments about price increases, and this time they’re sticking.” (FOMC 1988a: p.15)

“MR. FORRESTAL. A lot of the manufacturers are also reporting backlogs of up to six to seven weeks in orders.” (FOMC 1988a: p.16)

Keehn’s statement above also suggests that the structure generating the delivery delay is causally associated with the capacity utilization and the price level. This will be further expanded in the following sections.

While the majority supports the sound demand pattern in the economy, there are few anecdotes supporting the opposite. For example:

“MR. MELZER. I guess more importantly, for where we are now in terms of discussing anecdotal information, the sense I get from a major national retailer is that there is some disappointment with their sales performance. There is improvement in
relation to last year, but probably not as much as was being targeted.” (FOMC 1988a: p.17)

“Mr. Black. We have reports of heavy inventory accumulation, particularly at the retail level. There are some indications that wholesalers of consumer goods are starting to use incentives and promotions to generate greater retail orders.” (FOMC 1988a: p.16)

**Figure 40. Indicators of the Demand Trend**

6.2.3 Foreign Demand Sector

During the FOMC’s discussion on the inventory and the order pattern, a number of committee members suggest that they should isolate the foreign demand sector from the domestic demand sector. For example:
“MR. MORRIS. There’s also this issue that was stressed earlier—that we don’t know how much of the durable goods orders are from domestic origins and how much from foreign. It seems to me that we, as an institution that works on these data—perhaps you [Mr. Chairman] might use your good offices to try to see if we could expand this kind of differentiation in the data, because I think we are going to need it in the future.”

(FOMC 1988a: p.22)

The distinction between the foreign demand (i.e. the export demand) and the domestic demand is captured in the map as shown in Figure 41. The distinction is needed, because it helps the committee identify the source of strength in the order trend and to predict whether the trend is likely to continue in the future. In the following quote, Greenspan emphasizes the need to tease out the foreign orders to avoid bias in the order figures:

“CHAIRMAN GREENSPAN. You know, Mike, there is a problem with the new orders series, in the sense that these are orders placed at domestic facilities. And a very big part of the strength is in aircraft orders, a substantial part of which has to be for exports and long forward 1989-1990 deliveries. There’s an awful lot of export demand in those numbers as well as, probably, some tilting down in the proportion of imports to domestic purchases. So we probably are getting an upward bias in both the non defense capital goods shipment figures and the orders figures. I would suspect that when one makes the types of adjustments on exactly those numbers, one comes out very close to where Mike’s numbers are coming out.” (FOMC 1988a: p.3)
The committee perceives the export demand to be strong, and many expect the export pattern will support the economic growth in the future. For example:

“CHAIRMAN GREENSPAN. We have no evidence of that. What we get is that there is very strong export demand, orders coming in.” (FOMC 1988a: p.3)

“MR. PARRY. And then, since we think that correction is likely to be completed by midyear, our forecast in the second half is for growth of a little over 3 percent, largely on the strength of that improving net export position.” (FOMC 1988a: p.14)

“MR. BOYKIN. However, our manufacturing continues to show signs of improvement, and that’s mostly related to the lower dollar, of course.” (FOMC 1988a: p.19)

As in the quote above by Boykin, the committee talks about the sources of the strong export demand. The depreciation of the dollar is thought to be the main source. By improving the price competitiveness of U. S. produced goods, the dollar depreciation not only increases the foreign demand for domestic goods (Figure 42), but also increases the domestic demand for domestic goods (Figure 43) as suggested in the following quote:
“SPEAKER (?). You mentioned it and I’ve heard it elsewhere. And that is that some of the accumulation in retail inventories was planned--was desired in effect—to beat higher prices for imports.” (FOMC 1988a: p.1)

**Figure 42. Exchange Rate and Export Demand**

![Diagram of Exchange Rate and Export Demand]

**Figure 43. Exchange Rate and Domestic Demand**

![Diagram of Exchange Rate and Domestic Demand]
While the export demand benefits from the exchange rate, the committee also believes the trend is due to the sound economic situations in the partner trading countries. This raises a red flag to a few FOMC members. They are worried that the optimistic economic forecast based on the strong export demand has a risk of relying too much on the foreign GNP trend. For example:

“MS. SEGER. I have a final question on the estimate for real GNP in the other G-10 countries running below our forecasted real GNP growth in each year—1988 and 1989. That makes me wonder about our export boom, and whether or not that, in fact, can materialize to the extent we are talking about.” (FOMC 1988a: p.9)

“MR. FORRESTAL. I was going to ask Ted Truman the same question that Governor Seger raised with respect to real growth abroad. I guess Ted has basically answered the question, but if I could take it just a step further: Since this is basically an export-driven forecast, if countries like Germany and France and Italy, particularly Germany, which has not been very responsive to our overtures, were to fall short—I don’t mean into recession but short of the growth patterns we expect—is this forecast in serious trouble? I guess I would add that, given the weight of our trade with Japan and Canada, they apparently could carry a lot of it: and I wouldn’t expect them to fall very short. But suppose those other countries did, would you expect the forecast to come—

MR. TRUMAN. Well, I wouldn’t want to suggest that the difference between 2 percent growth and zero wouldn’t have an effect on our forecast. It would be something on the order of [unintelligible]. If you had 1 percent lower growth throughout this period in G-10 countries, we would say it could produce something like $13 billion, at an annual rate, lower growth of exports in the fourth quarter of 1989. That would be next year against this year. That would have a considerable impact on the forecast. That’s relatively small, but it would be noticeable in terms of our output, especially to the
extent that in some sense you have so much external stimulus—one thing that the
forecast itself doesn’t completely recognize. In a sense we have export-led growth here,
and some of the income out of that is being driven by that growth, and so you have
multiplier effects.” (FOMC 1988a: p.11)

The structure discussed above is represented in the map as shown in Figure 44.

![Figure 44. Foreign Economy and Export Demand](image)

The depreciation of dollar promotes both domestic and foreign demand, and puts
price pressure in the economy by increasing the rate of production. The relevant structure
will be discussed in the following section with capacity utilization. Another way that the
depreciation of dollar puts pressure on price is through the import price, as the following
quote suggests. The structure is described in Figure 45.

“MR. ANGELL. I’m becoming worried that we have been in a period of exchange rate
adjustment, with some import price increases, for long enough that it’s going to be very
difficult for us to go much longer without having a permanently higher inflation rate—
one that’s just not acceptable. It seems to me that it is important for us to be on guard
in that regard.” (FOMC 1988a: p.26)
Overall, the committee sees many positive signs in the demand sector, especially from the international aspects. However, the committee is concerned about the price pressure that may result from these activities. On the more conservative side, the committee is worried about situations where foreign economic growth may not sustain the trend of the strong foreign demand.

6.2.4 Supply Sector

There are proxies for estimating the economic performance and price pressure from the producer side of the view. Capacity utilization is the one of the most frequently used economic indicators. It represents the percentage of production capacity being used in the economy. It producers want to produce more, the capacity utilization increases. However, the production rate is limited by available production capacity. Having greater capacity for production lowers the capacity utilization rate. In other words, it represents how much slack resource the economy has. When there is not enough slack resource, it creates pressure on the price level. The structure is described in Figure 46. The
relationship between capacity utilization, production rate, and the price pressure can be found in the following quotes from the data:

“MR. PRELL. In terms of overall resource utilization: to have anything significantly slower than the GNP growth we have would basically bring about some greater degree of slack. It is conjectural whether we have precisely captured the desires of the Committee, but ultimately, we ended up with a forecast that sort of gave you about as much growth as we think you can get without putting enough pressure on the economy to get a real momentum developing in the inflation process.” (FOMC 1988a: p.2)

“MR. PRELL. We think there will be areas of significant strength, and I’ve tried to relate that to those areas of capacity utilization.” (FOMC 1988a: p.3)

“MR. BOEHNE. People tell me that they have seen this kind of situation before where they can’t get parts, and demand is strong, and price increases seem to come through, and that that usually is a leading indicator for some downturn. But things seem to be going very well currently.” (FOMC 1988a: p.13)

**Figure 46. Capacity Utilization and Price Pressure**
The FOMC members come up with many anecdotes of high capacity utilization rate. While these cases raise the group’s concern about the inflation risk, some members argue that the risk may not be so severe, because the industry has been making capital investments. The effort to increase the production capacity is expected to alleviate the bottleneck causing the price pressure.

How a high rate of capacity utilization can induce producers to invest in the production capacity is described in the following quotes. The structure is shown in Figure 47.

“MR. KEEHN. [I want to address] the capital expenditure issues that Frank Morris and Bob Black raised in a different way. Looking at the utilization rates on chart 7, some of these rates are getting pretty high. And I guess the question is: What does history tell us? When do industries, particularly textiles, chemicals, paper, and steel, which are operating at very high levels—and those are averages for each industry, which suggests that some are operating at higher levels—begin to move? At some point they’re going to begin to lose market share. And my experience is that market share is a very sensitive issue; when they hit that point they begin to spend some money. Does history tell us anything about that?” (FOMC 1988a: p.9-10)

“MR. PRELL. Well, I don’t think history identifies clear trigger points. Indeed, econometrically, our efforts to identify capacity utilization effects on investment turn up only modest positive results on that score. We tried to look beyond any econometric evidence, and sift through what stories we could find and conversations with people, I think there is something, as I indicated, to the story of some hesitancy on the part of some companies to expand capacity aggressively. But on the other hand, we can also uncover stories that, yes, at some plants operating at high levels of capacity, capacity is
being expanded by removing bottlenecks. We are expecting some fairly sizable gains in paper and chemicals.” (FOMC 1988a: p.10)

“MR. KEEHN. We talked about machine tools a little earlier, but one of our directors operates a very large machine tool company and they are operating at an 80 percent rate: they are enjoying the best quarter that they have had since 1982. The import penetration of machine tools, at least from their perspective, is down significantly and they think the Japanese are on a conscious program to try to curtail their exports to the United States. In the steel industry, I think there has been almost a spectacular turnaround, with the industries--certainly in our area—operating at very, very high levels. Delivery schedules are being lengthened out, and we are hearing increasing comments about price increases, and this time they’re sticking. The paper industry--I mentioned that a moment ago as well—is operating at rates over 90 percent, and I am hearing more noise that they’re getting into capital expenditures.” (FOMC 1988a: p.15)

Figure 47. Capital Investment and Price Pressure
Is the capital investment actually taking place? The anecdotes collected by the FOMC members show mixed signs. The following are positive cases supporting the investment trend:

“MR. MORRIS. I have two questions. Mr. Chairman. One, the part of the forecast I have a problem with is business fixed investment. [Given] sustained strength in the manufacturing sector, except maybe in automobiles, the staff is showing the manufacturing industry operating at higher levels of capacity. That is going to produce, unfortunately I think, some price strains as the year goes on. The staff projection shows a deceleration in business fixed investment against last year. Now, I find that hard to reconcile not only with normal cyclical patterns but also with the orders figures for the past four months. The projection has real plant and equipment spending up at a 2.9 percent annual rate and nondefense capital goods up at a 3.5 percent annual rate. These are unusually strong increases.” (FOMC 1988a: p.2)

“MR. PARRY. One of the things that I think is interesting is that real plant and equipment expenditures were weak in September and October, and actually picked up in November and December.” (FOMC 1988a: p.14)

On the other hands, there are anecdotes that suggest a different picture. The following are a few statements that are skeptical of capital investment:

“MR. PRELL. On the other hand, there are other areas in this economy, if we are right about the overall level and pattern of demand, where the stimulus to investment will not be as great. Obviously, in the financial sector, which is shrinking, they probably are not going to be buying as many computers and other office equipment. Demand for office space may be lower. There are drags in a number of sectors of business fixed investment as we see it: the office area in general, hotels, and probably areas that we
have missed in other commercial construction.” (FOMC 1988a: p.3)

“MR. FORRESTAL. A lot of these manufacturers are also reporting that their uncertainty about the dollar is causing them to hold back on some business fixed investment or capital expenditures. They got burned at the time that the dollar was very high and they’re reluctant to go into a lot of expensive business fixed investment at the moment.” (FOMC 1988a: p.16)

“MS. SEGER. I also think that housing is going to be somewhat weaker in the first half. Also some kinds of construction such as office buildings and shopping centers, those sorts of things, I think are going to be weaker than maybe is implied by the forecast.” (FOMC 1988a: p.21)

In order to determine whether the inventory level in the economy is an unwanted buildup or a voluntary decision, the FOMC needed to make a collective judgment about the strength of the economy’s demand sector. There were mixed signs of a strong demand and a weak demand depending on the industry that they examined. To resolve the uncertainty, the FOMC looked at the capacity utilization. Anecdotes supporting the high level of capacity utilization suggested that the economy’s demand is solid and the producers want to produce more to meet the demand. Does the economy have enough production capacity to meet the strong demand pattern? This raised the FOMC’s concern about inflation risk. The committee then examines anecdotes to see whether there are evidences of capacity investment. Capacity investment would relieve some of the price pressure that comes from the limited production capacity. As shown in the quoted data above, the committee finds mixed evidences of willingness to invest in the capacity. What should the committee do?
6.2.5 Financial Sector

Another major sector that plays an important role in the February 1988 meeting is the financial sector. As the economy recovers from the stock market crash of October 1987, the FOMC decision makers pay special attention to the sentiment in the financial sector and its implications in the manufacturing sector and consumer spending.

The first judgment the committee has to make is whether the economy got over the after-effects of the stock market crash. The data at the time of meeting support that the effects are over, as stated by the staff economist Prell in the following:

“MR. PRELL. We surmised from that, and everything else we could look at, that probably the stock market psychological effects were not as great as we might have feared they would be.” (FOMC 1988a: p.8)

The strong performance in the manufacturing sector and the sound demand pattern also supports the economy is unlikely to go into a recession with the stock market crash. However, the committee still feels that the financial sector is vulnerable. For example:

“MR. STERN. I also think we probably have not yet seen the effects of the stock market decline. I think that’s coming. (…) So, I think we have to be prepared for a certain amount of bumpiness as we go forward.” (FOMC 1988a: p.17)

“MR. BOYKIN. Anecdotally, I’ve had two or three business people visit with me from our small business advisory group, and they are concerned because they don’t feel that our financial institutions are in a position to meet their credit needs. This is a drag in terms of the credit that they need to move along. I think in many ways our business
people are more optimistic, but the timidity of the financial people to make loans is a real concern.” (FOMC 1988a: p.19)

“CHAIRMAN GREENSPAN. However, I must say that I pretty much agree with what Jerry Corrigan has been saying--namely, that if there is a problem out there, it’s in the financial area. And I must say to you that I’m bothered by this. We had a major shock in October and we seem to have temporarily come out of it. But the stock market, by anybody’s measure, is not low: it’s hanging up there. While a lot of the yield spread abnormalities have come down, it is still a very unstable situation. What’s concerning me is that there is a vulnerability out there which is continuing to heal but is not healed yet.” (FOMC 1988a: p.43)

More specifically, the high rate of savings is what caught the committee’s attention. High rate of savings means that people spend less, which is not a favorable economic sign. The following are the quotes that bring up the savings issue to the committee:

“MR. JOHNSON. I agree with what Jerry said—there has to be an external adjustment to get that [outcome] and we can’t let aggregate demand surge on us and waylay the trend that is developing now. But at the same time, we can’t afford a plunge in real spending. I think our whole scenario hangs very fragilely on the saving rate/consumption issue and how real income develops.” (FOMC 1988a: p.27)

“CHAIRMAN GREENSPAN. On the downside, there are two or three things that pop into my mind. One is the saving rate that was talked about yesterday. In that area, again, consistent with this trajectory argument, I think that we should not resist—indeed, we should welcome—a mild and modest updrift in the saving rate. That is one of the things that has to happen as a part of this larger adjustment process. On the other hand,
clearly, if the saving rate were to take a leap up, that, in turn, would imply a pattern of consumption spending that could well be associated with a recession. But I ask myself what could produce a leap in the saving rate rather than a drift. And the generic answer I get is something that shakes confidence. And of the things that enter my mind that can shake confidence, the one that still rings loudly is the financial sector—not necessarily the stock market in the first instance but some kind of further disruption on the financial side. Clearly, there is a risk there.” (FOMC 1988a: p.31)

The structure mentioned in above quotes is described in Figure 48. The financial market can shake the market confidence, and this can increase the saving rate. Greenspan believes a little increase in the saving rate is desirable, but if it is too high, it can damage consumption spending and slow down production.

**Figure 48. Financial Market and Consumer Spending**

![Figure 48. Financial Market and Consumer Spending](image-url)
The staff economist Prell thinks the saving rate is not unusually high. He gives a reason why the saving rate might appear high in the data and why it is not a great risk factor. However, he also agrees that if the saving rate becomes too high, it can pose problem with the consumer spending pattern. The following quote summarizes Prell’s position:

“MR. PRELL. As we view the saving rate question, I think picking out the first quarter probably overstates what we would perceive to be the movement in consumer behavior. The fourth quarter had a very big increase in farm subsidies, and farm proprietors’ income was up very sharply. We think that group tends to have a comparatively low marginal propensity to consume, so that tended to boost the saving rate. We may also have a somewhat similar phenomenon in the first quarter, with a big increase in government transfer funds from the social security COLA (Cost-of-living Adjustments) increase. Unless that is spent very rapidly, we would tend, in the short run, to have a slightly higher saving rate. (…) If one looks at the average saving rate for this year versus the average for last year—let alone what it was in the middle couple of quarters last year versus this year—I think there’s a noticeable increase in the saving rate. And it’s one that we do view as being generally consistent with the kind of wealth effect that we are building in from the stock market. Crudely, the general model results would suggest that you might get something on the order of a 1 percent higher saving rate for a period of time—well, there would be a gradual adjustment to that. I think we have some reasonable comfort with the range we’re showing—tailing off next year, as it came out in our forecast. We can’t really provide any particular explanation for it. The saving rate is to some extent a residual in the forecasting process, though it’s a check. We don’t view it as a really significant movement from what we see in the latter part of this year to the latter part of next year. But if consumers do retrench, and they’re a very big segment of the economy, then it would take a substantial offsetting
action of some sort to keep the economy on the same track. So, in that sense, it is really crucial.” (FOMC 1988a: p.12)

Since the saving rate is negatively associated with the spending pattern, anything that can “updrift” the saving rate is to be avoided. Greenspan and a number of committee members worry that any tightening policy may bring instability in the financial market as shown in the following quotes:

“CHAIRMAN GREENSPAN. And I’m basically concerned, in a way which in fact Governor Seger raised, that if we were to indicate that we were tightening, the shock to the markets I think would break the stock market and create some real problems. Yet one can easily argue that we can break the market by being too easy or too tight.” (FOMC 1988a: p.43)

“MR. ANGELL. I share your view, Mr. Chairman, that the financial markets do have some fragility to them. Given the circumstances we are in, I think it’s rather dangerous to be in a position of tightening credit at all. I’m not comfortable with even a small step towards tightening.” (FOMC 1988a: p.63)

In addition to the factors mentioned above in terms of the demand sector, the supply sector, and the financial sector, there are other areas in the economy discussed in the FOMC meeting as important information cues for judging the state of the economy. These can be found in the composite map generated in this study. The data source relevant to the specific parts of the map can be traced using the Conversation Identification Numbers (CIN), the Map Identification Numbers (MIN), and the Data Source Reference Table provided in the Appendix.
6.3 COLLECTIVE JUDGMENT AND THE POLICY DECISION

In the February 1988 meeting, the committee examines various parts of the economy to get a sense of the current state of the economy. The committee lacks the most up to date information about the economy, and due to the complex nature of the system, there are many uncertainties and unknowns. In order to make a monetary policy decision, the committee has to collectively build judgment to fill in the missing pieces. In the previous section, the process of building collective judgment is described using the data and the map structure elicited from the data. It shows how members bring in different anecdotes and weave a story together using their mental models. The anecdotes are not always consistent. They are not scientifically proven data. However, they do give the committee some sense about the most up-to-date view of the economy.

6.3.1 Collective Judgment on the State of the Economy

After all this discussion, what is the collective judgment made about the state of the economy?

With the exception of few members, the committee generally agrees the economy is in good shape. Consumer spending is strong, and fueled by the dollar depreciation, the export is doing well. As a result, the producers are getting orders at a rate that they feel a need to increase their inventory. There are order backlogs and delivery delays. The producers want to increase their production rate, but with the high capacity utilization rate, there is a cap on how much they can produce. This is generating a price pressure in
the economy. There is evidence of capacity investment, but it is not clear whether it is enough to alleviate the price pressure.

The committee feels that the risk of inflation is greater than the risk of economic downturn. This would require the committee to implement a tightening policy. However, the committee is worried that the tightening policy might disturb the financial market and adversely affect the consumer spending.

Reaching the collective judgment about the state of the economy, the committee needs to make a policy decision. The collective judgment process may have reduced the uncertainties facing the committee, but it does not guide the group to an easy, clear-cut solution. What should the FOMC do?

6.3.2 The Monetary Policy Decision from the February 1988 Meeting

At the February 1988 meeting, the FOMC is faced with two decision tasks. The committee needs to decide the short-term operating target and the long-term monetary objective. The short term policy alternatives recommended by the staff economists are given in the Blue Book. The alternatives are summarized in Table 12.

<table>
<thead>
<tr>
<th>General Direction</th>
<th>Borrowing Objective</th>
<th>Federal Fund Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policy A</td>
<td>Easing</td>
<td>$ 100 million</td>
</tr>
<tr>
<td>Policy B</td>
<td>Current Status</td>
<td>$ 250 million</td>
</tr>
<tr>
<td>Policy C</td>
<td>Tightening</td>
<td>$ 450 million</td>
</tr>
</tbody>
</table>
In determining the need for an open market operation, the FOMC uses operational targets. With the changing financial environment, the variable used as the target has been changed over the history of the Federal Reserve. During 1988, the borrowed reserve was used as the target. In the February 1988 meeting, the borrowing objective of $250 million (Policy B) is considered as the status-quo policy. With the borrowed reserve level, the federal fund rate of 6½ ~ 6¾ percent is expected. Policy A implies an easing policy, and Policy C implies a tightening policy.

With each policy, the committee can use “tilting language” in the policy directive. The language hints to the public the direction the committee intends to move in the future. For example, the directive might say, “somewhat lesser reserve restraint would be acceptable depending on the situation such as …,” to signal to the public that the committee is inclined to ease the money supply if necessary: It is a tilt towards easing. Likewise, the directive may tilt towards tightening by including the possibility of a “somewhat greater reserve restraint.” Sometimes the committee uses symmetric language, trying to signal its neutral position.

In the February 1988 meeting, the committee unanimously decides that they want to maintain the current level of reserve pressure. The members agree that there is a risk of inflation and they do not want to trigger the expectation for inflation. On the other hand, they all feel the need to assure the public on the financial market stability. The FOMC does not want give an impression to the public that they are going to contain the economic growth by tightening the money supply. According to the discussion of the group, tightening the money supply would hurt consumer spending behavior.
The FOMC votes for Alternative B, but they consider two different versions of it. One option is to include a tilt towards easing in the directive. The other is to set the borrowing target at $200 million but have a symmetric language. The latter would be a slight easing policy. The committee unanimously decides to go for the second option.

While they voted for a slight easing in the short run, the committee believes the economy is heated and the inflation risk must be checked. Not wanting to give an impression that the FOMC is committed to a long term easing attitude, the committee decides to take a slight tightening attitude toward their long term policy.

6.4 SUMMARY

In Chapter 6, the map elicited in the previous chapters is used to explain the FOMC’s collective judgment building process. The map describes the structure of the system collectively perceived by the decision-making group and is discussed during the February 1988 meeting.

In order to make a monetary decision, the FOMC needed to make various judgments to address uncertainties and unknowns in the economy. To assess the state of the economy, the group combines the available information with their model of the system. As a group, they weave together a story that explains what happened to the economy, what is happening, and what is going to happen. Their final policy decision is based on the process of building collective judgment.
This chapter described the process by showing how the structural model of the economy represented by the map is integrated with the anecdotes in the data. The group’s assessment of the economy starts with the high inventory level in the economy. The members bring in various anecdotes to judge whether the inventory is something that the producers intended or not. While the domestic demand show mixed signs, the committee finds out the export sector is quite strong. The high rate of capacity utilization in the economy also supports the theory that the inventory is planned, and this raises the committee’s concern about the price pressure. There are efforts to alleviate the pressure, but there are also evidences against it. The committee worries about the risk of inflation, but the members also believe that any disturbance in the financial market can deteriorate the consumer spending.

The collective judgment leads the committee to implement a slight easing policy in the short run so that the economy has time to fully recover from the recent stock market crash. However, to communicate the FOMC’s intention to control inflation to the public, the committee gives an impression for a tightening move in the long run.

The map elicited in this study is a tool to represent the group’s structural model of the system, but it is also used as an analytical tool to link the data to the model and to show how the collective judgment is created. The explanation of the decision-making process provided in this study is different from a story telling, because it is systematically elicited from the data.

The discussion provided in Chapter 6 demonstrates how a group’s decision-making process can be explained using the qualitative map grounded in the data. It also
explains the monetary policymaking in practice, especially the decision made in the
February 1988 FOMC meeting.
CHAPTER 7
CONCLUSION AND DISCUSSION

This study presents a systematic method to elicit a qualitative map from raw data. The map describes the decision makers’ collective model of system structure, and is used to explain how the group builds a collective judgment and generates a policy decision. In the final chapter, methodological and theoretical implications of this study will be discussed as well as the evaluation criteria for the map and the possibility of future research agenda.

7.1 INTEGRATION OF TWO DISCIPLINES

This study integrates the coding and mapping methods from grounded theory and system dynamics. The positivistic and interpretive perspectives of system dynamics open up diverse possibilities of interdisciplinary collaboration with different fields. Grounded theory is also very favorable toward interdisciplinary collaboration. While grounded theory lays out a framework for systematically discovering theories from data, the field is very flexible in terms of the specific use of the coding techniques. Grounded theory is also very open to different theoretical lenses.

The benefits of the methodological integration were hard to be overlooked by a system dynamics modeler who came across grounded theory while studying
organizational culture. However, if this new attempt to integrate the two methods is found to be useful, it is necessary to refine the method through further application and discussion. In this regard, it is important to explore more explicitly the value of the method and challenges it could face.

7.1.1 Benefits

The benefits of using an integrated method have been discussed throughout this study. First, the map developed in this study captures an artifact of a group process in the “product” form, but can be used to explain the “process” like a narrative tool. This is possible because the system dynamics mapping language is used with the ethnographic process of the map generation. The map of this study collects pieces of mental models observed during the decision-making process. The focus of the map is not on the description of the system structure but is on the process of generating a shared view. The map tracks how the group reaches a policy decision after building a series of collective judgments on various policy-related issues.

Second, the mapping provides a handle to organize and analyze qualitative data. It sifts the topic of interests in the data, and provides a big picture of what has been discussed and how they are related. In this study, the topic of interest was how the decision makers perceived the economy. The system dynamics mapping language was a useful tool in describing how the structure of the economy appeared in the decision group’s discussion. Such map has many possible ways to generate analytical insights. For
example, the map in this study was used to show what parts of the system structure received more attention during the meeting.

Third, by grounding the map in the data, the data gain more voice as opposed to the researcher. The process of transcribing and coding the data controls what is captured in the map. While the methodological lens and the researcher subjectivity inevitably influence the content of the map, one can be more clear about where and when such influence come into play.

Finally, by linking the map tightly with the data, it leaves a trace of how the coder interpreted the data. Interpretation of the data is a subjective process, and the documentation of the process allows others to understand the coder’s perspective on the data. This opens up a possibility of further examination and discussion of the study result.

7.1.2 Challenges

Grounded theory and system dynamics are both more than just research methods: They have own philosophical and theoretical perspectives. Their unique ways of looking at the world add value to the research that employs their methods. By adopting their methods, this study also integrates the worldview embedded in their methods. In this study, the interdisciplinary integration only took place at the level of methods. The integration barely took place at the philosophical or theoretical level. Therefore, the first challenge is to identify and resolve conflicts in the philosophical and theoretical assumptions caused by the methodological integration.
The second challenge involves the question of where this study belongs. The method developed in this study is used for a research purpose quite different from its disciplinary origins. In grounded theory, coding is used to discover a theory. In system dynamics, mapping is used to conceptualize the decision maker’s mental model of the system. In this study, the map is used to explain the collective judgment building process. As a result, the output of this study hangs uneasily between the two disciplines.

The third challenge involves the testing of usefulness of the method in other decision settings. Can this method be used for other decision groups explaining their collective judgment building process? If not, what are the necessary conditions to use this method? The FOMC in this study poses a very unique decision environment. The FOMC is an elite policymaking group composed of members who have relatively similar educational and professional backgrounds. The FOMC actively pursues a consensus in decision making. If the interdisciplinary method developed in this study is not replicable in other decision areas, it must be identified as to what makes the method applicable to the FOMC case.

Finally, it must be noted that there are other existing methods of mapping and coding than the ones used in this study. A challenge is to explore collaborative opportunities with other disciplines for further methodological development.
7.2 EVALUATION CRITERIA FOR THE MAP

What are the criteria for evaluating a map generated using the method developed in this study? The qualitative nature of the map suggests that it should be evaluated with the criteria in qualitative research.

7.2.1 Evaluation Criteria in Qualitative Research

There is a diverse perspective as to what should constitute evaluation criteria for qualitative research. Kirk and Miller (1986) suggest that the reliability and validity criteria from the positivist paradigm are applicable to qualitative research, although they are attained through different procedures. However, many qualitative researchers feel that applying evaluation criteria from the positivist paradigm to qualitative research is not appropriate (Lincoln and Guba 1985; Maxwell 1992). The evaluation criteria in qualitative research is not the criteria for testing the research results, but are more like a quality of integrity that is to be “assessed relative to purposes and circumstances” (Brinberg and McGrath 1985: p.21).

As alternative criteria for qualitative research, Lincoln and Guba (1985) suggest credibility, transferability, dependability, confirmability, and authenticity. Maxwell (1992) also proposes five criteria: descriptive validity, interpretive validity, theoretical validity, generalizability, and evaluative validity.

Stauss and Corbin (1998) emphasize objectivity and sensitivity. Objectivity is “the ability to achieve a certain degree of distance from the research materials and
represent them fairly” and “the ability to listen to the words of respondents and to give them a voice independent of that of the researcher” (p.35). In this sense, objectivity is not the concept opposite of subjectivity. Sensitivity is “the ability to respond to the subtle nuances of, and cues to, meanings in data” (p.35).

Maps developed using the method of this study should strive to achieve objectivity and sensitivity defined by Strauss and Corbin as well as the general evaluation criteria of qualitative research.

### 7.2.2 Objectivity and Sensitivity in this Study

In this study, the systematic coding was used to achieve objectivity. It distances the researcher from the data, and allows the researcher to listen to what the data is saying. Sensitivity is achieved by deepening the understanding of local knowledge (Geertz 1983). Even with the effort to enhance objectivity and sensitivity, the qualitative mapping in this study involves an interpretive process where the researcher’s subjective interpretation of the data influences the output of this study.

The researcher’s voice can show in various ways: In selecting variables and the relationship between variables, it is often necessary for the researcher to infer the native meaning in the context. The researcher’s lens influences how similar variables are grouped and to what level of aggregation the map should represent. The researcher identifies stocks and flows that are implicit in the data. The researcher makes a decision about implicit structures. The layout of the map is also influenced by the researcher’s mapping style.
As a result, if multiple coders each generate a map from the same data, the maps will have different look. The different perspectives of the multiple researchers can be thought of as diverse lenses that add analytical value. However, this must be differentiated with researcher bias due to one’s lack of understanding of the data or the native meaning system.

It is also true that the coding allows a greater convergence in the maps generated by different coders. The coding imposes the coders to employ a similar lens. If the codes identified in this study is applied to a multiple-coder setting, the coders would look for things such as the data segments relevant to the FOMC’s assessment of the economy, structural relationships in the economy, and the descriptions of economic variables that serves as information cues. Maps generated by multiple coders sharing a common coding scheme have greater similarities among them than maps generated by multiple coders each using different coding schemes.

The coding also makes the interpretive process more explicit. It discloses the various assumptions and perspectives the coders bring to interpret data. This opens up a possibility for the assumptions and perspectives to be shared and leads to a greater congruence between multiple coders. The potential for convergence is even greater when the coders share their theoretical or methodological backgrounds. For example, system dynamics modelers share mapping languages and a set of basic model structures for conceptualizing ideas. As a result, they will be inclined to represent phenomena with causal structures widely used in the field.
7.2.3 Implications for System Dynamics

The evaluation criteria discussed in this section has implications for system dynamics. The field incorporates interpretive and positivist paradigms. However, the criteria for evaluating system dynamics maps and models have been mostly from the positivist paradigm. The validity and reliability tests focus on the alignment between the modeled system and the real system. With such a positivist lens, interpretive aspects of the modeling process always leave some parts of the model, especially the parts of the model based on qualitative data, under the questions of validity and reliability.

As many qualitative researchers argue, the evaluation criteria for the positivist research are not appropriate for evaluating interpretive research. The interpretive aspects of the system dynamics modeling requires its maps and models to be evaluated against the qualitative criteria discussed in the previous section. This is an area of further reflection and discussion for the system dynamics community.

The method developed in this study can enhance objectivity in system dynamics modeling. The method implies that qualitative data to be transcribed and coded for causal structures and variable behaviors in order to generate qualitative maps and models. The coding scheme works like a lens that is systematically applied to the data. The process distances the map from the modeler and brings it closer to the data.

The method also suggests that qualitative maps in system dynamics to be tightly linked to the data source. This forces the modelers to document how they interpreted the data and transformed them into the maps and models. System dynamics maps and models become more open to eyes scrutinizing how the maps and models are generated. As a
result, in order to build confidence in the maps and models, the modelers must well understand the native meaning system and grasp subtle differences in nuances. It subjects the maps and models to a higher standard of sensitivity. Overall, this improves the quality of the maps and models, and builds greater degree confidence on the modeling work.

7.3 FURTHER APPLICATION POSSIBILITIES OF THE MAP

The main focus of this study is the development of a mapping method. The elicited map is then used to explain the collective judgment building process of the February 1988 FOMC meeting. However, there are other application possibilities of the maps elicited in similar ways. This will be the future research agenda.

First, maps generated from diverse group decision-making settings can collectively contribute to theory-building in group decision making. How decision groups select information and integrate individual mental models can be studied and the insights can be generalized if application cases are sufficiently accumulated.

Second, the map can be used to study stakeholder structure within a decision group. In this study, the arguments made by the decision group members are all captured in one map. However, by differentiating the arguments by the speaker, it is possible to trace how one’s position or opinion change during the group dynamics. For example, causal links or variables can be associated with not only the conversation identification numbers but also with group member identification number. Such a map can reveal how
the group members’ positions are divided and how they are addressed. It is also possible to represent a conflict between the sub-groups within the decision-making group.

Third, in system dynamics, whether decision makers tend to think in terms of feedback is of great interest. An accurate understanding of the feedback structure in the system is associated with enhanced decision performance. In general, people are not thought to be good with feedback thinking (Sterman 1989; Paich and Sterman 1993). Using the map in this study, it is possible to uncover whether a decision maker or a decision-making group understands the feedback structures in the system and how it influences the decision outcome. However, it must be noted that the mapping method in this study captures what is verbally expressed during the meeting. The gap between how people think and what people say must be further examined. Some insights can be gained from cognitive psychology. Still, the map application can answer questions like how influential a statement is in the decision-making process if the statement involves insights about feedback structures in the system.

Finally, additional mapping of the FOMC verbatim transcripts can reveal more insights about monetary policymaking in practice. Multiple maps can be elicited from the transcripts from different time periods. By comparing the maps, it is possible to find out whether there is a part of the system structure that is consistently discussed over time and whether there are parts of the structure that have changed over time. It is also possible to uncover what parts of the system structure receive more attention given a specific economic environment. If such an association is found, it may lead to a behavioral theory of the FOMC that predicts how the group would come to a collective decision in a given economic situation.
7.4 SUMMARY

The method integrating coding practice from grounded theory and the mapping language from system dynamics results in a map that explains the process of decision-making in a form that is similar to a narrative description. The map provides ways to organize and analyze the data, and grounding the map in the data makes it more objective by limiting the voice of the researcher. However, the interdisciplinary integration still faces challenges. The integration at the methodological level leaves a question of how to integrate different philosophical and theoretical positions that accompany the methods. The disciplinary identity of the map generated in this study must also be further considered.

In evaluating the map generated, it is suggested that criteria from the qualitative research realm is appropriate. The mapping method in this study attempted to achieve objectivity and sensitivity via coding and local knowledge, but it is also noted that the researcher subjectivity is inevitable. It is important to identify whether subjectivity adds theoretical value to data analysis or if it undermines the inferential accuracy of the study.

In the last section of the chapter, future research areas are discussed. The map has many application possibilities that have not been explored in this study. The mapping method demonstrated in this study can be used to develop theories of group decision making, stakeholder dynamics, feedback thinking, and monetary policymaking in practice.
APPENDIX

Variables and causal relationships found in the Federal Open Market Committee (FOMC) verbatim transcripts are linked together to create a composite map of the system collectively perceived by the decision-making group. Each section of the composite map is linked to its data source via the Conversation Identification Numbers (CINs) and the Map Identification Numbers (MINs). Using these codes, it is possible to look up the data segments relevant to a specific part of the composite map. It is also possible to trace how a specific data segment is represented in the composite map.

The following documents the relationship between the composite map of this study and the February 1988 FOMC meeting transcript.

1. **Locating the Data Segment Using the Conversation Identification Number (CIN)**

   The version of the transcript used for this study is available at the following Federal Reserve’s website:


   The CIN is assigned to every paragraph in the transcript. The first two digits of the CINs used in this study specify the page number in the transcript. The last two digits of the CINs specify the paragraph number on each page. For example, CIN 03-02 is the second paragraph on page 3. A paragraph that continues from the previous page is considered as the last paragraph of the previous page.
2. **Assigning the Map Identification Numbers (MIN)**

Two types of MINs are used in this study: the map identification numbers of the causal relationships (MINCs) and the map identification numbers for the variables (MINVs). The former is assigned to every causal link in the composite map, and the latter is assigned to every variable in the map. The number assignment was arbitrary. Figure 49 shows the MINCs used in this study. Figure 50 shows the MINVs used in this study.

3. **Data Source Reference Table**

The following tables 13 and 14 link the data source with the map using the CINs and the MINs. “x” implies an explicit relationship, and “i” implies an implicit relationship. The bottom row in each table shows how many times the causal link or the variable appeared in the data. In this study, the implicit and the explicit structures are counted with the same weights.
Figure 49. The Map Identification Numbers for Causal Links
Figure 50. The Map Identification Numbers for Variables
### Table 13. Data Source Table for Causal Links in the Map

| Map Identification Number for Causal Links 1-29 | CIN | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| 1-05 | | x | i | i | i | i | i | x | x | x | | | | | | | | | | | | | | | | | | | | x: explicit structures, i: implicit structures
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* x: explicit structures, i: implicit structures
| CIN | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 |
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| 1/06 | x | x |
| 1/07 | x |
| 1/08 | x |
| 1/09 | x |
| 1/10 | x |
| 1/11 | x |
| 1/12 | x | x |
| 2/01 | i | x |
| 2/02 | x |
| 2/03 | x |
| 2/04 | x |
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| 2/12 | x | x |
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| 2/15 | x |
| 2/16 | x |
| 2/17 | x |
| 2/18 | x |
| 2/19 | x |
| 2/20 | x |
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| 2/80 | x |
| 2/81 | x |
| 2/82 | x |
| 2/83 | x |
| 2/84 | x |
| 2/85 | x |
| 2/86 | x |

* x: explicit structures, i: implicit structures*
Table 15. Data Source Table for Variables in the Map

| Map Identification Number for Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 |
|----------------------------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 1                                      | i | x | i | i | i | i | i | i | i | x | i | i | i | i | i | x | i | i | i | i | x | i | i | i | i | i | i | x |
| 2                                      | x | i | i | i | i | i | i | x | i | x | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | x |
| 3                                      | x | i | i | i | i | i | i | i | x | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | x |
| 4                                      | x | i | i | i | i | i | i | i | i | x | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | x |
| 5                                      | x | i | i | i | i | i | i | i | i | i | x | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | x |
| 6                                      | x | i | i | i | i | i | i | i | i | i | i | x | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | x |
| 7                                      | x | i | i | i | i | i | i | i | i | i | i | i | x | i | i | i | i | i | i | i | i | i | i | i | i | i | i | x |
| 8                                      | x | i | i | i | i | i | i | i | i | i | i | i | i | x | i | i | i | i | i | i | i | i | i | i | i | i | i | x |
| 9                                      | x | i | i | i | i | i | i | i | i | i | i | i | i | i | x | i | i | i | i | i | i | i | i | i | i | i | i | x |
| 10                                     | x | i | i | i | i | i | i | i | i | i | i | i | i | i | i | x | i | i | i | i | i | i | i | i | i | i | i | x |
| 11                                     | x | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | x | i | i | i | i | i | i | i | i | i | i | x |
| 12                                     | x | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | x | i | i | i | i | i | i | i | i | i | x |
| 13                                     | x | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | x | i | i | i | i | i | i | i | i | x |
| 14                                     | x | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | x | i | i | i | i | i | i | i | x |
| 15                                     | x | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | x | i | i | i | i | i | i | x |
| 16                                     | x | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | x | i | i | i | i | i | x |
| 17                                     | x | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | x | i | i | i | i | x |
| 18                                     | x | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | x | i | i | i | x |
| 19                                     | x | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | x | i | i | x |
| 20                                     | x | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | x | i | x |
| 21                                     | x | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | x | x |
| 22                                     | x | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | x |
| 23                                     | x | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | x |
| 24                                     | x | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | x |
| 25                                     | x | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | x |
| 26                                     | x | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | i | x |

Count: 8 8 5 3 2 9 4 7 0 4 8 22 6 4 24 3 1 10 13 11 10 10 21 2 5 2

x: explicit structures, i: implicit structures
| Ops | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 |
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| 1_06 | x | x | | | | | | | | | | | | | | | | | | | | | | | |
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| 10_05 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10_06 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11_02 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11_05 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11_06 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12_02 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12_03 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12_04 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13_01 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13_04 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13_05 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14_01 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14_03 | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 14_05 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15_02 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15_03 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15_06 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16_02 | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 17_01 | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 18_06 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 19_02 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20_04 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20_06 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 22_01 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 23_01 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 24_01 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25_01 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 26_01 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 27_01 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 28_01 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 29_01 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 30_04 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 31_01 | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 32_01 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 32_02 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 32_04 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 33_03 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 34_01 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 34_02 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 34_04 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35_02 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35_03 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 36_03 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 37_01 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 38_12 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 63_07 | | | | | | | | | | | | | | | | | | | | | | | | | |

*Count: 1 3 6 5 18 31 1 29 23 8 6 5 10 11 5 9 10 9 8 7 8 1*

x: explicit structures, i: implicit structures
REFERENCES


