Toward Developing a Framework for Conducting Case Study Research

Shiva Ebneyamini¹ and Mohammad Reza Sadeghi Moghadam²

Abstract
This article reviews the use of case study research for both practical and theoretical issues especially in management field with the emphasis on management of technology and innovation. Many researchers commented on the methodological issues of the case study research from their point of view thus, presenting a comprehensive framework was missing. We try representing a general framework with methodological and analytical perspective to design, develop, and conduct case study research. To test the coverage of our framework, we have analyzed articles in three major journals related to the management of technology and innovation to approve our framework. This study represents a general structure to guide, design, and fulfill a case study research with levels and steps necessary for researchers to use in their research.

Keywords
case study research, methodological and analytical perspective, management of technology and innovation

Introduction

A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between the object of study and context are not clearly evident. It copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result relies on multiple sources of evidence, with data needing to coverage in a triangulating fashion, and as another result benefits from the prior development of theoretical propositions to guide data collection and analysis (Dul and Hak, 2008, p. 4; as cited in Yin, 2003).

The definition above is an example of an all-inclusive descriptive definition of case study research represented by Yin (2003). According to the definition of case study research, there is no doubt that this research strategy is one of the most powerful methods used by researchers to realize both practical and theoretical aims. Experienced qualitative researchers have identified case study research as a stand-alone qualitative approach. Case study research has a level of flexibility that is not readily offered by other qualitative approaches such as grounded theory or phenomenology. Case studies are designed to suit the case and research question and published case studies demonstrate wide diversity in study design (Hyett, Kenny, & Dickson-Swift, 2014). This is particularly true in today’s environment to cope with the growing frequency and magnitude of changes in technology and managerial methods (Voss, Tsikriktsis, & Frohlich, 2002), researchers in technology and innovation management need to use more field-based research methods.

A case study is expected to capture the complexity of a single case, and the methodology that enables this has developed within the social sciences. Such methodology is applied not only in the social sciences, such as psychology, sociology, anthropology, and economics, but also in practice-oriented fields such as environmental studies, social work, education, and business studies (Johansson, 2003). The role of case studies in research is a paradox. As Dul and Hak (2008) stated, on the one hand, case studies are widely used by many communities in business research; for example, case study research has consistently been one of the most powerful methods in operations management, particularly in the building of new theory. It is clearly an opinion that case study research in management can

¹ Faculty of Management, Department of Management of Technology, University of Tehran, Tehran, Iran
² Faculty of Management, Department of Industrial Management, University of Tehran, Tehran, Iran

Corresponding Author:
Shiva Ebneyamini, Faculty of Management, Department of Management of Technology, Tehran University, Tehran 0098, Iran.
Email: ebneyamini.sh@ut.ac.ir

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be rigorous, as is evidenced by case-based papers in both top European and U.S. journals. On the other hand, there is strong resistance to case study research in some communities and its use has been rather narrow, often restricted to just exploratory research. Case studies deserve a prominent role in business research and can be used for analyzing and solving business problems, as well as for building and testing business theories (Dul & Hak, 2008). For example in technology management areas where case study might be used according to McCutcheon and Meredith (1993) might be: What are the dynamics of technology implementation that transcend the particular technology being introduced? Or in operations management, closely related to management of technology field, the gap between what academics were assuming and the real conditions of operations led to growing disparities between operations management research’s prescriptive advice and workable answers for managers (e.g., McKay et al., 1988). Sensing this gap, a growing number of OM researchers have seen the need to gather better information about the realities of operations systems and to develop better, more complete theories about them. A prime means of developing well-grounded theories is through empirical, field-based research (McCutcheon & Meredith, 1993).

We went through three popular journals in the management of technology, based on their ranking using Scimago (http://www.scimagojr.com/journalrank.php?category=1405) which are Research Policy, R&D Management, and Technovation, to see whether the case study is used as a dominant strategy in the management field or not. We used Google Scholars advanced search, searched in all of the words “case study research” anywhere in the article between 2005 and 2015. The results of our search shows a wide use of case study as a methodology in the management of technology and innovation field (Technovation more than 68 papers, R&D Management more than 189 papers, Research Policy more than 162 papers).

In this article, we tried to use the experiences of operations management and the management of technology researchers. We try to represent a general framework with methodological and analytical perspectives in order to design, develop, and conduct case study research and then we have analyzed the mentioned journals article in the late 2015 to test our framework. The reminder of this study is planned as follows: First, we define case study as a method, then we review methodological issues in conducting a case study, after that we summarize the various viewpoints of case study researchers in Table 1, and finally, we have analyzed 2015 articles to see whether our framework covers the steps mentioned in our framework (Table 1) or not.

Case Study as a Method

Despite being one of the most frequently used qualitative research methodologies in educational research, the methodologists do not have a full consensus on the design and implementation of the case study, which hampers its full evolution (Yazan, 2015). Emerging researchers who plan to utilize the case study usually become confused “as to what a case study is and how it can be differentiated from other types of qualitative research” (Merriam, 1998).

We are going to represent a comprehensive and cohesive set of different definitions with different emphasis and perspectives of researchers in case study starting from 1970. The evolution of the definition of the case study can be seen by reviewing them.

The essence of a case study, the central tendency among all types of the case study, is that it tries to illuminate decision or set of decisions, why they were taken, how they were implemented, and with what results (Schramm, 1971, cited in Yin, 1989, pp. 22, 23). Gummesson (1988) argues that an important advantage of case study research is the opportunity for a holistic view of the process: “The detailed observations entailed in the case study method enable us to study many different aspects, examine them in relation to each other, view the process within its total environment and also use the researchers’ capacity for 'verstehen’”. “A case study is an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident and the investigator has little control over events” (Yin, 1989, 1994, 2009). In essence, Yin views the goal of case studies as understanding complex social phenomena and real-life events such as organizational and managerial processes. The case study is also defined as an ideal methodology when a holistic, in-depth investigation is needed (Feagin, Orum, & Sjoberg, 1991). Stake who is one of the main researchers in this field suggests that case study research is an investigation and analysis of a single or collective case, intended to capture the complexity of the object of study. Researchers who use case study are urged to seek out what is common and what is particular about the case. This involves careful and in-depth consideration of the nature of the case, historical background, physical setting, and other institutional and political contextual factors. The case is developed in the relationship between the researcher and informants and presented to engage the reader, inviting them to join in this interaction and in case discovery. Case studies have been used in varied investigations, particularly in sociological studies, but increasingly, in instruction (Stake, 1995). Stake mentions four defining characteristics of qualitative research which are valid for qualitative case studies as well: they are “holistic,” “empirically,” “interpretive,” and “emphatic.” Whether the study is experimental or quasi-experimental, the data collection and analysis methods are known to hide some details (Yazan, 2015). Case studies are designed to bring out the details from the viewpoint of the participants by using multiple sources of data (Tellis, 1997). Merriam (1998) defines case study research as “an intensive, holistic description and analysis of a bounded phenomenon such as a program, an institution, a person, a process, or a social unit.” In order to further differentiate case study method from casework, case method, and case history (case records), she stresses its unique distinctive attributes: particularistic (it focuses on a particular situation, event, program, or phenomenon); descriptive (it yields a rich, thick description of the phenomenon under study); heuristic (it...
illuminates the reader’s understanding of phenomenon under study (Yazan, 2015). Case study method enables a researcher to closely examine the data within a specific context. In most cases, a case study method selects a small geographical area or a very limited number of individuals as the subjects of study. Case studies, in their true essence, explore and investigate contemporary real-life phenomenon through detailed contextual analysis of a limited number of events or conditions and their relationships (Zainal, 2007).

Dul and Hak (2008) define the case study as a study in which:

- One case (single case study) or a small number of cases (comparative case study) in their real-life context are selected and
- Scores obtained from these cases are analyzed in a qualitative manner.

There are different ideas about what a case study is. If we try to find a common denominator that case study researchers might agree on, it would be something along the following lines: The case study should have a “case” which is the object of study. The case should be a complex functioning unit, be investigated in its natural context with a multitude of methods, and be contemporary (Johansson, 2003). Nevertheless, the case study researchers mentioned above emphasize different features. Stake points out that crucial to case study research are not the methods of investigation, but that the object of study is a case: “As a form of research, the case study is defined by the interest in individual cases, not by the methods of inquiry used.” Other researchers, such as Yin (1994), place more emphasis on the method and the techniques that constitute a case study (Johansson, 2003). Now that we have reviewed most of the definition of case study research in literature we can discuss the subissues regarding the nature of such research.

The Purpose of a Case Study Research

Researchers have different ideas, but many agree on what is the purpose of doing a research using a case study research strategy. We try to provide an overview of those here. First, we have to decide whether a case study can help us to achieve our research goal or not. There are three factors that determine the best research methodology: The types of questions to be answered, the extent of control over behavioral events, and the degree of focus on contemporary as opposed to historical events. Figure 1, based on Yin (1994), summarizes the different kinds of research questions and methods that are most appropriate based on the research questions.

Based on Figure 1, case study research is appropriate to be used for researches with “how” and “why” questions. Yin (1994) also presented at least four applications for a case study research: (1) to explain complex causal links in real-life interventions, (2) to describe the real-life context in which the intervention has occurred, (3) to describe the intervention itself, and (4) to explore those situations in which the intervention being evaluated has no clear set of outcomes. Meredith (1998) noted that there are three outstanding strengths of case study research: (1) The phenomenon can be studied in its natural setting and meaningful, relevant theory generated from the understanding gained through observing actual practice; (2) the case method allows the questions of why, what, and how, to be answered with a relatively full understanding of the nature and complexity of the complete phenomenon; and (3) the case method lends itself to early, exploratory investigations where variables are still unknown and the phenomenon not at all understood.

Voss and his colleagues (2002) have mentioned, as cited in Handfield and Melnyk (1998), that the purpose of the case study is (1) exploration to uncover areas for research and theory development; (2) theory building to identify/describe key variables, identifying linkages between variables and identifying “why” these relationships exist; (3) theory testing to test the theories developed in the previous stages or predict future outcomes; and (4) theory extension/refinement to better structure the theories in the light of the observed results. Dul and Hak (2008) noted that most of the researchers consider case study research as a useful research strategy (A) when the topic is broad and highly complex, (B) when there is not a lot of theory available, and (C) when “context” is very important. So they consider using case study for theory building, theory testing, hypothesis building, hypothesis testing, and description. We have considered these purposes in our framework in Framework section (Table 1). In our analysis of 15 latest articles published in three important journals of management of technology, 13 of the 15 of them were theory extension/refinement, one theory building, and one of them hypothesis testing.

Types of Case Study Research

In terms of defining types of case study research, researchers title them differently. Yin (1989) has identified some specific types of case study research: exploratory, explanatory, and descriptive. Stake (1995) identified three others: intrinsic, instrumental, and collective. Or according to Zainal (2007), other categories include interpretive and evaluative case studies. Dul and Hak (2008) categorize the case study research as the single case study and comparative case study. All in all, we believe that in using the case study research as a methodology we have two types: single case study or multiple case study which follows a replication logic. In our analysis of 15 latest articles published in three important journals of management of technology, 11 of the 15 of them were multiple case studies, four longitudinal case study and one single case study.

When to Use Case Study Research

Of course, choosing a research strategy or methodology depends on three things (Yin, 2014): research question, the extent of control the researcher has over actual behavioral events, and the degree of focus on contemporary as opposed to historical events. Case study research is generally thought of
The validity, meaningfulness, and insights generated from qualitative inquiry have more to do with information richness of the cases selected and the observational/analytical capabilities of the researcher than with sample size (Patton, 1999). To generalize to a theory is to provide some audience that supports a theory but not necessarily proves it definitively (Firestone, 1993). Others such as Yin (1984, 1994, 2003) have claimed that the problem of “generalization” can be solved and that, therefore, theories can also be tested in (preferably) “multiple case studies.”

Literal replication, examining cases where the theory would predict similar results (e.g., similar success with an equivalent type of project) and theoretical replication, examining cases where the theory points to different but predictable results (e.g., project failure; Yin, 1989). In the context of qualitative research, reliability is concerned with two questions: could the same study carried out by two researchers produce the same findings and could a study be repeated using the same researcher and respondents to yield the same finding (Kirk & Miller, 1986). Validity and reliability have a number of dimensions which is addressed in Figure 2.

The problem of validity in qualitative studies is related to the fact that most qualitative researchers work alone in the field. They focus on the finding rather than describe how the results were reached and they are limited in processing information (Miles & Huberman, 1994). Yin continually suggests that emerging researchers should maximize four conditions related to design quality: construct validity, internal validity, external validity, and reliability and keep these four “yardsticks” in their mind in every phase of their inquiry process so as to ensure the quality in their investigation (Yazan, 2015). Merriam (1998) represents six strategies to enhance internal validity (triangulation, member checks, long-term observation, peer examination, participatory research, and disclosure of researcher bias), three techniques to ensure external validity (explanation of investigator’s position with regard to the study, triangulation, and use of an audit trail) and three techniques to enhance external validity (use of thick description, typicity or modal categories, multisite designs).

The alleged lack of “generalizability” of the case study has its origin in confusion about selection of cases and populations (for testing) from a domain, on the one hand, and sampling from a population, on the other hand, and in confusion about what it is generalized (the study, its outcome, or a proposition) (Dul & Hak, 2008).

### Validity and Reliability Issues

The definition of generalization has appeared in the literature with regularity. It is a frequent criticism of case study research that the results are not widely applicable in real life (Tellis, 1997). Case study research is presented by some as a strictly exploratory research in which nothing can be proven, most often by referring to the alleged impossibility to “generalize” (Dul & Hak, 2008). Researchers have different interpretations on this issue.

Kirk and Miller’s (1986) definition takes into account the particular relationship between the researchers’ definition, the generation of data, and its interpretation: for reliability to be calculated, it is incumbent on the scientific investigator to document his or her procedure. This must be accomplished at such a level of abstraction that the loci of decisions internal to the project are made apparent. The curious public deserves to know the qualitative researcher prepares him or herself for the endeavor, and how the data is collected and analyzed.

### Review of Methodological Issues

Case studies often lack academic rigor and are, as such, regarded as inferior to more rigorous methods where there are more specific guidelines for collecting and analyzing data. These criticism stress that there is a need to be very explicit about the choices one makes and the need to justify them (Meyer, 2001). Yin (2003) has observed that a case study does not have a “codified design” like the other research strategies social scientists employ, which is the reason why some

| Strategy       | Form of research question |
|----------------|---------------------------|
| Experiment     | How, why                  |
| Survey         | Who, what, where, how many, how much |
| Archival analysis | Who, what, where, how many, how much |
| History        | How, why                  |
| Case study     | How, why                  |

**Figure 1.** Choosing a research strategy.
investigators do not grant it the merits as a notable research method. In other words, he concludes that “Unlike other research strategies, a comprehensive ‘catalog’ of research designs for case studies has yet to be developed.” Researchers offer different levels to fulfill the research using a case study strategy. For example, Yin (1994) proposes four levels: design the case study, conduct the case study, analyze the case study evidence, and develop the conclusions, recommendations, and implications.

Contrary to Yin who suggests a really tight and structured design for case study method, Stake (1995) argues for a flexible design which allows researchers to make major changes even after they proceed from design to research. as stated by Yazan (2015) Stake does not suggest a specific design for case study and his obvious flexibility in terms of case study design stems from his adoption of the notion of “progressive focusing,” which Parlett and Hamilton (1972) first put forward. Later on, Tellis (1997) developed four stage of the methodology based on a modification of the methodology devised by Yin (1984): design the case study protocol (determine the required skills and develop and review the protocol), conduct the case study (prepare for data collection, distribute questionnaire, and conduct interviews), analyze case study evidence (analytic strategy), and finally develop conclusions, recommendations, and implications based on the evidence.

Merriam (1998) presents step-by-step the process of designing qualitative research in a rather detailed fashion. Her discussion includes conducting a literature review, constructing a theoretical framework, identifying a research problem, crafting and sharpening research questions, and selecting the sample (purposive sampling). Voss and his colleagues (2002) believe that conducting a case study entails these steps: define the research framework, constructs, and questions; choosing cases; developing research instruments and protocols; and conducting the field research, analysis. Dul and Hak (2008) suggest a stepwise approach: preparation phase which entails defining research topic and defining the research general (theory oriented or practice oriented) and specific objective (theory building or testing, hypothesis building or testing, or descriptive). Research phase which entails defining the type of case study based on the propositions and hypothesis (single case study or comparative case study) and selecting cases, data collection, and data analysis. Lastly implications and report phase.

Based on this literature review authors believe that besides defining the research topic and question, the main stages in conducting a case study research contains the levels below.

### Selecting Cases

The logic of sampling cases is fundamentally different from statistical sampling. The logic in case studies involves theoretical sampling in which the goal is to choose cases that are likely to replicate or extend the emergence theory or to fill theoretical categories and provide examples for polar types (Eisenhardt, 1989). Whichever case selection strategy is used as the underlying principle common to all of these strategies is selecting information-rich cases. That is, cases worthy of in-depth study, this information richness is fundamental to deciding on the number of cases (Patton, 1999). Qualitative sampling seeks information richness (Crabtree and Miller, 1999). The selection of cases is purposeful, not random (Perry, 1998). Other researchers support this method of case selection and highlight the inappropriateness of random sampling, for example, Eisenhardt (1989) states that the random selection of case is neither necessary nor even preferable. Representativeness is not the criteria for case selection, rather the guarded choice of each case should be made such that it either predicts similar results for predictable reasons (i.e., literal replication) or produces contrary results for predictable reasons (i.e., theoretical replication) (Perry, 1998).

**Figure 2. Reliability and validity in case research.
Source: Yin (1994).**

| Test                      | Case study tactic                                      | Phase of research in which tactic occurs |
|---------------------------|--------------------------------------------------------|------------------------------------------|
| Construct validity        | -Use multiple sources of evidence                      | Data collection                          |
|                           | -Establish the chain of evidence                       | Data collection                          |
|                           | -Have the key informants review draft study report     | Data analysis                            |
| Internal validity         | -Do pattern matching or explanation building or time series analysis | Research design |
| External validity         | -Use replication logic in multiple case studies        | Data collection                          |
| Reliability               | -Use study protocol                                   | Data collection                          |
|                           | -Develop case study database                          | Data collection                          |

**Gathering Data**

There are recommendations proposed by researchers about data collection that if it’s done well, it will help the generalization and viability of the case study research:

Yin (1989, 1994) suggests three principles of data collection for case studies: use multiple sources of data, create a case study database, and maintain a chain of evidence. Stake (1995) states that essential parts of a data-gathering plan are definition of the case, list of research questions, identification of helpers, data sources, allocation of time, expenses, and intended reporting. Dul and Hak (2008) suggest a stepwise procedure for the development of valid and reliable procedures for measurement (data collection): formulate a precise definition of the concept; determine the object of measurement; identify the location of the object of measurement; specify how evidence of the value of the variable will be extracted from the object of measurement; specify how sources of evidence will be identified, selected, and accessed; specify how evidence will be recorded; specify how data will be categorized; and lastly write a measurement protocol.

As for data sources, Yin (1994) suggests documentation, archival records, interview, direct observation, participant
observation, and physical artifacts. As for data collection instruments, Stake (1995) suggests the use of observation, interview, and document review in qualitative case study research. Merriam (1998) suggests conducting effective interviews, being a careful observer, mining data from documents as techniques and procedures that researchers need in order to become effective users of the collection tools. Dul and Hak (2008) also propose a qualitative interview, using archives, questionnaire, and observation. Some recommendations mentioned by researchers while conducting an interview is that the starting question after the preliminaries should invite the interviewee to tell the story of their experience of whatever the research is about (Perry, 1998). The starting point is a question that is almost content free. This is your warranty that the answers came from the respondent and did not arise simply because your questions created a self-fulfilling prophecy (Dick, 1990). Be aware that the data collection in case study research can be both quantitative and qualitative. The results of our analysis appear in Table 1.

Data Analysis

Data analysis consists of examining, categorizing, tabulating, or otherwise recombining the evidence to address the initial propositions of a study. The analysis of the case study is one of the least developed aspects of the case study methodology. The researcher needs to rely on experience and the literature to present the evidence in various ways, using various interpretations (Tellis, 1997).

Case study researchers have different interpretations of the stage, for example, Miles and Huberman (1994) describe the phases of data analysis as data reduction, data display, and conclusion drawing and verification. Yin (1989, 1994) identifies three ways for this stage: pattern matching, explanation building, and time series. He also mentions the use of logic models and cross-case synthesis. None of these come with any formulas, although statistical calculations can be part of them. Eisenhardt (1989) suggests two stage for data analysis: the analysis within case data and searching for cross-case patterns. Stake (1995) identifies three ways: correspondence and patterns, categorical aggregation, or direct interpretation and naturalistic generalization. Merriam (1998) mentions six analytic strategies such as ethnographic analysis, narrative analysis, phenomenological analysis, constant comparative method, content analysis, and analytic induction. Dul and Hak (2008) also mention pattern matching and visual inspection as ways of analyzing data. The results of our analysis appear in Table 1.

Report

The guide for the case study report is often omitted from case study plans because investigators view the reporting phase as being far in the future. Yin (1994) proposed that the report is planned at the start. Case studies do not have a widely accepted reporting format - hence the experience of the investigator is a key factor (Tellis, 1997). Dul and Hak (2008) suggest that the report part is in relation with the object of the study if the research is practice-oriented the report has to mention the contributions and implications of study towards practitioners and if it is theory-oriented the report is toward the experts and the implications for the theory has to be reported. All in all, there is no specific way to report case study research which is accepted by all researchers but the guidelines offered can help the of case study research researchers to report.

Framework

Representing a framework which entails all the steps we mentioned above seemed useful. By reviewing almost all the literature on case study methodology, in this section, we try to

| researcher | Yin(1984,1995) | Stake (1995) | Tellis (1997) | Merriam (1998) | Voss et.al(2002) | Dul and Hak(2008) |
|------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Proposed methodology for conducting case study research | - Design the case study - Conduct the case study - Analyze the case study evidence - Develop the conclusions, recommendations, and implications | No specific step by step methodology | Almost the same as Yin(1995) | -Conducting a literature review -Constructing a theoretical framework -Identifying a research problem -Crafting and sharpening research questions -Selecting the sample (Purposive sampling) | -Define the research framework, constructs, and questions, -Choosing cases -Developing research instruments and protocols -Conducting the field research -Analysis | -Preparation phase -Research phase which - Implications and report phase. |

Figure 3. Methodologies proposed by researchers for conducting case study research.
| Purpose of Case Study Research | Reasons to Use Case Study Research | Types of Case Study Research | Methods of Gathering Data | Data Analysis in of Case Study Research |
|-------------------------------|-----------------------------------|-------------------------------|---------------------------|--------------------------------------|
| - Practice oriented           | - Exploration                     | - Exploratory                 | - Observation             | - Data reduction                     |
| - Theory oriented             | - Theory building                 | - Explanatory                 | - Interview               | - Data display                       |
|                               | - Theory testing                  | - Descriptive                 | - Document review          | - Conclusion drawing and verification|
|                               | - Theory extension/refinement     | - Intrinsic case study        | - Archival records         | - Pattern matching                    |
|                               | - Hypothesis testing              | - Instrumental case study     | - Participant observation  | - Explanation building               |
|                               | - Hypothesis building             | - Collective case study       | - and physical artifacts   | - Time series analysis                |
|                               | - Description                     | - Single case study           | - Use multiple sources of | - Cross-case synthesis                |
|                               |                                   | - Multiple case study         | data                      | - Categorical aggregation             |
|                               |                                   | - Interpretive case study     | - Create a case study      | - Direct interpretation              |
|                               |                                   | - Evaluative case study       | database                  | - Phenomenological analysis           |
|                               |                                   |                               | - Maintain a chain of      | - Constant comparative analysis       |
|                               |                                   |                               | evidence (Dul & Hak, 2008;| - Content analysis                    |
|                               |                                   |                               | Stake, 1995; Voss et al., 2002; Yin, 1993; Zainal, 2007) | - Analytic induction                 |
|                               |                                   |                               |                           | - Cross-case analysis                 |
|                               |                                   |                               |                           | - Within-case analysis                |
|                               |                                   |                               |                           | - Visual inspection (Eisenhardt, 1989; Huberman & Miles, 1994; Stake, 1995; Yazan, 2015) |
Toward an attention-based view of Evolving schemes of interpretation: We followed all the steps which are represented in Table 1. As mentioned before, the case study research is widely used as a research methodology by researchers in the management field. By carefully analyzing the articles, we have found that the framework presented in Table 2 (framework) is pervasive and all researchers passed the steps which we considered necessary to use the case study as the research methodology. To explain what was mainly in common in our analysis, it seemed like most of the researchers (93%) used the case study research for the purpose of conducting a theory-oriented research with the theory extension/refinement (86%) goal. In the gathering data phase, using qualitative interviews and archival data methods were well reported. Pattern matching (46%), cross-case analysis (46%), and data reduction (33%) are dominant in the analyzing data phase.

### Analyzing Management of Technology and Innovation Articles Using Case Study Methodology

In order to see whether our framework is pervasive enough, we decided to review some of the articles published in journals related to the management of technology and innovation. We followed all the steps which are represented in Table 1 and represented the results in tables that follow the same order. Case studies are used widely in the management field, as the literature seems to reflect that. As mentioned in the Introduction section the journals, we selected are *R&D MANAGEMENT* (http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1467-9310), *TECHNOVATION* (https://www.journals.elsevier.com/technovation/), and *RESEARCH POLICY* (https://www.journals.elsevier.com/research-policy/). We searched through the articles published between 2005 and 2015. Over 344 paper have been published using case study research as a methodology which shows the importance of this methodology in the management of technology and innovation issues. The results of analyzing 15 papers (the five latest articles published in each journal) which were accepted/published in 2015 are shown in following tables:

### Table 2. R&D Management.

| Articles                                                                 | Purpose of Case Study Research | Reasons to Use Case Study Research | Types of Case Study Research | Methods of Gathering Data | Data Analysis |
|-----------------------------------------------------------------------|---------------------------------|-----------------------------------|-----------------------------|----------------------------|---------------|
| Sustainability and scalability of university spinouts: a business model perspective (Bigdeli et al., 2015) | Theory oriented                 | Theory extension/refinement        | Comparative case study      | - Semistructured interview | - Data reduction (open coding) |
| One year ahead! Investigating the time lag between patent publication and market launch: insights from a longitudinal study in the automotive industry (Gerken et al., 2015) | Theory oriented                 | Theory extension/refinement        | Longitudinal case study     | - Archival data            | - Cross-case analysis (open coding) |
| Managing dual business models in emerging markets: an ambidexterity perspective (Winterhalten et al., 2015) | Theory oriented                 | Theory extension/refinement        | Comparative case study      | - Semistructured interview | - Visualisation techniques |
| Evolving schemes of interpretation: investigating the dual role of architectures in new product development (Magnusson & Lakemond, 2015) | Theory oriented                 | Theory extension/refinement        | Longitudinal case study     | - Archival data            | - Pattern matching |
| Toward an attention-based view of technology decisions (Palmie et al., 2015) | Theory oriented                 | Theory extension/refinement        | Comparative case study      | - Semistructured interview | - Cross-case analysis |

As mentioned before, the case study research is widely used as a research methodology by researchers in the management field. By carefully analyzing the articles, we have found that the framework presented in Table 2 (framework) is pervasive and all researchers passed the steps which we considered necessary to use the case study as the research methodology. To explain what was mainly in common in our analysis, it seemed like most of the researchers (93%) used the case study research for the purpose of conducting a theory-oriented research with the theory extension/refinement (86%) goal. In the gathering data phase, using qualitative interviews and archival data methods were well reported. Pattern matching (46%), cross-case analysis (46%), and data reduction (33%) are dominant in the analyzing data phase.
### Table 3. Technovation.

| Articles                                                                 | Purpose of Case Study Research | Reasons to Use Case Study Research | Types of Case Study Research | Methods of Gathering Data | Data Analysis                      |
|------------------------------------------------------------------------|--------------------------------|-----------------------------------|------------------------------|----------------------------|-----------------------------------|
| Boundaries of R&D collaboration (Back & Kohtamaki, 2015)                | Theory oriented                | Theory extension/refinement        | Comparative case study       | - Structured interview         | - Within-case analysis            |
|                                                                        |                                |                                   |                              | - Archival data               | - Cross-case analysis           |
|                                                                        |                                |                                   |                              | - Meetings                    |                                   |
|                                                                        |                                |                                   |                              | - Semistructured interview     |                                   |
|                                                                        |                                |                                   |                              | - Archival data               |                                   |
|                                                                        |                                |                                   |                              | - Informal meetings           |                                   |
|                                                                        |                                |                                   |                              | - Semi-structured interview   |                                   |
|                                                                        |                                |                                   |                              | - Archival data               |                                   |
| Identifying new dimensions of business incubation: a multilevel analysis of Karolinska institute’s incubation system (Baraldi & Havenvid, 2015) | Theory oriented                | Theory extension/refinement        | Longitudinal case study       | - Compare the narratives of informants |                                |
|                                                                        |                                |                                   |                              | - Pattern matching            |                                   |
| Understanding a new generation incubation model: the accelerator (Pauwels et al., 2015) | Theory oriented                | Theory extension/refinement        | Comparative case study       | - Writing individual case histories by using archival data |                                |
|                                                                        |                                |                                   |                              | - Using repertory grid method  |                                   |
|                                                                        |                                |                                   |                              | - Cross-case analysis          |                                   |
|                                                                        |                                |                                   |                              | - Cross-case analysis          |                                   |
|                                                                        |                                |                                   |                              | - Data reduction (open coding) |                                   |
| Situated regional university incubation: a multilevel stakeholder (Mc Adam et al., 2015) | Theory oriented                | Theory building                    | Comparative case study       | - Pattern matching            |                                   |
|                                                                        |                                |                                   |                              | - Cross-case analysis          |                                   |
| Innovation in start-ups: ideas filling the void of resources and capabilities (Paradkar et al., 2015) | Theory oriented                | Theory extension/refinement        | Comparative case study       | - Cross-case analysis          |                                   |
|                                                                        |                                |                                   |                              | - Cross-case analysis          |                                   |

### Table 4. Research Policy.

| Articles                                                                 | Purpose of Case Study Research | Reasons to Use Case Study Research | Types of Case Study Research | Methods of Gathering Data | Data Analysis                      |
|------------------------------------------------------------------------|--------------------------------|-----------------------------------|------------------------------|----------------------------|-----------------------------------|
| Impact of stronger patent regimes on technology transfer: the case study of the Thai automotive industry (Intarakumerd & Charoenporn, 2015) | Practice oriented             | Hypothesis testing                | Comparative case study       | - Interview                  | - Visual inspection               |
|                                                                        |                                |                                   |                              | - Archival data              |                                   |
| Commercializing user innovations by vertical diversification: the user-manufacturer innovator (Block et al., 2015) | Theory oriented               | Theory extension/refinement        | Comparative case study       | - Semi-structured interview   | - Data reduction (open coding)     |
|                                                                        |                                |                                   |                              | - Archival data              | - Cross-case analysis            |
|                                                                        |                                |                                   |                              | - Observation                | - Asking independent researchers to recode the text passages |
|                                                                        |                                |                                   |                              | - Semi-structured interview  | - Data reduction (open coding) and axial coding |
| Where and how to search? Search paths in open innovation (Lopez-Vega et al., 2015) | Theory oriented               | Theory extension/refinement        | Comparative case study       | - Interview                  | - Data reduction (open coding)     |
|                                                                        |                                |                                   |                              | - Archival data              | - Cross-case analysis            |
| Situated novelty: introducing a process perspective on the study of innovation (Janssen & putters, 2015) | Theory oriented               | Theory extension/refinement        | Comparative case study       | - Semi-structured interview   | - Asking independent researchers to recode the text passages |
|                                                                        |                                |                                   |                              | - Archival data              | - Data reduction (open coding) and axial coding |
| Understanding the emergence of new science and technology policies: policy entrepreneurial ship, agenda setting, and the development of European framework program (Edler & James, 2015) | Theory oriented               | Theory extension/refinement        | Single case study            | - Interview                  | Pattern matching                   |
|                                                                        |                                |                                   |                              | - Archival data              |                                   |
|                                                                        |                                |                                   |                              | - Observation                |                                   |
|                                                                        |                                |                                   |                              | - Observation                |                                   |
Implications and Limitations

In order to represent a cohesive framework and literature review with a methodological perspective, we have gone through a significant volume of articles and books available in case study research. Not every researcher in this field directly pointed out to the methodology of using the case study research, and their approaches are not the same, so by studying their papers and books over and over, we could extract what was mainly in common between researchers. In addition, there are a lot of articles using the qualitative method and especially case study, so we narrowed them to the 2005–2015 period.

As mentioned before, the case study is one of the most powerful methods used by researchers to realize both practical and theoretical aims. This study can be practical for researchers interested in case study research as we tried to represent a broad view of the nature of case study, different views of researchers and methodological issues related to this research strategy. Plus, the framework can help researchers to recognize which steps to follow, and what are the requirements or tools of each step to fulfill their research.

Conclusion

In this article, we reviewed and categorized the main steps and related issues in order to represent a pervasive framework for researchers using this methodology. We realized that the case study methodology is one of the dominant methodologies in the management of technology and innovation. This provided an opportunity for us to review some of the articles in this field to see whether our framework can cover the steps that other researchers followed in their papers. Fortunately, every single step and related contents fell inside our framework. This article can help researchers in using our framework to conduct their research much easier. For further studies, researchers in other fields can use our framework to see whether the articles published in their field cover the framework or not.

Acknowledgment

We thank all the experts in research methodology for assisting us in order to confirm our results in analytical section (results presented in Table 2, 3, and 4).

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Notes

1. Longitudinal case study is a single case study that the same subjects or cases are observed multiple times, and often over the course of many years.
2. They use the term “measurement” for the data collection step.

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