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METHODS ARTICLE

GROUNDED THEORY METHODOLOGY IN INFORMATION SYSTEMS RESEARCH[1]

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Grounded theory methodology (GTM), with its espoused goal of theory development of novel phenomena, has found broad application in Information Systems (IS) research. To investigate how GTM is applied in IS research and how the research contributions are contingent on those applications, we review 43 GTM-based articles in major IS and related journals. Ten of the articles develop theory. The other 33 articles use GTM to develop models and rich descriptions of new phenomena as their theoretical contribution. We show that each of the three forms is valuable to the IS community. For example, studies that develop theories and models are highly cited in the IS literature. We identify nine GTM procedures that are applied in various combinations to develop the three forms of research contribution. Treating GTM as a portfolio of the nine procedures, we examine the implications for the research contribution of adopting the core GTM procedures compared with a partial portfolio of those procedures.

Keywords: Grounded theory methodology, explorative, qualitative, research method, procedures, portfolio approach

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The appendix for this paper is located in the "Online Supplements" section of the *MIS Quarterly*'s website (http://www.misq.org).

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Introduction

Grounded theory methodology (GTM) is designed to enable the discovery of inductive theory. It "allows the researcher to develop a theoretical account of the general features of a topic while simultaneously grounding the account in empirical observations or data" (Martin and Turner 1986, p. 141). Developed four decades ago, GTM has become one of the most frequently adopted qualitative research methods in social science research (Morse 2009).

The GTM literature provides researchers with guidelines, advice, and perspectives regarding its use and to ensure the rigor of the research contribution (see Charmaz 2011; Glaser 1978; Strauss and Corbin 1990; Urquhart 2002). The method is particularly relevant for research on issues for which limited prior research has been conducted and for which theory building is needed (Fernandez 2004; Lehmann 2010; Seidel and Urquhart 2013). In IS research, GTM has been chosen frequently to study technological change and socio-technical behavior in emerging research domains (Birks et al. 2013; Matavire and Brown 2013; Urquhart and Fernandez 2006).

However, for two reasons, we contend that IS research has not exploited GTM to its full potential. One is that many studies do not develop theory, which is the espoused goal of GTM (Lehmann 2010; Urquhart et al. 2010). While each of the three forms of GTM results makes a theoretical contribution, we make a formal distinction between developing new theory and developing models and rich descriptions of new phenomena. The other reason is that there is ambiguity concerning how GTM should be applied in IS research (Birks et al. 2013; Sarker et al. 2013; Seidel and Urquhart 2013; Urquhart and Fernandez 2006).

In practice, the various applications of GTM challenge researchers, journal editors, and reviewers (Hughes and Jones 2003; Morse 2009). IS researchers would benefit from additional guidance on the appropriate applications of GTM procedures, particularly with regard to the consequences of the procedures chosen for the form of the research contribution (Sarker 2007). Editors and reviewers would benefit from a more nuanced understanding of the different forms of research contribution from GTM-based IS research (Sarker et al. 2013).

To explore these issues, we investigate how GTM is applied in IS research and how research contributions are contingent on the procedures adopted. To do this, we present a review of 43 GTM-based IS articles published before April 2013. We classify the research contribution of each article as taking one of three forms: *theories*, *models*, and *rich descriptions of phenomena*.

In making the distinction among the three forms of research contribution, we define theories to include the definitions of the relevant variables, the relationships among those variables, the justifications for those relationships, and the boundaries of the theory (Sutton and Staw 1995; Whetten 1989). Models include the definitions of the relevant variables and the relationships among those variables but do not fully justify those relationships and specify their boundaries. Thus, models are frequently the basis for theory development (Markus and Robey 1988; Sutton and Staw 1995). Rich descriptions are narratives based on empirical observations without abstraction (Van Maanen 1990).

The form of the research contribution is *contingent*[2] on the GTM procedures adopted. The development of theory is frequently contingent on the adoption of the full range of GTM procedures. In contrast, models and rich descriptions are frequently reported by studies that adopt a partial portfolio of GTM procedures. In addition, the analysis shows that GTM articles that develop theory are highly cited compared with non-GTM articles published in the same journal in the same year. GTM articles that develop models are also highly cited. Citation counts are lower for articles that develop rich descriptions.

The rest of the paper is organized into four sections. First, a framework is developed that includes the research contribution, the GTM procedures adopted, and the GTM context that guides our analysis. Second, the study design is presented. Third, we report the findings for and analysis of the GTM procedures adopted, their effects on the research contribution, and the influence of those contributions on the IS literature. Fourth, we discuss the findings and the implications for IS research.

A Framework for Investigating GTM in IS Research

GTM articles differ in the *form of the research contribution* that they make. These forms range from developing theory, the espoused goal of GTM, to publishing rich descriptions of new phenomena (Birks and Mills 2011; Lehmann 2010; Urquhart et al. 2010). For this research, we classify GTM research contributions in IS as the development of theories, models, and rich descriptions.

[2]In using the word contingent, we do not claim that the findings test for causality and its direction in the relationship. Rather, accepting the assumption in GTM that the methodology is the mechanism on which the research contribution is contingent, we show how, in this particular relationship and in the subsequent relationships reported in this paper, the research contribution is contingent on the GTM procedures adopted.

Table 1. Three Forms of Research Contribution

Form of Research Contribution	Description	Reference
Theory	Statements of descriptions, definitions of variables, their relationships, justifications for those relationships, and the boundaries of the theory.	Sutton and Staw 1995; Whetten 1989
Model	Definitions of abstract variables and their relationships.	Markus and Robey 1988; Sutton and Staw 1995
Rich description	Narratives of empirical observations without abstraction.	Hambrick 2007; Van Maanen 1990

It is generally accepted that the application of GTM requires tailoring *GTM procedures* to the research context (Hughes and Jones 2003; Morse 2009). However, disagreement exists regarding the degree of tailoring that is appropriate (Sarker 2007). Positions range from loose (Hood 2007; Locke 1996; Strauss 1987) to strict (Birks et al. 2013; Glaser 1992; Goulding 1999) adaptations. However, there is limited empirical research on how the various positions affect the form of the research contribution that is developed.

In addition, the application of GTM in IS depends on other *contextual factors*, including access to the research site and the duration of the study. Here, we develop a framework to review the application of GTM in IS research and the effects of differences in GTM practices on the form of the published research contribution. The framework includes three forms of research contribution, nine GTM procedures, and six contextual factors.

Research Contributions of GTM Articles in IS

While the espoused goal of GTM is the development of theory, GTM studies in IS do not exclusively develop theory. Instead, as Table 1 shows, these studies make three research contributions, namely, theories, models, and rich descriptions.

Sutton and Staw (1995) and Whetten (1989) define *theories*[3] to include definitions of abstract variables, their relationships, justifications for those relationships, and boundaries that limit the scope of the theory. Similarly, Gregor (2006) and Rivard (2014) define theories as consisting of descriptions, models, justifications, and boundary conditions. Thus, theories comprise both descriptions and explanations. Descriptions are empirical narratives that illustrate the author's arguments. Explanations specify the logic that justifies the selection of factors, the proposed causal relationships, and the boundaries of the theory (Bacharach 1989; Whetten 1989).

Markus and Robey (1988) and Sutton and Staw (1995) define *models* as definitions of abstract variables and their relationships. These variables and relationships are based on generalizations from data. Critically, models do not provide explanations for the relationships (Davis and Marquis 2005; Silverman 2014). In this sense, models are pre-theoretical representations of reality. Typically, the relationships among concepts, categories, and properties are formulated as hypotheses or propositions in a particular subject area (Glaser 1998; Whetten 1989).

Rich descriptions are narratives based on empirical observations without abstraction (Van Maanen 1990). They include objects, people, systems, activities, and events that occur in a particular area of study (Bacharach 1989). These narratives highlight the patterns and clusters among attributes within the data (Birks and Mills 2011; Hambrick 2007; Lehmann 2010). Essentially, rich descriptions are narrative reports of the major events, conceptualizing the emerging relationships among the variables involved (Becker 1993). These descriptions illuminate a phenomenon and help advance the practical relevance of a theory or the need to develop a theory (Sutton and Staw 1995; Van Maanen 1990).

Although Glaser and Strauss (1967) treat conceptual categories, their properties, and generalized relations as elements of theory, they do not provide a formal definition of theory (Charmaz 2006). Glaser's (1992) notion of fit, work, and modifiability captures both descriptive and explanatory elements. A theory fits if categories and properties capture the realities under study (description). A theory works if it explains major variations in behavior in the area (explanation). A theory is modifiable if it can include new data and new concepts (Glaser 1978).

[3]The grounded theory literature in sociology differentiates substantive and formal theories (Glaser 1978; Kearney 2007). Substantive theories are developed for an empirical area of inquiry, whereas formal theories are developed for a conceptual area of inquiry, comprising the analysis of several sets of data (Glaser 2006). In IS, however, GTM produces mainly substantive theories because IS has a culture of close domain fit as an applied discipline (Sarker 2007; Urquhart et al. 2010).

Table 2. GTM Procedures for Data Collection and Analysis

GTM Procedure	Description	Reference
Theoretical sampling	The process of selecting the data to be collected based on the analysis of previously collected data.	Glaser and Strauss 1967
Role of prior theory	The degree to which theories from the extant literature are used to inform GTM data collection and analysis.	Glaser and Strauss 1967; Strauss and Corbin 1990
Open coding	The act of attaching initial labels to all available data.	Glaser 1978
Axial coding	The detailed analysis of one category (around the "axis" of the category).	Strauss 1987
Selective coding	Coding limited to identifying only those instances related to the core category.	Glaser 1978
Theoretical coding	A coding step that relates the substantive categories generated from selective coding to one another.	Glaser 1978
Constant comparison	The process of constantly comparing any unit of data in one category with another unit.	Glaser and Strauss 1967
Memoing	Write-ups of ideas about concepts, categories, and the relationships among them that occur during the analysis.	Glaser 1978
Coding paradigm/ coding families	The Straussian paradigm is a pattern of analysis for examining data regarding conditions, interactions, tactics, and consequences. Glaser suggests a set of broader theoretical options, i.e., coding families.	Glaser 1978, 2005; Strauss and Corbin 1998

GTM Procedures in IS Research

There is no unique, generally accepted set of GTM procedures to guide the coding process during data collection and analysis. The GTM procedures presented in Table 2 identify two procedures for data collection and seven procedures for data analysis. *Theoretical sampling* and the *role of prior theory* guide the data collection.

Theoretical sampling reduces sampling bias, and increases data coverage and the saturation of categories (Glaser 1992). The role of prior theory captures the degree to which researchers are free of preconceived theoretical concepts and relationships when they enter the field (Baker et al. 1992; Sarker 2007; Suddaby 2006; Urquhart and Fernandez 2006). However, it is acceptable to use prior theory to motivate the relevance of a particular study, outline the research gap, and link the GTM results to the existing body of knowledge (Glaser 1992; Strauss and Corbin 1998; Urquhart 2002).

Although the literature contains an extensive discussion of second-generation approaches to GTM (see Charmaz 2011; Clarke 2005), GTM studies in IS generally follow either the Glaserian or Straussian coding approach (Glaser 1978; Strauss and Corbin 1998). Both begin with open coding, but they differ in subsequent steps. *Open coding* is the initial line-by-line coding of all data, which is often documented by example codes and the total number of open codes (see Smolander et al. 2008; Strong and Volkoff 2010).

GTM studies that follow Glaser (1978) in subsequent steps, apply *selective coding* by identifying categories that are related to the core category. Selective coding is documented by reporting on examples and explaining the reasons for conducting certain steps in abstraction (see Lee 2001). GTM studies that follow the Straussian coding procedure (Strauss 1987) conduct *axial coding*, which is performed to develop a deeper knowledge of all categories, as an additional step before applying selective coding. The studies reporting axial coding describe the properties of the categories and the implications of axial coding (Smolander et al. 2008).

Theoretical coding, which is the last step in Glaserian coding, identifies relationships between categories that are associated with the core category (Glaser 1978). Theoretical coding is documented by examples and the provision of additional details regarding their relationships (Gasson and Waters 2013).

Constant comparison is a procedure that guides analysis. The researcher systematically compares any unit of data with another unit to ensure that the discovery is grounded in rigorous coding and systematic procedures (Charmaz 2006). Studies report using constant comparison to generate concepts or categories (see Levina and Ross 2003) to generate new properties (see Gasson and Waters 2013), and to ensure the best fit between the analysis and the data (see Zahedi et al. 2006).

Memoing is a technique that is used to note theoretical ideas during data analysis and communicate insights from the data

Table 3. Contextual Factors of GTM Articles in IS Research

Contextual Factor	Description	Reference
GTM approach	Differentiates the original (Glaser and Strauss), Glaserian, Straussian, and second-generation versions of GTM.	Glaser 1978; Glaser and Strauss 1967; Morse et al. 2008; Strauss and Corbin 1990
GTM adaption	Whether the GTM approach adopted is customized to the research context or is combined with other research methods.	Matavire and Brown 2013; Morse et al. 2008
Core category	Accounts for most of the ongoing behavior in the substantive area being researched and communicates the central idea of the GTM result.	Glaser 1998
Duration of GTM	Number of months required to complete the GTM study.	
Citations per year	Citations per year as referenced in *Publish or Perish*.	Harzing and van der Wal 2008
Total citations	Total citations as referenced in *Publish or Perish*.	Harzing and van der Wal 2008

analysis (see Gasson and Waters 2013). Finally, whether the *coding paradigm* can meet the needs of GTM-based IS research has been debated on the basis that any theoretical perspectives embedded in the coding paradigm would restrict the data analysis (Urquhart et al. 2010). Studies have also extended the coding paradigm to include elements of Glaser's *coding families* to fit their IS research contexts (see Strong and Volkoff 2010).

Research Context of GTM Articles in IS

The framework adopted here identifies six contextual factors. First, the framework distinguishes between the four GTM approaches adopted: *original*, *Glaserian*, *Straussian*, and *second-generation* (see Table 3). Following their joint book on GTM, Glaser and Strauss independently developed the "Glaserian" and "Straussian" approaches (Glaser 1978; Strauss and Corbin 1998). The Straussian approach provides unambiguous process guidance, and it is widely applied in IS research (Strauss and Corbin 1990; Urquhart et al. 2010). In contrast, the Glaserian approach provides flexibility in procedural guidelines (Glaser 1978). A second generation of grounded theory methodologists has subsequently evolved (see Charmaz 2011; Clarke 2005).

Second, the framework recognizes whether the study employs GTM as its only methodology or combines it with another methodology (*degree of adaption*). Deviating from the recognizable labeling of GTM procedures requires additional explanation and justification (Sarker 2007). Third, the framework identifies whether the study develops a *core category* that "pulls together all the strands in order to offer an explanation of the behavior under study" (Goulding 1999, p. 9). The remaining three factors described in Table 3 are outcome measures: *duration of GTM*, *citations per year*, and *total citations* for each article. These measures are defined in the "Study Design" section below.

In combination, the forms of research contribution, GTM procedures, and the context, which are summarized in Tables 1, 2, and 3, provide an overview of the application of GTM and frame our analysis of GTM practice in IS research. Within this framework, we address three research questions:

(1) What are the research contributions of GTM articles in IS?

(2) How are these research contributions contingent on the GTM procedures employed?

(3) What is the influence of GTM articles on the IS literature?

Study Design

This review examines the research contributions of GTM-based studies published in major IS and related discipline journals. Specifically, the empirical basis for the review consists of two datasets. One dataset comprises GTM-based articles published in major IS and reference discipline journals.

The other dataset includes additional information provided by the authors of the GTM articles in response to an invitation to contribute to the review. After classifying[4] and analyzing the sample articles, we contacted the authors to validate our classification of their studies. We also asked five open-ended questions: (1) whether the authors had applied any additional grounded theory procedures that are not reported in their

[4]We use the terms classifying and classification here because coding is a critical construct in GTM.

articles, (2) the form of their research contribution, (3) their GTM strategy, (4) their impression of the role of GTM in IS research, and (5) their assessment of the strengths and weaknesses of GTM.

Sample and Data Collection

The sample for this review comprises GTM-based studies reported in 13 major IS and related discipline journals. The journal selection process followed Lowry et al. (2004). A list of the journals is presented in Table A2 in the appendix.

Potential studies for inclusion in the review sample were identified through multiple literature searches. The databases searched included ABI/INFORM, Science Direct, and Emerald Insight. The search period covered studies published after 1967 and before April 2013. The search identified the Huff and Munro (1985) paper as the first GTM-based article published in our sample. Articles published after April 2013 were excluded because estimates of their expected citations per year would potentially be biased and unreliable.

The initial database search identified 781 potential articles for inclusion in the review sample. To be included, an article must employ GTM as its primary research methodology. Here, GTM methodologies include Glaserian, Straussian, and any of the second-generation GTM methodologies. For example, we excluded articles that employ mixed-method approaches, which combine qualitative GTM with a quantitative methodology.

The most frequent reason for excluding an article from the review was that, although drawing on GTM, the study did not use it as the primary research methodology. This selection process identified 43 GTM articles in 13 journals (see Table A1 in the appendix for the authors and dates of publication). The 43 articles are referred to as the *sample* for the analysis.[5]

To validate our classification of each article, we were able to contact 86 of the 99 authors of the sample articles. We e-mailed these authors in early 2015, giving them a six-week deadline to respond. The authors were guaranteed confidentiality and anonymity. They were also offered the opportunity to read and comment on this review before its publication. Three e-mail reminders were sent to nonresponders, including an offer to meet with them at IS conferences.

Responses were received from the authors of 23 of the 43 articles (53%) in the GTM sample: 18 via e-mail and 5 via interviews at conferences. The authors commented on the classification process, typically writing several sentences in response to each of the five questions. The interviews ranged from 24 to 82 minutes and were recorded and transcribed.

Analysis

Our analysis involved three steps. First, we classified each of the 43 GTM articles and shared this classification process and its outcomes with the authors. Second, we reviewed the authors' responses. Third, we collected the citations of the 43 GTM articles to analyze the influence on the IS literature of each article.

The initial classification of the 43 articles was based on the 18 GTM characteristics in Tables 1, 2, and 3. For 14 of the characteristics, binary values are assigned to indicate their presence or absence. The four exceptions are theoretical sampling, the role of prior theory, constant comparison, and the coding paradigm. For these procedures, the binary classification is extended to include partial application and other approaches.

Two authors independently classified each of the 43 GTM articles ($r = 0.76$, Krippendorff 2004). Disagreements were resolved through discussion and clarification. The classification is presented in Table A1 in the appendix.

In the second step, the authors' responses were analyzed. Their responses to our classification scheme were used to refine our classifications. Where appropriate, we adjusted our classification (see notes "a" and "b" in Table A1 in the appendix).

The authors' responses to the open questions were used to provide additional insights into the use of GTM in IS. Specifically, we conducted open coding on the authors' qualitative responses to identify concepts and categories (Strauss and Corbin 1990). Selected results are documented in Table A5 in the appendix.

Third, we examined the influence of each GTM article on the IS literature. To control for journal impact factor scores and time biases, we analyzed the citations of each GTM article compared with those of other articles published in the same journal in the same year (Bornmann et al. 2008; Radicchi et al. 2008). To do so, we used *Publish or Perish* (http://www.harzing.com/resources/publish-or-perish) to collect the citations for all articles published in the corresponding journal and year and compared the GTM article citations with the citations for the median of the non-GTM articles (see Table A3 in the appendix). We chose the median to control for outliers that frequently occur in journal volumes.

[5] A more comprehensive list of classified articles that is continuously updated can be accessed at www.grounded-theory.com.

The citations per year were calculated based on the total number of citations up to 2015, divided by the years since the publication of the article. For example, the Levina and Ross (2003) article was published in Volume 27 of *MIS Quarterly*. It is cited 646 times, which is 53.8 citations per year. For the other 24 articles published in MIS Quarterly in 2003, the median article is cited 339 times, which is an average of 28.3 citations per year.

Findings

The Straussian approach is adopted in 35 articles (81%), making it the dominant GTM approach of the 43 GTM-based articles in the sample. Of these 35 articles, 20 articles (57%) combine GTM with other research methodologies. Only four of the 43 articles adopt the Glaserian approach. Three of these combine GTM with other research methodologies. Three of the 43 articles use the original Glaser and Strauss (1967) book as the primary reference for their research methodology. A second-generation approach is adopted by only one article: Ribes and Finholt (2009) adopt Clarke's (2005) guidance on situational analysis and combine it with ethnographic elements (Boyle 1994).

The articles in the sample make three forms of research contribution to the IS literature: theory development (*theory*), model building (*model*), and rich descriptions of new phenomena (*description*). To do this, the articles adopt various combinations of the nine GTM procedures: *theoretical sampling, role of prior theory, open coding, axial coding, selective coding, theoretical coding, constant comparison, memoing,* and *coding paradigm*. The research contribution developed is contingent on both the number and the combinations of GTM procedures adopted.

The citation analysis shows that theory articles are cited more frequently than articles that develop models, which in turn are cited more frequently than articles that develop rich descriptions. Overall, the GTM-based articles are cited more frequently than other articles published in the same journal in the same year. These patterns are presented under three headings: GTM procedures and research contributions, combinations of GTM procedures, and the impact of GTM-based articles.

GTM Procedures and Research Contributions

Ten articles (23%) develop theory as their research contribution. For example, Maznevski and Chudoba (2000) develop a theory of global virtual team dynamics and effectiveness by proposing a temporal rhythm of interaction incidents. Eighteen articles (42%) develop models. For example, Fabricatore et al. (2002) develop a player-centric model to analyze and enhance playability in video games. Fifteen studies (35%) develop rich descriptions of the central phenomenon. For example, Slack and Rowley (2002) provide a description of the design, location, profile, and architecture of information kiosks in four different environments.

The 43 sample articles employ different GTM procedures. Table A1 in the appendix shows that 21 articles (49%) apply theoretical sampling; 3 articles adopt non-GTM sampling strategies; and 19 articles (44%) do not adopt a sampling strategy. For example, Chang et al. (2011) employ a sampling strategy similar to the replication logic for case selection that is used in theory building from case studies. Kesseler (2008) follows the goal/question/metric method of Basili et al. (1994) to guide the data collection process.

As shown in Table 4, open coding and axial coding are applied frequently across all three types of research contributions. However, the research contributions are contingent on the frequency with which other procedures are employed. The role of prior theory is employed by 6 of the 10 articles (60%) that develop theory compared with 8 of the 18 articles (44%) that develop models and 6 of the 15 articles (40%) that develop rich descriptions. Selective or theoretical coding is employed by 9 of the articles (90%) that develop theory compared with 12 articles (67%) that develop models and 6 articles (40%) that develop rich descriptions.

Constant comparison is employed by 7 of the 10 articles (70%) that develop theory compared with 8 of the 18 articles (44%) that develop models and four of the 15 articles (27%) that develop rich descriptions. Memoing is employed by 5 articles (50%) that develop theory compared with three (18%) that develop models and two (13%) that develop rich descriptions.

Table 4 shows that the articles that develop theory, models, and rich descriptions differ in both the number of procedures used. The median number of GTM procedures adopted in the 10 articles that develop theory is 4.5. The median number of GTM procedures adopted by the 18 articles that develop models is 4.0, and the median number of GTM procedures adopted by the 15 articles that develop rich descriptions is 2.0. A one-tail Wilcoxon signed-rank test[6] shows that articles that develop theory use significantly more procedures compared with articles that develop models (p-value < 0.05). Similarly,

[6]The results of the Wilcoxon signed-rank test are reported in Table A4 in the appendix.

Table 4. Research Contribution and GTM Procedures

Type of Research Contribution	Number (Percentage) N = 43	GTM Procedure Applied (Number, Percentage of Articles of this Type)[a]							
		Role of Prior Theory	Open Coding	Axial Coding	Selective/ Theoretical Coding	Constant Comparison	Memoing	Total Procedures Adopted[b]	Median Number of Procedures
Theory	10 (23%)	6 (60%)	9 (90%)	8 (80%)	9 (90%)	7 (70%)	5 (50%)	50 (71%)	4.5
Model	18 (42%)	8 (44%)	17 (94%)	15 (83%)	12 (67%)	8 (44%)	3 (17%)	73 (58%)	4.0
Description	15 (35%)	6 (40%)	9 (60%)	6 (40%)	6 (40%)	4 (27%)	2 (13%)	38 (36%)	2.0

[a]We did not include the procedure "theoretical sampling" in this analysis, as authors reported situational factors (e.g., analyzing existing data) that limited applicability of theoretical sampling. We further did not include the procedure "coding paradigm" in this analysis given the discussion on its applicability in IS.

[b] Percentage of the maximum number of procedures that could have been adopted.

Table 5. Core Category and the Research Contribution

Type of Result	Number N = 43	Articles That Develop a Core Category (Number, Percentage)
Theory	10	10 (100%)
Model	18	9 (50%)
Description	15	4 (27%)

articles that develop models use significantly more procedures compared with articles that develop rich descriptions (p-value < 0.05). Data from the authors indicate that the selection of procedures was more likely to influence the type of research contribution than the converse, that the selection of procedures was determined by the espoused research goal (see Table A5 in the appendix).

In addition, Table 5 shows that articles that develop theory also develop core categories more frequently than articles that develop models and rich descriptions. All 10 articles (100%) that develop theory as the research contribution develop a core category. Nine of the 18 articles (50%) that develop models develop core categories. Only 4 of the 15 articles (27%) that develop rich descriptions develop core categories to synthesize the data. The form of research contribution is contingent on whether studies develop a core category (Fisher's exact test, p-value < 0.001).

Combinations of GTM Procedures

Treating the combination of theoretical sampling, constant comparison, and at least one form of coding as the core procedures for applying GTM, Table 6 reports that a set of core procedures is applied in 16 (37%) of the GTM-based articles. Of these articles, six develop theory, seven develop models, and three develop rich descriptions.

As shown in Table 6, a second set of articles that employ neither theoretical sampling nor constant comparison accounts for 19 (44%) of the sample articles. Of these articles, three develop theory, seven develop models, and nine develop rich descriptions. Together, these two mutually exclusive sets of articles account for 35 of the 43 articles (81%) in the sample. In addition, Table 6 shows that, when theoretical sampling or constant comparison is employed, the pre-requisite of at least one form of coding is also employed.

Figure 1 presents a 2×2 matrix of GTM procedures (full versus partial) and the research contribution (theory versus other) for the sample of 43 articles. GTM articles that apply theoretical sampling, constant comparison, and at least one form of coding are categorized as applying full GTM. Articles that omit one or more of these procedures are categorized as applying partial GTM. Only 6 of the 43 articles (14%) adopt full GTM and develop theory, which is the espoused goal of GTM studies. However, these six articles account for 60% of the articles that develop theory. Twenty-

Table 6. Combinations of GTM Procedures

Articles Using Theoretical Sampling			Articles Not Using Theoretical Sampling		
Number (Percentage) N = 21	Constant Comparison Used	Constant Comparison Not Used	Number (Percentage) N = 22	Constant Comparison Used	Constant Comparison Not Used
Coding procedure used	16 (37%)	5 (12%)	Coding procedure used	3 (7%)	14 (32%)
Coding procedure not used	0 (0%)	0 (0%)	Coding procedure not used	0 (0%)	5 (12%)

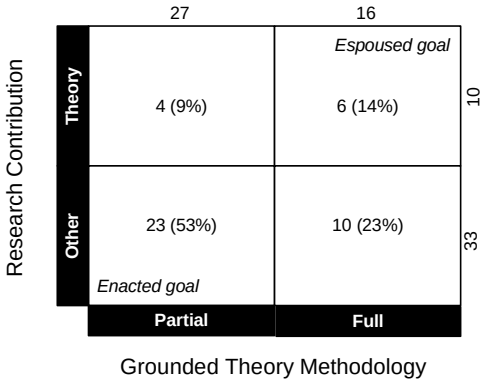

Figure 1. GTM Core Procedures and Research Contribution

Table 7. Impact of GTM-Based Research on the IS Literature

Methodology	Number	Average Citations Per Year	Type of Result	Number	Average Citations Per Year
GTM-based research	43	17.1	Theory	10	26.3
			Model	18	20.4
			Description	15	7.0
Non-GTM-based research	1598	13.3			

three of the sample articles (53%) apply partial GTM to develop a research contribution other than theory, thereby constituting the dominant enacted goal of GTM.

Impact of GTM-Based Articles

To investigate the impact of GTM articles on the IS literature, the citations for each GTM article are compared with the citations for non-GTM articles published in the same journal in the same year. Of the 43 GTM articles, 30 (69%) are cited significantly more frequently compared with the median non-GTM article ($Z = 2.40$, $p < 0.05$). On average, GTM articles are cited 17.1 times per year, while non-GTM articles are cited 13.3 times per year (Table 7). A detailed boxplot analysis of the citations is presented in Table A3 in the appendix.

Finally, we report the research contributions for full and partial GTM articles in Figure 1. The impact score for the six full GTM articles that produce theory is, on average, 23.9 citations per year. Of the other four articles that develop theory, the impact score for the three GTM articles that apply neither theoretical sampling nor constant comparison is, on average, 7.5 citations per year.

The tenth theory paper develops a theory of global virtual team dynamics and effectiveness (Maznevski and Chudoba 2000). It follows a Straussian approach, employing open, axial, and selective coding. The paper does not apply theore-

tical sampling or use memoing. Following this process, the authors use adaptive structuration theory as their analytical framework to identify the core category on which they develop their theory. The paper is an outlier in terms of its impact score with an average of 97.1 citations per year.

Discussion

The findings show that the research contributions of articles that employ GTM are contingent on the methodology used in practice compared with the espoused GTM methodology. Our findings are threefold. First, we define the three different forms of research contributions developed by the 43 GTM studies in the sample: Ten articles (23%) develop theory, which is the espoused goal of GTM. In contrast, 33 articles (77%) develop models or rich descriptions of phenomena. Frequently, the practice of GTM does not achieve its espoused goal.

Second, GTM articles that develop theory are highly cited (on average, 26.3 citations per year) compared with non-GTM articles published in the same journal in the same year (on average, 13.3 citations per year). Importantly, GTM articles that develop models are also highly cited (on average, 20.4 citations per year). Therefore, 28 articles (65%) in our sample of GTM-based articles develop research contributions that have a high impact on the IS literature (as measured by citations per year).

Third, the probability of developing theory is a positive function of the combination of GTM procedures employed. Sixteen articles (37%) in our sample apply the core GTM procedures of theoretical sampling, constant comparison, and at least one form of coding. Twenty-seven articles (63%) employ a subset of GTM procedures that are contingent on the research context. Articles that develop theory employ significantly more GTM procedures than do articles that develop models or rich descriptions.

In addition, the analysis presented above makes two minor contributions to methodology.[7] First, by contacting the articles' authors, we are able to validate the classification of the GTM procedures that the studies adopt, the research contribution that they make, and collect additional data on the GTM procedures used that are not reported in the article. Second, we define the citation benchmark as the citations per year for the median article in the same journal in the same year. This controls for differences in the journal impact score, date of publication, and years since publication.

[7]We thank one of the reviewers for this observation.

Below, we discuss the findings under three headings. First, we review the value of GTM-based research in IS. Second, we discuss the effect of the GTM procedures employed on the research contribution. Third, we consider the partial application of GTM procedures. We then consider five limitations of the findings and suggest potential avenues for future research.

The Value of GTM-Based Research

The 10 GTM articles that develop theory are highly cited. In total, these articles are cited 2,852 times. This is 26.3 citations per year compared with 13.3 citations per year for the non-GTM benchmark articles. Table 7 reports that the 18 articles that develop models are also highly cited with a citations-per-year average of 20.4. In contrast, the 15 articles that develop rich descriptions of new phenomena have a citations-per-year average of 7.0. Although the use of GTM to develop theory is well discussed in the literature (Glaser 1992; Glaser and Strauss 1967; Strauss and Corbin 1990), there is limited discussion of contributions other than the espoused development of theory.

The 10 articles that develop theory contribute new theoretical insights that are grounded in empirical observations and that account for previously unexplained major variance in the research domain. For example, Strong and Volkoff (2010) revisit enterprise systems as an existing domain to develop a new perspective on understanding the IT artifact. Similarly, Boudreau and Robey (2005) examine the adaptation of integrated information systems to develop a theory of improvised learning.

These two articles illustrate the power of GTM to reframe an existing research domain rather than to extend an existing theory. Both articles develop new perspectives on well-researched phenomena. They challenge the validity and applicability of existing theories, opening up new avenues for research. Their theories have been recognized, tested, and transferred to other contexts (see Bala and Venkatesh 2013; Tong et al. 2015).

Models can be the basis of new theories or can be reframed as theories if other researchers draw on the models to develop hypotheses to specify and test theories. For example, Pan et al. (2012) extended the Day et al. (2009) model of information flow impediments in the context of Hurricane Katrina into a theory of the positive and negative impediments to information flows. The high citation counts for the 18 articles that develop models highlight the value placed on the development of GTM-based models by the IS research community. In addition, Table 4 reports that 15 articles develop rich

descriptions of IS phenomena. These descriptions are valuable in two ways. First, they are valuable as teaching resources. For example, in a textbook by Sturdy (2012), the Lander et al. (2004) study of trust mechanisms in outsourcing relationships is used as an illustration of the cultural aspects of implementing customer relationship management and business intelligence systems.

Second, rich descriptions are valuable because they serve as sources of new domain knowledge for IS researchers. Such knowledge is important because the IS discipline is characterized by a rapidly changing practice environment due to technological innovations (Taylor et al. 2010). These new phenomena must be documented and understood before researchers can explain their causes and effects (Avison and Malaurent 2014; Davis and Marquis 2005). Potentially, rich descriptions identify critical empirical patterns that stimulate a deeper understanding of new phenomena, and motivate the development of models and/or theory of the phenomena (Hambrick 2007).

Publishing rich descriptions provides early insights into these phenomena. The patterns observed in a number of rich descriptions can serve as a basis for theorizing (Ågerfalk 2014; Birks et al. 2013; Hambrick 2007; Urquhart et al. 2010). In this way, rich descriptions can be a critical basis on which to develop theory in IS research (Avison and Malaurent 2014; Gregor 2014; Lee 2014; Markus 2014; Rowe 2011). For example, the initial analysis of enterprise systems by Volkoff et al. (2005) presents a rich description of the underlying dimensions of changing IT-based business processes. Subsequently, the same dataset is reanalyzed to develop a theory of technology-mediated organizational change (Volkoff et al. 2007) and a theory of misalignment in organization–enterprise systems (Strong and Volkoff 2010).

GTM Procedures and Research Contributions

The number of GTM procedures employed affects the research contribution (Table 4). The median number of procedures employed to develop theory and models is 4.5 and 4.0, respectively. The median number of procedures applied for rich description articles is 2.0. Here, we begin by discussing possible sources of these differences and their implications for authors, reviewers, and editors. We then consider the importance of developing a core category for the form of the research contribution (see Table 5).

The authors' goals could have influenced both the GTM procedures employed and the research contributions. To investigate this issue, we asked the authors about the espoused goals of their studies. All of the authors who responded confirmed that their research goal was to develop theory. However, where we classify the research contribution as developing models or rich descriptions, they confirmed our classifications, acknowledging that they did not develop theory.

The authors also explain that the review process strongly shaped their published article (see Table A5 in the appendix). Some reviewers highlighted the importance of documenting the GTM procedures, including reanalyzing the data and thus increasing the number of procedures employed. Other reviewers emphasized the importance of describing the phenomenon rather than applying and documenting GTM procedures. This emphasis may have influenced the number of procedures employed and, consequently, the development of models and rich descriptions rather than theories.

Applying the core GTM procedures is the *sine qua non* for developing theory in GTM studies. The gestation of a theory requires analytic capability and creativity, supported by the application of core GTM procedures (Birks et al. 2013; Glaser 2006; Strauss and Corbin 1990; Urquhart et al. 2010). These procedures support theory development through the three mechanisms of coding, theoretical sampling, and constant comparison.

The coding procedures are systematic processes that assist researchers in structuring and mastering the data. Theoretical sampling ensures the completeness of the developed categories because it guides additional data collection to close gaps in the emerging theory. Constant comparison ensures that the generated concepts fit with other data and the existing literature, and generates the properties of categories (Glaser and Strauss 1967). Constant comparison combines the coding elements with the deductive theoretical sampling in conceptualization (Glaser 1978).

Memoing ensures that novel insights triggered during the long process of collecting and analyzing the data are neither forgotten nor left underdeveloped. Identifying a core category focuses the research on one central theme in the data. It links the identified categories around the abstract category that best explains the phenomenon.

In addition, authors, reviewers, and editors should be aware of how choices among GTM procedures can affect the research contribution. For authors, this awareness involves recognizing that, when they depart from employing the core GTM procedures or when reviewers advise them to focus on describing the phenomenon rather than documenting their GTM procedures, these actions may influence the form of

their research contribution. Reviewers and editors should carefully consider how their recommendations shape articles for publication, guiding them toward the development of theories, models, or rich descriptions.

Partial Application of GTM Procedures

The findings above report the frequent use of subsets of GTM procedures in the sample articles. For example, Figure 1 shows that 4 of the 10 articles that develop theory adopt a partial portfolio of the GTM procedures. Contingent on the goal and context, either a full GTM protocol or a partial portfolio approach may be appropriate (see Abraham et al. 2013; Levina and Ross 2003).

When researchers publish GTM articles that develop rich descriptions of a new phenomenon, the GTM procedures for deriving theory from data are frequently omitted (Table 4). The authors' comments (see Table A5 in the appendix) identify three reasons why they employ a subset of the GTM procedures: the research setting did not permit the application of a specific GTM procedure; GTM is used in combination with another research method; and/or the authors lacked knowledge about specific GTM procedures.

First, several sample articles discuss the restrictive nature of the coding paradigm and adopt existing theories as coding paradigms for their analyses (Chakraborty et al. 2010; Mattarelli et al. 2013; Sarker et al. 2001). Other articles carefully apply the coding paradigm as a guiding principle, even though it does not fit all the data (Day et al. 2009). For example, the Strong and Volkoff (2010) analysis of organization–enterprise misfit uses an extended coding paradigm to integrate the various misfit categories.

Critically, only 21 of the sample articles (49%) use theoretical sampling. The authors give several reasons. For example, some articles use data collected for another purpose (Birks et al. 2013; Chakraborty et al. 2010). Kesseler (2008) replaces theoretical sampling with a goal/question/metric approach from software engineering to evaluate the software artifact, explaining that this approach is suited to the specific situation in which a software artifact is analyzed as a consequence of the social process of system implementation.

When asked to explain the tailoring of GTM, one author explains that the organization under study controlled the interview plan and the list of interviewees. This restriction forced the author to omit the intended theoretical sampling procedure. Similarly, other articles report limited and/or unique access to the field of study, including interviews with senior executives.

Second, 27 articles (63%) present a methodological rationale for adopting a partial GTM process. Frequently, GTM coding procedures are employed to structure case study data (see Chang et al. 2011; Lederman and Johnston 2011; Matavire and Brown 2013). For example, Levina and Ross (2003) use case write-ups to document case complexity and to incorporate feedback from the participating organizations. They then employ axial coding with checklist matrices to support the discovery of relationships among the variables.

Third, in response to our email, several authors acknowledge their lack of understanding of and/or inexperience with the recommended GTM procedures. For example, they report being unaware of some procedures (e.g., the coding paradigm) and lacking an understanding of how to implement particular procedures. Some authors report that their GTM study was conducted as part of a Ph.D. thesis. Due to the amount of time required to conduct the study, these Ph.D. students learned GTM by "doing" it and, in the process, made omissions that could not be rectified later.

These explanations have four implications for researchers who use GTM and a fifth implication for the development of GTM. First, researchers generally benefit from familiarizing themselves with GTM, and reviewing publications on recent developments in GTM, before beginning their research. In the same way that the objects under study change, the methods that we use to study them must also evolve. For example, deviating from the accepted methodology may allow the GTM procedures adopted to be matched to the specific research setting (Bryant and Charmaz 2007; Clarke 2005; Flick 2013; Morse et al. 2008; Urquhart 2012).

Second, researchers who combine GTM with other methodologies should be aware that adopting this approach frequently restricts the use of theoretical sampling, potentially limiting theory development. Third, authors who accept a convenient research opportunity that restricts the appropriate application of GTM should be aware that it might restrict the opportunity to fully employ GTM for theory development. Given the high cost of data collection and the potential threat to theory development, authors should think carefully before selecting a partial portfolio GTM strategy.

Fourth, the frequent adoption of and the aforementioned explanations for selecting subsets of the GTM procedures highlight the lack of any formal protocol for designing a GTM-based study. Treating the full set of procedures as a portfolio of procedures that can be recombined in various ways to serve different purposes, we propose a *partial portfolio approach* for GTM in which researchers adopt a subset of GTM procedures contingent on the goals of their research and the constraints imposed by the research context.

Fifth, treating GTM as a portfolio of procedures is consistent with both the Straussian preference for a procedural, standardized approach to GTM and the Glaserian preference for flexibility and theoretical integration (Jones and Noble 2007; Urquhart et al. 2010). Coding-based approaches frequently follow Straussian guidelines (see Espinosa et al. 2007). Integration-based GTM approaches tend to follow the Glaserian approach and thus focus less on coding mechanisms than on theoretical sensitivity and theory building (Gasson and Waters 2013).

Two cells in Table 6 account for 30 of the 43 sample articles (70%). Of these articles, 16 adopt the three core procedures of GTM. The other 14 articles employ a partial portfolio approach. They employ GTM-based coding procedures but do not employ theoretical sampling or constant comparison. Typically, the coding procedures are adopted in combination with other methodologies. Espinosa et al. (2007) is an example of this approach. The authors employ open and axial coding to analyze a case study.

Table 6 also reports that eight articles combine coding procedures with either theoretical sampling or constant comparison. Maznevski and Chudoba (2000) report that field access limited their planned sample selection procedure. With 97 citations per year, this paper is a strong argument for developing a formal treatment of a partial portfolio GTM approach.

In a formal treatment of a partial portfolio approach, the articles in Table 6 would help document the boundaries of GTM-based research. In addition, by formally "grounding" the development of GTM in the practice of GTM, including its various forms of research contribution, GTM would become more flexible, formally contingent on the research context. Establishing evaluation criteria for good partial portfolio GTM research designs would increase methodological clarity, make GTM more robust in the sense that the probability of developing different research contributions would be formally related to choices among GTM procedures, and potentially increase the use of GTM in IS research (Sarker 2007).

We speculate that the critical first step in this GTM development would be to relax the requirement or insistence that GTM-based studies must produce theory and to accept that they also make a major contribution by developing pretheoretical models and rich descriptions of new phenomena. Formally examining how various combinations of GTM-based procedures contribute to research would then be possible. Critically, this step would also address how to combine GTM with other research methodologies. We see this paper as a small step toward the maturation stage of qualitative research in IS (Sarker 2007).

Limitations and Future Research

This research is subject to a number of limitations. We review five here and suggest potential directions for future research. First, we adopt citations per year as a proxy for a study's contribution to the IS literature. Although citation networks, the number of coauthors, and article length could bias the results, citations per year is a good proxy for the influence of GTM-based articles on the IS literature compared with that of non-GTM articles (Harzing and van der Wal 2008). Future research could examine in more detail the reasons why GTM articles are cited in IS research, including properties of the article (for example, length and research domain), the authors (for example, experience), and the journal (for example, editorial policy) (Bornmann et al. 2008; Radicchi et al. 2008).

Second, articles are cited for various reasons. One is their research contribution. Another is as a reference for the methodology adopted in the referencing article. The latter would positively bias an article's citation score as a proxy for its research contribution to the IS literature.[8]

To investigate the magnitude of this potential bias, we examined the articles that referenced the ten GTM articles that develop theory.[9] In all, 88% of the citations of these articles are for their research contribution and 12% are for their methodology. Any bias in the research impact of each GTM article in the sample relative to that of the median non-GTM article in the same year in the same journal is likely to be small. Future research could examine the impact of an article's score to examine other research methods or the usefulness of IS theories in general.

Third, the process of classifying GTM articles within our framework is partly subjective. However, the classification is validated by two factors. One is the high inter-coder reliability. The other is that the replies from the authors of 23 studies in the sample validated 86% of our classifications.

Fourth, our classification of GTM results into theory, models, and rich descriptions may not reflect all aspects of the ongoing theory discussion in IS (see Avison and Malaurent 2014; Gregor 2006; Grover and Lyytinen 2015). However, our analysis provides a first step toward understanding opportunities for rich descriptions in GTM research. Possible areas

[8]We thank one of the reviewers for this insight.

[9]Due to resource limitations, it was not possible to examine all the articles that have cited the 43 articles in our sample. We restrict this analysis to a stratified random sample: that is, 10% of the 2,852 articles that reference the ten articles in our sample that develop theory.

of inquiry may include the application of new technologies or well-developed topics, such as security, big data, IT personnel, or IT platforms, which could benefit from fresh theorizing.

Fifth, our analysis is based on the published articles in our sample of 43 GTM articles. Some authors may have applied GTM procedures that are not documented in the published journal articles (see Table A1 in the appendix), which could potentially relocate articles from the left column to the right column in Figure 1.

However, the authors of three of the four theory articles that apply partial GTM explain the reasons that they had omitted procedures. These reasons include data collection contingencies, the tailoring of procedures based on their GTM expertise, and the labeling of exploratory work as GTM (see Table A5 in the appendix). Their reasons did not require changes to our classifications, confirming the adoption of the partial application of GTM procedures in their studies.

Future research could include a study of factors that inhibit the publication of GTM-based studies in IS or develop guidelines for writing and reviewing partial portfolio GTM research in IS. Such research would simultaneously ensure methodological coherence and create novel methodological combinations (Sarker et al. 2013). The tailoring of GTM to study emerging phenomena, including big data, offers fruitful avenues for understanding the continuous adoption of GTM. A promising starting point might be to examine various configurations of the partial portfolio GTM approach.

Conclusion

Our findings show that there is no single unique approach to the practice of GTM-based research. This makes it difficult for researchers to choose the appropriate combinations of GTM procedures and to report their findings, and for reviewers and editors to evaluate the results of those GTM studies. However, it also provides scholars with the opportunity to address multiple goals by adopting the GTM procedures that best match their own circumstances. For authors, this raises implications for study design, including procedure selection, the quality of the documentation, and the nature and impact of the research contribution.

For future GTM studies, researchers should formally decide whether theory development is the primary goal. If so, we recommend that the maximum number of GTM procedures should be deployed. Together with developing a core category, the six GTM procedures, theoretical sampling, constant comparison, axial coding, selective coding, theoretical coding, and memoing, are important for developing theory.

When theory development is not the primary goal, researchers should employ partial portfolio strategies to develop models or rich descriptions. These methodologies are particularly appropriate when exploring a new phenomenon, understanding IS-related phenomena in complex environments, or combining GTM with other research methods. Field access, context, or other situational conditions may limit the application of particular GTM procedures or require the adaptation of the procedures.

The approaches for presenting research based on a partial portfolio of GTM procedures vary in terms of structure, style, and the use of illustrative field data (Gioia et al. 2013; Langley and Abdallah 2011). This heterogeneity is important in technologically dynamic contexts, where one style does not fit all. In addition, our analysis suggests that different types of GTM-based research contributions are highly valued by the IS community. These types of results can be developed further in the iterative theorizing process (Fernandez 2004). Studies that maximize novelty rather than revelation, richness, and trustworthiness must fully document their procedures. While we acknowledge and appreciate the importance of the narrative flow, publication is likely to be contingent on the quality of the documentation.

The take-aways for journal editors and review boards are twofold. One is to acknowledge the research contribution of models and rich descriptions. The other is to enable the research contribution from a partial portfolio approach to GTM by developing guidelines for reviewers to evaluate this approach.

Although some journals limit publication to theory, others welcome a variety of research contributions. For example, studies based on a partial GTM portfolio can contribute to research by describing new phenomena in the field of IS practice. They can enrich our understanding of IS practice and potentially serve as the basis for future theory building.

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METHODS ARTICLE

GROUNDED THEORY METHODOLOGY IN INFORMATION SYSTEMS RESEARCH

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Appendix

Sample

Table A1. Classification of GTM Characteristics in the GTM Sample[1]

		GTM Procedures									GTM Context					
Article	Form of Contributio	Theoretical Sampling	Role of Prior	Open Coding	Axial Coding	Selective Coding	Theoretical Coding	Constant Compariso	Memoing	Coding Paradigm	GTM Approach	GTM Adaptions	Core Category	Duration (Months)	Citations per Year[c]	Total Citations[c]
Barrett and Walsham 1999	T[b]	○	○	○	○	○	○	◐	○	○	S	○	●	34	13.88	222
Maznevski and Chudoba 2000	T[b]	○	○	●[a]	●	●[a]	○	●[a]	○	●[a]	S	●	●	21	97.07	1456
Larsen et al. 2009	T[b]	○	●	●	●	○	○	○	●	○	S	●	●	○	4.5	26
Goulielmos 2004	T	○	●	●	●	●	○	○	○	○	S	○	●	○	4.18	46
Boudreau and Robey 2005	T	●	●	●	●	●	○	●	○	○	S	○	●	15	62.9	629
Volkoff et al. 2007	T	●[a]	●	●	●	●	○	●	●	●	S	●	●	36	28.38	227
Ransbotham and Mitra 2009	T	●	○	●	●	●	○	●	○	○	S	○	●	3-4[a]	12.17	73
Strong and Volkoff 2010	T	●	●	●	●	●	○	●	●	●	S	○	●	36	31	155
Abraham et al. 2013	T	●	○[b]	●	●	●	○	●[a]	●	●[a]	S	●	●[b]	20	4	8
Gasson and Waters 2013	T	●	●	●	○	●	●	●	●	○	G	●	●	2.5	5	10
Smolander et al. 2008	M[b]	●	●	●	●	●	○	●	○	○	S	●	●[a]	12	4.71	33
Huff and Munro 1985	M	●[a]	○	●[a]	○	○	○	◐[a]	○	○	G[a]	○	●[a]	9[a]	6.43	193
Orlikowski 1993	M	○	●	●	●	○	○	●	○	●	S	○	○	○	69	1518
Crook and Kumar 1998	M	●	◐	●	●	●	○	●	○	●	S	○	●	○	13.12	223
Scott 2000	M	○	○	●	●	○	○	○	○	●	S	○	○	6	22.80	342
Scott and Kaindl 2000	M	○	●	●	●	○	○	○	○	●	S	●	○	18	11.27	169
Lee 2001	M	◐	●	●	●	●	○	✪	○	○	S	●	○	6	10.5	147
Fabricatore et al. 2002	M	●[a]	○[a]	●	●	●[a]	○	●	●	●[a]	S	○	●	14[a]	11.31	147
Levina and Ross 2003	M	●	◐	●	●	●[a]	○	●[a]	●	●[a]	S	●	●[a]	40[a]	53.83	646
Nasirin and Birks 2003	M	●	◐	○	○	○	○	✪	○	○	GS	●	○	○	2,5	30
Sherif and Vinze 2003	M	●	○	●	○	●	○	●	○	●	S	●	○	○	5.33	64
Smith and Kumar 2004	M	●	○	●	●	●	○	●	○	●	S	●	●	○	11.64	128
Shah 2006	M	○	●	●	●	●	○	○	○	○	S	○	○	○	66.0	594
Espinosa et al. 2007	M	○	○	●	●	○	○	○	○	○	S	●	○	○	30.75	246
Xu and Ramesh 2007	M	○	●	●	●	●	○	✪	○	○	S	○	○	○	4.38	35
Day et al. 2009	M	○	●	●	●	●	○	◐	○	◐	S	●	●	○	10.67	64
Palka et al. 2009	M	●	●	●	●	●	○	○	○	●	S	○	●	15	18.5	111
Chakraborty et al. 2010	M	●	○[a]	●	●	●	○	●[a]	●	✪	S	●	●[a]	40[a]	14.4	72
Seeley and Targett 1997	D	○	●	●	○	●	○	○	○	○	S	●	●	○	1.17	21
De Vreede et al. 1998	D	●	○	●	○	○	○	✪	○	○	S	●	○	24	8.12	138
Seeley and Targett 1999	D	○	◐	○	○	○	○	○	○	○	S	●	●	○	3.69	59
Jones and Hughes 2001	D	●	●	●	●	●	○	●	●	○	S	○	○	○	8.86	124
Slack and Rowley 2002	D	○	◐	○	○	○	○	○	○	○	S	○	○	2	2.85	37
Debreceny et al. 2003	D	○	○	○	○	○	○	○	○	○	S	●	○	○	3	36
Lander et al. 2004	D	○	○	●	●	○	○	○	○	○	S	●	○	○	14.09	155
Volkoff et al. 2005	D	●	●	●	●	●[a]	○	●	○	●[a]	G[a]	○	●[a]	36	11	110
Zahedi et al. 2006	D	○	○	○	○	○	○	●	○	○	G	●	○	○	4	36
Hackney et al. 2007	D	●	○	●	●	●	○	✪	○	○	S	●	○	○	5.13	41
Tschang 2007	D	○	●	○	○	○	○	○	○	○	GS	●	○	36	16.63	133
Kesseler 2008	D	◐	●	○	○	○	○	✪	○	○	GS	●	○	56	2.86	20
Ribes and Finholt 2009	D	●[a]	○	●[a]	○	○	○	●	○	✪[a]	2G	●	●[a]	56	17.83	107
Chang et al. 2011	D	◐	○	●	●	●	○	○	○	○	S	●	○	○	3.25	13
Lederman and Johnston 2011	D	○	●	●	●	●	○	○	●	○	S	●	○	○	2.5	10

● Does apply
◐ Does apply partially/indicated
✪ Other
○ Not reported
[a] Change after contacting the authors based on additional information
[b] Change after contacting the authors based on false coding
[c] Citations from Google Scholar as of Spring 2015
[d] Reverse coding

T Theory
M Model
D Description
GS Glaser and Strauss 1967
S Straussian
G Glaserian
2G Second generation (e.g., Clarke)

[1]The articles analyzed in this dataset are limited to the years 1985 to 2013. A more comprehensive list of classified articles that is continuously updated can be accessed at www.grounded-theory.com.

Table A2. Analysis of GTM Articles per Journal

Journal	Abbreviation	Number of GTM	Description	Model	Theory	Average Duration (Months)[1]	Average GTM Procedures	Average Citations of GTM Articles	No. of GTM Articles Cited < 50% of All	No. of GTM Articles Cited ≥ 50% of All	Year of First GTM Article	Year of Last GTM Article
European Journal of Information Systems	EJIS	8	5	1	2	17.6	6.3	5.6	2	6	2001	2013
Information and Management	I&M	8	2	6	0	12.0	4.8	9.0	3	5	1998	2004
Journal of Management Information Systems	JMIS	5	2	3	0	15.0	3.6	26.4	2	3	2000	2007
Information Systems Journal	ISJ	4	2	0	2	56.0	2.9	3.2	4	0	1997	2009
MIS Quarterly	MISQ	4	0	3	1	28.3	5.8	40.1	0	4	1985	2010
Organization Science	OS	4	1	0	3	27.0	5.3	51.2	0	4	2000	2007
Journal of the Association of Information Systems	JAIS	3	1	2	0	48.0	6.0	14.3	0	3	2009	2010
Information Systems Research	ISR	2	0	0	2	18.8	3.8	13.0	1	1	1999	2009
Decision Support Systems	DSS	1	1	0	0	-	2.0	3.0	1	0	2003	2003
Human-Computer Interaction	HCI	1	0	1	0	14.0	8.0	11.3	0	1	2002	2002
International Journal of Information Management	IJIM	1	1	0	0	2.0	0.5	2.8	0	1	2002	2002
Journal of Information Technology	JIT	1	0	1	0	15.0	5.0	18.5	0	1	2009	2009
Management Science	MS	1	0	1	0	-	3.0	4.0	0	1	2006	2006

[1]As reported in the article or by the authors in their responses.

Analysis

Boxplot analysis. We conducted a boxplot analysis to examine the number of citations of a GTM article in relation to other articles published in the same journal in the same year. We compiled a boxplot for each GTM article with those in the same journal in the same year. For example, the citations for the 2003 Levina and Ross article (646) are compared with the citations for the other articles in Volume 27 of *MIS Quarterly*.

In each boxplot, the vertical bar represents the median of the citations per article. The box represents the interquartile range, from the 25th to 75th percentile. The ends of the whiskers (the lines extending vertically from the boxes) represent the highest value within the 1.5 interquartile range from the upper quartile and the lowest value within the 1.5 interquartile range from the lower quartile. The position of each GTM paper is marked in its respective boxplot.

Table A3. Overview of Boxplot Analysis of GTM Articles

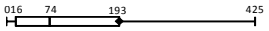
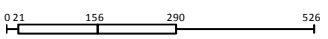
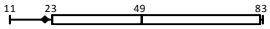
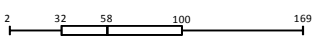
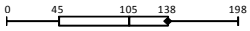
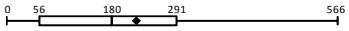
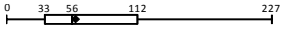
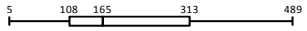
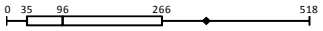
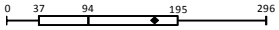
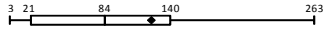
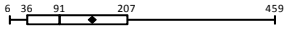
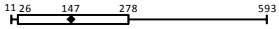
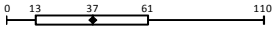
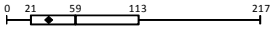
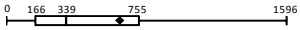
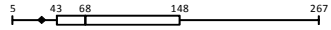
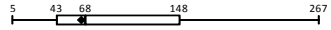
GTM Article	Journal	Total Citations	Quartile Position	Boxplot of Citations of Articles Published in the Same Journal in the Same Year
Huff and Munro 1985	MISQ	193	Upper Quartile	
Orlikowski 1993	MISQ	1518	Outlier	 a
Seeley and Targett 1997	ISJ	21	Lower Quartile	
Crook and Kumar 1998	I&M	223	Outlier	 a
De Vreede et al. 1998	JMIS	138	Upper Quartile	
Barrett and Walsham 1999	ISR	222	Upper Quartile	
Seeley and Targett 1999	I&M	59	Upper Quartile	
Maznevski and Chudoba 2000	OS	1456	Outlier	 a
Scott 2000	JMIS	342	Upper Quartile	
Scott and Kaindl 2000	I&M	169	Upper Quartile	
Jones and Hughes 2001	EJIS	124	Upper Quartile	
Lee 2001	I&M	147	Upper Quartile	
Fabricatore et al. 2002	HCI	147	Median	
Slack and Rowley 2002	IJIM	37	Median	
Debreceny et al. 2003	DSS	36	Lower Quartile	
Levina and Ross 2003	MISQ	646	Upper Quartile	
Nasirin and Birks 2003	I&M	30	Lower Quartile	
Sherif and Vinze 2003	I&M	64	Lower Quartile	

Table A3. Overview of Boxplot Analysis of GTM Articles (Continued)

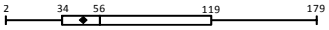
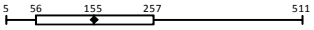
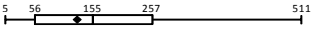
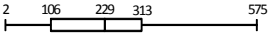
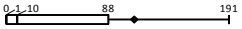
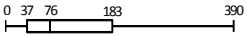
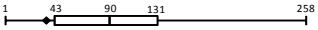
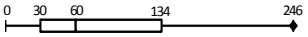
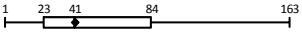
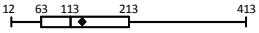
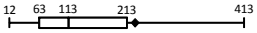
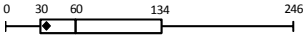
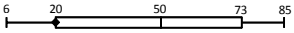
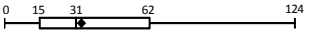
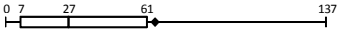
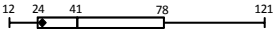
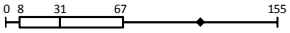
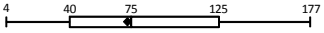
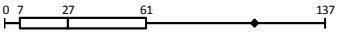
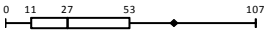
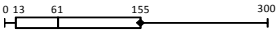
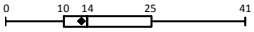
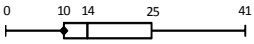
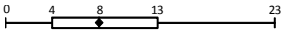
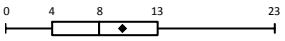
GTM Article	Journal	Total citations	Quartile position	Boxplot of Citations of Articles Published in the Same Journal in the Same Year
Goulielmos 2004	ISJ	46	Lower Quartile	
Lander et al. 2004	I&M	155	Upper Quartile	
Smith and Kumar 2004	I&M	128	Lower Quartile	
Boudreau and Robey 2005	OS	629	Outlier	 a
Volkoff et al. 2005	EJIS	110	Upper Quartile	
Shah 2006	MS	594	Outlier	 a
Zahedi et al. 2006	JMIS	36	Lower Quartile	
Espinosa et al. 2007	JMIS	246	Upper Quartile	
Hackney et al. 2007	EJIS	41	Upper Quartile	
Tschang 2007	OS	133	Upper Quartile	
Volkoff et al. 2007	OS	227	Upper Quartile	
Xu and Ramesh 2007	JMIS	35	Lower Quartile	
Kesseler 2008	ISJ	20	Lower Quartile	
Smolander et al. 2008	EJIS	33	Upper Quartile	
Day et al. 2009	JAIS	64	Upper Quartile	
Larsen et al. 2009	ISJ	26	Lower Quartile	
Palka et al. 2009	JIT	111	Upper Quartile	
Ransbotham and Mitra 2009	ISR	73	Lower Quartile	

Table A3. Overview of Boxplot Analysis of GTM Articles (Continued)

GTM Article	Journal	Total citations	Quartile position	Boxplot of Citations of Articles Published in the Same Journal in the Same Year
Ribes and Finholt 2009	JAIS	107	Upper Quartile	
Chakraborty et al. 2010	JAIS	72	Upper Quartile	
Strong and Volkoff 2010	MISQ	155	Upper Quartile	
Chang et al. 2011	EJIS	13	Lower Quartile	
Lederman and Johnston 2011	EJIS	10	Lower Quartile	
Abraham et al. 2013	EJIS	8	Median	
Gasson and Waters 2013	EJIS	10	Upper Quartile	

[a] Outliers are not marked in the boxplot.

Table A4. The Effect of GTM Procedures on Research Contribution

Sensitivity Analysis Theory and Description[a]				
Type of Result	**Mean**	**Median**	**W**	**p-value**
Theory	4.4	4.5	119	0.007
Description	2.2	2		
Sensitivity Analysis Model and Description[a]				
Type of Result	**Mean**	**Median**	**W**	**p-value**
Model	3.5	4	191.5	0.019
Description	2.2	2		
Sensitivity Analysis Theory and Model[a]				
Type of Result	**Mean**	**Median**	**W**	**p-value**
Theory	4.4	4.5	126.5	0.035
Model	3.5	4		

[a] A one-sided Wilcoxon signed-rank test is reported; because of the direction of the relationship, for example, the number of procedures adopted by studies that develop theory is hypothesized to be higher than the number of procedures adopted by studies that develop models.

Additional Analysis

Responses from Authors

We contacted the authors to check our classification of their articles. We received responses from the authors of 23 articles. The authors confirm 86% of our classification. Sixteen responses (70%) report a discrepancy between our classification and the actual analysis in their study. Nine responders indicate that not all applied procedures are reported in the final article. Of these unreported procedures, the coding paradigm and constant comparison are most frequently omitted from the published article.

Other responses included discrepancies about the form of contribution and the presence of a core category. Each discrepancy was discussed by the research team and was changed when the authors' comments were convincing. For 9 of the 51 suggested changes, we decided against changing our classification. With regard to the form of contribution, the authors had a different understanding of our definitions or did not provide additional arguments. Here, we recoded the paper to revise our classification.

In addition to checking the classification, the authors commented broadly on their experiences with GTM in IS research. Several themes emerged from these open answers.[2] The authors provided various reasons why they omitted or altered GTM procedures, ranging from IS culture to personal preferences. Table A5 reports representative quotations from the authors' responses, our classification, and the emerging themes.

Table A5. Themes, Codes, and Representative Quotations on Experiences of Using GTM

Theme	Code	Representative Quotations from the Authors' Answers
Situational context	Limitations of studying organizational phenomena	"The only technique I wouldn't use is theoretical sampling, and that is because I usually study topics that are somewhat sensitive and I need to accept interviews when available rather than when I would like. I would add that there are many shortcomings of traditional GTM that can be overcome by using other techniques drawn from other methods; mentioning these in a paper only opens one up to another onslaught of idiotic criticism." *Author Lisa*
	Uniqueness of the case	"So we had this excellent opportunity to collect this data . … The case was unique and we [would have] had to wait a long time for the next [occurrence]. Of course, you can hardly replicate that, but still, this is interesting for the community. I study emerging technologies as well, different perspective, but again you can easily provide interesting parts." *Author Betty*
	Fit of GTM to research task	"Between rounds two and three, we completely re-analyzed our data and only then were we able to recognize and describe the complexity of what happened in straightforward terms, especially the insights around CORE CATEGORY. We were fortunate to receive constructive reviews [that] provided guidance and encouragement so we could find the theory in our data." *Author Jo*
GTM strategy	Purpose of the study	"A study of an emerging phenomenon may not require theoretical sampling to produce interesting and useful insights to the academic community. Providing 'some' insight in a timely manner is preferable to gathering enough data over an extended period of time to provide a 'final answer.'" *Author Ann*
	Mixing GTM strategies	"We did use Glaser and Strauss. So after talking with GTM EXPERT he said you can mix these. So we did Straussian because that is what the reviewers knew and so if you start with it open and selective coding, but then do axial coding. … So what we tried with this mix is we tried to take the best of both to take some structure from Strauss. But the openness to the data, that comes from Glaser." *Author Chloe*
	Experience allows tailoring	"GTM in complete form is beneficial to novice researchers because it specifies the set of activities which, if followed, promises to result in a contribution. Its rigor provides a defense against criticism often directed toward qualitative research (i.e., that it is not rigorous). In later studies, the authors have adopted basic tenets of GTM depending on the research task. These tenets are just as valuable when taken individually as when taken as a whole. In fact, the procedures existed before GTM was formalized." *Author Stacy*
Incomplete document-ation of GTM procedures	Lacking knowledge	"The only indication of us using a Straussian approach was the word 'axial coding,' but this was mostly because at the time, we did not fully understand the difference. … Now, with deeper understanding of GTM, I can say that we used the Glaserian approach. … we applied selective coding and identification of core category. This was not explained in the paper because I (and my co-author) were not versed enough in GTM terminology to properly explain what we did." *Author Mary*
	Authors did not report all GTM procedures	"We should clarify that during the review process, the manuscript included procedural details, which illustrated/demonstrated the analysis carried out by this study and helped satisfy expectations of rigor of the review team. The material was omitted from the published manuscript since the details were likely to detract attention from the main purpose of the study." *Author Jane*

[2]The names of the authors, journals, and research topics discussed here have been changed to protect the anonymity of our respondents.

Table A5. Themes, Codes, and Representative Quotations on Experiences of Using GTM (Continued)		
Theme	**Code**	**Representative Quotations from the Authors' Answers**
Review process influence	Reviewers did not allow GTM adaption	"Interestingly, I now discourage students from using the term grounded theory when they publish because I feel that some reviewers are very critical if it isn't applied in a purely Straussian way or whatever way they prefer. … I am currently writing another paper using this data and am not certain if I will refer to GTM." *Author Lisa*
	Fashion trends	"So essentially we had some problems with the reviewers on getting our paper published. In [the early 2000s] Glaser was out. We just kind of left our approach and took out what they said. We didn't take the methods out, we just at first had a strong claim in here that we're doing a Glaserian approach and the reviewers hammered on us for that. … Whatever I sent in the reviewers said why aren't you using PROCEDURE? And I said to my colleague who did all the data analysis—just switch it to PROCEDURE. Because there are subtle differences between them but it doesn't change the basic story." *Author Chloe*
	Low number of high-quality GTM reviewers	"It has also been our experience that while the increased acceptance of GTM has increased expertise within the discipline, increasing the number of well-informed reviewers, there still remains a considerable variance. We have encountered reviewers who have raised poorly conceived objections to our approach based on an incomplete understanding of GTM. Such reviews may, in our opinion, bias an editor who does not have expertise on the methodology." *Author Jane*

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