CHAPTER 3:

RESEARCH DESIGN
3. Introduction

In this chapter, detailed discussions on the research design and research methodology, along with justifications for choosing the same have been covered.

3.1 Research Design

The research design starts with identification of the research gaps done in the literature review section, and then designing the research questions and the approach of research- steps, case studies, data analysis and conclusions.

Case study based research has been the chosen methodology for this research work, as this is primarily implementation-based and the research outcomes have been tested in enterprise scenarios on which the cases are built. The discussion on applicability of case-study research as a valid methodology emphasizes that

- it depends on the research objective which research strategy fits best: The case study or the survey.

- For theory-testing research, the answer to the question is that the choice depends on the type of proposition that is tested. A deterministic proposition (e.g. a necessary condition) can be tested in only one instance by using a single case study (replications with other cases must enhance the generalizability of the proposition), and a probabilistic proposition must be tested in a group of instances (and again replications must enhance the generalizability of the proposition).

3.2 Research Gaps and Need/ Rationale for Research

From the literature review in section 2, it has been discussed and shown that, although sufficient research has gone into various diverse, apparently ‘independent’ dimensions of technical/application-oriented aspects of knowledge management e.g. knowledge
classification, extraction, representation etc., there are still some gaps that demand more research, e.g.:

- The technical aspects of knowledge representation and classification have been studied in depth. Numerous models in these domains have been proposed, developed and tested. But, while the works are great in terms of depth e.g. analyses of each algorithm and their applications, the interconnections and inter-dependencies of these techniques have hardly been studied. That is to say, the depth-focused research efforts, while being wonderful in terms of mathematical and technical brilliance, are often seemingly ‘fragmented’ or so deep in themselves that one tends to miss the broader contexts i.e. ‘knowledge management’ where these tools are supposed to be applied.

- Even while diving deep into these algorithms, a few fundamental aspects that are of tremendous practical relevance, are often overlooked, may be due to the ‘over-rigor’ or too much emphasis on to the algorithms themselves rather than studying their application-contexts. For example, loads of text mining algorithms have been proposed. But a simple aspect of using whatever little bit ‘semi-structured’, ‘short-text’ elements that are mostly there along with all long-body free-flowing texts, has not been fully practically explicitly exploited by most of these otherwise high-performance, validated algorithms.

- Automating the knowledge extraction process by integrating them with simple standard artificial intelligence based machine learning algorithms, has not been fully explored and exploited as an idea either.
Similarly, knowledge measurability and attempts to ‘visually’ represent knowledge elements as part of an organizational memory, is also a not-so-explored domain.

3.3 Research Questions: Models and Solutions

To address these gaps, the work presented in this thesis has primarily attempted to develop and validate by application, process models that will

- Work on knowledge pre-classification by trying to create ‘information labels’ or knowledge labels’ using the short-texts like titles or headers or subject lines of email messages or long texts etc. [addresses a key research gap on knowledge representation – classification]
- Automate the knowledge extraction process by integrating the similarity metrics algorithms etc to the machine learning algorithms [addresses the research gap of knowledge extraction from tacit/ implicit unstructured sources]
- Create a ‘visual’ representation of specific knowledge elements and attempting to partially measure the knowledge content or ‘knowledge entropy’ of any knowledge element, conceptually similar to ‘information entropy’ related ideas. [addresses the research gap of ‘knowledge measurability]

As all these are process models, it will not be possible to validate them without actually applying them. Therefore:

- This research work is a ‘theory-testing’ equivalent or theory-testing type rather than theory-building type. The theories i.e. the process models have been developed by the researchers but will have to be tested for their
The applicability in specific application contexts, to ensure both their application validity and value.

- This work thereby being more ‘experiments’ or 'application-driven' than ‘exploratory’ in nature, and therefore would not fit to the typical ‘survey-based’ research methodology framework at all.

- The application contexts required for testing and validating the process models developed in this work can be best provided by specific application instance i.e. testing them by applying them on to specific case studies.

**Using product development analogies to theory development:**

If theories can also be perceived or ‘conceptualized’ as products of cognitive processes i.e. thinking and/or imagining and/or experimenting and/or implementing processes, then product development strategies can be applied to theory development as well.

If the Thomke’s framework can be conceptually applicable to theory development as well, then the steps mentioned here: design-->build-->test-->analyze: can be applicable to theories as well. This can be thought as the ‘prototyping’ equivalent of theory building. In that case, the case studies are the ‘test-beds’ for the new theoretical models built and run and the results analyzed.

Therefore, for this research work, the case-study based methodology is found to be more appropriate than the survey-based methodologies, for reasons mentioned above. In this context, the process models are the theories that are developed and to be tested for their merits and appropriateness in an application context. Case studies provide exactly that application context which is analogous to an experimental ‘set-up’ in which theories are tested. The process models will be applied in the contexts or ‘set-up’s of the case studies, and their outputs will be analyzed for their application
relevance which can then be generalized for evaluating the application potential of the process models in various other contexts.

3.4 **Research Methodology**

Based on the discussions presented in sections 3.1 and 3.2 above, the following case-based research methodology has been used in this thesis:

Step I: Introduction to knowledge management and organizational memory: technical and management aspects, challenges, research issues, dimensions of the domain of knowledge management and organizational memory

Step II: Literature review on knowledge management and organizational memory, specifically with regard to techniques pertaining to knowledge classification, knowledge extraction and knowledge representation and measurability, in context of knowledge management and organizational memory

Step III: Identification of gaps by analyzing the literature review section, framing the research objectives and problems

Step IV: Choosing the most appropriate methodology amongst the choice of available research methodologies, based on the research objectives and problems

Step V: Developing the process models for knowledge pre-classification, extraction, representation and measurability in context of organizational memory, analyzing the process models for applications using various examples and algorithm analysis techniques

Step VI: Testing the process models by applying them on real-life cases: This step includes two real-life case studies – one on domino’s pizza customer interactions – knowledge management applications, and the other on Amex competency framework for managing their organizational knowledge about available competencies of
resources i.e. employees. The process models for knowledge pre-classification and extraction has been applied on the Domino’s customer interactions case study, and the model responses have been analyzed for their performance criteria and value. Process models for knowledge representation and measurability has been applied and tested on the Amex competency case-study, for their performance and value.

Step VII: Discussing the application value of the process models developed, tested and validated by the case-study research methodology in this work, in terms of their application potential, value and performance issues.

Step VIII: Concluding the research work in terms of the value of the validated models in real-life contexts or applied knowledge management to build organizational memory in different organizational contexts, their limitations, extension and further research possibilities.

Over the decade, especially from 2005 onwards case study as a valid research methodology especially in fields like political science, social sciences including management, has seen tremendous growth and acceptability. As case studies are increasingly applied, particularly in the management and business areas, both in practical business areas as well as a valid pedagogical tool in academia, research focused on case study applications have gained significant momentum over these years.

This methodology, originally proposed by Robert K. Yin in the 'The Case Study as a Aerious Research Strategy' (Yin, 1981), has gradually drawn significant attention from researchers across various scientific disciplines. In 2008, researchers from RSM Erasmus University have systematized these developments, and formulated them into a comprehensive framework, presented in a book by Jan Dul and Tony Hak, Case Study Methodology in Business Research (Butterworth-Heinemann, 2008).
The basic premises as suggested in this seminal work on case study as a research tool are:

- Case study research is an appropriate and often preferable research strategy for theory testing, predominantly in case of most management theories where practices precedes the theorization

- Many propositions can be tested in single cases. Generalizability of the outcomes of such tests can be achieved by conducting replication studies. Applications proven valid in a specific case context can be replicated in different case contexts. The generalizable aspect here is the applicability of the concept for the proposed and validated tool, fitting it to various different application contexts.

Any important category of theories can be tested in single cases consists of necessary condition propositions. According to Goertz’s First Law “For any research area one can find important necessary condition hypotheses”. (Necessary Conditions: Theory, methodology, and applications (Rowman & Littlefield, 2003), edited by Gary Goertz and Harvey Starr.)

Tony Hak and Jan Dul, two leading case study researchers in political science and in management discussed these aspects in context of business science. Main underpinning contributions are still from Gary Goertz (Professor of Political Science, University of Arizona, USA) and Chris Voss (Professor of Operations and Technology, London Business School, UK).

The following definition of a case study had been proposed and accepted by the researchers:

A case study is a study in which

(a) one case (single case study) or a small number of cases (comparative casestudy) in their real life context are selected and
(b) applications of models are tested upon then and these contextual application scores obtained from these cases are analyzed in a qualitative manner.

This is the methodology that has been adopted in this body of research and as a basis of this thesis, as the process models developed in this research are all application-oriented and needs to be applied in specific organizational contexts to realistically demonstrate the value they may bring to any specific organizational context, as a generalizable hypothesis. The process models for knowledge classification- various algorithms for knowledge ‘pre-classification’, as well as contextual knowledge extraction process models, have been demonstrated in application to customer interactions in case of Domino’s pizza. The knowledge representation model developed in this research work- called the ‘Spider-web’ and accordingly the measurability metrics - ‘knowledge entropy’ concepts and corresponding process models have been demonstrated in the context of the American Express Competency Mapping case-study.

The focus of this research work is more on ‘testing’ the applications of the proposed theories i.e. the mathematical process models developed herein for organizational knowledge elements classification-extraction-representation, than on construction of any theory. Hence the case-based application-examples are the more suitable research approach in this context for testing the mathematical process model ‘theories’ that are developed in this research.

For example, in a thesis titled “Case research in purchasing and supply management: opportunities and challenges”, Dubois and Araujo talk about “the application of qualitative methods” (qualitative measurement and qualitative data analysis) as a synonym for case study research, where they provide some insights into how to contrast the case study research strategy with the (“quantitative”) survey strategy.
The real methodological issue here, as found by the authors, corroborates the researcher’s view in this thesis that choice and applicability of a certain methodology or any class of methodologies depend primarily on specific, stated research objectives as to which research strategy fits best, be it qualitative or quantitative, parametric or non-parametric, case study-based or survey-based and so on. This work has been a welcome contribution to the discussion about case study methodology in business research. The focus on the need of consistency between the research objective and its design is well justified and hence deeply appreciated rather than any futile attempt to purely theoretically contribute to quantitative and qualitative camps or a suggested midway with mixed or hybrid methods. Some research objectives require a case study strategy, and other research objectives require a survey strategy, it can be seen as simple as that.

A case study can be broadly defined as a study in which: (a) one case (single case study) or a small number of cases (comparative case study) in their real life context are selected; and (b) scores obtained from these cases are analyzed in a qualitative manner (Dul and Hak, 2008). Case study methodology seems to be more appropriate generally where

1) Exploration and experimentation are part of the research objectives. This way, case studies can be used as good-fits both for theory-building(exploration) or theory-testing( experimentation).

2) Cases can be used as a tool to persuade a reader who may be not-so-well-trained with statistical methods, but can relate to real-world events through his/her natural experiences.

3) Flexibility of the case method and possibility of a fluid discussion and description of the ‘casing process’ can bring in the advantages of agility to a research design
4) The seemingly unwillingness of users of case-studies to attempt a theoretical generalization leads to more experiment-oriented, agile thinking processes that are not confined within the boundaries of underlying assumptions or constraints.

George and Bennett (2005) offered another viewpoint or lens through which the research community can look at cases as a toll, called “within-case analysis”. This includes references to procedures of purposeful sampling as a means of “choosing cases from which in-depth understandings and insights can be gleaned” George and Bennett (2005) they state that “case studies can also play an important role in theory-testing”

Some important aspects in light of this discussion should be analyzed well, e.g. how researchers should choose specific cases to illustrate or test a proposed theory or model. Majority of researchers opine towards selecting ‘most likely’ cases as they can help generalizing the theory as best as possible without losing much on the application-context specificities. In case a “least likely” test is used, it is assumed that there are propositions that can be tested in a single case. The concept of a “least likely” or of a “most likely” case is usually relevant only in the context of a strategy of theory-testing where the tests can qualify as instances open to replication. This way, even single case studies can be used for theory testing and generalizability in case studies can be realized by replication. If a single case provides us with insight only about things for example relationship between two entities or various process models or practices from a best-practice case or a worst-practice case, where dimensions of proposed processes or models are observable in a single instance of an object of study (Dul and Hak, 2008), that can still remain a valid application so long as the concept is open to replication. That is to say, the process models either as-it-is
or with slight tweaks or customizations can be applied to various other different case contexts and their results can be observed or analyzed using similar set of parameters. However, any probabilistic phenomenon can never lend itself to observations in a single case. Such phenomena can only be discovered and tested in multiple instance research, of which survey research is the prime example. On the contrary, if a relation or phenomenon can be observed in a single case, then the single case can be used for a test. This is the case for this thesis work, where different process models developed are tested for applicability, value and performance on two case studies as two example contexts. The phenomenon observed from the case applications of the developed process models are then analyzed for the value the models bring in, in the contexts of the single cases, and their business relevance and application relevance that can be then replicated in different application contexts i.e. different cases. This way, the case-based validation of the developed process models can lead to a theorization of the process models through customized replication possibilities.

Lots of observations of applied, practical relevance can actually be better facilitated by testing models on single or multiple case instances. While focusing on the role of case study research in theory development, the most important category of theoretical statements that are testable in a single case is the category of necessary condition propositions i.e. to theorize the applicability of process models for example. By condition propositions it is meant that these propositions define the states that a dependent concept (an ‘‘effect’’) can exist only if an independent concept (‘‘cause’’) has a specified value. This value is the necessary condition (Goertz and Starr, 2003; Dul and Hak, 2008).

For example, in a hypotheses the necessary condition can be coined as ‘‘The average revenue for last 10 years of the companies under consideration for these process
models should be more than 100 million USD”. Such a necessary condition hypothesis could be tested in a single case, be replicated in another single case in a different context i.e. another country or another format i.e. a single-company, a conglomerate or an MNC and so on, until one is satisfied that no contrary case i.e. ‘black swans’ can be found. This is the typical context of this research work where

- the process models suggested i.e. ‘causes’
- given certain necessary conditions i.e. ‘knowledge is of value to these organizations’
- would bring in some ‘effects’ i.e. business values derived from the extracted, categorized and adequately represented knowledge e.g. understanding customers better or their changing preferences better etc.,

in different ways and different degrees.

### 3.5 Case-based Research Methodology and it’s Applicability

A significant difference between the experiment-based research methodology and the case study-based research methodology is that the experiment manipulates instances i.e. experiments are created in an artificial ‘laboratory’-like environment where the real-world control levers are often ‘set up’ i.e. controlled during an experiment. On the other hand, a case study does not attempt to ‘control’ any of the real-world levers. It simply tries to tell the story that is as much close to reality as possible.

Therefore, broadly speaking, an experiment can be thought as a study in which one or more variable characteristics of an object of study are manipulated in one or multiple (“experimental”) instances of an object of study and in which scores obtained in the experimental instance or instances are analyzed.

But using the word ‘Manipulation’ in this context, it can be interpreted that even though theories are traditionally generalized by experiments, various parameters of
the experiment ‘environment’ (i.e. context) are ‘manipulated’ i.e. kept fixed or ‘controlled’ and thus are also not typically reflecting the real-world environment in which the experiment is happening. That is to say, experiments also do not happen in a ‘purely natural’, purely ‘random’ context. So their results should also not be viewed as ‘easily generalizable’, given their context-dependencies that are usually covered either explicitly or in the underlying assumptions. That means, if we interpret experiment results without paying attention to the assumptions, we are vulnerable to the problems of generalization assuming the results are ‘context-free’ when in reality, no experiments can be ‘context-free’.

A most common example of a traditional research methodology tool is a ‘survey’. Surveys- the most popular and widely used traditional instrument for experimental studies, also studies instances in their real life context. A survey is a study in which

1) a single population in the real life context is selected and
2) scores obtained from this population are analyzed in a quantitative (statistical) manner.

But, the survey and the case study are different in a number of ways, i.e.

1) the number of instances from which data are collected for the analysis and, consequently, the ‘sampling bias’ that gets introduced in emulating the ‘real-world’ behaviors
2) Unavoidable ‘researcher’s thinking bias introduced during the formulation of the testable hypotheses – this includes very fundamental assumptions like the hypotheses or research problems in question

   a) Are ‘generalizable’ in the first place, and
   b) Instances’ behaviors or responses are not time or any other variable-variant
3) the method chosen for data analysis also introduces it’s inherent assumptions-based biases into the research findings.

In this context, it is worthwhile mentioning a landmark work called ‘Predictably Irrational’ by Dan Orielly - an MIT Professor. The work describes how the fundamental assumptions on ‘bounded rationality’ of human beings do not hold any good in emulating real-world behaviors, and how various different situational stimuli can elicit completely different responses from the same human respondents’ sampling instances.

To apply Case Study Methodology in Business Research, the structures and guidelines are required for researchers from a wide range of disciplines to develop their case study research in a consistent and rigorous manner. These guidelines should clarify the differences between practice-oriented and theory-oriented research and, within the latter category, between theory-testing and theory-building. It should also describe in detail how to design and conduct different types of case study research.

The main issues in Case Study research are to:

1) present a broad spectrum of types of case study research that includes the three major categories:
   1. practice-oriented case studies,
   2. theory-building case studies and
   3. theory-testing case studies

in one consistent methodological framework.

2) Applicability issues and clear objectives to justify that the case study is the preferred research strategy for testing deterministic propositions such as those expressing a necessary condition case by case and that the survey is the preferred research strategy for testing probabilistic propositions.
3) Replication-ability issues as is appropriate in contexts of all theory-testing research, irrespective of which research strategy is chosen for a specific test. Replication is needed in all theory-testing research, not only in case studies.

Overall, the case study based research methodologies give more weight to the importance of theory-testing relative to theory-building.

While the case study approach to research is not fool-proof or can be claimed to be completely devoid of any of these biases either, it simply serves a few major purposes in research

1) It does not even attempt to ‘force-fit’ any research conclusion as a generalizable theory; on the other hand it just emulated some specific real-world application example scenarios. Other real-world scenarios can be very different, and this difference is well-accepted in case-study based research.

2) It promotes ‘examples’-driven methodology that does not try to generalize or undermine the richness of the typicality or specificities of any real-world contexts.

3) This way, the case-study approach really seems to be a ‘best practice’ or any practice instance approach, that is as close to real world application scenarios as possible.

The case study draws conclusions on the basis of a “qualitative” analysis for example, a demo of system as is the case in the context of this research, or similar visual inspections of scores from one single instance (single case study) or from a small number of instances (comparative case study).
Surveys draw conclusions on the basis of a quantitative (statistical) analysis of data from a population with a large number of instances.

The proposed definition of the case study does not include statements on data collection or measurement techniques. In this view research strategies do not differ, in principle, in terms of methods of measurement. For all three research strategies discussed, the data analyzed can be quantitative or qualitative, depending on the research questions, structuredness of the research domain, and the specific research effort context. Measurement methods that are usually associated with case studies, such as the qualitative interviews or demonstration responses or using multiple sources of evidence could also be used in the other research strategies. Similarly, measurement methods that are usually associated with other research strategies, such as quantitative performance measurements in experiments, could also be used in case studies. Principles of measurement and the quality criteria that apply to it, such as reliability and validity, apply to any measurement in any research strategy.

Although in a case study quantitative data can be used to generate the scores to be analyzed, the interpretation of scores of the small number of cases in order to generate the outcome of the study is done qualitatively e.g. by a system demonstration and analyzing the results or visual inspection etc. and not statistically. Summarily speaking, the case study is a research strategy defined by the number of instances (N=1 or N=small) that is studied as well as the “qualitative” or non-statistical method of analysis of all kinds of (quantitative and qualitative) data.

Hence, the case-study research methodology has the following dimensions:
The case study based research methodology can be designed as an appropriate research strategy for theory-testing, but it does not try to generalize the theory overall, and tries to maintain the ‘real-worldliness’ of the case contexts or application scenario instances.

Researchers must make a choice between the survey and the case study as the main strategy in their research, if an experiment is not feasible. The case study is the preferred research strategy for testing deterministic application propositions case by case, and the survey is the preferred research strategy for testing probabilistic propositions in a population.

The role of case study research in theory-testing research gets confusing especially when propositions are not precisely specified. It is relatively easy to build relevant propositions but much more difficult to find out whether they are supported and, if so, for which domain. It certainly takes much more effort and time to test propositions than to build them. Particularly, theory development requires many replications. This is a general statement about theory development, and as such is not related to the case study only. However, it is important to make this point because case study research is often promoted as particularly suited for generating new propositions in “exploratory” studies. Contrary to such promotion, designing and conducting a case study with a theory-building i.e. with exploratory aims is often not useful because

(a) It is usually more important for the development of a theory that already formulated propositions are tested and that such tests are replicable and

(b) There are usually much more effective and efficient ways of building propositions.

Then, for any research area one can find important necessary condition propositions. For example, the work by Gary Goertzon research areas in political science, applies to research areas in business research as well. Necessary condition statements are
particularly relevant for managerial problems that are formulated as “critical success factors”, i.e. conditions that should be in place to make success possible at all.

A common criticism of case study research concerns the alleged “lack of generalizability” of the results of a case study. However, every test result needs replication or generalizability, be it a one-shot survey of a population, a one-shot experiment, and a one-shot case study.

However, one broad issue where the consensus almost the research community that seems to build up is that there is more need for theory-testing research than for theory-building research.

This implies that the choice for either the case study or the survey as the research strategy in a theory-testing study must depend on the type of proposition and not on, for example, the method of measurement i.e. intensive or extensive; “qualitative” or “quantitative”, a researcher’s preferences or habits, or what is fashionable in a discipline or field. If the proposition is more inclined towards ‘testing’ a proposed theory or some theoretical mathematical model etc., then case-study approach may offer better application suitability. This is exactly the case in the context of the research work of this thesis.

In view of the entire research methodology theoretical landscape, contrast between quantitative methods and qualitative methods that is one of the most discussed topics in the research community, many well-known researchers in this field feel this to be a rather practice-oriented applicability question than being a major methodological issue in business research, including purchasing and supply management. Discussion on ‘theories of methodologies’ often get obscured by confusion about the meanings of “quantitative methods” and “qualitative methods”, which in turn obscures real
issues of applicability, generalize-ability or ‘theorize-ability’ of a concept and so on. For any discussion on reputed quantitative methods–qualitative methods contrasts, it is necessary to make a distinction between two different concepts of “methods”. i.e. the purpose or objectives of ‘what’ these methods are for. There can be various different methods for various different things, e.g.:

(1) Methods for measurement where data are collected and coded in order to produce scores that represent the observed values of the variables. These scores can be numerical (‘quantitative’) or textual (‘qualitative’). Measurement is called “quantitative” if the obtained score is numerical and measurement is called “qualitative” if the resulting score is textual. It is worth-observing that the methods of data collection cannot be classified in this way. Standardized questionnaires can result in qualitative as well as in quantitative scores and ethnographic field notes can result in quantitative as well as in qualitative scores.

(2) Data analysis Methods-using these methods, scores must be analyzed in order to produce the outcome of a study. This analysis consists of either statistical analysis (“quantitative”) or visual inspection (“qualitative”).

The confusion about the terms “qualitative and quantitative methods” is apparent in the two thesis mentioned, one being a thesis by Batenburg’s thesis on “E-procurement adoption by European firms: a quantitative analysis” as an example of actually being a qualitative analysis, even though the viewpoint mentioned in the title of the work is ‘quantitative’. However, this work is partially quantitative as the scores that are analyzed are numerical. At the same time, test of hypotheses in the context of the referred work, on the relation between a nation’s cultural dimensions and its companies’ e-procurement rates, are not completely quantifiable across all dimensions. For example, in context of any cross-country economic or cultural
analysis, if a tool like Hofstede’s cultural dimension “uncertainty avoidance” is used, it will be very hard to absolutely quantify that dimension. Similarly, as Dul and Hak says about the methods for measurement:

“Batenburg’s hypothesis that organizations in countries with high uncertainty avoidance scores have low e-procurement adoption rates relates two variables, ‘e-procurement adoption rate’ and ‘uncertainty avoidance score’. The numerical score used by Batenburg for a country’s e-procurement adoption rate is the percentage of firms from a sample of industries in a country that have said in an interview that they do purchase on-line. This score is calculated by counting the positive answers of informants to the following question inn a questionnaire: “Does your company use internet or other on-line services to purchase goods or services?” For a nation’s ‘uncertainty avoidance’ Hofstede’s score is used.” [Dul and Hak, 2006]

From the quote as given above, both variables under question represent numerical scores, hence Batenburg’s measurement can be called quantitative. But as to the method for analysis is concerned in the same work, Batenburg presents the numerical scores in a scatter plot with 7 points (countries). A quantitative (statistical) analysis of the data is not possible due to the low number of cases (N ≈ 7). Therefore, this is conducted by a qualitative data analysis technique i.e. visual inspection. This inspection in the work results in the finding that ‘on the average’ countries with higher uncertainty scores have lower e-procurement adoption. But this finding suggests that there is a “probabilistic relation” between uncertainty avoidance and e-procurement adoption e.g. if a country has a higher score on uncertainty avoidance, it is likely but cannot be surely said that it has a higher e-procurement adoption. Based on this outcome of his qualitative analysis, Batenburg concludes that his hypothesis
has been confirmed. The qualitative analysis appears to be internally valid in principle, although it is clear that only the probabilistic version of his hypothesis is confirmed. At the same time, an attempt for deterministic version of the hypothesis is clearly not confirmed by the data.

In light of the discussion presented by Dul and Hak, 2008, Batenburg’s suggestion that quantitative methods are more ‘hard’ or ‘factual’ than qualitative data, may not hold good neither for measurement nor for analysis.

Terms such as ‘hard’ and ‘factual’ are very subjective in themselves and thus are difficult to apply to any measurement theory or practice in general e.g. that are based on data from surveys conducted by different companies with different interview practices, in different kinds of samples, with unknown response rates, in different countries.

Moreover, if support is found for a proposition in a single case, it is still unknown to what extent the proposition is generalizable, i.e. whether it is supported by the facts of other cases. This implies that the test must be replicated in other cases. If the proposition is supported in a series of tests, confidence is gained in the generalizability of the proposition. The extent of confidence is greater if support for a proposition is found in ‘least likely’ cases (i.e. cases for which, for theoretical or practical reasons, it was considered unlikely that support for the proposition would be found) than if they are found in ‘more likely’ or ‘most likely’ cases (i.e. cases for which it was considered likely that support for the proposition would be found).

Dubois and Araujo’s contribution to the discussion about case study methodology in business research is significant because it is one of the very first contributions in business research in which reference is made to the considerable progress in thinking
about case study research in other disciplines, notably political science, by authors such as Ragin (2000), George and Bennett (2005), and Mahoney and Goertz (2006).

In the next sections, the research work is presented in three consecutive sections on knowledge pre-classification, knowledge extraction, and knowledge representation and measurability, respectively.

### 3.6 Summary

The chapter discusses about the definition and differences between case-based methodology and survey-based methodologies. It attempts to justify the application suitability of the case-based methodology for the current research in this thesis. The major findings are:

| Definitions of Case based methodology, differences between case-based methodology and survey-based methodologies | As presented in the seminal works of Dull and Hak. Survey-based methodologies work best for generalizable hypothesis, not application-based contributions. |
| Application suitability of case-based methodology | For demonstrative, application-based systems-related contributions, case-based research methodologies are best suited. |
| Why is Case-based methodology best-suited for applied research as presented in this thesis | This research is on Knowledge Management Systems and applications of various process models in KMS phases of classification, extraction and representation, that are designed, built and require be testing and demonstrating in real-life application environment. This can be best done using the case-based research methodology. |

### 3.7 Conclusion

Case based research methodology has been chosen for this thesis work as 1) it is found in the literature review on methodology to be the most appropriate one for application-oriented management research i.e. solving a management problem in general (Knowledge Management problems in the context of this thesis) by demonstrating model solution(s) applied in specific, real-life case contexts. 2) Case-
based research methodology has been found to be used in a big way in modern Operations and systems management research domains, in global business schools like MIT-Sloan, and HBS. Research on supply chains for example have been done at MIT-Sloan with cases from Pepsi and Tata Nano project. This way, in terms of methodology this thesis demonstrates appropriate use of the case-based research in the management domain, supported by ‘Best Practices’ from global arena.