Measures for the research construct

Questionnaire design: The questionnaire was pretested with four sets of people – academicians, industry experts, IT consultants, and sample respondents who later took part in the actual survey. The academicians were from India’s leading institutes having a global reputation for their research. Industry professionals who took part in pretesting were having both, academic as well as professional excellence in knowledge management. Similar criteria were applied for selecting IT consultants. These four sets of people also reported on the overall layout of the questionnaire and the comprehensiveness of the questions as a measure of the constructs, thereby confirming face validity. To support construct validity, each item in the construct questionnaire was developed based on research literature (see the validity of Naresh Malhotra, Marketing Research).

Research Objective: The proposed research study will focus on the following aspects of use of KM in this sector:

(i) the status of the use of KM in the medium sized companies in the IT industry and to find out the success factor for implementing KM
(ii) to study the impact of using KM on firm’s performance
(iii) to study the KM systems of two companies where KM is successfully implemented and suggest a proposed model which can be replicated/tailor-made in other similar units
**Research Design:** We use a questionnaire to elicit responses from employees at managerial level of different IT companies in Eastern India.

**Why eastern India?:** The reason for choosing this study in Eastern India is because of ease of eliciting responses from companies as language, trust as well as networking with managers is more. Another major reason is that the Eastern part of India is now attracting a lot of attention from IT companies, local as well as global with an eye to tap the pool of knowledge workers.

**Sample Frame, Sample size and Data collection:** The sampling frame consists of IT companies spread over Kolkata, Bhubaneswar & Ranchi, main IT locations in Eastern India. These companies are medium sized ie with employee strength between 50 – 500 employees (Torgier Dingsoyr, NUST). These companies are in business for over 5 years in India. The average revenue is between INR50 – INR500 crores. The managers interviewed were in managerial position for more than 2 years past. Selecting such a sampling frame ensures reliability and authenticity of the data collected.

The sample size of 12 is representative because of the more than 300 companies registered with STPI Kolkata and Bhubaneswar, approximately 50 – 60 companies are actually in operation

We used structured interviews to ask questions on impact of KM on their companies both in terms of revenue as well as market reach. Two sets of questionnaires were prepared to elicit responses from our sampling frame ie managers.

**Data Analysis:** An Exploratory research using the Case study method is used to understand the relationship between KM and its impact on medium sized IT
companies in Eastern India. Confidence interval, pattern matching and triangulation were used to analyze the responses given by the respondents.
A brief note on case method of research, reliability and validity (external validity and internal validity), pattern matching and triangulation methods:

Case Study Research:
Case study research is a time-honored, traditional approach to the study of topics in social science and management. Because only a few instances are normally studied, the case researcher will typically uncover more variables than he or she has data points, making statistical control (ex., through multiple regression) an impossibility. This, however, may be considered a strength of case study research: it has the capability of uncovering causal paths and mechanisms, and through richness of detail, identifying causal influences and interaction effects which might not be treated as operationalized variables in a statistical study, As such it may be particularly helpful in generating hypotheses and theories in developing fields of inquiry.

In recent years there has been increased attention to implementation of case studies in a systematic, stand-alone manner which increases the validity of associated findings. However, although case study research may be used in its own right, it is more often recommended as part of a multimethod approach ("triangulation") in which the same dependent variable is investigated using multiple additional procedures (ex., also grounded theory, survey research, sociometry and network analysis, focus groups, content analysis, ethnography, participant observation, narrative analysis, archival data, or others).

Key Concepts and Terms
- Types of case studies. Jensen and Rodgers (2001: 237-239) set forth a typology of case studies, including these types:

  1. Snapshot case studies: Detailed, objective study of one research entity at one point in time. Hypothesis-testing by comparing patterns across
sub-entities (ex., comparing departments within the case study agency).

2. **Longitudinal case studies.** Quantitative and/or qualitative study of one research entity at multiple time points.

3. **Pre-post case studies.** Study of one research entity at two time points separated by a critical event. A critical event is one which on the basis of a theory under study would be expected to impact case observations significantly.

4. **Patchwork case studies.** A set of multiple case studies of the same research entity, using snapshot, longitudinal, and/or pre-post designs. This multi-design approach is intended to provide a more holistic view of the dynamics of the research subject.

5. **Comparative case studies.** A set of multiple case studies of multiple research entities for the purpose of cross-unit comparison. Both qualitative and quantitative comparisons are generally made.

- **Representativeness.** Unlike random sample surveys, case studies are not representative of entire populations, nor do they claim to be. The case study researcher should take care not to generalize beyond cases similar to the one(s) studied. Provided the researcher refrains from over-generalization, case study research is not methodologically invalid simply because selected cases cannot be presumed to be representative of entire populations. Put another way, in statistical analysis one is generalizing to a population based on a sample which is representative of that population. In case studies, in comparison, one is generalizing to a theory based on cases selected to represent dimensions of that theory.

- **Case selection should be theory-driven.** When theories are associated with causal typologies, the researcher should select at least one case which falls in
each category. That cases are not quantitative does not relieve the case researcher from identifying what dependent variable(s) are to be explained and what independent variables may be relevant. Not only should observation of these variables be part of the case study, but ideally the researcher would study cases which collectively illustrate every causal path in the model suggested by theory. To do this, the researcher ideally would select cases which reflect opposite ends of the dimensions defining the dependent and key independent variables. Where this is not possible, often the case, the researcher should be explicit about which causal types of cases are omitted from analysis. Cases cited in the literature as counter-cases to the selected theory should not be omitted. In public administration, "best practices" lists may provide cases for selection, though it is necessary also to pick contrasting cases. Yin (2003: 47) calls this multiple case study approach one of "replication logic," by which he meant that cases are selected either to replicate findings or to illustrate contrasting results based on theoretically predictable reasons.

- Cross-theoretic case selection. As multiple theories can conform to a given set of data, particularly sparse data as in case study research, the case research design is strengthened if the focus of the study concerns two or more clearly contrasting theories. This enables the researcher to derive and then test contrasting expectations about what would happen under each theory in the case setting(s) at hand.

- Other selection criteria: Yin (1984) points out that researchers may select cases not only when they are critical (to testing a theory), but also when they are revelatory (reveal relationships which cannot be studied by other means) or unusual (throws light on extreme cases).
Pattern matching is the attempt of the case researcher to establish that a preponderance of cases are not inconsistent with each of the links in the theoretical model which drives the case study. For instance, in a study of juvenile delinquency in a school setting, bearing on the theory that broken homes lead to juvenile delinquency, cases should not display a high level of broken homes and simultaneously a low level of delinquency. That is, the researcher attempts to find qualitative or quantitative evidence in the case that the effect association for each causal path in the theoretical model under consideration was of non-zero value and was of the expected sign.

Process tracing is the a more systematic approach to pattern matching in which the researcher attempts, for each case studied, to find evidence not only that patterns in the cases match theoretical expectations but also that (1) there is some qualitative or quantitative evidence that the effect association which was upheld by pattern matching was, in fact, the result of a causal process and does not merely reflect spurious association; and (2) that each link in the theory-based causal model also was of the effect magnitude predicted by theory. While process tracing cannot resolve indeterminancy (selecting among alternative models, all consistent with case information), it can establish in which types of cases the model does not apply.

Controlled observation is the most common form of process tracing. Its name derives from the fact that the researcher attempts to control for effects by looking for model units of analysis (ex. people, in the case of hypotheses about people) which shift substantially in magnitude or even valence, on key variables in the model being investigated. In a study of prison
culture, for instance, in the course of a case study an individual may shift from being free to being incarcerated; or in a study of organizational culture, an individual may shift from being a rank-and-file employee to being a supervisor). Such shifts can be examined to see if associated shifts in other variables (ex., opinions) also change as predicted by the model. Controlled observation as a technique dictates that the case study (1) be long enough in time to chronicle such shifts, and (2) favor case selection of cases where shifts are known to have occurred or are likely to occur.

- **Time series analysis** is a special and more rigorous case of process tracing, in which the researcher also attempts to establish not only the existence, sign, and magnitude of each model link is as expected, but also the temporal sequence of events relating the variables in the model. This requires observations at multiple points in time, not just before-after observations, in order to establish that the magnitude of a given effect is outside the range of normal fluctuation of the time series.

- **Critical incident technique (CIT).** CIT is a method of case selection and analysis developed in the 1950s by the Air Force at the University of Pittsburgh (see Flanagan, 1954). It is a methodology associated with the American Institutes for Research (AIR), founded by John C. Flanagan as a more empirical data collection method thought to be superior to conventional survey research. AIR has provided an extensive bibliography on CIT. Cases are selected based on their being
important, significant, and critical to determining either an
effective or ineffective outcome. Effective outcomes are those
which solve a problem or resolve a situation. Ineffective
outcomes are those which only partially solve problems or
resolve situations, but also create new problems or new needs
for resolution. By collecting a large number of brief, factual
reports on critical incidents, researchers attempt to identify
common factors associated with effective outcomes. These
factors may be set forth in "critical requirements" or
"acceptable performance" standards for the organization.

- Congruence testing is an even more systematic approach to pattern
  matching which requires the selection of pairs of cases which are
  identical in causal type, except for the difference of one independent
  variable. Differences in the dependent variable are attributed to
  incongruency on the independent. Where there are a large number of
cases, it may be possible to replace congruence testing with statistical
methods of correlation and control.

- Explanation-building is an alternative or supplement to pattern matching.
  Under explanation-building, the researcher does not start out with a theory to
be investigated. Rather, the researcher attempts to induce theory from case
examples chosen to represent diversity on some dependent variable (ex.,
cities with different outcomes on reducing welfare rolls). A list of possible
causes of the dependent variable is constructed through literature review and
brainstorming, and information is gathered on each cause for each selected
case. The researcher then inventories causal attributes which are common to
all cases, common only to cases high on the dependent variable, and
common only to cases low on the dependent variable. The researcher comes
to a provisional conclusion that the differentiating attributes are the significant causes, while those common to all cases are not. Explanation-building is particularly compelling when there are plausible rival explanations which can be rebutted by this method. Explanation-building can also be a supplement to pattern matching, as when it is used to generate a new, more plausible model after pattern matching disconfirms an initial model.

- **Meta-Analysis** is a particular methodology for extending grounded theory to a number of case studies. In meta-analysis the researcher creates a *meta-analytic schedule*, which is a cross-case summary table in which the rows are case studies and the columns are variable-related findings or other study attributes (ex., time frame, research entity, case study design type, number and selection method for interviewees, threats to validity like researcher involvement in the research entity). The cell entries may be simple checkmarks indicating a given study supported a given variable relationship, or the cell entries may be brief summaries of findings on a given relationship or brief description of study attributes. The purpose of meta-analysis is to allow the researcher to use the summary of case studies reflected in the meta-analytic table to make theoretical generalizations. In doing so, sometimes the researcher will weight the cases according to the number of research entities studied, since some case studies may examine multiple entities. See Hodson (1999); Jensen and Rodgers (2001: 239 ff.). Hodson (1999: 74-80) reproduces an example of a meta-analytic schedule for the topic of workplace ethnography.

Problems of meta-analysis include what even case study advocates admit is the "formidable challenge" (Jensen and Rodgers, 2001: 241) involved in developing a standardized meta-analytic schedule which fits the myriad dimensions of any
sizeable number of case studies. No widely accepted "standardized" schedules exist. Moreover, for any given proposed schedule, many or most specific case studies will simply not report findings in one or more of the column categories, forcing meta-analysts either to accept a great deal of missing data or to have to do additional research by contacting case authors or even case subjects.

Considerations in implementing meta-analytic schedules:

1. **Variables:** In addition to substantive variables particular to the researcher's subject, methodological variables should be collected, such as date of data collection, subject pool, and methodological techniques employed.

2. **Coder training.** It is customary to provide formal training for coders, who ideally should not be the researchers so that data collection is separated from data interpretation.

3. **Reliability.** The researcher must establish inter-rater reliability, which in turn implies there must be multiple raters. Reliability is generally increased through rater debriefing sessions in which raters are encouraged to discuss coding challenges. Duplicate coding (allowing 10% or so of records to be coded by two coders rather than one) is also used to track reliability. In larger projects, rating may be cross-validated across two or more groups of coders.

4. **Data weighting.** Meta-analysis often involves statistical analysis of results, where cases are studies. The researcher must decide whether cases based on a larger sample size should be weighted more in any statistical analysis. In general, weighting is appropriate when cases are drawn from the same population to which the researcher wishes to generalize.
5. **Handling missing data.** Dropping cases where some variables have missing data is generally unacceptable unless there are only a very small number of such cases as (1) it is more likely that missing-data cases are related to the variables of the study than that they are randomly distributed, and (2) dropping cases when the number of cases is not large (as is typical of meta-analytic studies) diminishes the power of any statistical analysis. There is no good solution for missing data. See the separate section on data imputation, but maximum likelihood estimation of missing values carries fewer assumptions about data distribution than using regression estimates or substituting means. SPSS supports MLE imputation.

6. **Outliers.** Metapanalysis often involves results coded from a relatively small number of cases (ex., < 100). Consequently, any statistical analysis may be affected strongly by the presence of outlier cases. *Sensitivity analysis* should be conducted to understand the difference in statistical conclusions with and without the outlier cases included. The researcher may decide that *deviant case analysis* may be appropriate, based on a finding that relationships among the variables operate differently for outlier cases.

7. **Spatial autocorrelation.** It is possible that central tendencies and conclusions emerging from meta-analytic studies will be biased because cases cluster spatially. If many cases are from a spatially neighboring area and if the relationships being studied are spatially related, then generalization to a larger reference area will be biased. If the researcher has included longitude and latitude (or some other spatial indicator) as variables, then many geographic information systems packages and some statistical packages can check for spatial
autocorrelation (see Land and Deane, 1992). However, a visual approach of mapping cases to identify clusters, then comparing in-cluster and out-of-cluster statistical results usually is a sufficient check on spatial autocorrelation.

Assumptions

- Cases selected based on dimensions of a theory (pattern-matching) or on diversity on a dependent phenomenon (explanation-building).
- No generalization to a population beyond cases similar to those studied.
- Conclusions should be phrased in terms of model elimination, not model validation. Numerous alternative theories may be consistent with data gathered from a case study.

Case study approaches have difficulty in terms of evaluation of low-probability causal paths in a model as any given case selected for study may fail to display such a path, even when it exists in the larger population of potential cases.
Reliability & Validity
We often think of reliability and validity as separate ideas but, in fact, they're related to each other. Here, William M K Trochim (2006), wants to show you two ways you can think about their relationship.

One of my favorite metaphors for the relationship between reliability is that of the target. Think of the center of the target as the concept that you are trying to measure. Imagine that for each person you are measuring, you are taking a shot at the target. If you measure the concept perfectly for a person, you are hitting the center of the target. If you don't, you are missing the center. The more you are off for that person, the further you are from the center.

The figure above shows four possible situations. In the first one, you are hitting the target consistently, but you are missing the center of the target. That is, you are consistently and systematically measuring the wrong value for all respondents. This measure is reliable, but no valid (that is, it's consistent but wrong). The second, shows hits that are randomly spread across the target. You seldom hit the center of the target but, on average, you are getting the right answer for the group (but not very well for individuals). In this case, you get a valid group estimate, but you are inconsistent. Here, you can clearly see that reliability is directly related to the variability of your measure. The third scenario shows a case where your hits are spread across the target and you are consistently missing the center. Your
measure in this case is neither reliable nor valid. Finally, we see the "Robin Hood" scenario -- you consistently hit the center of the target. Your measure is both reliable and valid (I bet you never thought of Robin Hood in those terms before).

Another way we can think about the relationship between reliability and validity is shown in the figure below. Here, we set up a 2x2 table. The columns of the table indicate whether you are trying to measure the same or different concepts. The rows show whether you are using the same or different methods of measurement. Imagine that we have two concepts we would like to measure, student verbal and math ability. Furthermore, imagine that we can measure each of these in two ways. First, we can use a written, paper-and-pencil exam (very much like the SAT or GRE exams). Second, we can ask the student's classroom teacher to give us a rating of the student's ability based on their own classroom observation.

![Concept Table]

The first cell on the upper left shows the comparison of the verbal written test score with the verbal written test score. But how can we compare the same measure with itself? We could do this by estimating the reliability of the written test through a test-retest correlation, parallel forms, or an internal consistency
measure (See Types of Reliability). What we are estimating in this cell is the reliability of the measure.

The cell on the lower left shows a comparison of the verbal written measure with the verbal teacher observation rating. Because we are trying to measure the same concept, we are looking at convergent validity (See Measurement Validity Types).

The cell on the upper right shows the comparison of the verbal written exam with the math written exam. Here, we are comparing two different concepts (verbal versus math) and so we would expect the relationship to be lower than a comparison of the same concept with itself (e.g., verbal versus verbal or math versus math). Thus, we are trying to discriminate between two concepts and we would consider this discriminant validity.

Finally, we have the cell on the lower right. Here, we are comparing the verbal written exam with the math teacher observation rating. Like the cell on the upper right, we are also trying to compare two different concepts (verbal versus math) and so this is a discriminant validity estimate. But here, we are also trying to compare two different methods of measurement (written exam versus teacher observation rating). So, we'll call this very discriminant to indicate that we would expect the relationship in this cell to be even lower than in the one above it.

The four cells incorporate the different values that we examine in the multitrait-multimethod approach to estimating construct validity.

When we look at reliability and validity in this way, we see that, rather than being distinct, they actually form a continuum. On one end is the situation where the concepts and methods of measurement are the same (reliability) and on the other is
the situation where concepts and methods of measurement are different (very discriminant validity)
The Theory of Pattern Matching
A pattern is any arrangement of objects or entities. The term "arrangement" is used here to indicate that a pattern is by definition non-random and at least potentially describable. All theories imply some pattern, but theories and patterns are not the same thing. In general, a theory postulates structural relationships between key constructs. The theory can be used as the basis for generating patterns of predictions. For instance, E=MC2 can be considered a theoretical formulation. A pattern of expectations can be developed from this formula by generating predicted values for one of these variables given fixed values of the others. Not all theories are stated in mathematical form, especially in applied social research, but all theories provide information that enables the generation of patterns of predictions.
Pattern matching always involves an attempt to link two patterns where one is a theoretical pattern and the other is an observed or operational one. The top part of the figure shows the realm of theory. The theory might originate from a formal tradition of theorizing, might be the ideas or "hunches" of the investigator, or might arise from some combination of these. The conceptualization task involves the translation of these ideas into a specifiable theoretical pattern indicated by the top shape in the figure. The bottom part of the figure indicates the realm of observation. This is broadly meant to include direct observation in the form of impressions, field notes, and the like, as well as more formal objective measures. The collection or organization of relevant operationalizations (i.e., relevant to the theoretical pattern) is termed the observational pattern and is indicated by the lower shape in the figure. The inferential task involves the attempt to relate, link or match these two patterns as indicated by the double arrow in the center of the figure. To the extent that the patterns match, one can conclude that the theory and any other theories which might predict the same observed pattern receive support.

It is important to demonstrate that there are no plausible alternative theories that account for the observed pattern and this task is made much easier when the theoretical pattern of interest is a unique one. In effect, a more complex theoretical pattern is like a unique fingerprint which one is seeking in the observed pattern. With more complex theoretical patterns it is usually more difficult to construe sensible alternative patterns that would also predict the same result. To the extent
that theoretical and observed patterns do not match, the theory may be incorrect or poorly formulated, the observations may be inappropriate or inaccurate, or some combination of both states may exist.

All research employs pattern matching principles, although this is seldom done consciously. In the traditional two-group experimental context, for instance, the typical theoretical outcome pattern is the hypothesis that there will be a significant difference between treated and untreated groups. The observed outcome pattern might consist of the averages for the two groups on one or more measures. The pattern match is accomplished by a test of significance such as the t-test or ANOVA. In survey research, pattern matching forms the basis of generalizations across different concepts or population subgroups. In qualitative research pattern matching lies at the heart of any attempt to conduct thematic analyses.

While current research methods can be described in pattern matching terms, the idea of pattern matching implies more, and suggests how one might improve on these current methods. Specifically, pattern matching implies that more complex patterns, if matched, yield greater validity for the theory. Pattern matching does not differ fundamentally from traditional hypothesis testing and model building approaches. A theoretical pattern is a hypothesis about what is expected in the data. The observed pattern consists of the data that are used to examine the theoretical model. The major differences between pattern matching and more traditional hypothesis testing approaches are that pattern matching encourages the use of more complex or detailed hypotheses and treats the observations from a multivariate rather than a univariate perspective.
Pattern Matching for Construct Validity
The idea of using pattern matching as a rubric for assessing construct validity is an area where the author have tried to make a contribution (Trochim, W., (1985). Pattern matching, validity, and conceptualization in program evaluation. Evaluation Review, 9, 5, 575-604 and Trochim, W. (1989). Outcome pattern matching and program theory. Evaluation and Program Planning, 12, 355-366.), although this work was very clearly foreshadowed, especially in much of Donald T. Campbell's writings. Here, the author tries to explain what is meant by pattern matching with respect to construct validity. While pattern matching can be used to address a variety of questions in social research, the emphasis here is on its use in assessing construct validity.

The accompanying figure shows the pattern matching structure for an example involving five measurement constructs -- arithmetic, algebra, geometry, spelling,
and reading. In this example, we'll use concept mapping to develop the theoretical pattern among these constructs. In the concept mapping we generate a large set of potential arithmetic, algebra, geometry, spelling, and reading questions. We sort them into piles of similar questions and develop a map that shows each question in relation to the others. On the map, questions that are more similar are closer to each other, those less similar are more distant. From the map, we can find the straight-line distances between all pair of points (i.e., all questions). This is the matrix of interpoint distances. We might use the questions from the map in constructing our measurement instrument, or we might sample from these questions. On the observed side, we have one or more test instruments that contain a number of questions about arithmetic, algebra, geometry, spelling, and reading. We analyze the data and construct a matrix of inter-item correlations.

What we want to do is compare the matrix of interpoint distances from our concept map (i.e., the theoretical pattern) with the correlation matrix of the questions (i.e., the observed pattern). How do we achieve this? Let's assume that we had 100 prospective questions on our concept map, 20 for each construct. Correspondingly, we have 100 questions on our measurement instrument, 20 in each area. Thus, both matrices are 100x100 in size. Because both matrices are symmetric, we actually have \( \frac{N(N-1)}{2} = \frac{100(99)}{2} = 9900/2 = 4,950 \) unique pairs (excluding the diagonal). If we "string out" the values in each matrix we can construct a vector or column of 4,950 numbers for each matrix. The first number is the value comparing pair (1,2), the next is (1,3) and so on to (N-1, N) or (99, 100). Now, we can compute the overall correlation between these two columns, which is the correlation between our theoretical and observed patterns, the "pattern matching correlation." In this example, let's assume it is -.93. Why would it be a negative correlation? Because we are correlating distances on the map with the similarities
in the correlations and we expect that greater distance on the map should be associated with lower correlation and less distance with greater correlation.

The pattern matching correlation is our overall estimate of the degree of construct validity in this example because it estimates the degree to which the operational measures reflect our theoretical expectations.

Advantages and Disadvantages of Pattern Matching
There are several disadvantages of the pattern matching approach to construct validity. The most obvious is that pattern matching requires that you specify your theory of the constructs rather precisely. This is typically not done in applied social research, at least not to the level of specificity implied here. But perhaps it should be done. Perhaps the more restrictive assumption is that you are able to structure
the theoretical and observed patterns the same way so that you can directly correlate them. We needed to quantify both patterns and, ultimately, describe them in matrices that had the same dimensions. In most research as it is currently done it will be relatively easy to construct a matrix of the inter-item correlations. But we seldom currently use methods like concept mapping that enables us to estimate theoretical patterns that can be linked with observed ones. Again, perhaps we ought to do this more frequently.

There are a number of advantages of the pattern matching approach, especially relative to the multitrait-multimethod matrix (MTMM). First, it is more general and flexible than MTMM. It does not require that you measure each construct with multiple methods. Second, it treats convergence and discrimination as a continuum. Concepts are more or less similar and so their interrelations would be more or less convergent or discriminant. This moves the convergent/discriminant distinction away from the simplistic dichotomous categorical notion to one that is more suitably post-positivist and continuous in nature. Third, the pattern matching approach does make it possible to estimate the overall construct validity for a set of measures in a specific context. Notice that we don't estimate construct validity for a single measure. That's because construct validity, like discrimination, is always a relative metric. Just as we can only ask whether you have distinguished something if there is something to distinguish it from, we can only assess construct validity in terms of a theoretical semantic or nomological net, the conceptual context within which it resides. The pattern matching correlation tells us, for our particular study, whether there is a demonstrable relationship between how we theoretically expect our measures will interrelate and how they do in practice. Finally, because pattern matching requires a more specific theoretical pattern than we typically articulate, it requires us to specify what we think about the constructs in our studies. Social research has long been criticized for conceptual sloppiness, for re-packaging old
constructs in new terminology and failing to develop an evolution of research around key theoretical constructs. Perhaps the emphasis on theory articulation in pattern matching would encourage us to be more careful about the conceptual underpinnings of our empirical work. And, after all, isn't that what construct validity is all about?
Triangulation
Denzin (1984) identified four types of triangulation: *Data source triangulation*, when the researcher looks for the data to remain the same in different contexts; *Investigator triangulation*, when several investigators examine the same phenomenon; *Theory triangulation*, when investigators with different viewpoints interpret the same results; and *Methodological triangulation*, when one approach is followed by another, to increase confidence in the interpretation.
**Construct Validity**

Construct validity refers to the degree to which inferences can legitimately be made from the operationalizations in your study to the theoretical constructs on which those operationalizations were based. Like external validity, construct validity is related to generalizing. But, where external validity involves generalizing from your study context to other people, places or times, construct validity involves generalizing from your program or measures to the *concept* of your program or measures. You might think of construct validity as a "labeling" issue. When you implement a program that you call a "Head Start" program, is your label an accurate one? When you measure what you term "self esteem" is that what you were really measuring?

I would like to tell two major stories here. The first is the more straightforward one. I'll discuss several ways of thinking about the idea of construct validity, several metaphors that might provide you with a foundation in the richness of this idea. Then, I'll discuss the major construct validity threats, the kinds of arguments your critics are likely to raise when you make a claim that your program or measure is valid. In most research methods texts, construct validity is presented in the section on measurement. And, it is typically presented as one of many different types of validity (e.g., face validity, predictive validity, concurrent validity) that you might want to be sure your measures have. I don't see it that way at all. I see construct validity as the overarching quality with all of the other measurement validity labels falling beneath it. And, I don't see construct validity as limited only to measurement. As I've already implied, I think it is as much a part of the independent variable -- the program or treatment -- as it is the dependent variable. So, I'll try to make some sense of the various measurement validity types and try to move you to think instead of the validity of *any* operationalization as falling within
the general category of construct validity, with a variety of subcategories and subtypes.

The second story I want to tell is more historical in nature. During World War II, the U.S. government involved hundreds (and perhaps thousands) of psychologists and psychology graduate students in the development of a wide array of measures that were relevant to the war effort. They needed personality screening tests for prospective fighter pilots, personnel measures that would enable sensible assignment of people to job skills, psychophysical measures to test reaction times, and so on. After the war, these psychologists needed to find gainful employment outside of the military context, and it's not surprising that many of them moved into testing and measurement in a civilian context. During the early 1950s, the American Psychological Association began to become increasingly concerned with the quality or validity of all of the new measures that were being generated and decided to convene an effort to set standards for psychological measures. The first formal articulation of the idea of construct validity came from this effort and was couched under the somewhat grandiose idea of the nomological network. The nomological network provided a theoretical basis for the idea of construct validity, but it didn't provide practicing researchers with a way to actually establish whether their measures had construct validity. In 1959, an attempt was made to develop a method for assessing construct validity using what is called a multitrait-multimethod matrix, or MTMM for short. In order to argue that your measures had construct validity under the MTMM approach, you had to demonstrate that there was both convergent and discriminant validity in your measures. You demonstrated convergent validity when you showed that measures that are theoretically supposed to be highly interrelated are, in practice, highly interrelated. And, you showed discriminant validity when you demonstrated that measures that
shouldn't be related to each other in fact were not. While the MTMM did provide a methodology for assessing construct validity, it was a difficult one to implement well, especially in applied social research contexts and, in fact, has seldom been formally attempted. When we examine carefully the thinking about construct validity that underlies both the nomological network and the MTMM, one of the key themes we can identify in both is the idea of "pattern." When we claim that our programs or measures have construct validity, we are essentially claiming that we as researchers understand how our constructs or theories of the programs and measures operate in theory and we claim that we can provide evidence that they behave in practice the way we think they should. The researcher essentially has a theory of how the programs and measures related to each other (and other theoretical terms), a theoretical pattern if you will. And, the researcher provides evidence through observation that the programs or measures actually behave that way in reality, an observed pattern. When we claim construct validity, we're essentially claiming that our observed pattern -- how things operate in reality -- corresponds with our theoretical pattern -- how we think the world works. I call this process pattern matching, and I believe that it is the heart of construct validity. It is clearly an underlying theme in both the nomological network and the MTMM ideas. And, I think that we can develop concrete and feasible methods that enable practicing researchers to assess pattern matches -- to assess the construct validity of their research. The section on pattern matching lays out my idea of how we might use this approach to assess construct validity.
**Methodology used for this Research:**
We have used Triangulation i.e. use of multiple sources for data collection, including interviews as well as archival data.

Generalization is not automatic. A theory must be tested through replications of the findings in a second or even a third neighborhood where the theory has specified that same result should occur. Once such replication has been made, the result might be accepted. This replication logic is the same that underlies the use of experiments. This has been done through all the 12 cases that we have studied.

**Construct Validity is ensured by having:**

1. Multiple sources of evidence
2. Established chain of evidence
3. Having key informants review the draft case studies

**Internal Validity is ensured by having:**

1. Pattern-matching
2. Explanation building

**External Validity is ensured by having:**

1. Using replication logic in multiple case studies

**Reliability is ensured by having:**

1. Using case study protocol
2. Developing a case study database
Deriving the ‘Working Hypotheses’

In order to form the working hypothesis, apart from idea got from literature survey, a pilot study was also carried out:

Pilot study
A pilot study was conducted in 2007, in the eastern region consisting of Kolkata, Bhubaneswar and Ranchi cities. The total number of companies surveyed was 8 out of which 7 responded, the breakup of the respondents were Kolkata 4 companies, Bhubaneswar 2 companies and Ranchi 1 company.

The results from the pilot study were mixed, the general level of understanding and implementation of knowledge management were low, but some companies had utilized knowledge management especially for product development.

The companies which were using knowledge management found that it was very helpful especially in new product development and reducing time to market

Hence, from the literature review as well as the initial pilot study, we can draw the working hypotheses for this research:

1. There is a positive link between Knowledge Management and Business Performance in Medium sized Information Technology companies in Eastern India

2. The reason medium sized IT companies in Eastern India do not use KM is because of lack of awareness about the impact of knowledge management on business performance

The importance of these above mentioned studies leads us to the next step ie tabulating the results and the discussions of the same