Longitudinal Analysis and Organizational Effectiveness

by

Sabyasachi Mondal

Table of Content

1. Introduction

Longitudinal thinking and longitudinal analysis methods pose great potential for developing most comprehensive and creative probe into the organizational issues and problems. It has the capability of giving faster, easier, reliable and more sensible probe result. The issue is well described by S K Tamotia and Vinayshil Gautam in their book - "Essays in Longitudinal Thinking: The Best of Ijtd".

According to them, this tool is very useful to analyze the organizational structure. This tool is also useful to factor variables into issues of technological choice and development. The variables constituting organizational structure are - "bureaucracy," "span of control," "job satisfaction," and "work design." The variables defining organizational process are defined - "organizational policies," "information processing factors" (such as "environment scanning," "freedom of working," and "communication"), "knowledge management," "change management," and "organizational factors" (such as "top management support"). The variables defining organizational growth are considered as "technology" and "innovative capability." Apart that, this longitudinal thinking tool also accounts for the constraints and the facilitations provided by the environment. If we compare this longitudinal thinking tool with the other available approaches, then we will understand that this approach of organization management helps results to come faster, easier and in a more reliable fashion.

2. Longitudinal Thinking

The longitudinal thinking process can help establish a useful pattern or trend between a dependent and an independent factor, over a considerable period of time. Though there are other methods that can do this job, but longitudinal thinking process can also reveal impact of other surrounding or circumstantial or peripheral factors that play an important role in the between the key independent and dependent variables.

We can explain it by a formula. Suppose one researcher is trying to probe if there is any relationship between the academic qualifications of employees of an organization, and their innovation capability. Here we assume that academic qualifications of an employee is independent variable and his/her innovation capability is a dependent variable [i.e. –

the assumption is that innovation capability depends on academic qualification of employee.]

Hence the equation can be formed as

(*INNOVATION*) = m x (*ACAD*) + c, where c is a constant

[*ACAD = academic qualification, e.g. – diploma, undergrad, post grad, post doc*]

Now an effective longitudinal thinking process will help to probe in the constant (c). This probe may reveal what are the other peripheral factors [may be - organizational culture, leadership, employee liberty etc.] that may impact the dynamics of the relation between INNOVATION and ACAD.

The process of longitudinal thinking has two major underlying sub-processes. They are longitudinal study and longitudinal analysis.

2.1 Longitudinal Analysis

2.1.1 A Detailed Examination of Data and Evidence to Reveal Trends over Time.

Longitudinal analysis in social sciences and biological sciences are generally used to reveal patterns in target population's achievement, behavior, etc. over a number of years. Results can reveal the relative impact of different operating environments, for example. For example, the impact of modified management practices in an organization over a number of years can be evaluated by analyzing the achievements and behavior of employees and other stakeholders in the organizational process.

2.1.2 Differences between Longitudinal Analysis, Trend Analysis and Cross Sectional Analysis

There are quite a few important differences between longitudinal analysis, trend analysis and cross sectional analysis. To give an example of the difference between trend analysis and longitudinal analysis, suppose that we were to observe a decline in the number of

people holding unionized jobs (a cross-sectional analysis). From there, we may have some idea that job separations from unionized jobs have increased or, alternatively, that fewer people are being hired for unionized jobs. Adding the longitudinal analysis would show the relative importance of each.

Study the "event" - The switch from trend to longitudinal thinking is simple if we make the individual's event the focus of analysis. For example, rather than track people who are unemployed, the study population could become "people who lose their job" over a specified time. Longitudinal data give a "before and after" picture from which to study the determinants or the consequences of job loss.

Other events that could be examined using data of circumstantial evidence include changing jobs, returning to school full-time, getting off social assistance, or forming a common-law union, to give just a few examples. The variability of "states" that people experience over time may also be of interest. For example, what proportion of the population experiences relatively stable income over time?

Now let us describe the difference between the longitudinal analysis and cross sectional analysis. We can start to Solve the "moving" target" issue, which is described below:-

This is a question of defining the target population for a single point in time, for example persons who married or had a child in 1993. Unlike cross-sectional analysis, where the people making up the population change according to who fits the criterion each year, longitudinal analysis looks at the same people over time, based on whether they fit the criterion at the selected time. The population can be fixed at either the beginning or the end of the total period studied, depending on whether a "before" or "after" picture is required.

The definition of the target population indicates which year's longitudinal weight should be used, since the theoretically constant longitudinal weight is in fact adjusted slightly for non-response each year.

Also one need observe carefully the individual when studying families. Because, for longitudinal analysis, the same logic requiring that you study the same individuals over time would suggest that the same families have to be tracked over time for family data. However, families can change composition over time and do very frequently, causing great difficulty for the definition of "longitudinal families". The solution is very simple: study the family characteristics of individuals. The individual becomes the unit of analysis, and family characteristics are attributes of the individual.
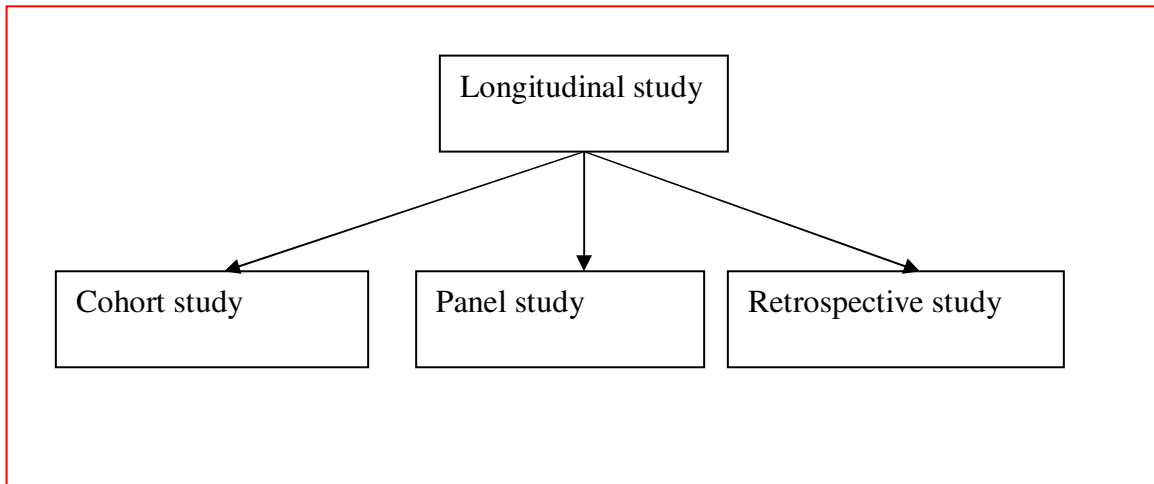
2.2 Longitudinal Study

A longitudinal study is a correlation research study that involves repeated observations of the same items over long periods of time — often many decades. It is a type of observational study. Longitudinal studies are often used in psychology to study developmental trends across the life span, and in sociology to study life events throughout lifetimes or generations. The reason for this is that unlike cross-sectional studies, longitudinal studies track the same people, and therefore the differences observed in those people are less likely to be the result of cultural differences across generations. Because of this benefit, longitudinal studies make observing changes more accurate and they are applied in various other fields. In medicine, the design is used to uncover predictors of certain diseases. In advertising, the Communicus System, the design is used to identify the changes that advertising has produced in the attitudes and behaviors of those within the target audience who have seen the advertising campaign.

Because longitudinal studies are observational, in the sense that they observe the state of the world without manipulating it, it has been argued that they may have less power to detect causal relationships than do experiments. But because of the repeated observation at the individual level, they have more power than cross-sectional observational studies, by virtue of being able to exclude time-invariant unobserved individual differences, and by virtue of observing the temporal order of events.

Longitudinal studies allow social scientists to distinguish short from long-term phenomena, such as poverty. If the poverty rate is 10% at a point in time, this may mean that 10% of the population are always poor, or that the whole population experiences

poverty for 10% of the time. It is not possible to conclude which of these possibilities is the case using one-off cross-sectional studies.

Types of longitudinal studies include cohort studies and panel studies. Cohort studies sample a cohort, defined as a group experiencing some event (typically birth) in a selected time period, and studying them at intervals through time.

Panel studies sample a cross-section, and survey it at (usually regular) intervals. Basically it is a a case-control study in which cases and controls are drawn from within a prospective study. All cases who developed the outcome of interest during the follow-up are selected and compared with a subgroup of the non-cases. For example, in biological methods - Exposure is defined prior to disease development based on data collected at baseline or on assays conducted in biological samples collected at baseline.

A retrospective study is a longitudinal study that looks back in time. For instance a researcher may look up the medical records of previous years to look for a trend.

3. Cohort Analysis and Thinking Process

A cohort is a group of people who share a common characteristic or experience within a defined period (e.g., are born, leave school, lose their job, are exposed to a drug or a vaccine, etc.). Thus a group of people who were born on a day or in a particular period, say 1948, form a birth cohort. The comparison group may be the general population from

which the cohort is drawn, or it may be another cohort of persons thought to have had little or no exposure to the substance under investigation, but otherwise similar. Alternatively, subgroups within the cohort may be compared with each other.

So essentially a cohort is a set of individuals entering a system at the same time. Individuals in a cohort are presumed to have similarities due to shared experiences that differentiate them from other cohorts. Cohort analysis seeks to explain an outcome through exploitation of differences between cohorts, as well as differences across two other temporal dimensions: "age" (time since system entry) and "period" (times when an outcome is measured)

Application In management - a cohort study is often undertaken to obtain evidence to try to refute the existence of a suspected association between cause and effect; failure to refute a hypothesis strengthens confidence in it. Crucially, the cohort is identified before the appearance of the problems and organizational issue under investigation. The study groups, so defined, are observed over a period of time to determine the frequency of new incidence of the studied organizational issue among them. The cohort cannot therefore be defined as a group of people who already have been under that particular organizational issue in some peripheral level. Prospective (longitudinal) cohort studies between targets and their organizational issues strongly aide in studying causal associations, though distinguishing true causality usually requires further corroboration from further experimental probe.

3.1 Variations of Cohort Study

A cohort study has three variations; they are prospective cohort and retrospective cohort and Household panel
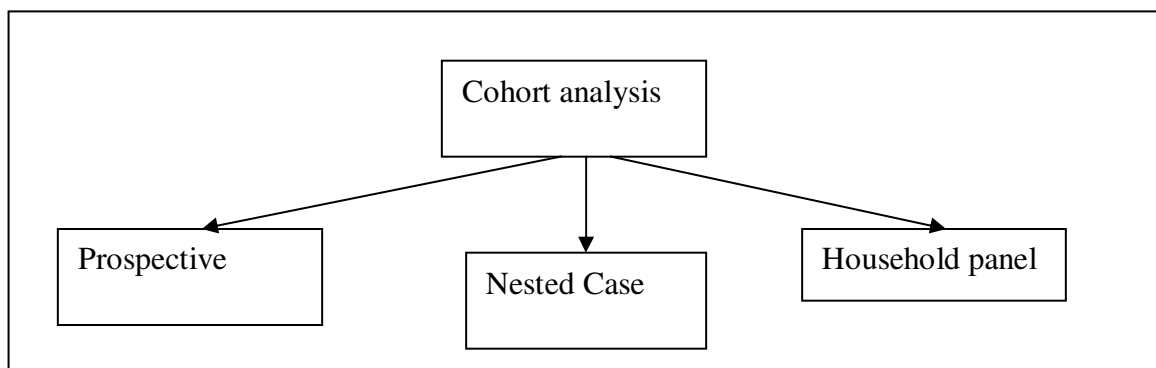
1) A "prospective cohort" defines the groups before the study is done, while a "retrospective cohort" does the grouping after the data is collected. Whereas prospective cohorts should be summarized with the relative risk, retrospective cohorts should be summarized with the odds ratio.

2) A nested case-control study is a type of study design where new case controls are applied into cohorts that were defined before the study began.[1]

Compared with case-control studies, nested case-control studies can reduce 'recall bias' and temporal ambiguity, and compared with cohort studies can reduce cost and save time. The drawback of nested case-control studies is non-diseased persons from whom the controls are selected may not be fully representative of the original cohort, due to death or failure to follow-up cases.

3) Household panel survey

Household panel surveys are an important sub-type of cohort study. These draw representative samples of households and survey them, following all individuals through time on a usually annual basis

3.2 How Recall Error is Reduced

The advantage of prospective cohort study data is the longitudinal observation of the individual through time, and the collection of data at regular intervals, so recall error is reduced. However, cohort studies are expensive to conduct, are sensitive to attrition and take a long follow-up time to generate useful data. Nevertheless, the results that are obtained from long-term cohort studies are of substantially superior quality to retrospective/cross-sectional studies, and cohort studies are considered the gold standard in observational epidemiology. Moreover, cohort studies are informative for efficiently studying a wide-range of exposure-disease associations.

Some cohort studies track groups of employees from their onset of career, and record a wide range of information (exposures) about them. The value of a cohort study depends

on the researchers' capacity to stay in touch with all members of the cohort. Some of these studies have continued for decades.

3.3 Experimental Example of Cohort

An example of an question that can be answered by the use of a cohort study is: does an independent variable X (say, high academic level) correlate with outcome Y (say, innovation capability)? Such a study would recruit a group of under graduate and post graduates and follow them for a set period of time and note differences in the incidence of success between the groups at the end of this time. The groups are *matched* in terms of many other variables such as economic status and other health status so that the variable is assessed; the independent variable (in this case, academic level) can be isolated as the cause of the dependent variable (in this case, innovation outcome).

In this example, a statistically significant increase in the incidence of high innovation in post graduate people group as compared to the undergraduate group is evidence in favor of the hypothesis. However, rare outcomes are generally not studied with the use of a cohort study, but are rather studied with the use of a case-control study.

Shorter term studies are commonly used in social science research as a form of experimental trial, or means to test a particular hypothesis of experimental importance. Such studies typically follow two groups of targets for a period of time and compare an endpoint or outcome measure between the two groups.

Randomized controlled trials, or RCTs are a superior methodology in the hierarchy of evidence, because they limit the potential for bias by randomly assigning one patient pool to an intervention and another patient pool to non-intervention (or placebo). This minimizes the chance that the incidence of confounding variables will differ between the two groups.

Nevertheless, it is sometimes not practical or ethical to perform RCTs to answer a experimental question. To take our example, if we already had reasonable evidence that

high academic status causes high innovation capabilty then persuading a pool of undergraduates not to follow path of innovation in order to test this hypothesis would generally be considered quite unethical.

Cohort style of longitudinal study is long used for impact of social conditions on public health. For example:- An example of a cohort study that has been going on for more than 50 years is the Framingham Heart Study.

The largest cohort study in women is the Nurses' Health Study. Started in 1976, it is tracking over 120,000 nurses and has been analyzed for many different conditions and outcomes.

The largest cohort study in Africa is the Birth to Twenty Study which began in 1990 and tracks a cohort of over 3,000 children born in the weeks following Nelson Mandela's release from prison.

4. Longitudinal Thinking and Organizational Effectiveness in Learning Process

From a long time onwards, there had been a significant amount of study to understand the relation between organizational learning and individual learning. Many such famous organizational learning literatures seem to be following in the tradition of learning theories and taking a psychological or individual perspective on the phenomenon. There is a debate among the scholars about whether or not organizations can learn and many just take the approach that organizational learning is the sum total of the individual learning occurring in the workplace (Argyris & Schon, 1996; Levitt & March, 1988; Normann, 1985; Weick & Westley, 1996).

But recently and slowly, the focus shifted to one that is more anthropological and, therefore, focused on group learning. Many social scientists also believe that there is a shift from seeing learning as just cognitive to see it as occurring when groups try to make sense out of their world? As a result of this new view of organizational learning there

would be some of the necessary shifts in attitudes, beliefs and practices. One need to explore why companies would want to become learning organizations.

As described and emphasized earlier, There is no doubt that the group approach to learning is very compatible with humanistic learning. We need to explore group learning as something different from the accumulation of individual learning In a very thought provoking, compelling and significantly important article, the author uses the Native American medicine wheel to develop a model of organizational learning that is circular, longitudinal and integrative rather than linear, cross- sectional and compartmental. Learning is something that happens all the time (Cowan, 1995).

As mentioned earlier, in a very thought provoking, compelling and significant article called "Rhythms of Learning: Patterns That Bridge Individuals and Organizations" by David Cowan (1995), develops a model for organizational learning based on concepts from the Native American medicine wheel. First, it is worth briefly describing the medicine wheel symbolized by a circle showing the four directions on a compass. The direction of movement is clockwise with learning beginning in the East that involves anticipation, direction, vision, and an expanded perspective. As you move around the circle from East to South, learners examine their new visionary ideas with attention to issues of action and implementation. The South is the place for curiosity and innocence where the learner closely examines details. The movement from the South to the West is the time to find the personal and social resolve to implement the vision. It is the time to accept the responsibility for the plan and figure out how it will fit with our lives, conviction and self-assurance. So in the West reflection is important along with letting go of any attachments formed earlier in the process. Moving from West to North is a making way for the new as old ideas die. It is a time for leadership and empathy for those who may need help as they journey along the medicine wheel path. The North is a time for integration and wisdom and sharing oneself with others so they may grow. Lastly, the movement from North to East involves an inner process of renewal and an awareness for the need to continue cycling around the wheel.

When incorporating the medicine wheel concepts into organizational learning, Cowan advocates four new premises for learning. First, learning needs to be seen as part of every performance and every relationship within an organization. Organizational learning, therefore, becomes an everyday occurrence with everyone taking responsibility for keeping the organization learning. Second, he also believes we need to move from a linear view of learning to one that is circular or a spiral. This is vital due to our continually changing contexts. We also need to learn more about the process of learning. With this view relearning, reexamining, rethinking, play, exploration, alternative paths and areas become very important.

Thirdly, Cowan calls for a movement from cross- sectional to longitudinal thinking. This position acknowledges the flows of learning where learning can occur on many levels and in different directions. For example, some employees can explore new ideas while others sustain the core identity of the company by maintaining consistency. Since learning occurs in relationships, flow helps us see them as continually changing so organizational structures need to change too. This leads to a growing emphasis on the value of diversity. Longitudinal thinking helps groups focus on harmony, balance, maturity and survival rather than immediate gratification.

Lastly, our view of learning also needs to change from one that is compartmental to one that is integrative. To Cowan this means valuing wisdom rather than expertise. Expertise always operates within a narrow scope and is only useful when one knows the context. Wisdom becomes more important when operating in uncertain contexts. Wisdom extends knowledge so we choose the game that is played as well as the means, ends and values more intelligently. Kofman and Senge (1993) say we need action but only when it comes from reflection that combines cognition, the body, emotions and spirit.

Shift from expertise to wisdom.

Cowan (1995) believes organizations must shift from their linear and compartmental view of learning to one that is circular, longitudinal and integrative. Our current view of learning is a linear progression from novice to expert. Cowan points out that expertise is

only useful when we know the context and consult the right expert. Today we cannot know the context because the environment is continually changing. This situation calls for wisdom rather than expertise. The scope of expertise is becoming too narrow to operate effectively in a rapidly changing world. Brown and Gray (1997) put the need another way, "The difference, increasingly, pivots not on information but on interpretation -- the ability to make meaning out of still- emerging patterns" Wisdom extends knowledge and helps us to choose both the means and the ends as well as the values and the game we want to play.

5. Longitudinal Thinking and Organizational Planning: Plan before Planning.

Planning is the most strategic activity in which we engage because the very nature of planning causes us to look forward and to consider options and goals. Planning before doing gives us the luxury of considering the implications of each action which is much harder to do if we are caught up in ongoing operations. An effective planning process contributes directly to the success of software development by eliminating wasteful actions that don't contribute directly.

The act of planning requires longitudinal thinking and reveals logical linkages. These processes help illuminate conceptual gaps and even some incorrect assumptions so that the resulting plan will be an accurate description of what has to be accomplished and how it can be accomplished.

So there is a need for plan before planning.

We can consider the following high-level planning activities:

Establish the high-level goal – The goal may be to create a deliverable or accomplish some intermediate step toward completion of the deliverable. This activity should be revisited periodically so that planners can remind themselves of the goal. This keeps the planning focused and on track.

Scan the environment – This step identifies the forces that will facilitate achievement of the goal and those forces that will impede efforts to achieve the goal. This step provides the essential context and constraints that make the resulting plan realistic.

Analyze the high-level goal – The high-level goal must be converted into an operational goal or set of goals. To me this is the most often miss-handled step. The planners try to derive a concrete set of activities for a high-level goal but the goal is not sufficiently specific to allow measurement. The goal(s) in a good plan should be specific enough to be measured and sufficiently broad to be strategically significant accomplishments.

Develop strategies and tactics – For each operational goal, a strategy needs to be adopted and tactics identified. I have previously discussed the use of Porter's Five Forces strategy development approach in the context of developing a production strategy for a product line [McGregor 04]. This technique guides the thought processes by providing five standard forces that the strategy must resolve.

Develop schedules and assign responsibilities – Each activity in the selected tactics is assigned and the schedule for its execution is recorded. The success of the Toyota Production System (TPS) points to the need for very specific assignments. Each activity should be the responsibility of a specific person with other specific persons assigned in backup and escalation roles.

6. Longitudinal Assessment for Grading System in Performance Appraisal

Longitudinal assessment for performance appraisal rating is based on performance during the performance appraisal term (over time). At the end of the performance appraisal rating period, each employee is compared her/his their own beginning level. Employees who progress the most from their starting point are the ones who earn the best performance rates. This requires explanation in advance to avoid misunderstanding. Otherwise, some advanced employees might think they can rest on their expertise and get

a good performance rate without achieving new things. Highly capable employees should not be rewarded for coasting.

Advanced employees need to be challenged to take on more difficult and challenging versions of assignments. Employees with a strong background can also be given a chance to learn more by preparing for and helping with some aspects of the training. This could take the form of class presentations about artists whose thinking reflects that of a recent class assignment.

Advanced employees can be involved in training where more advanced employees are given credit when they can compose and phrase training issues and materials that help less advanced employees learn to focus and think better. In addition to raising thinking questions during the creative time, these kinds of questions can be added to the feedback employees get on their completed assignments. To have employees do some training is not exploitation so long as they also have time to develop their own artwork. Having employees help with training and training is very wise pedagogy, if we have advanced employees who can be coached to be good trainers. As trainers we know how much new material and thinking skills we develop when we train something even though we thought we knew all about what we are training.

Advanced employees can also learn to be good team members when a group of employees are organized into teams to do cooperative projects planning, decision making, risk evaluation etc, and so on. Many advanced employees as well as highly creative employees are particularly challenged to exceed when they are asked to take special responsibilities.

6.1 Importance of Longitudinal Observations

With experience, many trainers get fairly good at intuitive assessments based on casual longitudinal observations. Others use things like documentations, portfolios, journals, digital records, and so on to keep longitudinal records for each employee. Performance is assessed by comparing before and after skills development, before and after ability to develop ideas, before and after composition, and before and after knowledge absorption.

Employees can even be asked to keep the records for themselves. Employees can even be asked to self-report and list what they know about art that they did not know prior to the class. This is a way to foster better thinking habits. Knowing that they are responsible to keep tabs on their own performance, some employees actually try harder to practice and try harder to remember what is learned during the course. Good employees already know how to do this. That is why they are good employees. Performance to habitually think and act artistically is the essence of performance in art.

6.2 Longitudinal Assessment

Longitudinal assessment can include thinking habits, development of innovation skills, efficient work habits, the ability to synthesize, create, and even character traits such as respect for others and ethical development. These are very important in today's world. They are precisely the kinds of performance advocated by Howard Gardner in *The Five Minds for the Future* 2007. It is worth to be mentioned that Hetland (1) and her coauthors along with their list eight habits of mind learned in studio art classes. If we agree with these, it makes sense that they should also be the basis of our performance appraisal rating. The eight habits are: 1) develop craft, 2) engage and persist, 3) envision, 4) express, 5) observe, 6) reflect, 7) search and explore, and 8) understand the work domain. Art of employees can improve (or deteriorate) in any or all of these categories during a studio art course

6.3 Longitudinal Assessment Vs. Normative assessment

However the unfortunate and sad fact is, most of the organizations believe in normative grading and normative assessment. Normative assessment for grading is too common and by itself may be unfair. It is based on a comparison of the each individual to standardized goals at the end of the grading period. In some of the literature it is call summative grading. In summative grading we collect achievement and knowledge scores. Summative scores are commonly used to determine if a student is qualified to be promoted to the next grade or graduate. The standard is the same for everybody in the group. It feels unfair to grade on this basis because it may result in failure to properly recognize very competent and hard working beginners who are being compared with

others who many have a lot more previous experience. Those with a large amount of prior practice may not be experiencing nearly as much learning as the beginner.

6.4 Longitudinal Assessment to Encourage Longitudinal Learning

The ideal practice should be, for performance appraisal managers, to use both summative and longitudinal grading. In the organizations, it is usual to feel that appraisal should be assessed longitudinally (on growth and improvement). Normative grading might be gradually introduced for part of the grade in organizational performance. Though most organizational performance appraisals are graded on a normative basis, but the more enlightened instructors give significant credit for those who progress the most from their starting point in the career. Employers may say they want to know who is most qualified so they know who to hire. In reality, if one is hiring a trainer or another domain graduate, one should hire the ones who can learn new things easily and willingly (longitudinal learners) - not simply those that already know the most (highest summative achievement). Strongly self-motivated hard working creative employees should be able to get good grades under either system.

7. Conclusion

As Meenakshi Khemka, Globsyn Business School, Kolkata, mentioned "Organizations pass through various phases in the process of their development. Each phase is defined by the organization's structure, processes, and various growth factors. Identifying the distinct phases in the evolution process helps us understand the organizational dynamics. Every phase begins with a set of givens. The present state of an organization is an accumulated product of the experiences of the past states. The process of identifying and understanding the givens is defined as longitudinal thinking. A study of the historical data related to an organisation's growth gives insight into its legacy factors and structural stability. This also helps to locate the factors which contributed to the continuity and discontinuity in its growth path."

From her analysis it was evident that the structural variables, autonomy of work design, and job satisfaction had a significant correlation with the dependent variables, innovation

and R&D. From her analysis of the variables related to organisational processes, the organisational policies and top management support had a significant correlation with innovation and R&D.

8. Reference and Bibliography

1. Cowan, D. A. (1995). Rhythms of Learning: Patterns That Bridge Individuals and Organizations. Journal of management Inquiry, 4(3), 222-246. Quoted in http://home.flash.net/~jteague/Sue/orglearn.html

2. Diggle, P., Heagerty, P., Liang, K., and Zeger, S. (2002), Analysis of Longitudinal Data (2nd ed.), New York: Oxford University Press.

3. Editor's Note, "Labour and Income Dynamics", Volume 4, Number 3, September 1995

4. Gardner, Howard [2007], The Five Minds for the Future, Harvard Business School Press, Cambridge.

5. Garrett M. FITZMAURICE[2005], "Applied Longitudinal Analysis", Technometrics issue: May, 2005

6. Hand, D., and Crowder, M. (1996), Practical Longitudinal Data Analysis, New York: Chapman & Hall.

7. Hetland, Lois; Winner, Ellen; Veenema, Shirley; Sheridan, Kimberly [2007], Studio Thinking: The real benefits of visual arts education, Teacher College Press, Columbia, NY

8. John D. McGregor [2006],"Planning before plans", JOURNAL OF OBJECT TECHNOLOGY, Vol. 5, No. 2, March - April 2006, pp 27-34

9. S.k. Tamotia; Vinayshil Gautam[2005], "Essays In Longitudinal Thinking: The Best Of Ijtd" , ISBN: 8180691918

10. William M. Mason[2001], "Cohort Analysis", California Center for Population Research - On-Line Working Paper Series, April 2001