Understanding Different Issues of Unit of Analysis in a Business Research

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Abstract

The main aim of the paper was to understand the different issues of unit of analysis in a business research. The qualitative approach was used to explore the different issues related to unit of analysis through in-depth review of literature. In this paper different levels of unit of analysis are described. The relation between the unit of analysis and unit of observation is explained. Faulty reasoning about the unit of analysis is discussed with suitable examples. The possible data analysis options are discussed taking into consideration the unit of analysis. This paper will be a good reference material for new researchers in understanding the unit of analysis for the planning and designing their research work at master's and doctorate level.

Keywords: *Ecological Fallacy, Hierarchical Linear Modeling, Reductionalism, Social Artifacts, Unit of Analysis, Unit of Sampling and Unit of Observation.*

INTRODUCTION

Defining the unit of analysis is the first step in analyzing the data (Trochim, 2006). The unit of analysis is the person or object from which the business researcher

collects data. It answers the question of 'what' and 'who' is being studied in a business research. It is the whole unit being researched. It includes individuals, groups of individuals, organizations of individuals, countries, technologies and objects that are the aim of the investigation. Identifying the unit of analysis may seem like an easily perceived step, but it is oftentimes overlooked in business research. What a researcher call a given unit of analysis-an individual, a process or social artifact is meaningless. The meaningful is to clarify about what your unit of analysis is. When a researcher is conducting a research work, he must decide whether he is studying managerial skills or managers, supervision or supervisors, corporate sector or corporate executives. Otherwise, he must be ready for drawing invalid conclusions. The main aim of the paper is to understand the different issues concerned to unit of analysis in a business research.

NEED AND SIGNIFICANCE OF THE STUDY

There is no limit to what or who can be studied in a business research. When unit of analysis is not clear to researcher, he cannot define the research problem, he cannot make hypothesis, he cannot decide sampling method, he cannot select the right measuring instrument for data collection, he cannot decide valid data analysis option and finally he cannot generalize the results to a population. His whole research work will come under danger situation. Unit of analysis affects every element of the research process. Therefore, determining the unit of analysis has a key role in any research process. Mostly to determine the unit of analysis is not a serious problem. For instance, if a researcher is studying the job motivation and performance

of employess, the employee will be the unit of analysis because both job motivation and job performance are concerned to attributes of employees. But in some cases, determining the unit of analysis may not be that sample. For instance, If a researcher wants to study why few districts have poor sales growth, then the unit of analysis becomes the districts, and not sales. This is because the aim of our inquiry are districts and not sales. There is not that easy to determine the unit of analysis in complex studies. Although, there is not much literature available that covers the unit of analysis in details. Babbie (2005), Singleton & Straits (1988) and Neuman (2006) have discussed unit of analysis in their writings in brief. Therefore, there is an immediate need to understand the different issues concerned to unit of analysis. It will help the researchers in planning and designing their research work at the master's level and doctorate level.

STATEMENT OF THE PROBLEM

An explorative study of the different issues concerned to unit of analysis in business research.

THE OBJECTIVES OF THE STUDY

The main objectives of the study were:

1. To describe the various levels of unit of analysis.
2. To examine the difference between the unit of analysis and unit of observation.
3. To understand the faulty reasoning about a unit of analysis.
4. To explain the data analysis options regarding unit of analysis.

RESEARCH METHODOLOGY

This research paper was based on the qualitative approach of research. An explorative research

method was adopted for the study. In this method, a literature survey of the unit of analysis was done from research papers, books and websites to answer the research objectives. This was a conceptual study that is why no statistical tools and techniques were used.

LEVELS OF UNITS OF ANALYSIS

There are nearly infinite varieties of potential units of analysis in business research. Although individuals are the most common unit of analysis, but various research problems can be answered more accurately through the analysis of other type of units. Indeed, social scientists can study anything that bears on social life. In 'Man, the State and War', Waltz (2001) creates a tripartite analysis with three different units of analysis: the man, the state, and the war.

(Rosenberg, 1968) identified speaks of individual, group, organizational, institutional, spatial, cultural and societal units as unit of analysis in a social research. (John and Lofland, 1995) found Speak of practices, episodes, encounters, roles, relationships, groups, organizations, settlements, social worlds, lifestyles and subcultures as a suitable unit of study. Object, person, dyad, group, social artifact, space, time, or event are the type of unit of analysis (Babbie, 2005; Yurdusev, 1993). The four different units of analysis (see Fig. 1) in social science research are individuals, groups, organizations and social artifacts (Babbie, 2005).The important point is to understand the logic behind unit of analysis. Once the logic is grasped, the chance for useful research increases. In business research, the most commonly used units of analysis are individuals, aggregates, social artifacts, period of time and geographical units.
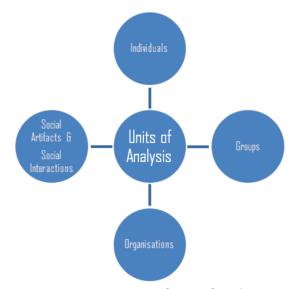

Figure 1: Categories of Unit of Analysis

Individual Level

Individuals are the most typical units of analysis in a business research. These are the first level of unit of analysis. The researcher might be interested in investigating the behaviours, perception, attitude or opinion of employees. Employees may belongs to rural area or urban area or may belongs to rich family or poor family. A researcher might examine whether employees belong to rural area come on right time as compared to employees belongs to urban area. He can also examine whether employees of rural area belongs to poor family come on right time as compared to employees of rural area belongs to rich family. In each case, as the unit of analysis the individual (employee) is being described and explained. The study of employees as a unit of analysis can provide insight into business problems related to human resource and consumer behaviours. For instance, job satisfaction and consumer buying behaviour affect the business and therefore it becomes necessary to study about job satisfaction of employees and consumer behaviour. Mostly

psychologists tend to focus on the study of individuals. The study of individuals might be very useful in the success of a business. Their information and experiences disclose important facts. Therefore, individuals are being used very much in business researches.

Aggregates Level

Social scientists do not always study people. They also study the aggregate of the people like groups, communities or nations. The social scientists tend to describe and explain groups, communities and social interactions by aggregating the responses of the people. Aggregates level can be classified into two categories – Group (informally structured groups) and Organization (formally structured groups).

Group Level

The next levels of units of analysis are groups of individuals. A group means two or more people who interact with each other, share same characteristics and have sense of unity. Many definitions also stress on the interdependence or objective similarity (Turner, 1982; Platow, Grace & Smithson, 2011) and who identify themselves as members of the group (Reicher, 1982). Therefore, society and gang are the example of a group. They can be like some clubs, but much less formal (see Fig. 2) (Webster's Online Dictionary, 2012).

Some examples of research where the units of analysis are more than one person are studies of groups like siblings and identical twins, family functioning and small group functioning. In such cases an entire group constitutes one unit and can be compared to another similar group. The group can be anything from families to people who belongs
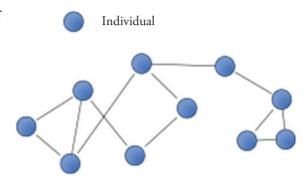

Figure 2: Structure of a Group (Informally Structured)

to a gender, to friends group, to the Facebook group and to department of a company. By studying groups, a researcher can reveal how groups are formed and how different forces like age, experience, class or gender affects the group. The data from an individual can only describe that individual, but when aggregated provides an accurate picture of the group to which that individual belongs. Generally, sociologists investigate groups of people as do Economists. Business people are always interested in making teams and groups to complete their projects. It means they are always interested in studying the groups of the people and their group behaviour.

Organizational Level

After groups of individuals, the next level of units of analysis is organizations. Organisations refer to formally structured groups (see Fig. 3). It may include corporations, religious groups, army divisions, colleges, academic departments, supermarkets, business organizations and so on. Social organization include qualities like as sexual composition, leadership styles, organizational structure, communication systems, and so on. (Susan & Wheelan, 2005; Chapais & Berman, 2004). Wide known social organizations including religious institutions (Lim, Putnam, Robert, 2010). Social organizations are
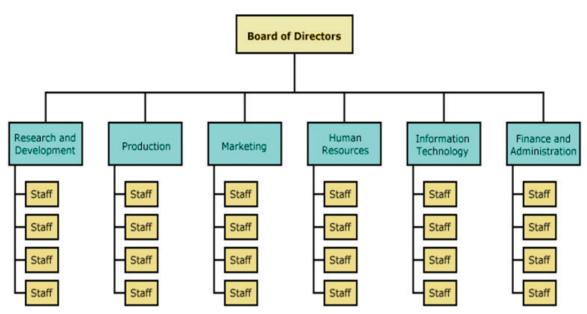
Figure 3: Structure of an Organization (Formally Structured)

structured in a hierarchical system (Moody, White, Douglas, 2003). Social organizations are viewed in different forms within society such as created through institutions like schools or governments (Hasmath, Hildebrandt, Hsu, 2016). In the social sciences, organizations are the object of analysis for a number of disciplines, such as sociology, economics, political science, psychology, management, and organizational communication (Douma & Schreuder, 2013).

Organizations differ from groups in the context that they are considered more formally as well more organized. A researcher might be interested in studying a corporation by which he can imply its results to the population of all the organizations. An organization can be studied in terms of number of workers, net annual turnover, net assets, and number of projects and so on. He might be interested in knowing whether large organization hires a larger or smaller percentage female staff than do small organization. The researchers who study organizations might be interested in understanding, how organizations like Reliance, Amazon, HCL impacts our social and economic life. Business people tend to focus on the study of business organizations.

Social Artifacts Level

Apart from human beings, things are also the subject matter of study. Human made objects or things in different societies are called social artifacts. Social artifacts refers to objects, representations, assemblages, institutions, knowledge and conceptual frameworks that are used to attain a particular expression, interpretation, goal, or desired ends (IGI Global dictionary, 2017). Cultural artifact is a term used in the social sciences, particularly anthropology, ethnology, and sociology for anything created by humans which gives information about their culture (Richard J. Watts, 1981). Social artifacts can be anything around us like books, newspapers, advertisements, websites, technological devices, films, photographs, paintings, cloths, poems, jokes, students excuses for coming late, scientific discoveries, furniture, machines, buildings, and so forth built by people. The list

is truly endless. Social artifacts are created by humans for social beings or their behaviour. As people or groups of people imply over a population in a business research, in the same way each social object implies over a set of all objects of the same class. All business books, all business magazines, all business papers and all business case studies are the examples of same class objects. In a business research using business magazines as the units of analysis, an individual magazine might be characterized by its number of articles, frequency, price, content and description of its editor. Then the population of a related kind of magazines could be analyzed for the purpose of description and explanation. The philosopher Marx W. Wartofsky (1979) categorized artifacts as primary artifacts that are used in production (such as a camera), as secondary artifacts that are related to primary artifacts (such as a user-manual for a camera) and as tertiary artifacts that are related to representations of secondary artifacts (such as a sculpture of a user-manual for camera). A scientific analysis of artifacts provides valuable information about the individuals and group of individuals who created or used them. The researcher who studies artifacts might be interested in understanding about new trend in advertising, promotion, distribution, buying and so on.

Social Interaction Level

Social interaction is one more type of social artifacts. Social interactions include anything from making eye contact with a co-worker, buying something in a store, friendship choices, traffic accidents, airline hijackings, race riots, murder, rape, professional counseling, whatsapp chatting and other social phenomena such as voting, final exams, formalized interactions like court cases or

hearings. A researcher might be interested in investigating about the smart phone addictions that exists among young employees. The researcher might discover that some addictions are concerned to social media centered while other addictions are related to online games and movies that discourage interaction among individuals. The findings of the smart phone addictions would describe that a social phenomenon is being studied as a unit of analysis. However, the unit of observation would likely be individuals (employees). A researcher who studies social interactions might be interested in understanding how larger social structures and forces shape, how people behave and interact on a daily basis, or how they shape traditions like Deewali shopping or weddings. They might also be interested in understanding how social order is maintained. Anthropologists often consider only social artifacts as the unit of analysis for their studies.

RESEARCH PROBLEM AND UNIT OF ANALYSIS

Unit of analysis is an important part of the process of defining the research problem (see Fig. 4). Unit of analysis depends on the research problem. Once a research problem is identified, a researcher will have to identify the units of analysis as a part of the process of defining the research problem and deciding the methodology of the research work. If a researcher is interested in studying individual's buying behaviour, or their attitudes to online shopping, then in each case the unit of analysis will be an individual. If a researcher wants to study group behaviour of a sales team in an organization, then the unit of analysis will be a group. If the aim of a study is to understand how a business organization can improve the profitability or make good
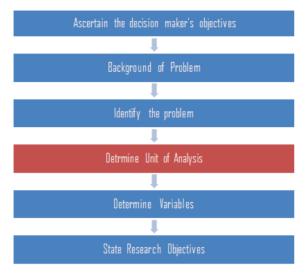
Figure 4: The Process of Defining the Research Problem

managerial decisions, then the unit of analysis will be an organization. In such cases, even though decisions are taken by people in these organizations, these people are supposed to represent their organizational decisions rather than their personal decisions. If the aim of a research study is to understand the differences between national cultures of two nations, the unit of analysis becomes a nation. If a researcher is interested in knowing how to make websites more attractive to its users, then the unit of analysis is a website, not its users.

Sometimes to identify the unit of analysis becomes a complex task. If a researcher wants to compare sales of different products in different districts, the unit of analysis becomes the products, not sales. Further, if a researcher wants to investigate the performance of the sales executives, then the unit of analysis becomes the individual. Similarly, if a researcher wants to understand why some products are more successful than others, then our unit of analysis is a product. However, if a researcher wants to explain how some organizations innovate more consistent

than others, then the unit of analysis is the organization. Hence, two similar research questions within the same research work may contain two completely different units of analysis.

RESEARCH METHODS AND UNIT OF ANALYSIS

Surveys, experiments and field research are conducted to enquire about the individual, not objects or things. Aggregate of the individual data describes and explains about groups, organizations and nations. Here it is very clear that such methods are not adopted to study social artifacts. A researcher needs a particular method for studying social artifacts. One of the very commonly used methods to study social artifacts is content analysis. It is a research method that quantifies the information in social artifacts. The technique of quantifying the data is called coding. During the process of coding a social artifact, the researcher makes a judgment about a social artifact as per predefined standards. Generally more than one judge is used during coding so that more objective results can be achieved.

UNITS OF ANALYSIS WITH DISTINCT CONCEPTS

There are various concepts in the research process which are very similar and confusing with the unit of analysis. The researcher must be very attentive about the differences among these concepts. The unit of analysis must be pre-identified before a research study is commenced. The data collection and data analysis strategies need to be aligned with it in order to achieve coherence in the research design (Dixon, Durrheim & Tredoux, 2007). The distinct but related concepts with reference to data collection and data analysis are as follows:

Unit of Sampling

Unit of analysis and unit of sampling are two confusing concepts for the new researchers. Sometimes the researcher thinks that both are the same, but in few studies, he experiences that both are different. One (unit of analysis) is used to analyse the data and another one (unit of sampling) is used to select the sample for data collection. If a researcher is comparing the workers of the two companies on performance scores, the unit of the sampling is the worker because the researcher has to collect a score for each worker. On the other hand, if a researcher is comparing the two companies on organizational climate, here the unit of analysis is the organization, because researcher only has an organizational climate score as a whole and not for each worker. For different types of analyses in the same study a researcher may use different units of analysis. If a researcher decides to base an analysis on worker' performance scores, worker is the unit. But if researcher decides to compare companies performances, in such case, since the data that goes into the analysis is the average itself, the unit of analysis is actually the company. Even though you had data at the worker level, you use aggregates in

this analysis. This is true in business research, where we usually compare departmental performances, but collected performance data at the employee level. The discussion concludes that in first case unit of analysis is individual as well as a unit of sampling, but in second case unit of analysis is organization but a unit of sampling is individual. It means the unit of analysis and unit of sampling may differ with each other in different situations.

Unit of Observation

Observation unit is mostly confused with the unit of analysis. Unit of observation refers to the entity at which measurements are done and unit of analysis refers to the entity on the basis of which analysis is done. Primary data is collected on the basis of observation unit and research conclusions are determined on the basis of unit of analysis. So, in most of the cases, both are same, but not always. In the context of conclusive research, units of observation could be workers and units of analysis could be company, if companies are compared.

The workers can be both the units of observation and units of analysis if workers are compared. The workers can be the unit

Table 1: Unit of Analysis vs Unit of Observation

Research Problem/ Research Questions	Unit of Analysis	Data Collection	Unit of Observation
To investigate the consumers buying behaviour towards online shopping.	Individuals (Consumers)	Survey of consumers	Individuals (Consumers)
To examine the impact of work team cohesiveness on its performance.	Group (Work Team)	Survey of team members	Individuals (Team Members)
How a company can make good managerial decisions?	Organization	Survey of managers	Individuals (Managers)
How do various organizations address the problem of electronic gadget addiction?	Organizations	Content analysis	Documents
How to make web pages more attractive to its users?	Social Artifacts (Web Pages)	Survey of the users	Individuals (Users)

of analyses and performance scores the unit of observations if several observations are available per worker.

Since variables are the characteristics of the unit of observation, there would be as many units of observation as there are variables in the study. For instance, the correlation between the heights of mothers and their sons is analyzed. There would be two units of observation which are mother and son and the dyad (father and son relationship) would be the unit of analysis. The unit of observation is found at low level of aggregation, but the unit of analysis is found at a higher level of aggregation. Together, the unit of observation and the unit of analysis define the population of a research enterprise (Blalock, Hubert, 1972).

FAULTY REASONING ABOUT UNIT OF ANALYSIS

An error in reasoning due to faulty assumptions is called fallacy. Ecological fallacy and exceptional fallacies are the two main faulty reasoning about a unit of analysis. Each fallacy represents a possible shortcomings regarding unit of analysis. Either of the two fallacies can occur in conducting research work and drawing conclusions from the results.

Ecological Fallacy

The ecological fallacy takes place when a researcher draws conclusions about individuals on the basis of analysis of a group data. It is a logical fallacy where conclusions at the individual level are deducted from the conclusions of the group to which individual belongs. For instance, the researcher collects the management scores of a specific classroom and finds that the class has the highest average score in the entire college. Later the researcher

met with one of the student from that class and he thinks that the students must be genius in management. Here Fallacy happens. A student who belongs to a class that has highest average score in management subject does not mean that he is a high scorer in management subject. He could be the lowest scorer. The researcher should be aware of the *ecological fallacy* (Robinson, 1950).

Exceptional Fallacy

Exceptional fallacy just reverses of ecological fallacy. It happens when the researcher reaches a group conclusion on the basis of exceptional cases. For instance, if a researcher sees an old person taking poor decisions in a company and concludes that "all old persons take poor decisions". Here Fallacy happens. The results drawn under a study conducted at a group level cannot apply at the individual level. On the other hand, the results drawn at the individual level can not apply to the group level. It concludes that the analysis under a study must be conducted at the same level at which generalizations are desired.

Risk of Reductionalism

Reductionism means seeing and explaining complex phenomena in terms of a single and narrow concept or a set of concepts. If a researcher reduces a complex reality into a simple explanation, it is called reductionalism. Scientists from various disciplines tend to find different types of solutions to a research problem and ignore the others. Sociologists tend to focus only on sociological aspects, economists tend to focus only on economic aspects and psychologists tend to focus only on the psychological aspects of the research problem. While describing and explaining all human behaviour in terms of economic factors, in terms of psychological factors and

If the only tool you have a hammer

You tend to see every problem as a nail

Figure 5: Reductionalism

in terms of sociological factors, it is economic reductionism, psychological reductionism and sociological reductionism respectively. When a researcher investigates about the single reason, he bears the risk of reductionism. It suggests that a specific unit of analysis is more relevant than others which are not true.

DATA ANALYSIS OPTIONS

Identifying the unit of analysis and conducting an appropriate data analysis in not a difficult job as long as all the variables in the research work are attributes of the same social unit. On the other hand, when variables of the investigation are operatanalizations of different attributes with different levels, it is a difficult task to identify the appropriate unit of analysis and tools of data analysis. For instance, a study in which the effect of group size on the work performance of the employees is investigated. Since size of the group is an attribute of the group and work performance is an individual attribute, it may confuse the researcher in determining correct unit of analysis. A researcher can consider the group size as an individual attribute and specify the employees as the unit of analysis if the simple random sampling procedure is adopted in the selection of a sample. There is no problem in claiming the group size as an individual attribute since a researcher can categorize employees as those who enrolled

in small size groups and those who enrolled in large size groups. Even then, the most important thing in determining the unit of analysis is to ensure that the observations are independent of one another. Statistical analysis is necessary to determine the extent to which units are independent (Kenny, Kashy & Bolger's, 1998). Drawing a sample which involves more than one employee from the same company group would violate this assumption because the values of the independent variable for these group mates cannot be different from one another. It is not probable to have such a sample if simple random sampling is employed. But in practice, simple random sampling is rarely considered feasible and cluster sampling is more widely applied. Typically, groups would be the sampling unit of such a study due to budget and time constraints which means the assumption of independence of observations would be violated at an unacceptable level. Researcher has the following three options in these situations (Kenny, 1996).

Disaggregation Method

Before the development of multi-level analysis, the research problem of within correlated observations was handled in two ways. One was to ignore the fact that the observations are correlated and second was to combine the correlated observations in one value. Both methods are used frequently. Ignoring the facts mean that correlated observations are analyzed as independent. This type of analysis is called 'naive' analysis, where 'standard' regression analysis can be adopted. This way of analyzing clustered data is also known as the 'disaggregation method'.

Aggregation Method

The term aggregate refers to a group of

individuals who are independent to one another but who are at the same place and time. In a social science research, it refers to the aggregate of the data collected from these individuals. Data scores that represent the average of a group of individuals instead of each individual are called aggregates. In aggregation method, data is collected of the variable at lower level and then the analysis is conducted at a higher level. For instance, data is collected at employees' level and analysis is conducted at the organizational level. When a researcher aggregates data, he uses one or more summary statistics, such as a mean, median, or mode, to provide a simple and quick description of some phenomenon of interest. Aggregation approach has two drawbacks. One is that the unit analysis will change from individual to group which means that it would not be justified to generalize results to the individuals (ecological fallacy) and second is that the individual variability is discarded from the analysis which might provide useful information in description and explaining the criterion variable.

Hierarchical Linear Modeling (HLM)

HLM is recommended because of the limitations of disaggregation and aggregation techniques. It is a time consuming technique. It contains multi-steps in its process. It is a statistical technique of advanced analysis in which the independence of units of observation is circumvented by taking the hierarchical structure of the data into consideration. All the observations are analyzed and degree of non-independence is empirically estimated. It is done so by allowing the components of the regression equation to vary among clusters at higher levels and estimating the variability of these so-called 'random' parameters. The most important requirement of this approach

is that it requires much larger sample sizes. This approach should be applied only if the research design involves multiple levels of data analysis.

CONCLUSION

Unit of analysis answers the question of 'what' and 'who' is being studied in a business research. It helps in determining what type of data a researcher should collect from his study and who he collects it from. When a researcher is conducting a research work, he must decide whether he is studying managerial skills or managers, supervision or supervisors, corporate sector or corporate executives. Otherwise, he bears the risk of drawing invalid conclusions. Once a research problem is selected, a researcher will have to identify the units of analysis as a part of the process of defining the research problem and deciding the methodology of the research work. The unit of analysis remains at the level at which researcher reaches at the conclusions and the unit of observation remains at the level at which researcher collect the data. So, in most of the cases, both are same, but not always. The analysis under a research study must be conducted at the same level at which generalizations are desired otherwise researcher may face the ecological and exceptional fallacy. Doing the appropriate data analysis in not a challenging job as long as all the variables in the study are attributes of the same social unit. But, when variables of the investigation are operatanalizations of the attributes with different levels, it is a difficult task to find the appropriate unit of analysis and technique of data analysis. Therefore, the researcher must keep in the mind clearly that preferences of sampling methods or level of analysis would affect the applicability of analysis methods and the generalizability of

the research findings. This paper will be very useful for new researchers in understanding the unit of analysis for planning and designing their research work at the master's and doctorate level.

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