Constructing a Conceptual Framework for Quantitative Data Analysis in Social Science Research

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Abstract

The article proposes how to construct a conceptual framework in social science research using the quantitative paradigm. The purpose of the paper is to provide a guideline for drawing a conceptual framework to students writing proposals based on scientific justification for data analysis. The paper explains how constructs are interlinked to develop a conceptual framework. The article argues that a conceptual framework is not a fixed network of variables but possesses ontological, epistemological, and methodological assumptions and each concept within a conceptual framework plays an ontological or epistemological role. The ontological assumptions explain how knowledge is or what knowledge is, the epistemological assumptions relate to how things really are done and how things certainly work in an assumed reality, and the methodological assumptions relate to the process of building the conceptual framework and assessing what it can tell us about the real world. Therefore, the conceptual frame shows how variables are interlinked, how analysis will be carried out and how the subsequent model will look like. In conclusion, the conceptual framework is not a form of fixed diagram but portrays the kind of analysis that will be or has been carried out in a study.

Keywords: concepts, conceptual framework, control, dependent, independent, mediation, moderation, variables

During proposal and dissertation presentations by students, I have seen panellists aggravating the confusion of students who are novice researchers by coercing them to draw conceptual frameworks in certain ways with conceptual frames situated in certain positions and arrows going specifically in certain directions with no scientific or theoretical justification but because that is the format described in the university's postgraduate research handbook. This makes a conceptual framework a predetermined drawing or something cast in stone with no scientific basis. In the end, students have conceptual frameworks in their proposals whose purpose they cannot justify or provide an explanation of what they represent. However, it should be noted that in research there are no "dogmas" but everything is based on scientific underpinnings that give direction to the research process. Now, this raises the question as to what is a conceptual framework. However, defining a conceptual framework requires one to first define certain terms that are crucial in a conceptual framework including concept, frame, framework, construct and variables. The purpose of the paper is

to provide a guideline for drawing a conceptual framework to students writing proposals based on scientific justification for data analysis.

Terms in Conceptual Framework

Important terms in a conceptual framework are *concepts*, *frame*, *framework*, *construct* and *variables*. Defined, a concept expresses an abstraction formed by generalisation from particulars (Levy & Ellis, 2006). Concepts are abstractions and represent only certain aspects of reality (Pokharel, 2009). A concept describes a mental representation used to group things or ideas by their shared attributes. The word concept reflects organising or classifying a term (Turkington & Harris, 2006). Therefore, a concept denotes how a phenomenon, an idea, a term or a word is broken into small classifications. In research, the easiest way to identify concepts is to use research tools (questionnaires) showing how terms have been broken down (dimensionalised). An example of such a tool is the "multifactor leadership questionnaire" by Kanste, Miettunen and Kyngäs (2007) entitled "Psychometric properties of the Multifactor Leadership Questionnaire among nurses." Psychometrics are concerned with objective measurement and in research they refer to the construction and validation of measurement instruments and assessing if these instruments are reliable and valid forms of measurement (Ginty, 2013). Reliability and validity are the main measurement properties of such instruments (Souza, Alexandre & Guirardello, 2017). In this paper, concepts adopted for use as examples are leadership styles, work environment, job satisfaction, personal factors and organisational commitment. Going by the definition of the term *concept*, leadership styles is an abstraction (concept) generalising different styles of management manifested by a leader that are transformational, transactional and laissez-faire. Or simply put, transformational, transactional and laissez-faire leadership styles are abstract or general ideas about how scholars think of what leadership styles are.

A *frame* is a more or less abstract idea that encircles a study the way a frame encircles a picture and provides a space in which it is situated. The frame helps explain or justify why and how the study is being done, lets readers know what the study is and is not about and helps researchers support and interpret findings (Casanave & Li, 2015). A *conceptual framework* therefore is a network of interlinked concepts (concepts in a frame) that together provide a comprehensive understanding of a phenomenon or phenomena. The concepts that constitute a conceptual framework support one another, articulate their respective phenomena, and establish a framework-specific philosophy (Tamene, 2016). A conceptual framework (or a concept map) is a diagrammatic presentation in which concepts or constructs (or variables) and their relationships are translated into a visual picture to illustrate the interconnections between the independent, extraneous, and dependent variables as well as with any other variables significant in a study. It is a conception or model of what is out there that one plans to study and how it will be studied (Onen, 2016). Conceptual frameworks consist of a set of linked concepts and propositions that

are designed to draw attention to what is important regarding a phenomenon of interest. Conceptual frameworks, therefore, can help organize thinking, observation, and interpretation related to a particular phenomenon and function as maps that enhance coherence of empirical inquiry (Hudon, Gervais & Hunt, 2015).

Nevertheless, conceptual frameworks represent less formal means of organising phenomena than theories. Whereas theories depict strict abstract generalisations that are formal and systematic explanations about how phenomena are interrelated, conceptual frameworks are less formal and are developed by virtue of their relevance to a common theme. Therefore, while the conceptual model generally is a description of the perception of the phenomenon of interest hence more loosely structured and reflecting the assumptions and philosophical views of its designer, theories use deductive reasoning to generate highly structured ideas. Conceptual frameworks generate hypotheses to be tested and suggest how the data collection instruments should look like (Akpabio, 2015). Thus, conceptual frameworks are not fixed networks but they possess ontological, epistemological, and methodological assumptions, and each concept within a conceptual framework plays an ontological or epistemological role.

Ontology derives from the Greek words "ontos" meaning "existence" and "logos" meaning "knowledge" (Arp, Smith, & Spear, 2015). Thus, ontology as a branch of philosophy is the science of what is, of the kinds and structures of objects, properties, events, processes and relations in an area of reality (Smith, 2003). Ontologically, a conceptual framework shows the kind of knowledge, objects and properties in the concepts being studied. In simple terms, each concept describes knowledge (ontology). Ontological assumptions relate to "knowledge of the way things are, the nature of reality, real existence, and real action" (Jabareen, 2009), and explain "how knowledge is or what knowledge is." On the other hand, the term epistemology is derived from the ancient Greek verb 'epistame' which means to know something very well or internalise something (Dieronitou, 2014). *Epistemology* deals with knowledge as in investigating what knowledge is and how knowledge is created (Tennis, 2008; Uzun, 2016), and epistemological assumptions relate to how things really are done and how things really work in an assumed reality, which could be by independently observing and measuring social phenomena, or by mutually constructing knowledge (Ültanir, 2012). A conceptual framework therefore describes how knowledge will be studied in terms of relating variables. For *methodology*, it refers to the general approach the researcher takes in carrying out a research study (Williams, 2007) and methodological assumptions relate to the process of building the conceptual framework and assessing what it can tell us about the real world. With regard to the relationship between methodology and the conceptual framework, Onen (2016) explains that a good conceptual framework informs the rest of the design of the study.

The goal of a conceptual framework is to categorise and describe concepts relevant to the study and map relationships among them (Rocco & Plakhotnik, 2009). A framework describes the conceptual line through which concepts connect and make meaning. In conceptual frameworks, concepts have components and are defined by them. Every concept has a description defined by its components and every concept contains components originating from other concepts. Concepts do not stand alone, but are related to other concepts and form meaning. Therefore, the conceptual connection with other concepts creates a framework of related or interlinked concepts (Tamene, 2016). While terms namely; "concept, construct and variables" are often used interchangeably or are considered to mean by some researchers, there are slight differences between them. For instance, whereas *a concept* expresses an abstraction formed by generalisation from particulars, a *construct* is a concept with added meaning deliberately and consciously invented or adopted for a special scientific purpose (operationalisation) (Levy & Ellis, 2006). In other words, a construct is a concept but has the added meaning having been deliberately and consciously invented or adopted for a special scientific purpose (Lee, 2007).

Operationalisation refers to the process of developing indicators or items for measuring these constructs. For instance, considering the construct of leadership styles, the attributes could be transformational, transactional and laissez-faire leadership styles and these can be operationalised by their indicators or items as: transformational leadership (idealised influence, inspirational motivation, intellectual stimulation and individualised consideration); transactional leadership (contingent rewards and management-by-exception); and laissez-faire leadership (reaction to problems, no action, decision avoidance, expression restriction and delayed response) (Kanste et al., 2007). Important to note is whether constructs are unidimensional or multidimensional. *Unidimensional* constructs are those that are expected to have a single underlying dimension. These constructs can be measured using a single measure or test. Multidimensional constructs consist of two or more underlying dimensions that can be measured separately (Bhattacherjee, 2012). An example of a unidimensional concept in social science disciplines is "employee retention" (employee measurement scale by Kyndt, Dochy, Michielsen & Moeyaert, 2009) while leadership styles is a multi-dimensional construct comprising of the indicators indicated above.

On the other hand, a *variable* is a property that takes on different values (Levy & Ellis, 2006). A variable is a statistical term meaning a quantity that can take on different possible values (Onen, 2016). A variable is a symbol to which numerals or values are assigned (Lee, 2007). A variable can be looked at as a characteristic (or an attribute) that can take a variety of forms (or values) at different times, or in different people or places, or in different circumstances. Accordingly, examples of variables include educational status, marital status, gender, religion, ethnic group, ability, and temper, among others. If the values of a variable are expressed in numbers to indicate the amount, degree, quantity

or magnitude of the attribute, then it is called a quantitative variable. But if a variable is expressed in terms of qualities, then it is called a qualitative variable (Onen, 2016). Since, conceptual frameworks possess ontological, epistemological, and methodological assumptions, conceptual frameworks should be drawn bearing in mind the nature of nature of knowledge, how the knowledge will be studied and the process of studying the knowledge. This is means that the conceptual framework should be drawn in a logical manner reflecting the kind of results that will be produced by the study, how the results will be produced and through what processes. The results can either be descriptive or inferential in nature. Since concepts and constructs are sometimes assigned values in social science research in order to carry out quantitative analysis, they become variables. Therefore, it is very important to understand the different variables to include in a conceptual framework.

Variables in a Conceptual Framework

There are different types of variables but the main ones in social research include dependent, independent, mediating, moderating and extraneous. *Dependent variable* also known as a *response* variable is the variable that the researcher is usually most interested in understanding and possibly interested in predicting (Flannelly, Flannelly, & Jankowski, 2014). The dependent variable is the outcome measure and is ordinarily the condition a researcher is trying to explain. Naturally, the dependent variable should be a behaviour variable (Lee, 2007). The dependent variable is thus the main variable in a study and is the problem that calls for a study. *Independent variable* refers to the variable that is presumed to have an effect on another variable (a dependent variable). This predicting variable is called independent because one of the major aims of research is to understand the causes of phenomena. The presumed cause in a cause-effect relationship is called the independent variable, and the presumed effect is called the dependent variable (Flannelly et al., 2014). The independent variable my predict the dependent variable but one independent variable may not adequately capture underlying interrelationships among constructs, that is, the variance of a dependent variable can be better explained by more than one independent variable in a multiple regression analysis (Mishra, 2010). However, Flannelly et al. (2014) expound that it is important to remember that variables are not inherently independent or dependent variables. An independent variable in one study might be a dependent variable in another study.

Mediating variables also known as intermediate, intervening or process variables are those that are explained by independent variables while also explaining dependent variables (Bhattacherjee, 2012; Namazi & Namazi, 2016). A mediating variable (ME) can simply be explained as referring to that variable that occurs as a result of the independent variable which then causes a dependent variable to occur. Mediation analysis helps to explain if for instance, an intervention measure produced a change in the constructs it was designed to change (MacKinnon & Luecken, 2011). *Moderating variables* are those

variables that influence the relationship between independent and dependent variables (Bhattacherjee, 2012). Moderator effects are also called interactions because they interact with the relationship between two other variables (MacKinnon & Luecken, 2011). Moderation (MO) occurs when the effect of an independent variable on a dependent variable varies according to the level of a third variable. A moderator is an independent variable that affects the strength and/ or direction of the association between another independent variable and an outcome variable (Farooq & Vij, 2017). A moderating variable in fact acts like the second independent variable. While a moderating variable plays the same function as an independent variable, the former does not have any correlation with the latter (Namazi & Namazi, 2016). *Extraneous variables* also known as nuisance variables, confounding (or simply confound or confounder) variables are those variables that can alter or obscure the relationship between the independent variable and dependent variable, or indicate there is a causal relationship between them when none exists (Flannelly et al., 2014). In experiments, researchers try to control extraneous variables by controlling the conditions of the experimental environment to keep variables as constant as possible (Johnson & Christensen, 2014). However, according to Flannelly et al. (2014), in social science research experimental control often is not sufficient because individuals vary in many ways that are extraneous to the purpose of a study. Such extraneous variables may include their age, gender, tribe, income and education. If experimental control is not possible, the researcher has three options for dealing with extraneous variables.

First, the researcher can match the study participants on the possible confounds, such as matching experimental and control subjects by age, gender, and other key possible confounding variables although this can be difficult to do (Pourhoseingholi, Baghestani & Vahedi, 2012). The second way is to incorporate an extraneous variable as an independent variable in the study design. For instance, if age is likely to have an effect on the relationship between the independent variable and dependent variable, the participants can be grouped into subgroups of different ages such as those who are above 20 but below 30 years, those who are above 30 but below 40 years, and those who are 40 years and above. This method is called stratification and the effects of stratified variables are usually included in the statistical analyses (Johnson & Christensen, 2010). The third way is to use the person's age as an independent variable in the statistical analyses. It is a common practice to measure an extraneous variable and include the measure of it only in the statistical analysis as a way to control for variation in the levels of the variable among the study's participants. Regardless of the approach used to control extraneous variables, it is always important to see if the participants vary in ways that could affect the dependent variable. When extraneous variables are used as independent variables in the statistical analyses, they are called *covariates*. Demographic and other personal characteristics are considered to be covariates (or *control variables*) or independent variables in statistical analyses contingent upon

whether a researcher is specifically interested in the relationship between these variables and the dependent variable (Flannelly et al., 2014). In a conceptual framework, a frame shows how these variables are interlinked, how analysis will be carried out and how the subsequent model will look like. The examples of how the variables are interlinked follow.

Samples of Conceptual Frameworks

Using the examples of the concepts (leadership styles, work environment, job satisfaction, personal factors and organisational commitment) adopted in this article, examples of different conceptual frameworks follow. The description of the variables is independent variable (IV), dependent variable (DV), mediating variable (ME), moderating variable (MO) and control variable/ extraneous variable (EX).

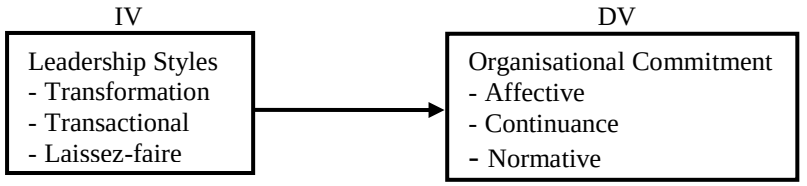

Figure 1. A Conceptual framework in the simplest form (Fairchild & MacKinnon, 2009; Kitchel & Ball, 2014).

Figure 1 presents a conceptual framework in its simplest form in a model illustrating a relationship between X and Y (IV and DV) (Kitchel & Ball, 2014). The framework shows the total effect of the IV on the DV.

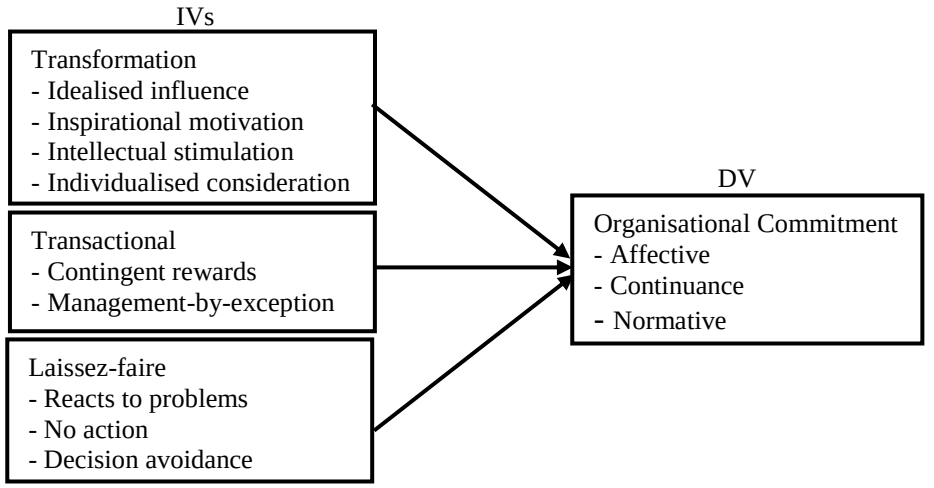

Figure 2. Conceptual framework for multivariate analysis in the simplest form developed by the author.

Figure 2 presents a conceptual framework for multivariate analysis in its simplest form. This very simplistic conceptual model illustrates a relationship

between X_1, X_2, X_3 and Y (IV1, IV2, 1V3 and DV). This conceptual framework is the basis for a simple multiple linear regression model with the three leadership variables forming independent data indices tested against organizational commitment also derived from an index of its three elements as shown in the framework. The framework shows the total effect of the IVs on the DV.

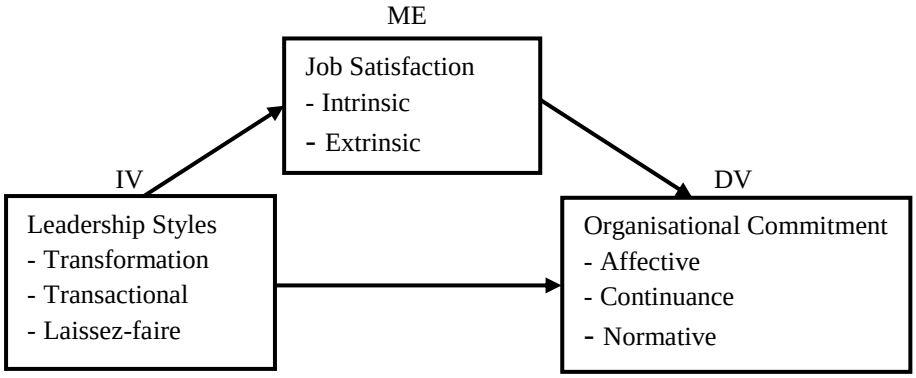

Figure 3.1. Conceptual framework for single mediator model (MacKinnon, 2011).

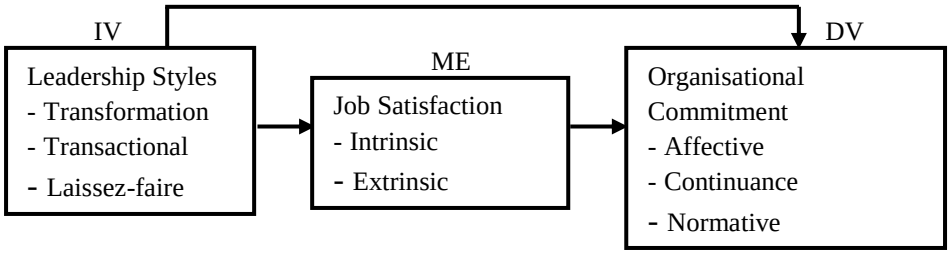

Figure 3.2. Conceptual framework for single mediator model developed by the author.

Conceptual frameworks in Figures 3.1 and 3.2 indicate a single mediator model showing addition of a third variable to the IV and DV relationship so that the causal sequence is modelled with the IV causing the ME, and ME causing DV, that is, X→M→Y. The use of a mediating variable in a design is central as an intervention designed to affect behaviour (MacKinnon, 2011). The framework thus shows that the IV has an influence on the ME which in turn helps to influence the DV.

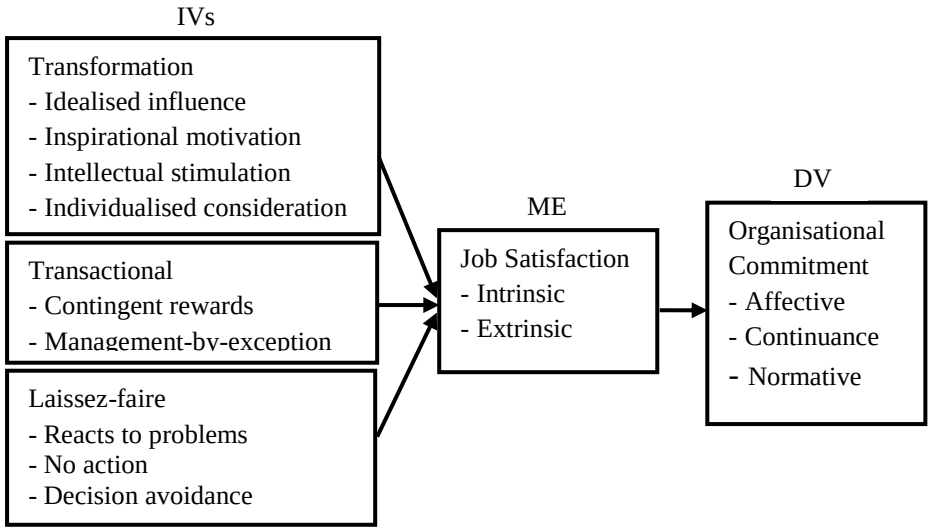

Figure 4. Conceptual framework for multivariate analysis with a single mediator (Svinicki, 2008).

The conceptual framework in Figure 4 indicates a single mediator model showing addition of a fifth variable to the IV1 – IV3 and DV relationship so that the causal sequence is modelled with the IVs causing the ME, and ME causing DV, that is, X_1, X_2, X_3 →M→Y. The framework thus shows that the IVs have an influence on the ME which in turn helps them to influence the DV.

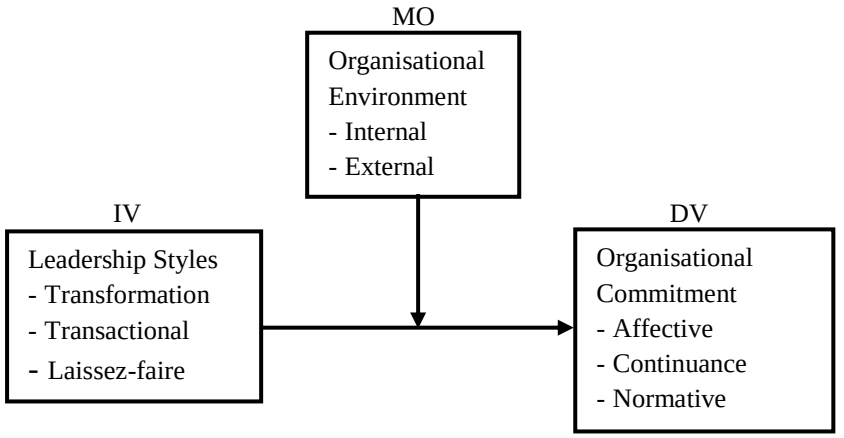

Figure 5.1. Conceptual framework with a single moderator variable (Fairchild & MacKinnon, 2009).

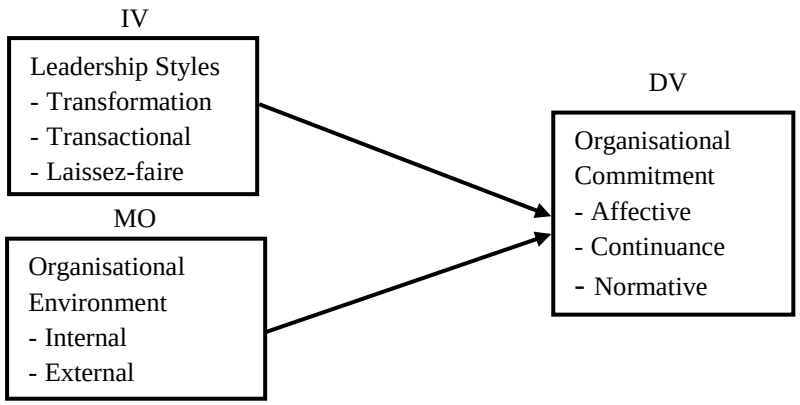

Figure 5.2. Conceptual framework with a single moderator model (MacKinnon, 2011).

The frameworks in Figures 5.1 & 5.2 show that in the relationship between the IV and the DV there is a third factor (the moderating factor). The moderator is not part of a causal sequence but qualifies the relation between X and Y. The framework suggests that the strength and form of a relation between two variables may depend on the value of a moderating variable. In a moderation relationship, the relationship between two variables X and Y depends on the value of the moderator variable (MacKinnon, 2011). However, the arrangement of variables in the framework does not change meaning as long as the moderator factors is structured in as a supporting variable.

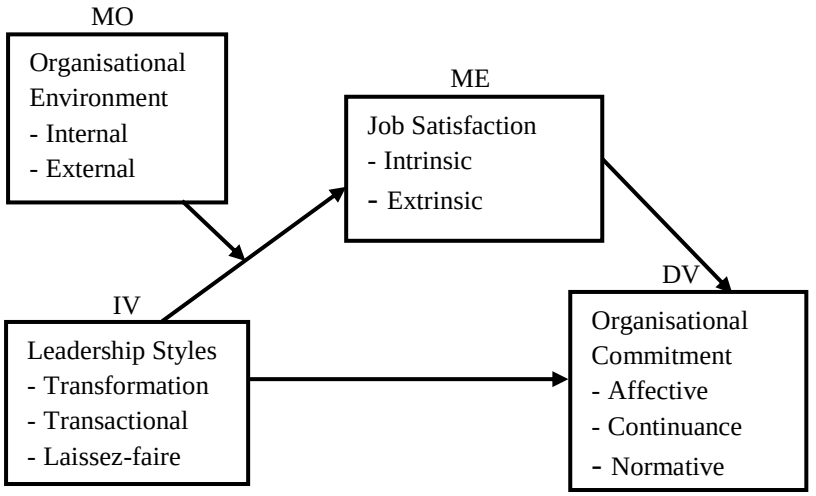

Figure 6. Conceptual framework for the mediation of a moderator effect example (Fairchild & MacKinnon, 2009).

The conceptual framework in Figure 6 presents a multivariate relationship between variables in a study involving analysis of a direct effect, and moderated and mediated effects. According to Fairchild and MacKinnon (2009), by combining the analysis of these effects in a single analysis, the researcher may identify effective components in a project. Separate analyses of mediation and moderation may be used to show the strength of each variable.

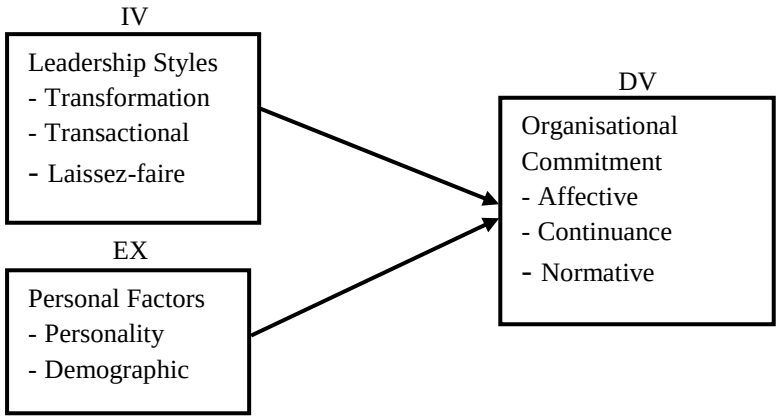

Figure 7.1. Conceptual framework for a single control model developed by the author.

The framework in Figure 7.1 shows that an extraneous variable or control variable can be incorporated as an independent variable in the statistical analysis to establish the extent of its effect on the relationship between the IV and DV (Flannelly et al., 2014). When the effect is established, then one can know the extent of the effect of the extraneous or control variable in the model.

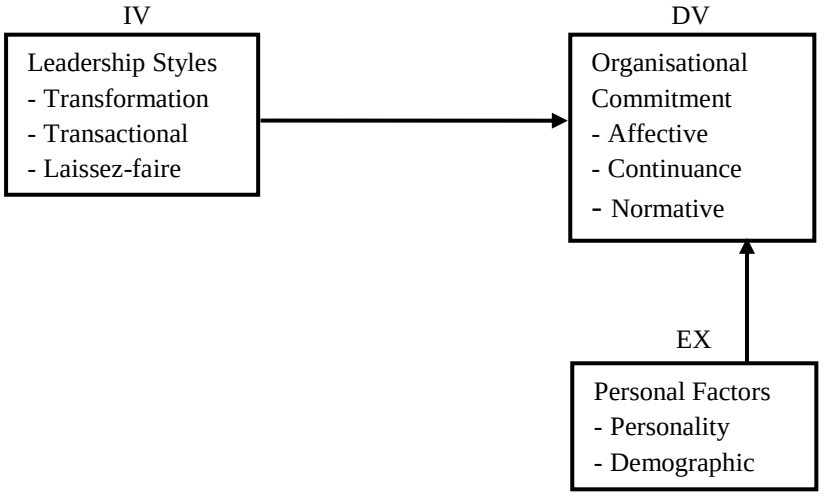

Figure 7.2. Conceptual framework for a single control model (Onen, 2016).

The conceptual framework in Figure 7.2 shows that extraneous variables can inform the findings of the study. However, according to Onen (2016), if the researcher has confidence that all the extraneous variables have been adequately controlled and will therefore not influence the dependent variable significantly, then they may be omitted from the model so that only the independent and the dependent variables are related directly. However, if not controlled, their effect should be tested to find out their effect in the analysis model.

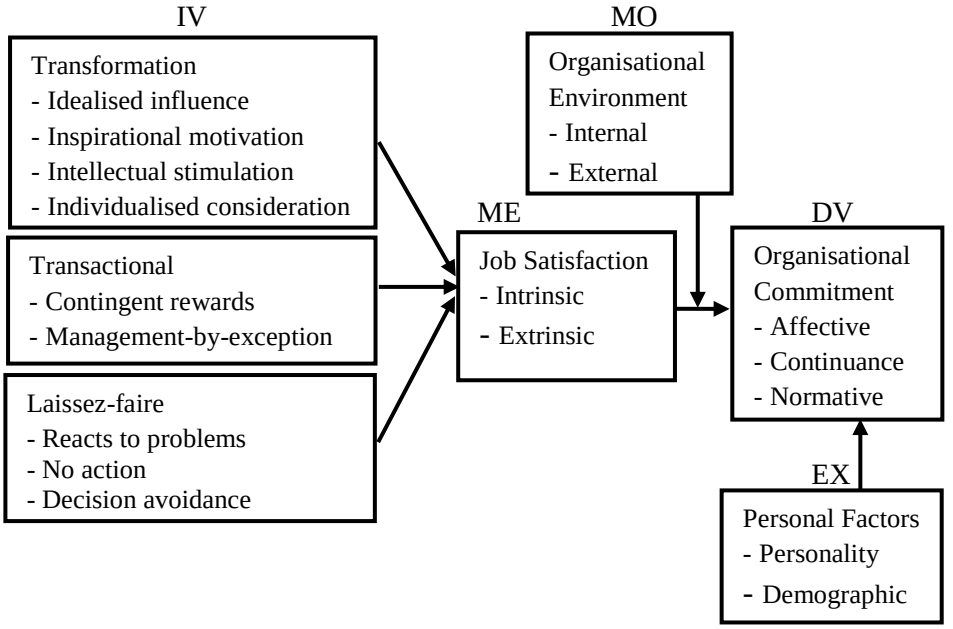

Figure 8. Conceptual framework for multivariate analysis in a general joint model

The framework in Figure 8 shows that the different variables namely IV, ME, MO, EX and DV can be included in one analysis model. This helps in showing how the different variables affect each other in the relationship with the DV in direct and indirect relationships.

Conclusion

In conclusion, the conceptual framework comprises concepts that may be developed into constructs and given values, they become variables. The variables include dependent, independent, mediating, moderating and extraneous. The diagrammatical connecting of variables in frames encircling variables to form a conceptual framework is not dogmatic that is, a fixed diagram but portrays the kind of analysis that will be or has been carried out in a study.

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