Quantitative Research and Theory Building: Dubin's Method

Susan A. Lynham

Advances in Developing Human Resources 2002 4: 242
DOI: 10.1177/15222302004003003

Chapter 2

Quantitative Research and Theory Building: Dubin's Method

Susan A. Lynham

The problem and the solution. There are a number of strategies and methods that the theory builder can use to develop applied theory. Each strategy and method is informed by assumptions about what makes for knowledge and in turn good theory—and each is a way of seeing and understanding the phenomenon central to the theory. Dubin, a recognized scholar in applied theory building, advocates a theory-then-research strategy and quantitative hypothetico-deductive approach to applied theory building. This chapter focuses on Dubin's quantitative method of theory building for applied disciplines, a two-part, eight-step theory-building method as a specific variation of the general method of theory-building research in applied disciplines presented in chapter 1.

Robert Dubin (1978), in his landmark book *Theory Building*, cautioned against knowing and practicing "the form of theory-research" (p. 267) while not knowing the substance thereof. It is the purpose of this chapter to present the reader with both the form, that is, the shape, structure, and outward appearance, as well as the substance, or what might be considered as the essence, of a quantitative theory-building methodology. The form of applied theory building is presented by way of a description of the hypothetico-deductive method and the continual deduction-driven refrain that is embedded in this hypothetico-deductive approach to applied theory building. The theory-research cycle that contains Dubin's two-part, eight-step theory-building method necessary for the development of valid, trustworthy applied theory is then presented in Figure 1. The substance of this applied theory-building method is a detailed presentation of this two-part, eight-step process. The chapter concludes with an illustrative summary of the relationship between Dubin's two-part, eight-step theory-building method and the research questions of the study of application, together with some implications of this explicit theory-building method for research and practice in human resource development (HRD) and other applied disciplines.

Advances in Developing Human Resources Vol. 4, No. 3 August 2002 242-276

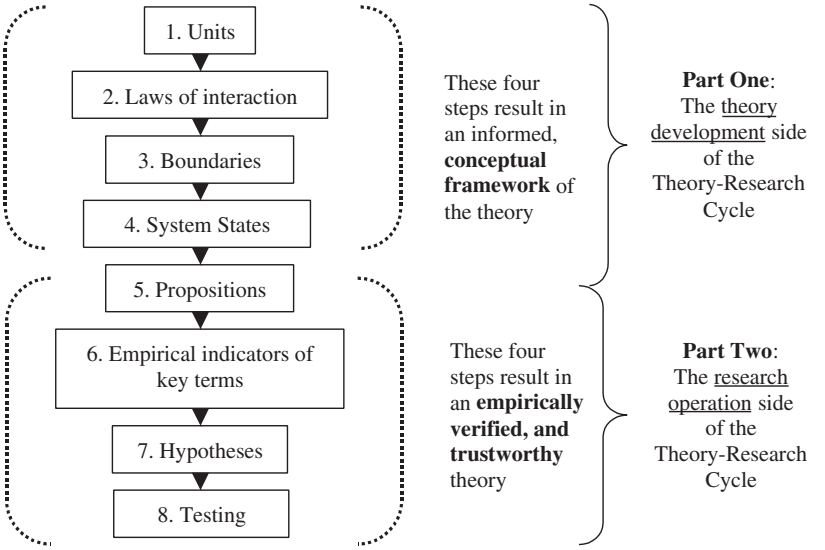

FIGURE 1: Dubin's Theory-Building Method as an Eight-Step Theory-Research Cycle

The Form of Dubin's Quantitative Theory-Building Method

The shape of Dubin's (1976, 1978) theory-building research method is based on two distinct and related conceptual and methodological components. The first component is the hypothetico-deductive approach to the construction of knowledge. This first component in turn informs the second, namely, a theory-to-research, or "theory-then-research" (Reynolds, 1971, p. 144), strategy for theory development and verification.

The Hypothetico-Deductive Approach to Knowledge Construction

The notion of the hypothetico-deductive method implies a predisposition to a particular perspective of what makes for theory and, therefore, an appropriate method of theory construction and verification: "A theory in science is a general statement (or hypotheses) from which particular inferences may be deduced" and wherein "observations can then be seen as confirming or falsifying hypotheses" (Honderich, 1995, p. 385). Kaplan (1964) described this method as "the most widely accepted reconstruction of science" (p. 9):

> According to this reconstruction, the scientist, by a combination of careful observation, shrewd guesses, and scientific intuition arrives at a set of postulates governing the phenomena in which he is interested; from these he deduces observable consequences; he then tests these consequences by experiment, and so confirms or disconfirms the postulates, replacing them, where necessary, by others, and so continuing. (pp. 9-10)

The hypothetico-deductive method of knowledge construction is contained within the empirical-analytical approach to science (Hultgren & Coomer, 1989) and view of theory-building inquiry (see Lynham, 2002, Table 1, chap. 1). This method therefore directs theory-building researcher-theorists in a number of ways: that their theory-building endeavors should be motivated by a practical/technical interest of means and ends; should assume that observational data are the foundation of knowledge; should pursue the purpose of explanation, prediction, and control; and should result in the desired outcome of developing transferable, generalizable laws and explanations of organizational and human behavior. This hypothetico-deductive method is therefore central to the two-part theory-research cycle and eight-step theory-building research method advocated by Dubin (1978) to be discussed in the following sections of this chapter. It should be noted that the discussions following are not intended to be sufficient to convey the detailed complexity of Dubin's theory-building research method but rather sufficient for the reader to gain a sense of and feel for the basic form and essence of this theory-building method. Those wishing to employ this method of applied theory building are urged to consult Dubin's 278-page book in this regard.

The Two-Part Theory-Research Cycle and Dubin's Eight-Step Applied Theory-Building Method

Dubin (1978) contributed a widely recognized research method and accompanying language for theory building in an applied field. At a conceptual level, his method can be presented as a continuous theory-research cycle composed of two parts, the first being the theoretical side of the cycle and the second the research operation side of the cycle (Lynham, 2000a) (also see Figure 1). Successful completion of the first part, or theoretical side, of the cycle results in an informed, conceptual framework of the theory, whereas successful completion of the second part, or research operation side, results in an empirically verified and trustworthy theory (Lynham, 2000a). The task of the theory-researcher is to consistently and conscientiously move through each of the two parts of the cycle, by following the precise substance of Dubin's applied theory-building method, which is made explicit through four theory development and four research operation, or theory verification, steps, as indicated in Figure 1 (Lynham, 2000a). Following the form and substance of this two-part theory-research cycle and eight-step applied theory-building method is considered necessary and sufficient to ensure both rigor and relevance in the resulting theory.

The first task of the theory development side of the cycle, and the first step in the applied theory-building method, requires identification of the units of the theory, also known as the concepts of the theory. These units represent the things or variables whose interactions constitute the subject matter, or phenomenon, that is the attention of the theory. After the units of the theory have been identified, the next step in theory development is to specify how the units interact and relate to one another, which is accomplished by stipulating the laws of interaction that pertain to the units of the theory. The laws of interaction show how changes in one or more of the units of the theory influence the remaining units. It is significant to note that describing the units of the theory and how these units interact (that is, the laws of interaction) makes for the major contribution to knowledge that is generated by the theory (Dubin, 1978; Lynham, 2000a; Torraco, 1994, 2000).

Next in the theory development process is the task of determining the boundaries of the theory. This third step in the applied theory-building method enables the researcher-theorist to determine the limited domain of the world in which the theory is expected to hold true, or to hold up. Determining the boundaries of the theory enables the researcher-theorist to set and clarify the aspects of the real world that the theory is attempting to model and therefore bounds, or limits, the theoretical domain of the theory from other aspects of the real world that the theory is not attempting to model and explain. The fourth step in the applied theory-building method, and the final step in the theory development side of the cycle, is the specification of the system states of the theory. System states indicate the complexity of the real world that the theory is presumed to represent and the different conditions under which the theory operates. Theories can have numerous or few system states, but all units of the specified system states are determinant and measurable and are distinctive for each state of the theoretical system (Dubin, 1978).

Attention to Steps 1 through 4 completes the theory development part of the theory-research cycle of the theory-building method as specified by Dubin (1978). Successful completion of this part of the applied theory-building process constitutes the conceptual development of the theory and results in the explicit output of a conceptual or theoretical framework of the theory. To ensure the informed nature of this theoretical framework, the researcher-theorist is compelled to rely on thorough and scholarly exploration and study of current and related literature and research, as well as on her or his observed experience of the phenomenon in the real world. Once the theoretical framework of the theory has been developed, the researcher-theorist is ready to move on to the second part of the theory-research cycle, which also makes up the research operation side of Dubin's theory-building method.

The research operation side of the theory-research cycle of theory building in applied disciplines consists of four steps, which coincide with Steps 5

through 8 of Dubin's theory-building method. These four steps involve specifying the propositions of the theory, identifying the empirical indicators of the theory, constructing the hypotheses of the theory, and finally, developing and implementing a plan of research to test and thereby confirm the trustworthiness of the theory.

Specifying the propositions of the theory requires that the researcher-theorist derive truth statements or logical deductions about the theory in action. These propositions are grounded in the explanatory and predictive power embedded in the theoretical framework of the theory constructed during the theory development part of the process. This fifth step in Dubin's method is of further significance in that it is often at this point in the theory-building process that the researcher-theorist ends the journey, for this step marks the point at which the theory is considered developed and made ready for further translation to and testing in practice. The taking of the rest of this research operation side of the applied theory-building process can be the task of the originating researcher-theorist or others who wish to further test and confirm, or disconfirm, the theory's explanatory and predictive capabilities and trustworthiness in practice.

Once the propositions of the theory have been specified, the next (and sixth) step facing the researcher-theorist is to identify the empirical indicators of the theory. Identifying empirical indicators is necessary to make the proposition statements testable and is needed for each unit in each proposition whose test is sought (Dubin, 1978).

The seventh step in quantitative theory-building process, and still part of the research operation side of the cycle, requires that the researcher-theorist construct hypotheses. This step involves logically substituting the empirical indicators in the proposition statements with testable, confirmable hypotheses and enables the researcher-theorist to subject the theory to empirical testing in the real world. The final step in Dubin's theory-building process is to engage in the actual testing of the theory through a thoughtfully specified research plan of ongoing data gathering to enable adequate verification and/or continuous refinement of the theory. Successful completion of these last four steps completes the research operation side of the theory-research cycle and results in an empirically verified and trustworthy theory, as well as marks the completion of the rigorous theory-building process as outlined by Dubin (1978).

The Substance of Dubin's Quantitative Theory-Building Method

As indicated in Figure 1, Dubin's quantitative theory-building method is composed of two parts, one theory development and one research operation, each of which is further constituted by four specific steps. The essence of

each of these eight steps that make up this particular applied theory-building method is further illustrated by way of explicit description and a brief overview example application of Steps 1 through 6. The example comprises extracts of a theory of responsible leadership for performance (Lynham, 2000a) (full documentation is available from the author) and illustrates the outcomes of Steps 1 through 6 of this theory-building research method in action.

The Four Steps of Part 1 of Dubin's Quantitative Theory-Building Method

As indicated earlier, and in Figure 1, the first part of the theory-research cycle embedded in Dubin's eight-step theory-building research method is constituted by four theory development steps. The first step requires that the units of the theory be identified. The second step involves establishing the laws of interaction applicable to the units of the theory. The third step requires that the boundaries of the theory be determined. And the fourth and final step in theory development involves specification of the system states and their effects on the theory. It is worth reemphasizing that the purpose of this first, theory development part of the theory-building cycle is to develop an informed theoretical framework, a system of knowledge that explains the explanatory essence of the theory in action.

Part 1, Step 1: Identifying the units of the theory. The units of a theory are sometimes described as the concepts of the theory, or the basic ideas that make up the theory (Cohen, 1991; Dubin, 1978; Reynolds, 1971). The units represent the things about which the researcher is trying to make sense and are informed by literature and experience. By translating these concepts to units, the researcher-theorist is able to identify the things or variables whose interactions make up the subject matter of attention (Dubin, 1978), in the example provided that of responsible leadership for performance (Lynham, 1998, 2000a). It must be noted that units represent the properties of things rather than the things themselves (Dubin, 1978).

The units of the theory can also be described as "the things out of which the theory is built" (Dubin, 1976, p. 26). They are the basic building blocks from which the researcher-theorist constructs the theory, the raw conceptual material from which the theory emerges (Cohen, 1991; Torraco, 2000). Description of the units of the theory enables the researcher-theorist to answer the first theory development question: What are the units of the theory?

When identifying and selecting the units of a theory, there are five dichotomies of characteristics that must be considered by the researcher-theorist: (a) unit versus event, (b) attribute versus variable, (c) real versus nominal,

(d) primitive versus sophisticated, and (e) collective versus member (Dubin, 1978). Further to these dichotomies, Dubin identified five types of units among which the researcher-theorist must distinguish, namely, enumerative, associative, relational, statistical, and summative units. For further description of these dichotomies and types of units, consult Dubin's (1978) text, chapter 3.

The kinds of units used in the theory are determined by the choices made by the researcher-theorist regarding these dichotomous characteristics and unit types. The kinds of units used in a theory are important as they can affect the theory in a number of ways, for example, its structure, the kinds of explanations and predictions the theory can generate, and the extensiveness of the tests that can be made of the theory (Dubin, 1978).

A further and important requirement of this step in Dubin's method of theory building is to consider the outcome of developing the units of the theory against a number of criteria, identified by Dubin (1978) for this first theory development step. Five criteria can be identified for this first step in the theory development process, namely, rigor and exactness, parsimony, completeness, logical consistency, and the degree of conformity to the limitations on employment and combination of the units. A brief description of each criterion follows.

The criterion of completeness is linked only to the use of associative units and the resulting possible zero value of these units. By employing associative units, predictions about the theoretical system, in this example that of responsible leadership for performance, must include states in which these units go to zero or even become negative. This issue becomes important for the eventual testing of the completeness of the theory, that is, of the completeness of the predictions generated by the theory.

The notion of logical consistency relates to the logic of the types of units combined in and used to compose the theory. The use of only one type of theory unit confines the results of the theory. For example, the use of only enumerative or only associative units confines the results "to just the first quadrant of the Cartesian co-ordinate system" (Dubin, 1978, p. 69). On the other hand, the combination of enumerative with associative units in a single theory enables a better spread of data across the "four quadrants of the Cartesian co-ordinate system" (Dubin, 1978, p. 70). What units the researcher-theorist decides to use in the theory therefore influences the kinds of studies that can later be used to gather and study data on the theory and, ultimately, be used to verify and refine the theory.

In the development of the units of a theory, the researcher-theorist is required to uphold three limiting rules regarding the combination of types of units in a theory. The first rule states that "a relational unit is not combined in the same theory with enumerative or associative units that are themselves properties of that relational unit" (Dubin, 1978, p. 73). The second rule states,

> Where a statistical unit is employed, it is by definition a property of a collective. In the same theory do not combine such a statistical unit with any kind of unit (enumerative, associative, or relational) describing a property of members of the same collective. (pp. 74-75)

The third rule states that "summative units have utility in education and communication with those who are naïve in a field. Summative units are not employed in scientific models" (Dubin, 1978, p. 78).

The preceding discussion concludes the description of the first step in the theory development phase of Dubin's (1978) theory-building method. The outcome of this section is the identification and description of the units of the theory, as highlighted in Figure 2 and the application example at the end of this section, and answers the first theory development question: What are the units of the theory? The task of the next and second step in the theory development part of this theory-building inquiry method is to consider the nature of the relationships between the three units of the theory.

Part 1, Step 2: Establishing the laws of interaction that govern the theory. The second step of theory development in Dubin's theory building research method is the specification of the laws of interaction applicable to the units of the theory. The laws of interaction describe the interaction among the units of the theory and enable the researcher-theorist to answer the second theory development question: What are the laws of interaction of the theory?

The laws of interaction make explicit and specific the manner in which the units of the theory interact with one another (Dubin, 1978; Torraco, 1994, 2000). A law of interaction is a statement by the researcher-theorist of the relationship between units and shows how the units of the theory are linked to each other. It is important to note that at this stage of the development of the theory, these laws of interaction relate to the relationship between the units of the theory and not to the conceptual dimensions of each unit of the theory. Dubin (1978) highlighted three general categories or types of laws of interaction, namely, categoric, sequential, and determinant.

Categoric laws of interaction indicate that values of a unit of the theory are associated with values of another unit. This type of law is common in the social sciences and indicates "a greater-than-chance probability that the units are related" (Dubin, 1978, p. 98). Categoric laws are symmetrical in nature, meaning that "it does not matter whether one or the other of the units comes first in the statement of the law" (Dubin, 1978, p. 100). Words typically employed in this kind of law of interaction are *is associated with*; for example, Unit A is associated with Unit B (Dubin, 1978, p. 101).

Two categoric laws of interaction were identified for the theory of responsible leadership for performance (Lynham, 2000a). The first pertains to the theory as a whole and the second to the symmetrical nature of the relationship between the three units of the theory. See the corresponding discussion in the application example at the end of this section.

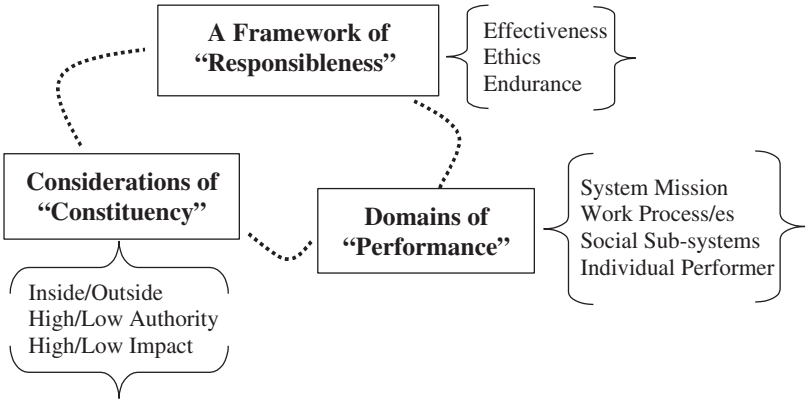

FIGURE 2: Responsible Leadership for Performance: A Model of the Units of the Theory and Supporting Conceptual Dimensions

Sequential laws are a second type of law of interaction and make use of a time dimension to describe the relationships between two or more units. A sequential law of interaction therefore identifies a temporal interval between the values of two or more units and indicates that the relationship between the units concerned is unidirectional. As a result, sequential laws are asymmetrical, with a time lapse between the units being a characteristic of this type of law of interaction. Words typically employed in this kind of law of interaction are *succeeded by* or *preceded by*; for example, "specified values of Unit A are succeeded by specified values of Unit B with a time interval of X" (Dubin, 1978, p. 103).

Two sequential-type laws of interaction were identified for the theory of responsible leadership for performance (Lynham, 2000a). These are highlighted in the corresponding discussion and Figures 3 and 4, as well as in the application example presented at the end of this section.

At the outset of the development of the example theory, it was suggested by the researcher-theorist that leadership could and should be thought of as a system, that is, as a set of defined, interdependent parts that interact within some defined boundary (Dubin, 1978). The theory of responsible leadership for performance (Lynham, 2000a) is a systems view of leadership and presents leadership as a set of three interdependent units, interacting within the context and boundaries of a performance system (see corresponding discussion and Figure 4, as well as application example at the end of this section).

A determinant law of interaction is one that relates determinate values of one unit of the theory with determinate values of another unit. Determinant laws of interaction therefore describe specific relationships between units with determinate values, and as a result, these laws of interaction are typically used in the physical sciences where such precise relationships are

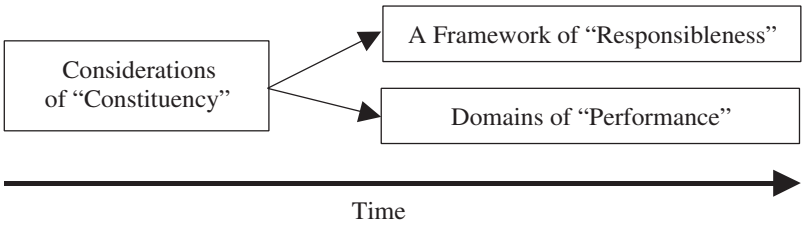

FIGURE 3: A Diagram of the First Sequential Relationship Between the Three Units of the Theory

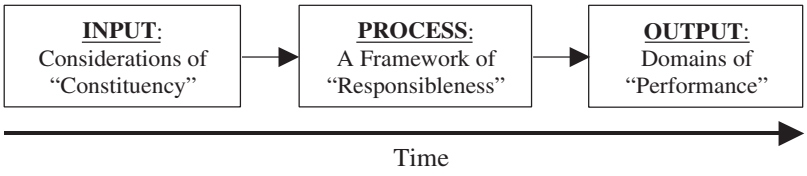

FIGURE 4: A Diagram of the Second Sequential Relationship Between the Three Units of the Theory

more common than in the behavioral sciences (Dubin, 1978; Torraco, 2000). At this time, there are no determinant laws of interaction in the example theory of responsible leadership for performance.

The two types of laws of interaction employed in the example theory, namely, categoric and sequential laws, govern the relationships between the three units of the theory (Dubin, 1978; Torraco, 2000). It must be noted that laws of interaction do not necessarily indicate causality: "A statement of interaction or relationship is not necessarily a statement of causality" (Dubin, 1978, p. 92). Furthermore, Dubin (1978) informed us that laws of interaction are never in themselves measured. Only the values of the units in a relationship are measured. The scientific law is therefore tested empirically "if, and only if, values are empirically assigned to the units employed in the law" (p. 94).

Besides being distinguishable by type, laws of interaction can also be differentiated by levels of efficiency. Dubin (1978) identified four general levels of efficiency of a law, namely, "(1) presence-absence (lowest level of efficiency); (2) directionality; (3) covariation; and (4) rate of change (highest level of efficiency)" (p. 109). These levels of efficiency are of a cumulative nature and tend

to correspond with the scientific sophistication of a specific scientific discipline. According to Dubin,

> As the sophistication improves in a given scientific discipline [so] the laws of interaction employed in that discipline move to a higher level of efficiency. . . . It should be possible to measure the level of sophistication of a given discipline by the efficiency of the laws therein employed. (p. 111)

Dubin further indicated that the lowest level and the second level of efficiency are often employed in laws of the social and behavioral sciences and are accepted as indicating scientific precision in these sciences.

Categoric laws of interaction are always at the lowest level of efficiency, indicating a presence-absence relationship between the units of the theory. Sequential laws of interaction, on the other hand, "may achieve any level of efficiency" (Dubin, 1978, p. 111). The laws of interaction of the example theory are at the first two (lower end) levels of efficiency of a law, namely, presence-absence and directionality.

In addition to determining the laws of interaction of a theory, the researcher-theorist must also consider the outcomes of this second step in Dubin's theory-building inquiry method against criteria of excellence for completion of this step. The outcome of determining the laws of interaction of a theory can be considered against a single criterion, namely, that of parsimony (Dubin, 1978). As explained in the development of the units of the theory, parsimony relates to the degree to which the theory contains a minimum of complexity and assumptions. Parsimony, as a criterion of theory development, also refers to the complexity of the laws of interaction employed in the theory. The higher the level of efficiency reflected in the laws of interaction, that is, presence-absence, directionality, covariation, or rate of change, the more sophisticated and complex the laws of interaction are considered to be. In the example theory, briefly presented in the application example at the end of this section, the two categoric laws are at the lowest level of efficiency (presence-absence), whereas the two sequential laws are at the second lowest level of efficiency (directionality).

Besides the efficiency level of the laws of interaction of the theory, the criterion of parsimony also relates to the maximum versus the minimum number of laws required to relate the units of a theory at least once with each other (Dubin, 1978). To this end, the key laws of interaction presented in the example theory (see application example at end of section) are considered a minimum to make explicit and clear the nature of the interrelationship between the three units of the theory. By restricting the laws of interaction of the theory to currently low levels of efficiency and minimum numbers, the researcher-theorist attempted to ensure further parsimony of her theory of leadership (Lynham, 2000a). This section concludes the second theory development step in Dubin's theory-building method. The outcome of this step enables the researcher-theorist to answer the second theory develop-

ment question: What are the laws of interaction of the theory? Once the units and the laws of interaction of the theory have been established, the next and third step in this applied theory–building method is to determine the boundaries of the theory.

Part 1, Step 3: Determining the boundaries of the theory. The boundaries of a theory are established to determine and clarify the domains within which the theory is expected to hold up and apply (Dubin, 1978). It must be remembered that a theory is an attempt by the researcher-theorist to model some theoretical aspect of the real world (Torraco, 1997). As such, a theory is limited to an aspect of the real world that it is trying to model. The boundaries of a theory therefore establish the real-world limits of the theory and in so doing distinguish the theoretical domain of the theory from those aspects of the real world not addressed or explained by the theory.

The determination and clarification of the boundaries of a theory require response to the third of the four theory development questions: What are the boundaries of the theory? By addressing this theory development question, the researcher-theorist is able to complete Step 3 of Dubin's theory-building inquiry method and compare the outcome to the criteria of excellence for this third theory development step. The boundaries of a theory are important in that they enable the researcher-theorist to make clear and explicit the limited portions of the world within which the theory is expected to hold (Dubin, 1978). Of equal import is that the boundaries of a theory also enable the researcher-theorist to represent the theoretical framework of the theory as an empirical and bounded system of knowledge and explanation (Dubin, 1978).

Dubin (1978) distinguished between a closed and an open boundary (p. 126), advocating the use of an open boundary "when there is exchange over the boundary between the domains through which the boundary extends" (Torraco, 1994, p. 162). On the other hand, Dubin advocated a closed boundary when "exchange does not take place between the domains through which the boundary extends" (Torraco, 1994, p. 162).

When using a theory-to-research strategy of theory building, as is inherent to the nature of Dubin's method of theory building, the boundaries of a theory are determined not by empirical data but rather through the use of logic. The boundary of the theory must be chosen, through the logic of the researcher-theorist, to indicate the "domain over which the [theory] operates as a system" (Dubin, 1978, p. 141). The boundary of the theoretical system acts to specify "the furthest extension over the empirical world that the [theoretical] model is expected to operate" (Dubin, 1978, p. 141). The domain of the theory therefore becomes "that portion of the empirical world included within the boundaries" (Dubin, 1978, p. 141). Dubin (1978) indicated that "the domain of a [theory] is always bounded" and that "to determine the domain of a [theoretical] model requires the determination of its

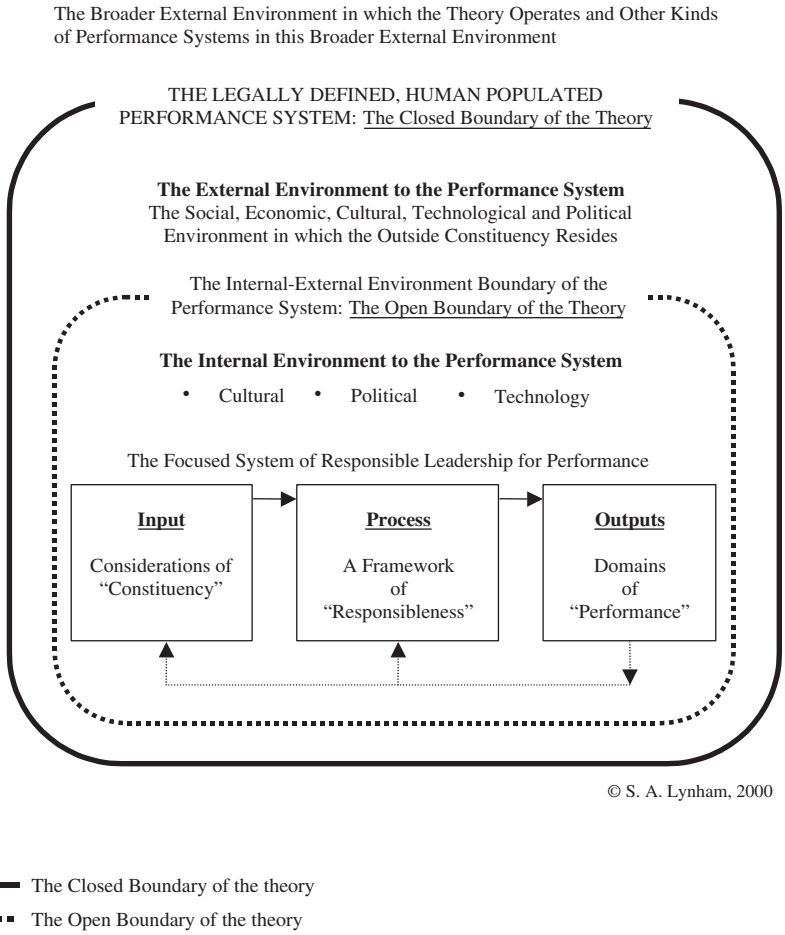

FIGURE 5: The Boundaries of a Theory of Responsible Leadership for Performance
Note: © S. A. Lynham, 2000.

boundaries" (p. 141). By way of example, the boundaries and corresponding domains of the theory of responsible leadership for performance (Lynham, 2000a) are presented in the application example at the end of this section and Figure 5.

Once the boundaries of the theory have been determined, the researcher-theorist is required to compare the resulting boundaries against two step-related criteria of excellence identified by Dubin (1978), namely, homogeneity (including the satisfaction of three specific internal and external boundary-determining requirements) and generalization.

The criterion of homogeneity requires that "the units employed in the theory and the laws by which they interact satisfy the same boundary-determining criteria" (Dubin, 1978, p. 127). Dubin (1978) further specified that "a theoretical model is said to be bounded when the limiting values on the units comprising the model are known. The limiting values are always determinate" (p. 126). In comparing the output of this third theory development step with the corresponding boundary-determining criteria, it is important to first clarify some basic related concepts, namely, boundary criteria, interior boundary-determining criteria, and external boundary-determining criteria.

"The boundary-determining criteria of a [theory]," said Dubin (1978), "apply with equal force to the units employed and the laws of interaction among these units. The units [of a theory] must fit inside the boundaries before the [theory] is complete" (pp. 126-127). Internal boundary-determining criteria are those that are "derived from the characteristics of the units and the laws employed in the [theory]" (p. 128). Dubin specified four possible internal boundary-determining criteria, namely, truth tables of the logician, establishing a "limit of probability on the values taken by the units employed in a theory" (p. 130), "subsetting the property space" (p. 131), and alignment between the relationships specified in the laws of interaction and those included in the domain of the theory. External boundary-determining criteria, on the other hand, "are those imposed from outside the [theory]" (p. 132).

The application of internal and external boundary-determining criteria is related to the theory-building strategy employed by the researcher-theorist in developing the theory. In a research-to-theory strategy of theory building, these criteria are determined through empirical research and measurement of the units and laws of interaction employed in the theory. In this type of theory-building strategy, the empirical data gathered through research are then used by the researcher-theorist to derive the boundaries of the theory (Dubin, 1978; Reynolds, 1971). In a theory-to-research strategy of theory building, the researcher-theorist determines the boundaries of the theory logically (Dubin, 1978).

The criterion of generalization of a theory relates to domain size of the theory. Thus, the bigger the domain, the more general the theory (Dubin, 1978). Reducing the number of boundary-determining criteria also serves to enlarge the domain of the theory. Employing two boundaries in the example theory and applying two boundary-determining criteria enabled the researcher-theorist to limit the generalization of this theory of leadership. As indicated in the application example at the end of this section, the theory of responsible leadership for performance (Lynham, 2000a) is not an unlimited, unbounded theory of leadership. At the same time, the somewhat broad domain of the theory can later be shown to have implications for understand-

ing and including knowledge from other leadership theories into that of the theory of responsible leadership for performance.

This section concludes discussion of the essences of the third step in the theory development part of Dubin's theory-building method. The outcome of this third step is the determination and clarification of the two boundaries, one open and one closed, of the example theory, as presented in Figure 5 and the application example at the end of this section. These boundaries make clear and explicit the real-world domain over which the example theory is expected to apply and hold up.

Clarification of the boundaries of the theory enables the researcher-theorist to answer the third theory development question: What are the boundaries of the theory? The next and fourth step in the first theory development part of Dubin's applied theory-building method is that of specifying the system states of the theory.

Part 1, Step 4: Specifying the system states of the theory. A system state is a condition of the system being modeled in which the units of the theory interact differently. Thus, a system state represents a condition under which the theory is operative (Dubin, 1978; Torraco, 1994, 1999, 2000). Specifying the system states under which the theory is expected to operate requires response to the fourth and last theory development question: What are the system states of the theory? Through response to this theory development question, the researcher-theorist is able to complete Step 4 and the first part (the theory development side) of Dubin's applied theory-building method.

Dubin (1976, 1978) defined a system state as a condition of the system being modeled in which all the units of the system take on characteristic values that have persistence through time, regardless of the length of the time interval. All units of the system have values that are determinant, meaning they are measurable and distinctive for that state of the system.

Dubin (1978) further identified three criteria of importance to the researcher-theorist when identifying the system states of the theory, namely, (a) inclusiveness, (b) persistence, and (c) distinctiveness. The criterion of inclusiveness refers to the need for all the units of the system to be included in the system state of the theory (Dubin, 1978; Torraco, 1994, 2000). The criterion of persistence requires that the system state persist through a meaningful period of time (Dubin, 1978; Torraco, 1994, 2000). And the criterion of distinctiveness requires that all units take on determinant, that is, measurable and distinctive, values for the system state (Dubin, 1978; Torraco, 1994, 2000).

The specification of the system states of the theory enables the researcher-theorist to answer the fourth, theory development, question: What are the system states of the theory? The completion of this fourth step also enables the researcher-theorist to conclude the first theory development

part of the quantitative theory-building method (Dubin, 1978). It should be recalled that an important outcome of this first theory development part of Dubin's two-part, eight-step theory-building method is an informed, conceptual, or theoretical framework of the theory.

At this stage of the theory-building process, the four theory development questions have been addressed by describing the units, specifying the laws of interaction, determining the boundaries, and identifying the system states of the theory. Addressing the four theory development questions thus enabled the researcher-theorist to develop and present an informed conceptual and theoretical framework, that is, a theoretical system of knowledge, of the example theory, as indicated in the corresponding discussion and Figure 6, as well as in the application example following.

Application example. At the outset of this section discussion, four steps were identified as necessary for the development of the example theory of responsible leadership for performance (Lynham, 2000a), namely, (a) a description of the units of the theory, (b) specification of the laws of interaction of the theory, (c) determination of the boundaries of the theory, and (d) identification of the system states of the theory. The conclusion of each of these four steps allowed the researcher-theorist to answer the following four corresponding theory development questions and conclude the theory development side of the theory-research cycle embedded in Dubin's eight-step applied theory-building method: (a) What are the units of a theory of responsible leadership for performance? (b) What are the laws of interaction of a theory of responsible leadership for performance? (c) What are the boundaries of a theory of responsible leadership for performance? and (d) What are the system states of a theory of responsible leadership for performance?

In answering the first of these four theory development questions, three units and their conceptual dimensions were described for the theory (see Figure 2). The first unit identified was considerations of constituency, with three conceptual dimensions being identified as integral to this unit. These were whether the constituency resides inside or outside the performance system in which the leadership occurred, whether the constituency has high or low authority over the performance system concerned, and whether the constituency has high or low potential impact over that performance system. The second identified unit of the theory was a framework of responsibleness, consisting of three conceptual dimensions, namely, effectiveness, ethics, and endurance (White Newman, 1993). The third unit identified in the theory was domains of performance. The four conceptual dimensions of this third unit of the theory included systems mission, work processes, social subsystems, and the individual performer (Holton, 1999).

The rationale and theoretical support for each of these three units and their conceptual dimensions were considered in detail. The three units were

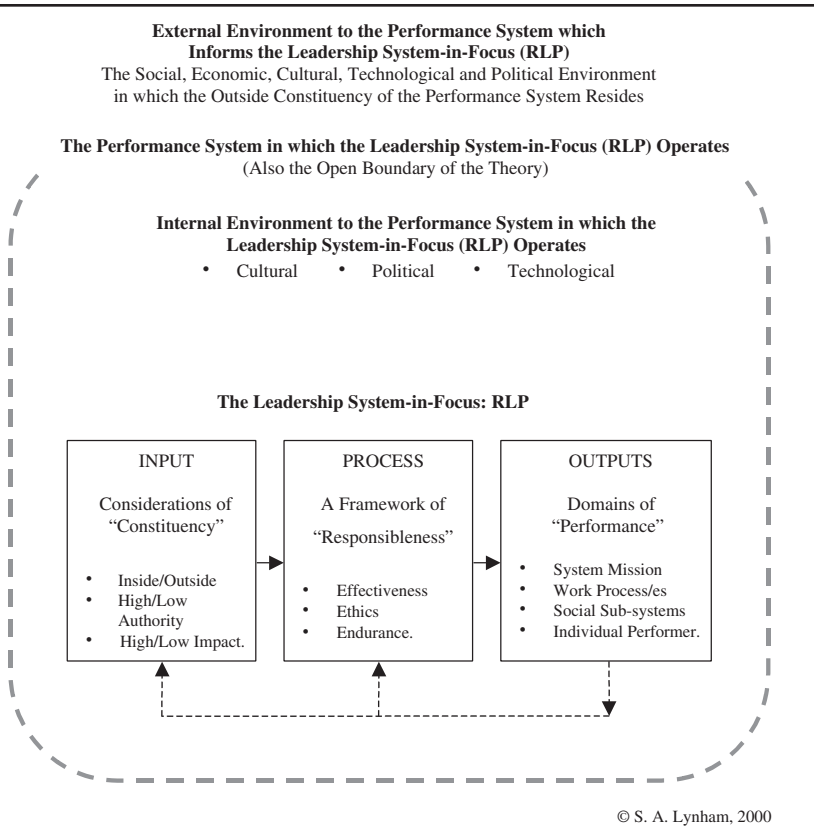

FIGURE 6: The Theoretical Framework of a Theory of Responsible Leadership for Performance

Note: © S. A. Lynham, 2000.

also shown to satisfy the five criteria for identification of the units of a theory, namely, rigor and exactness, parsimony, completeness, logical consistency, and degree of conformity to the limitations on employment and combination of the units.

In answering the second theory development question, four laws of interaction were specified for the example theory of responsible leadership for performance, two of a categoric (associative) nature and two of a sequential (temporal) nature. The first two categoric (associative) laws of interaction are as follows:

- Law 1: All three units of the theory, namely, considerations of constituency, a framework of responsibleness, and domains of performance, are associated with and required for responsible leadership for performance, and

- Law 2: Each unit of the theory, namely, considerations of constituency, a framework of responsibleness, and domains of performance, interrelates with each other unit of the theory.

These two associative laws gave rise to the first principle that informs the system states of the example theory, namely, that in the absence of any one of the three units and interaction among the units, the theoretical system of responsible leadership for performance is either unbalanced or destroyed. Law 3, the first sequential (temporal) law of interaction of the theory, states that considerations of constituency precede a framework of responsibleness and domains of performance in the theory of responsible leadership for performance (see Figure 3).

Law 4, the second sequential law of the theory, illustrated in Figure 4, specifies that the units of the theory of responsible leadership for performance can be thought of in terms of inputs, process, and outputs, where the unit of considerations of constituency forms the input, the unit a framework of responsibleness forms the process, and the unit domains of performance forms the output of the theory. These two temporal laws gave rise to the second principle that informs the system states of the theory, namely, that responsible leadership for performance results only when the three units of the theory are arranged in an interacting system of inputs, processes, and outputs (see Figure 4).

The supporting logic to the four laws of interaction of the theory of responsible leadership for performance was provided. The four laws of interaction were also shown to satisfy the criterion of parsimony required in the specification of the laws of a theory.

In response to the third theory development question, two boundaries, one closed and one open, were determined and clarified, as indicated in Figure 5. The first boundary, a closed boundary, determined the overall domain over which the example theory of responsible leadership for performance is expected to hold up. This boundary was shown to have two distinctions. The first was that of a legally defined, human-populated performance system, and the second was the social, political, technical, economic, technological, and cultural external environment in which the outside constituency of the performance system resides (see the solid black border line of Figure 5). These two boundary-determining features—of a legally defined, human-populated performance system and the social, political, economic, technological, and cultural external environment in which outside constituency resides—were shown to separate the domain of the theory from other kinds of performance systems and the broader external environment not addressed by the theory. The second boundary, an open boundary, determined in the development of the theory was shown to exist within the domain of all legally defined, human-populated performance systems (shown by the dash line in Figure 5). This second boundary allowed the system of responsible leadership for performance to be understood as a leadership system-in-

focus and corresponded with the internal-external boundary of the performance system in which the leadership system occurred.

The clarifying logic behind the determination of these two boundaries of the theory was presented. The two boundaries presented in the theory of responsible leadership for performance were also shown to satisfy the two criteria for determining the boundaries of a theory, namely, homogeneity and generalization.

Finally, to address the fourth and last theory development question, two system states were identified for the example theory of responsible leadership for performance, namely, that of balance and unbalance. To identify these system states, the system being focused on in the theory was first shown to be that of responsible leadership for performance, as presented in Figure 6.

Some characteristic values of each of the three units of the theory in each of the two system states of responsible leadership for performance were identified and shown to satisfy the three criteria of inclusiveness, persistence, and distinctiveness required for the identification of the system states of a theory. The supporting logic behind the two system states of the theory was also presented.

This concludes the presentation and discussion of the substance of the theory development side and the first part of the quantitative theory-building method. Making explicit the substance of the next part of the theory-building method requires description of the research operation side of Dubin's (1978) theory-building process.

The Four Steps of Part 2 of Dubin's Quantitative Theory-Building Method

The second part of the process requires the completion of Steps 5 to 8 of Dubin's two-part, eight-step theory-building inquiry method. This part of the theory-building method therefore includes specifying the propositions of the theory, identifying the empirical indicators for the key terms within the theory, constructing hypotheses to enable testing of the theory, and developing a purposeful research agenda to test the theory and/or its component parts in action.

It should be remembered that the second part of Dubin's theory-building method, also known as the research operation side of the two-part theory-building cycle, has as its main purpose the verification, or confirmation, of the theoretical framework completed during the first theory development part of the theory-building cycle. Through the address of the four steps central to the second part of the theory-building process, the theoretical framework that was the outcome of Part 1 of the process is operationalized by completing Steps 5 through 7 of Dubin's eight-step theory-building method

and then tested through completion of Step 8 in Dubin's quantitative theory-building process. Operationalization of the theoretical framework developed in Part 1 is achieved by first specifying propositions derived from the framework, then identifying corresponding empirical indicators informed by the propositions, and finally constructing hypotheses based on the propositions and informed by the empirical indicators.

Once the theoretical framework has been operationalized, the researcher-theorist can begin the conduct of related research to test and confirm, or indeed disconfirm, the theoretical framework in practice, or action. Neither operationalization nor testing of the theory through research is a one-time event. Rather, operationalization and testing of the theory should be understood as an ongoing, accumulative process of theory testing, confirmation, refinement, and further development. This continual refrain between the theory development and research operation sides of the two-part, eight-step theory-building inquiry method is meant to ensure that the researcher-theorist constantly adapts, tests, and readapts the theory until she or he has confidence in the trustworthiness of the theory in explaining action and outcome in the real world and/or continues to adapt the theory to incorporate new insights, knowledge, and experience to this predictive and explanatory end.

The sections following provide a brief description of the substance of the research operation side, second part, involving Steps 5 through 8, of Dubin's two-part, eight-step theory-building method. To the extent that the example theory of leadership was partially operationalized, an application subsection on the related theory-building steps is included in the related theory-building step descriptions.

Part 2, Step 5: Specification of the propositions of the theory. Propositions are, according to Dubin (1978), "truth statements about the theory" (p. 160) and are concerned with "the ways in which a theoretical model are put to use" (p. 159). The propositions of a theory are considered true by virtue of being statements that are logically derived from the theory itself (Dubin, 1978; Torraco, 2000). Because propositions can be subjected to empirical testing, they, in turn, enable the theory to be subjected to empirical testing (Torraco, 2000). The identification of propositions is therefore a first and necessary step in operationalizing the theory, or in getting the theory ready to be put to the test. Propositions enable the researcher-theorist to begin to make predictions from the theoretical framework about the values of the units of the theoretical framework in the real world. Specification of the propositions of a theory enables the researcher-theorist to answer the fifth question in Dubin's theory-building method and the first research operation question in this theory-building process: What are the propositions of the theory?

It is important to note, when considering propositions of a theoretical framework, that these truth statements "are not necessarily truth statements about

aspects of the real world that the theory represents" (Torraco, 1994, p. 166). Indeed,

> to address the problem of matching the theory with the real world the theory is intended to model, it is necessary to convert the proposition statements, first to empirical indicators, and then into hypotheses, and then to test the hypotheses through research. (Torraco, 1994, p. 166)

The issue of the conversion of the propositions of the theory to empirical indicators and hypotheses is dealt with in Part 2, Steps 6 and 7, of Dubin's theory-building method.

Dubin (1978) suggested that the propositions of a theory are "constructed logically and intellectually by the theorist" (p. 164). According to Dubin, this logic and intellectual nature of propositions make proposition statements "synthetic," meaning that "these are statements that follow as true from the [theoretical framework] about which they are made" (p. 164). Furthermore, he indicated that "this synthetic quality of propositions makes clear that we are not talking at this point about the empirical accuracy of the proposition statements" (p. 164). According to Dubin (1978) and Torraco (1994), proposition statements of a theory must be considered true if they are logically derived from a theoretical system of specified units, laws of interaction, boundaries, and system states. Dubin emphasized this internal truth to proposition statements further: "The sole test of the accuracy of a proposition is whether or not it follows logically from the [theoretical framework] to which it applies" (p. 164).

Dubin (1978) highlighted three types of proposition statements. The first type may be made "about the values of a single unit of the [theoretical framework], the value of that unit being revealed in relation to the value of the other units connected to the unit in question by a law of interaction" (p. 166). The second type of propositions "may be predictions about the continuity of a system state that in turn involves a prediction about the conjoined values of all units in the system" (p. 166). And the third type may involve "predictions about the oscillation of the system from one state to another . . . and involves predictions about the values of all units of the system as they pass over the boundary of one system state into another" (p. 166). According to Dubin, these three types of predictions "exhaust the logical possibilities" of the predictions and represent the "full range of truth statements" (p. 166) that can be logically derived from the theoretical framework about the theory in action.

"A proposition of a theoretical [framework] is, therefore, a truth statement about the [theoretical framework] in operation" (Dubin, 1978, p. 163). Typically, proposition statements take the form of "If . . . then" (Dubin, 1978, p. 164). Cohen (1991) referred to propositions as the knowledge claims of the theory in action. Because propositions are truth statements about the theory in use, it can be safely assumed that propositions can be

made from any theoretical framework "that has had its units, laws of interaction, boundaries and system states specified" (Torraco, 1994, p. 166). The logic of these propositions is informed by the logic of the theoretical framework of the theory.

Further to the specification of the propositions of the theory, Dubin (1978) indicated that in specifying propositions for a theory, there are three criteria for consideration by the researcher-theorist, namely, consistency, accuracy, and parsimony. The criterion of consistency in specifying the propositions of a theory refers to the notion that the truth of the propositions "be established by reference to only one system of logic for all the propositions set forth in the [theoretical framework]" (p. 160). To meet this criterion in the example theory of responsible leadership for performance (Lynham, 2000a), the logic of the systems framework was used to guide the specification of the propositions. A system has specific characteristics, namely, a name, a purpose, parts, interactions among the parts, and outcomes or outputs (Dubin, 1978; Senge, 1990; Swanson, 1994; Von Bertalanffy, 1968). Each of the propositions of this theory is associated with one or more of these system characteristics to ensure consistency in the propositions specified for the theory.

The criterion of accuracy refers to whether the propositions follow logically from the theoretical framework to which they apply. Each of the propositions specified for the example theory is informed by and follows from the specified system of units, laws of interaction, boundaries, and system states that make up the theoretical framework of the theory. The logic of these components of the theoretical framework of responsible leadership for performance is maintained in the logic of the specified propositions of the theory.

The criterion of parsimony, when considered in relation to the specification of the propositions of a theory, refers to the use of what Dubin (1978) called "strategic propositions" (p. 166). Dubin pointed out that "in principle, every [theoretical framework] should give rise to an infinite number of propositions" (p. 166). However, it is not the job, in the specification of the propositions of a theory, to identify all possible propositions for that theory. It is, according to Dubin, more important to seek some parsimony in the specification of propositions. This is achieved by reducing the large number of possible propositions to a handful "that satisfies our sense of what is important to test in determining whether or not the theory accurately models the empirical domain it purports to represent" (p. 167). Fifty-three potential propositions were initially specified from the theoretical framework of responsible leadership for performance. Through application of the framework of system characteristics indicated in the above criterion of consistency, these propositions were then sorted and reduced to the 8 specified in the application example following. It was felt by the researcher-theorist that

these 8 propositions were of a strategic (rather than a trivial) nature in terms of future testing of the theory.

Application example. Eight propositions were specified for the example theory of responsible leadership for performance (Lynham, 2000a) and covered the first two types of proposition statements identified by Dubin, namely, the value of units of the theory in relation to other units and connected by the laws of interaction and predictions about the conjoined values of all the units in the theory. The eight proposition statements logically derived from the theoretical framework of the theory of responsible leadership for performance are as follows.

1. Responsible leadership for performance is a theory of leadership as a system-in-focus. Leadership is a purposeful, focused system not an individual or a process managed by an individual.
2. All systems have a purpose. The purpose of responsible leadership for performance is to serve the needs and desired outcomes of the constituency of a performance system by positively affecting multiple domains of performance in a responsible (effective, ethical, and enduring) manner.
3. The content of responsible leadership for performance is derived from all three units of the theory—considerations of constituency, a framework of responsibleness, and domains of performance. If all three units are not present and interacting, then there is not responsible leadership for performance.
4. For leadership to be considered responsible, it must demonstrate, and be judged to demonstrate, effectiveness, ethics, and endurance. If one of these three attribute properties is missing from leadership, then that leadership can no longer be considered responsible.
5. The units of the theory—considerations of constituency, a framework of responsibleness, and domains of performance—are interdependent. If there is change in one unit, then it can be expected that there will be changes in the other two units.
6. As responsibleness (effectiveness, ethics, and endurance) increases, performance of the whole performance system can be expected to increase.
7. Constituency is a necessary requirement for leadership. Without constituency, there is no leadership.
8. Without guiding inputs from constituency, and outputs in the form of performance, the phenomenon of leadership collapses.

Specification of the propositions of the theory enables the researcher-theorist to answer the research operation question of, What are the propositions of the theory? Once the propositions of the theory have been specified, the researcher-theorist is able to proceed to the second step in the operationalization of the theory, and the sixth step in Dubin's two-part, eight-step theory-building method, namely, to identify empirical indicators for the theory.

Part 2, Step 6: Identifying empirical indicators of the theory. In the sixth step of Dubin's (1978) theory-building method, the researcher-theorist is essentially concerned with "finding the empirical indicators that produce the values on the

units employed in the (theoretical) model" (p. 181). Completing this next step enables the researcher-theorist to answer the theory-operationalizing question, What are the empirical indicators of the theory?

An empirical indicator is, according to Dubin (1978), "an operation employed by the researcher[-theorist] to secure measurements of values on a unit" (p. 182). "In order that a unit be measured to indicate a value on it, the thing itself must be apprehended by an empirical indicator" (p. 181). Identification of empirical indicators therefore involves a process of measurement of the unit concerned. This process of measurement contains two parts; namely, "both the *operation* of measuring [must be duplicable by others] and the *results or value produced* [must produce equivalent values when measured by others] by this operation" (p. 182). Empirical indicators must therefore satisfy the two principal criteria of what Dubin called "operationism" (p. 183) and "reliability" (p. 185).

Further to these two parts to empirical indicators, Dubin (1978) also identified two classes of empirical indicators. The first is the class of "absolute indicators," which refer to indicators that "have no question as to what they measure" (p. 193). An example of an absolute empirical indicator in the social sciences would be race, sex, or age. The second class refers to "relative indicators" (p. 195). "The primary characteristic of a relative indicator is that it may be employed as an empirical indicator of several different theoretical units" (p. 195). An example offered by Dubin of a relative empirical indicator is income, which can be employed as a measure of both economic position and social class position.

The types of units used in a theory affect the empirical indicators identified. The example theory of responsible leadership for performance uses three types of units, namely, enumerative (considerations of constituency), associative (domains of performance), and relational (a framework of responsibleness). It will be recalled that an enumerative unit, like that of considerations of constituency, "is a characteristic of a thing in all its conditions" (Dubin, 1978, p. 186). "This definition suggests that any empirical indicator used to establish the value of an enumerative unit has to generate non-zero values for that unit in whatever conditions the unit is found" (Dubin, 1978, p. 186). Thus, the indicator used for an enumerative unit in a theory may never produce a zero value. In the theory of responsible leadership for performance, it is clear that without constituency, there can be no leadership. An associative unit may be understood as "a property characteristic of a unit in only some of its conditions" (Dubin, 1978, p. 187). The difference between an enumerative unit and an associative unit is that an associative unit, like that of domains of performance, must have a real zero value. In the theory of responsible leadership for performance, the unit of domains of performance can show a zero value of performance output, meaning that leadership has had no impact on performance in the perfor-

mance system concerned. Indeed, this associative unit of the theory may be indexed by a continuum of negative, zero, and positive values.

The third type of unit employed in the example theory is that of a relational unit, which "is a property characteristic of a thing that can be determined only by the relation among the properties of the thing" (Dubin, 1978, p. 188). The unit of responsibleness in the theory of responsible leadership for performance is of a relational type. Responsible leadership only exists due to the functional relationship between effectiveness, ethics, and endurance. As indicated in one of the propositions of the theory, unless leadership demonstrates effectiveness, ethics, and endurance, that leadership cannot be considered responsible. A zero value in any one of these three property characteristics will render the value of responsible leadership zero, or "not responsible."

Further to the requirements for the identification of empirical indicators of the theory, Dubin (1978) specified two conditions or criteria for the process of measurement inherent in the identified empirical indicators of a theory. The first is that the operation of measurement is specified, and the second is that the results or values produced by this operation are identified. Both of these criteria are partially met in the empirical indicators identified for the example theory. However, more rigorous refinement and specification of the operations of measurement and values produced by these operations will need to be developed by the researcher-theorist. This is, in part, the task of Step 8, the testing of the theory through research.

Further to these two criteria, it is also required that the values of the unit indicators comply with the value requirements for the three types of units employed in the example theory—enumerative, associative, and relational. The requirements of empirical indicators for the three types of units of the example theory were taken into account and adhered to in the identification of the empirical indicators (see Table 1).

Completion of this sixth step in the theory-building method allowed the researcher-theorist to begin to address the second research operation question of, What are the empirical indicators of the theory? It will be recalled that the completion of the fifth step of Dubin's (1978) theory-building method allowed the researcher-theorist to address the first research operation question: What are the propositions of the theory? A third operation-related question in the theory-building process is, What are the hypotheses of the theory? Once the researcher-theorist has responded to all three of these theory-operationalizing questions, the theory is considered ready to take to the real world for testing, verification, or confirmation and further refinement.

This further operationalizing of the theory must occur through the construction of hypotheses (theory-building Step 7), derived from the propositions and informed by the empirical indicators of the theory. Once the theory

TABLE 1: Example of Two Empirical Indicators for Application Example Theory

Unit	Empirical Indicator
Responsibleness	Part 1: The value of responsibleness increases as measured by effectiveness, ethics, and endurance, where effectiveness is measured by constituency perception of effective leadership practices (White Newman, 1993), ethics is measured by constituency perception of ethical leadership habits (Posner & Kouzes, 1996; White Newman, 1993), and endurance is measured by constituency perception of the employment of enduring resources (Collins & Porras, 1994; White Newman, 1993).
Performance	Part 2: The value of whole-system performance increases as measured by mission-related, work process, social subsystem, and individual units of performance in terms of time, quality, quantity, and alignment (Gibson, Ivancevich, & Donnelly, 1994; Holton, 1999; Rummler & Brache, 1995; Swanson, 1996; Swanson & Holton, 1999).

has been made ready for testing, that is operationalized, it can then be verified or confirmed through the conduct of testing research (theory-building Step 8). Refinement of the theory is an ongoing process and occurs through continued testing and research and the use of the outcomes of this testing and research to both improve and further prove the theory.

Part 2, Step 7: Constructing the hypotheses to test the theory. Before the theory can be tested and verified through research, hypotheses must be constructed from the theory, a step that coincides with Step 7 of Dubin's (1978) theory-building method. Step 7 is required to establish the link between the theoretical framework and the researcher-theorist's understanding of the real world (as reflected in the theoretical framework). This linkage between the theoretical framework and the real world is made possible by translating some of the propositions of the theory to testable hypotheses, a process further informed by the empirical indicators identified for the units of the theory. Step 8 is then required to verify the theory in action in the real world by putting the constructed hypotheses to the test through research.

Step 7, construction of the hypotheses of the theory, represents the completion of the theoretical formulation of and from the theoretical framework of the theory (Dubin, 1978). "An hypothesis," according to Dubin (1978), "may be defined as the predictions about the values of the units of a theory in which empirical indicators are employed for the named units in each proposition" (p. 206). The hypotheses of a theory therefore tell us what the empirical indicators for the units—in the example theory, for constituency, respon-

sibleness, and performance—are and "mirror the propositions" (p. 206) of the theoretical framework.

Dubin (1978) highlighted two criteria of import in constructing hypotheses of the theory. First, he stated that "every hypothesis is homologous with the proposition for which it stands" (p. 207), indicating homology between the hypotheses and their corresponding propositions as a necessary criterion of excellence for this seventh step in the theory-building process. Second, he stated that to determine hypotheses, the researcher-theorist must identify the necessary and sufficient conditions of each unit of the theory. These necessary and sufficient conditions of each unit of the theory are obtained from the definition, and component parts, of each unit of the theory.

In constructing the hypotheses of the theory, the researcher-theorist is confronted with a decision of quantity; that is, How many hypotheses are enough for testing the theory? Dubin (1978) offered some noteworthy insights in this regard. First, he suggested that "every proposition [in the theory] has the potential of being converted to a large number of hypotheses" (p. 208). On this point, he proceeded to say that "the general rule is that a new hypothesis is established each time a different empirical indicator is employed for any one of the units designated a proposition" (p. 209). He correspondingly further indicated that "this rule establishes the fact that the number of hypotheses is rapidly expanded as skill and imagination are utilized in developing empirical indicators" (p. 209).

Second, Dubin (1978) did suggest that not all propositions of the theory need to be converted to hypotheses:

> There is no logic that insists that only those [theoretical frameworks] whose propositions are all testable should be employed in science. Indeed this restriction, representing the extreme positions of operationalists, has proved needless. All theoretical [frameworks] need to be testable by converting at least some of their propositions to hypotheses. It is not a requirement, however, that all propositions of a [theoretical framework] be testable. (p. 209)

Ultimately, this question of a sufficient number of hypotheses, according to Dubin, "poses a question of research efficiency" (p. 209).

It is therefore clear that various strategies may be employed in the formulation of hypotheses, and these strategies are usually chosen in accordance with available research time and resources. These strategies can vary from being extensive, where all the strategic propositions of the theory are tested; to focusing attention on one or several strategic propositions; to being ad hoc, where hypotheses are generalized to propositions. An important quality of these alternative strategies for hypotheses construction is that they should not be considered mutually exclusive by the researcher-theorist.

Construction of the hypotheses of a theory clearly performs an important theory-building and research operation function in that it allows the researcher-theorist to answer the research operation question, What are the hypotheses of the theory? Stated in another way, the basic question the

researcher-theorist is concerned with in this seventh step in Dubin's (1978) theory-building process is one of, "What is the reality test we can make of this theoretical [framework]?" (p. 206). The answer to this question is ultimately provided by the hypotheses construction strategy, or strategies, employed by the researcher-theorist in the conduct of this step in the theory-building process.

Part 2, Step 8: Testing the theory through a developed plan of research. Step 8 involves the testing of the theory through empirical research. This step represents the fourth step in the second part of Dubin's (1978) two-part, eight-step theory-building method and allows the researcher-theorist to answer the final research operation and theory verification question: What is the critical research needed to verify the theory? To address this question, the researcher-theorist must decide on his or her research stance toward the theory. This stance involves either proving the adequacy of the theoretical framework or improving the starting theoretical framework. The choice of research stance will inform and determine the type and extent of research testing undertaken by the researcher-theorist. For example, doing research for the purpose of improving the theoretical model involves descriptive research, whereas doing research to test the theory involves hypothesis testing (Dubin, 1978).

Outcomes, or research results, from this eighth step in Dubin's quantitative theory-building method also inform the ongoing refinement of the theory. This overlapping link between theory verification and theory refinement is encapsulated in a research stance aimed at continuously improving the theory.

Implications of Dubin's Quantitative Theory-Building Method for Applied Theory-Building

Dubin (1978) used the concept "perpetual theory building" (p. 220) to indicate that one is never done with theory building. This notion of ongoing theory building, of ongoing refinement of the theory, speaks to the recursive deductive-inductive refrain between the results of research and testing and the use of those results to further inform and continually develop and improve the theory. This implies an ongoing refrain between theory development, refinement, and research.

The hypothetico-deductive method of theory building, reflected in the applied theory-building methods of Cohen (1991), Reynolds (1971), Hearn (1958), and Dubin (1978), is based on the assumption of falsification (Cohen, 1991; Honderich, 1995; Root, 1993), meaning that until proven otherwise, the knowledge embedded in the theory is taken to be true. As a result, theories of this nature are never complete and require continual discourse between the theoretical framework of the theory and the theory in

use. Purposeful testing and refining of the theory are therefore the ongoing responsibility and challenge of theory building in an applied field.

A Summative Overview of the Theory-Building Method

The outcomes of this chapter conclude the presentation of Dubin's two-part, eight-step quantitative method of theory building for applied disciplines. The essential form and essence of this theory-building method are summarized by way of an overview presented in Table 2. This table presents a summarizing overview of the relationship between the two parts, eight corresponding steps, and the essential research questions of applied theory building encapsulated in Dubin's quantitative theory-building method.

Closing Reflections

Clearly, the task of theory building in an applied field is a series of repeated and ongoing conversations between research and practice, between concept development and concept verification, through research in the real world. As is the experience of this author, the singular completion of this two-part theory-research cycle and eight-step theory-building method marks the beginning and not the culmination of the lengthy business and challenge of building theory in applied disciplines.

Dubin (1978) offered a thoughtful concluding insight to those who brave this challenge of theory building. He cautioned that the task of building theory is both a heartening and a disheartening one. It is heartening, he suggested, in that when well done, theory building should result in a clear and simple explanation of how a phenomenon works in the real world. On the other hand, he explained that when well done, the outcomes of theory building should result in a clear and simple explanation of how a phenomenon works in the real world! I remember well the experience of this paradoxical caution when developing the theory of responsible leadership for performance. I also learned from this caution and experience that it is the task of good applied theories to make what is often tacit or implicit knowledge explicit. So, when you first unveil the theoretical framework of your newly developed theory and your practitioner-colleague responds with, "Well, what's new about this? I knew this all along," take that comment as the promise of one of the greatest compliments of the potential usefulness and worthiness of your theory. Do not be disheartened by it, for it is usually a good indicator that the explanation of your theory just helped make your practitioner-colleague's implicit knowledge of the phenomenon concerned explicit for the first time, and that is an essential outcome of theory in applied disciplines.

(text continues on p. 275)

TABLE 2: The Relationship Between the Two Parts, Eight Steps, and Theory-Building Research Questions in Dubin's Quantitative Theory-Building Method

A: The Two Parts in Dubin's Theory-Building Method	B: The Eight Steps in Dubin's Theory-Building Method	C: An Operational Description of the Theory-Building Steps	D: Corresponding Theory-Building Research Questions Addressed
Part 1 Description: The theory development side of the theory-research cycle Purpose: To develop an informed conceptual framework of the theory Output: An informed theoretical or conceptual framework of the theory	1. Identifying the units of the theory	• Also known as the concepts of the theory. Involves the translation of the concepts to units, that is, to things or variables whose interactions constitute the subject matter of attention. A theoretical framework is used to specify the manner in which these units interact with each other. • Addresses Part 1, Step 1 of Dubin's theory-building method by developing responses to the first theory development question, What are the units of the theory? • Compares the outcomes of the first theory development step to five quality criteria for Step 1: rigor and exactness, parsimony, completeness, logical consistency, and degree of conformity to the combination limitations of the units.	Attending to this first part and first four theory development steps enables the researcher-theorist to answer the theory-building research question, Can the theory be developed?
	2. Establishing the laws of interaction that govern the theory	• Specifies the interactions among the concepts and units of the theoretical framework. • Addresses Part 1, Step 2 of Dubin's theory-building method by developing responses to the second theory development question, What are the laws of interaction of the theory? • Compares the outcomes of the second theory development step to quality criterion of parsimony.	

(continued)

TABLE 2 Continued

A: The Two Parts in Dubin's Theory-Building Method	B: The Eight Steps in Dubin's Theory-Building Method	C: An Operational Description of the Theory-Building Steps	D: Corresponding Theory-Building Research Questions Addressed
	3. Determining and clarifying the boundaries of the theory	• Theoretical frameworks are generally limited portions of the world; therefore, one must explore and set forth the boundaries within which the theory is expected to hold and apply. • Addresses Part 1, Step 3 of Dubin's theory-building method by developing responses to the third theory development question, What are the boundaries of the theory? • Compares the outcomes of the third theory development step to two quality criteria: homogeneity and generalization.	
	4. Specifying the system states of the theory	• Specifies the conditions under which the theory is operative and reveals the complexity of the complex portion of the real world that the theoretical framework is presumed to represent; each of the units interacts differently in the system states. • Addresses Part 1, Step 4 of Dubin's theory-building method by developing responses to the fourth and final theory development question, What are the system states of the theory? • Compares the outcomes of the fourth and final theory development step to three quality criteria: inclusiveness, persistence, and distinctiveness.	
Part 2 Description: The research operation side of the theory-research cycle	5. Specification of the propositions of the theory	• Once the four basic theory development steps resulting in a theoretical framework are addressed, the researcher-theorist is in a position to derive conclusions that represent logical and	Attending to this second part and four research

Purpose: To build an operationalized and empirically verifiable and trustworthy theory Output: an empirically verified and trustworthy theory		true deductions about the theoretical framework in operation, or the propositions of the theoretical framework. • Addresses the first step in Part 2 and corresponding Step 5 of Dubin's theory-building method by developing responses to the following theory operationalization question: What are the propositions of the theory? • Compares the outcomes of the first theory operationalization step to three quality criteria: consistency, accuracy, and parsimony.	operation steps enables the researcher-theorist to answer the theory building questions, Can the theory be operationalized? and Can the theory be verified? Also enables the researcher-theorist to answer the ongoing theory-building question, Can the theory be continually refined and developed?
	6. Identifying empirical indicators of the theory	• Enables the researcher-theorist to determine whether the theoretical framework of the theory does in fact represent the real world by converting each term in each proposition whose test is sought into an empirical indicator, which in turn secures measures of values on the units of the theory. • Addresses Part 2, Step 6 of Dubin's theory-building method by developing responses to the second theory operationalization question, What are the empirical indicators of the theory? • Compares the outcomes of the second theory operationalization step to two quality criteria: specification of the operation of measurement and identification of the results or values produced.	
	7. Constructing the hypotheses to test the theory	• This next and seventh theory-building step involves substituting the empirical indicators in the proposition statement with testable hypotheses. The research operation then involves measuring the values on the empirical indicators of the hypotheses to determine if the theoretically predicted values are achieved or approximated in the research test. It is here where issues of validity arise in the theory-research cycle. • Addresses Part 2, Step 7 in Dubin's theory-building method by developing responses to the third theory operationalization	

(continued)

TABLE 2 Continued

A: The Two Parts in Dubin's Theory-Building Method	B: The Eight Steps in Dubin's Theory-Building Method	C: An Operational Description of the Theory-Building Steps	D: Corresponding Theory-Building Research Questions Addressed
		question, What are the hypotheses of the theory? • Compares the outcomes of this third theory operationalization Step 2, quality criteria: homology between the hypotheses and their corresponding propositions and identification of the necessary and sufficient conditions of each unit of the theory.	
	8. Testing the theory through a developed plan of research	• This is the eighth and last step in theory building and involves testing the theory in practice, that is, against the real world. Important in this step is that the empirical indicators employed in testing the theory have a reasonable level of reliability. The testing of an applied theory is an ongoing process and must result in continuous refinement of the theory. The researcher-theorist is faced with two theory-testing stances, or combinations thereof, namely, to conduct research designed to prove the adequacy of the theoretical framework or research to improve the starting theoretical framework. • Addresses Step 8 of Dubin's theory-building method by developing responses to the following theory verification and ongoing refinement question: What is the critical research needed to verify the theory? • Compares the outcomes of this final and theory verification step to the quality criteria for the scientific method employed to test and verify the theory.	

The task of building theory in an applied field is a demanding and difficult one; in fact, it is a grandiose and ambitious challenge (Lynham, 2000b). Its intent is to bring trustworthy knowledge and action to practice for purposes of improved understanding, action, and outcome. As is too often the case in applied fields, witnessed by the oversupply of popular atheoretical literature on the bookshelves of any large bookstore, this task and responsibility should not be forgone for the sake of bringing unsubstantiated knowledge to market before its time. In an applied field, such action is irresponsible of scholars who act with the full awareness that this knowledge will be used by practitioners to solve human and organizational problems. The pressure to bring knowledge to market should not transcend scholarship, not in applied fields like those of HRD and management, where the actions of one can affect so many and have such huge repercussions on human and organizational performance.

References

Cohen, B. P. (1991). *Developing sociological knowledge: Theory and method* (2nd ed.). Chicago: Nelson-Hall.

Collins, J. C., & Porras, J. I. (1994). *Built to last: Successful habits of visionary companies*. New York: HarperBusiness.

Dubin, R. (1976). Theory building in applied areas. In M. D. Dunnette (Ed.), *Handbook of industrial and organizational psychology* (pp. 17-39). Chicago: Rand McNally.

Dubin, R. (1978). *Theory building* (Rev. ed.). New York: Free Press.

Gibson, J. L., Ivancevich, J. M., & Donnelly, J. H., Jr. (1994). *Organizations: Business, structure, processes* (8th ed.). Boston: Irwin.

Hearn, G. (1958). *Theory building in social work*. Toronto, Canada: University of Toronto Press.

Holton, E. F., III. (1999). Performance domains and their boundaries. *Advances in Developing Human Resources*, *1*, 26-46.

Honderich, T. (Ed.). (1995). *The Oxford companion to philosophy*. New York: Oxford Press.

Hultgren, F. H., & Coomer, D. L. (Eds.). (1989). *Alternative modes of inquiry in home economics research*. Peoria, IL: Glencoe.

Kaplan, A. (1964). *The conduct of inquiry: Methodology for behavioral science*. San Francisco: Chandler.

Lynham, S. A. (1998). The development and evaluation of a model of responsible leadership for performance: Beginning the journey. *Human Resource Development International*, *1*(2), 207-220.

Lynham, S. A. (2000a). *The development of a theory of responsible leadership for performance* (Tech. Rep.). St. Paul: University of Minnesota, Human Resource Development Research Center.

Lynham, S. A. (2000b). Theory building in the human resource development profession. *Human Resource Development Quarterly*, *11*(2), 159-178.

Lynham, S. A. (2002). The general method of theory-building research in applied disciplines. *Advances in Developing Human Resources*, *4*(3), 221-241.

Posner, B., & Kouzes, J. (1996). Ten lessons for leaders and leadership developers. *Journal of Leadership Studies*, *3*(3), 3-10.

Reynolds, P. D. (1971). *A primer in theory construction*. New York: Macmillan.

Root, M. (1993). *Philosophy of social science*. Cambridge, MA: Blackwell.

Rummler, G. A., & Brache, A. P. (1995). *Improving performance: How to manage the white space on the organization chart* (2nd ed.). San Francisco: Jossey-Bass.

Senge, P. M. (1990). *The fifth discipline: The art and practice of the learning organization*. New York: Currency Doubleday.

Swanson, R. A. (1994). *Analysis for improving performance: Tools for diagnosing organizations and documenting workplace expertise*. San Francisco: Berrett-Koehler.

Swanson, R. A. (1996). *What I learned this year.* St. Paul: University of Minnesota, Human Resource Development Research Center.

Swanson, R. A., & Holton, E. F., III. (1999). *Results: How to assess performance, learning, and perceptions in organizations*. San Francisco: Berrett-Koehler.

Torraco, R. J. (1994). *The development and validation of a theory of work analysis*. St. Paul: University of Minnesota, Human Resource Development Research Center.

Torraco, R. J. (1997). Theory-building research methods. In R. A. Swanson & E. F. Holton III (Eds.), *Human resource development handbook: Linking research and practice* (pp. 114-137). San Francisco: Berrett-Koehler.

Torraco, R. J. (Ed.). (1999). Performance improvement: Theory and practice. *Advances in Developing Human Resources*, *1*.

Torraco, R. J. (2000). A theory of knowledge management. *Advances in Developing Human Resources*, *5*, 38-62.

Von Bertalanffy, L. (1968). *General systems theory: Foundations, development, application*. New York: George Braziller.

White Newman, J. B. (1993). *The three E's of leadership: A model and metaphor for effective, ethical and enduring leadership*. Unpublished manuscript, College of St. Catherine, St. Paul, MN.