AN INTERDISCIPLINARY MODEL FOR BEHAVIOR ANALYSIS AND INTERVENTION IN AGRICULTURAL EXTENSION AND RURAL DEVELOPMENT

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Abstract

Against the background of interdisciplinary behavior theories, and based on extensive empirical research, an interdisciplinary model for behavior analysis and intervention is proposed. The model is based on needs, perceptions and knowledge, which, as intervening variables, represent the direct causes or potential change forces. It lends itself for analyzing behavior in situation analyses and for planning change strategies focused on individuals, groups or communities.

The article gives a brief overview of the rationale behind the model and describes the critical behavior determinants, which, if analyzed, are assumed to provide an insight into adoption behavior and, consequently, provide a basis for behavior modification.

The Problem and Theoretical Background

Agricultural and rural development implies behavioral change that usually is the result of external intervention. To be systematic and purpose-oriented, this intervention should be based on situation surveys and analyses providing, amongst others, an inventory of relevant behavior determinants. The identification and research of these determinants should take place within the framework of a sound theory of behavioral change. Since the classical investigation by Ryan & Gross (1943) into the adoption of hybrid corn, different approaches and concepts have been proposed and used. Albrecht (1969) classified the approaches as teaching method, atomistic communication, socio-cultural communication, and situation-functional approaches. However, no interdisciplinary theory that is useful for practitioners and that provides for the complexity, diversity and situation-specificity of human behavior, has been developed.

In seeking an appropriate theoretical explanation for behavioral change in extension, Hruschka (1969) singled out Lewin’s (1951) field theory as potentially the most useful. The basic notion of Lewin’s field theory is that the behavior (B) of an individual is a function (f) of the total situation or the life space (Lsp) of the individual, consisting of the individual (P) and his environment (E), both of which are interdependent. This relationship can be expressed as $B = f(Lsp) = f(P,E)$.

Field theory has limitations and weaknesses, particularly its deductive capacity, and has been criticized by several authors such as Koch (1941) and London (1944). Nevertheless, several advantages support its choice and application as an appropriate theory for agricultural extension purposes (Hruschka, 1969). Complex and diverse situations can be analyzed to study relevant factors influencing behavior. As both a molar and molecular theory, it is interdisciplinary in nature, and has all the ingredients of a theory acceptable for different behavior related disciplines (Madsen, 1968). Its major practical advantage lies in the fact that it is a theory of “change” and “changing”, and consequently not subject to the...
criticism that Bennis (1965, p. 339) leveled against other theories in the social and behavioral sciences, that “...they are strangely silent on methods of directing and implementing change”. Furthermore, the theory, and its derived models, can easily be understood by practitioners, mainly because of familiar principles or concepts such as field, force, valence, and movement, commonly used in the natural sciences. Particularly useful is the hypothetical construct of the “force field” of co-existing and dynamically interdependent forces, implying that behavioral change, or the lack thereof, is explainable by this constellation of interacting forces. Behavioral change, it is suggested, can be brought about and directed by changing the force field: by adding or strengthening “driving” or “positive” forces leading towards change, and/or by reducing or eliminating “negative forces” that restrain or prevent change.

Hruschka (1969) made a valuable contribution in drawing attention to the field theory’s value as a theoretical concept for extension, and also in developing broad guidelines for analyzing the field or life space. However, she did not specify or give concrete meaning to the so-called “forces”. This is a prerequisite for their systematic identification and analysis.

Tolman (1967), introducing his theory of action based on the assumptions that behavior is intentional, governed by expectancies, and the outcome of the individual’s behavior space, put forward the concept of intervening variables. He differentiated between three sets of variables: independent, dependent, and intervening. Intervening variables, which make up the “intermediate behavior space” corresponding to Lewin’s “life space”, can be the primary focus of behavior analysis and thus drastically reduce the number of variables studied. In the context of Lewin’s field theory, this implies a distinction between (a) variables that intervene and thus have a direct influence on decision-making or behavior, and (b) variables that are independent and, thus, have a more indirect influence, which is manifested in behavior via the intervening variables. Only intervening variables would qualify as forces directly responsible for bringing about change, whereas independent variables would be regarded as only having an influence on the forces bringing about change.

Using the above framework, the great number of variables already found to be correlated with behavior (Rogers, 1983, p. 261) can be effectively reduced to a “check list” that is surveyable, and is still sufficiently comprehensive to make direct or indirect provision for all causes of behavior. This is achieved by sub-dividing behavior determinants into independent and intervening variables, and concentrating on those determinants that are the most imminent, i.e., the immediate precursors or direct causes of a particular act. The rationale behind this categorization is similar to that used by Tolman (1967), with the difference that not all overt variables are accepted and categorized as intervening variables, but only those that are regarded to be the most imminent and direct causes of adoption behavior. For example, research findings indicate that the influence of variables such as aptitude, education, and age on adoption behavior appears to occur indirectly through intervening variables, such as perception (Düvel, 1975). As such, while a causal relationship cannot be definitely established, an analysis of intervening variables could provide insight into behavior since these variables potentially encompass all influences on decision making and behavior.

A Practitioner’s Model for Behavior Analysis

The theoretical framework outlined above, supported by research indicating that independent variables appear to influence behavior via intervening variables (Düvel, 1975), emphasizes the key role of intervening variables in a behavior model. Relevant intervening variables found through research to influence behavior (De Klerk & Düvel, 1982; Düvel, 1975; Düvel & Afful, 1994; Düvel & Botha, 1989; Düvel & Scholtz, 1986; Louw & Düvel, 1978; Marincowitz & Düvel, 1987) are needs, perceptions, and knowledge. These variables are incorporated into a behavior...
analysis model in a cause-effect relationship, as shown in Figure 1.

The proposed model represents a framework for problem conceptualization. In agricultural development, the problem is generally one of poor efficiency (e.g., economic or production efficiency), usually the result of some form of behavior (e.g., practice adoption behavior). The model outlines two basic causal relationships: (a) the poor or non-adoption of appropriate practices ($P_1$, $P_2$, $P_3$, ..........$P_x$) which results in poor efficiency, and (b) the hypothetical causes of poor or non-adoption of any one practice ($P_i$) that can be traced to the intervening variables of need, perception, and knowledge.

In its simplest form, the poor or non-adoption of a practice can be traced to two basic causes. The individual is unwilling or unable to adopt. Unwillingness can be linked directly or indirectly to a lack of need, unfavorable perception, and/or lack of knowledge. Factors related to inability tend to be independent in nature, and fall mainly under the broad category of personal and environmental variables. They can also be grouped under one of the perception attributes, namely compatibility.

Needs as behavior determinants

Needs, drives, motives, incentives, desires, and goals have been associated with forces that incite the individual to action, or that sustain or give direction to motion. They energize behavior and give it direction.

The vocabulary of motivation has as yet not been firmly established, with the result that concepts like drives and needs (Hilgard, Atkinson & Atkinson, 1971; Tolman, 1967), or motives and incentives (Arnold, Eysenck & Meili, 1971; Hilgard, Atkinson & Atkinson, 1971;) are often used as synonyms, sometimes even interchanged. The intention here is to draw attention to this dilemma, and not to provide more clarity or even to attempt a more puristic nomenclature. What is noteworthy, though, is a natural interdependence between needs and related concepts. There appears to exist a field polarity consisting of a need (usually some form of deprivation resulting in disequilibrium or tension) located within the individual, and a goal-object situated in the environment. The goal-object assumes a positive character (positive incentive) if it is perceived by the individual as having a potential need-satisfying capacity, and a negative valence if there is a perceived threat of deprivation (negative incentive).

Like needs (Maslow, 1954), goal-objects exist in a certain hierarchical order, but with a strong inter-dependency. Primary goals, regarded as the direct means of attaining person-located or basic needs (Madsen, 1968) can be achieved through secondary goals, which, in turn, are achieved through tertiary goals. In this way, the lower-order goal represents the means for achieving the higher-order goal. This relationship, in the context of the psychological field of Lewin (1951) or the behavior space of Tolman (1967), has been illustrated by Düvel (1987, p 4).

Primary goals that are sought to satisfy one or more basic needs are achieved by certain means or methods (secondary goals), which, in turn, are achieved by means of still more specific objectives (tertiary goals). The preferred path toward the primary goal may not necessarily be the most appropriate, but is perceived as such by the individual.

From the practitioner's point of view it could be argued that even needs are relatively unimportant, since they are largely reflected in the goal-object(s). Behavior, after all, is directly focused on or oriented toward the goal as a means of need satisfaction. The attractiveness (valence) of the goal(s), as perceived or judged by the individual, could provide a sound basis for explaining and affecting change as it is a reflection of need compatibility. Lending support to this "short-cut" approach, i.e., focusing on intervening rather than independent variables, is the observation that goal valence is easier to measure than basic needs (Heyns & Düvel, 1980), because respondents tend to be more hesitant to reveal personal information. The more direct need-related causes of adoption behavior, specified in Figure 1, are (a) lack of aspiration (1.1), and (b) need incompatibility (1.2).
Lack of or insufficient aspirations to adopt practices and/or engage in agricultural development has been found to be a critical factor in several research studies (De Klerk & Düvel, 1982; Düvel, 1975; Düvel & Brockman, 1992; Düvel & Scholtz, 1992; Louw & Düvel, 1978). Specifically, as shown in Figure 1, this condition may be the result of (a) overrating (or underrating) own efficiency (1.1.1), (b) being unaware of possibilities or the optimum (1.1.2), and (c) being satisfied with the present situation or having a sub-optimal aspiration (1.1.3).

In the context of aspirations, efficiency does not necessarily refer to an objectively calculated cost-benefit ratio, but how the client subjectively rates his/her performance (e.g., in production or practice adoption) compared with some parameter he/she regards as valid or acceptable. These judgements (1.1.1 to 1.1.3) have to do with the perception of a problem, where a problem is regarded as the difference between "what is" (present situation) and "what can be" (desired situation). Figure 2 is an illustration of a perceived problem, showing how the problem (or need tension) is determined by the gap between the existing and desired situation.

If the existing situation, for example, with regard to efficiency of production or practice adoption, is over-estimated due to misperception (1.1.1), the perceived scope of the problem or potential need tension is reduced. If, at the same time, there is limited knowledge concerning the optimum that is achievable (1.1.2), the potential problem and need can be further reduced to an insignificant level. Empirical findings (Düvel & Scholtz, 1986) illustrating the tendency among farmers to over-rate their own efficiency are presented in Figure 3.

The over-rating is based on a comparison between the ratings of specialists (subject specialists and extension workers) and farmers, and on the assumption that the specialists have, because of their wider frame of reference, a more realistic view. That this misperception, and therefore the more limited need, is directly related to adoption behavior and efficiency, is illustrated in Figure 4, which summarizes findings from research studies in different fields (Düvel, 1972; Düvel & Afful, 1994; Louw & Düvel, 1978). As the over-rating or misperception decreases, the efficiency or practice adoption tends to increase.

It is also possible that the problem is correctly perceived, but the individual is satisfied with the situation (1.1.3). The opposite is also possible, namely that the individual underrates him/herself on efficiency. In extreme cases when this happens, the goal-object may appear unattainable, resulting in resignation or frustration on the part of the individual.
Figure 2. Problem magnitude or need tension as influenced by perception

![Diagram showing problem or need tension as influenced by perception]

Figure 3. Assessment of rangelands condition by farmers, extension workers, and pasture specialists (Düvel & Scholtz, 1986)

![Bar chart showing assessment of rangelands condition]

- Farmer
- Extension Worker
- Pasture Specialist
Possible interventions when dealing with lack of aspirations are:

1. In cases of over-estimation or misperception (1.1.1), tactfully advising farmers about the reality of their situation without embarrassing them.

2. In cases where farmers are unaware of possibilities (1.1.2), providing convincing evidence about the optimum, and that its achievement is worthwhile.

3. Whenever an individual is satisfied with his/her situation (1.1.3), this implies contentment, but can also relate to an underlying problem of need incompatibility. In the former case, and particularly if the contentment cannot be attributed to misperceptions (1.1.1 and 1.1.3), an intervention is questionable from an ethical point of view.

Incompatibility of suggested solutions to increase efficiency or adopt specific practices with the needs, aspirations, goods or problems of individuals is another cause of non-adoption. The solution does not fit into the life space, psychic field or need situation, in that it is not perceived as a need-related goal, or as a means of achieving such a goal. The solution would have to satisfy a primary, secondary, tertiary or lower order goal.

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Figure 4. Average perception discrepancy between specialists and farmers concerning the efficiency of farmers (Düvel, 1994)
The relationship between perceived incompatibility of an innovation and the needs of an individual and non-adoption is supported by empirical research (Düvel & Afful, 1994; Düvel & Brockman, 1992; Düvel & Scholtz, 1992). In the example cited in Table 1, Düvel & Scholtz (1992) show that only one respondent perceived a compatibility between his needs and the recommended grazing management system. That respondent was also the only person to completely implement the system. Problems are relevant because of their need-relatedness. They usually represent constraints en route to the goal. These constraints can temporarily overshadow the goal as attention is diverted to the problem, the immediate objective being to overcome it. For this reason, problems are a form of a need and an appropriate focus of any extension or intervention strategy. The specific innovation should, if possible, be compatible with or lead to a solution of the perceived major problem.

Table 1

<table>
<thead>
<tr>
<th>Economic Need</th>
<th>Respondents reporting compatibility of needs with improved rangelands management</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Compatible</td>
</tr>
<tr>
<td></td>
<td>n</td>
</tr>
<tr>
<td>Increasing profitability of enterprise</td>
<td>1</td>
</tr>
<tr>
<td>Increasing stock production efficiency</td>
<td>7</td>
</tr>
</tbody>
</table>

Perception

Although perceptions and needs are related and interwoven, the need to identify all direct behavior determinants as specifically as possible justifies a separate focus on perception. While needs usually relate to all positive or driving forces which, in sum, constitute attractiveness, perceptions are more specific, and are analyzed on the basis of attributes of innovations. Rogers’ (1983) five-way classification of innovation attributes was adapted and integrated with the concept of field forces to define three categories for classifying individual perceptions of the attributes of innovations. As shown in the model in Figure 1, these categories are prominence, relative advantages, and compatibility (Düvel, 1987).

Prominence. The need to identify causes of non- or poor adoption as specifically as possible led to a change in Rogers’ concept of relative advantage, to the notion of relative advantages, elaborating specific advantages and disadvantages in economic, social, managerial, and other areas. Research by Düvel and Scholtz (1992) revealed that innovations may be perceived positively without being adopted, simply because another alternative is preferred or perceived even more positively, i.e., more prominently. This emphasized the need for a comparison between alternatives as implied in Rogers’ (1983) concept of “relative advantage”. However, because of the potential confusion between relative advantage and relative advantages, it was decided to refer to the former as prominence. Prominence is, therefore, similar to Rogers’ (1983) concept of relative advantage, and is a measure of how prominent, or how more or less advantageous (attractive) the innovation as a whole is compared with other alternatives.

An example of the importance of this aspect of perception is the findings of the Düvel and Scholtz (1992) study, where the large majority of respondents had a favorable perception of the recommended innovation (grazing system). However, only 38 % preferred it to other alternatives, and there was a highly significant
negative correlation ($r = -0.316; p = 0.005$) between perceived prominence and practice adoption.

**Relative advantages.** An unfavorable perception concerning relative advantages refers to both advantages and disadvantages of the innovation. The possible causes of non-adoption could thus be (a) an unawareness of the advantages (Figure 1, 2.2), and/or (b) awareness of disadvantages (Figure 1, 2.3).

Both advantages and disadvantages are need-related in that they contribute to the overall attractiveness or unattractiveness of an innovation. In a certain need context they can constitute positive (driving) and negative (impeding) forces. The imbalance between negative and positive forces as a cause of non-adoption could be the result of unawareness of advantages, or awareness of disadvantages. This would imply that insufficient knowledge is not a negative force, but rather an absent negative force. In practice, this differentiation is not critical. What is important is that the various forces, whether positive or negative, are identified and systematically addressed in extension programs.

**Compatibility.** Whereas relative advantages refer to an innovation or goal-object, compatibility is related to the situation, i.e., the perceived relevance of the innovation in the individual's specific situation. Compatibility, or incompatibility, is not a unidimensional factor but can refer to a wide range of personal, physical, economic, social, and cultural aspects.

This category of behavior determinants does not include compatibility of needs (Figure 1, 1.2). The reasoning behind this is that need compatibility represents basic positive forces, whereas other compatibility aspects are constraints en route to the goal. Therefore, they represent potential negative forces, which, once overcome and once adoption has occurred, are no longer relevant. This means that compatibility aspects are potential negative forces; they can be overcome or neutralized, but do not constitute positive or driving forces. In other words, these aspects, if incompatible, cannot bring about change. On the other hand, the negative forces associated with disadvantages are inherent attributes of the innovation, and consequently continue to exist even after adoption. Viewed in this light, most of the factors preventing adoption due to inability can also fall into this category.

**Knowledge**

Knowledge relevant to innovation or practice adoption can be categorized as (a) basic knowledge or knowledge of principles, (b) knowledge associated with the awareness of relative advantages, and (c) knowledge of the application of an innovation or practice.

The first two types of knowledge are related to each other, but from a motivation point of view only knowledge concerning relative advantages is important. This type of knowledge can be regarded as an intrinsic part of perception and thus largely overlaps with it. It is for this reason that an analysis of perception also includes relevant aspects of knowledge.

Knowledge of principles is important because it provides insight, and has a bearing on the intensity with which the relative advantages are perceived as field forces. Basic knowledge is also fundamental if clients are to become independent or self-sufficient in terms of decision making and self-help.

Practical knowledge is a pre-requisite for implementation or, in terms of Lewin's (1951) model, one of the last areas through which it is necessary to move before goal achievement. This is largely provided for under compatibility with situational factors (Figure 1, 2.4), and supports the conclusion that, through an analysis of perception, most relevant aspects of knowledge can be identified.

**Inability**

Inability is the second major cause of non-adoption. It relates, as shown in Figure 1, to the same situational factors influencing perceptions of compatibility. This means that the reasons for
inability to adopt would be identifiable from the analysis of incompatible situational factors (2.4).

**Application of the model**

The model proposed in this study is a hypothetical construct providing an inventory of potential causes of the non-adoptions of a practice or innovation. It lends itself to the planning of research into adoption behavior or, more commonly, for planning situation surveys prior to the planning and launching of development programs.

The recommended procedure entails an initial brief definition of the problem (e.g., lacking efficiency or poor practice adoption) followed by conceptualization of the problem using the model framework (Figure 1). The hypothetical causes provide a basis for constructing survey questionnaires. Survey results will show which of the hypothetical causes are in fact causes, and to what degree.

Figure 5 is a summary of the results of a typical problem analyzed with the aid of this model, showing the constellation of forces identified with regard to over-stocking of natural rangeland, or the non-adoptions of the recommended stocking rate. The length of vectors (forces) indicates the percentage of target audience members associated with positive and negative forces. The large-scale non-adoptions of recommended stocking rates is explained by the imbalance of negative over positive forces. The results can also form the basis for an intervention program, which would entail the systematic strengthening of positive forces, or elimination of negative forces.

**Conclusion**

The suggested model based on Lewin’s and Tolman’s theories focuses on intervening variables which are assumed to represent forces directly responsible for adoption behavior. Evidence suggests that for analysis and promotional purposes this approach has promising possibilities, but it needs to be further developed and refined. It still has to be ascertained whether additional intervening variables have to be included, and how these can be reliably measured. In designing and refining reliable measuring techniques and devices, attention will have to be given to aspects of valence and probability. Furthermore, refinements and adjustments to the model might be necessary to effectively deal with problems of over-adoptions. However, the model as proposed already serves a useful framework in evaluation studies and behavior research, and has also been found to be very useful in facilitating meaningful participation and involvement of community members in the planning and development of extension or development programs.
<table>
<thead>
<tr>
<th>POSITIVE FORCES (% Respondents)</th>
<th>NEGATIVE FORCES (% Respondents)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Correct grazing assessment</td>
<td>18.5</td>
</tr>
<tr>
<td>2. Need for rangelands improvement</td>
<td>55.0</td>
</tr>
<tr>
<td>3. Aspiration scope: Rangelands improvement</td>
<td>45.0</td>
</tr>
<tr>
<td>4. Correct grazing management assessment</td>
<td>29.6</td>
</tr>
<tr>
<td>5. Correct stock condition assessment</td>
<td>65.8</td>
</tr>
<tr>
<td>6. Aspiration scope: Need for stock improvement</td>
<td>70.4</td>
</tr>
<tr>
<td>7. Primary Goal: Rangeland improvement</td>
<td>70.2</td>
</tr>
<tr>
<td>8. Primary Goal: Stock improvement</td>
<td>100.0</td>
</tr>
<tr>
<td>9. Need compatibility: Rangelands improvement</td>
<td>39.0</td>
</tr>
<tr>
<td>10. Need compatibility: Management improvement</td>
<td>61.0</td>
</tr>
<tr>
<td>11. Need compatibility: Stock improvement</td>
<td>83.2</td>
</tr>
<tr>
<td>12. Advantage awareness: No overgrazing</td>
<td>89.5</td>
</tr>
<tr>
<td>13. Advantage awareness: Camp resting</td>
<td>92.7</td>
</tr>
<tr>
<td>14. Advantage awareness: Improved stock condition</td>
<td>49.4</td>
</tr>
<tr>
<td>15. Prominence: Stock reduction</td>
<td>94.8</td>
</tr>
<tr>
<td>16. Theft*</td>
<td>2.7</td>
</tr>
<tr>
<td>17. Drought*</td>
<td>39.0</td>
</tr>
<tr>
<td>18. Investment in cattle</td>
<td>61.0</td>
</tr>
<tr>
<td>19. Stock numbers as status symbol*</td>
<td>53.4</td>
</tr>
<tr>
<td>20. Low sale price of cattle</td>
<td>2.7</td>
</tr>
<tr>
<td>21. Custom: Loaning cattle*</td>
<td>39.3</td>
</tr>
<tr>
<td>22. Equitable implementation of stock reduction*</td>
<td>26.3</td>
</tr>
<tr>
<td>23. Reduced cattle numbers*</td>
<td>22.1</td>
</tr>
</tbody>
</table>

* The absence of a positive force does not necessarily imply the existence of a positive force

Figure 5. Positive and negative forces pertaining to stock reduction, N = 95 (Düvel, 1995)

References


