



Classification of Organizational Behavior at the National Agrarian University of La Selva Based on Plithogenic Sets

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Abstract. In human organizations, there are group ways of conducting themselves, the interaction between members, and internal dynamics, among others that make the organization maintain a specific behavior as if it were an individual. This is the so-called Organizational Behavior, which is important to identify within a particular organization to improve the performance and efficiency of the entity. There are four types of organizational behavior models, namely, autocratic, custodial, supportive, and collegial. This paper aims to classify the organization that belongs to the office of the Academic Vice-Rector of the National Agrarian University of La Selva in Peru. To do this we use the theory of Plithogenic Sets. This theory is flexible enough to allow the study of complex phenomena such as the one we are dealing with, where there are influences from various aspects. In the research, we surveyed 30 members of these offices to carry out the evaluation. This will contribute to improving the performance of the organization.

Keywords: Organizational Development, Organizational Behavior, Plithogeny, plithogenic sets, plithogenic decision-making, Single-Valued Neutrosophic Number.

1 Introduction

Organizational Development (OD) emerged in the late 1950s and early 1960s as a dynamic, continuous process adopted to achieve planned changes in the organization, based on realistic diagnoses of the situation. This change focuses on values, attitudes, relationships, and organizational climate; it uses strategies, methods, and instruments aimed at optimizing the interaction between people and groups. Its main objectives include generating a higher quality of work life, and productivity, increasing the effectiveness and health of the organization, as well as the necessary capacity to adapt to an increasingly competitive world, ensuring its survival and the mutual development of the company-employee binomial.

Achieving this requires a global vision of the organization, an open systems approach, compatibility with environmental conditions, a responsible and conscious contract of management, developing the potential of people, groups, subsystems, and their relationships, the institutionalization of the process, and the self-sustainability of changes.

OD is not something new and although it is based on discoveries from the human and administrative sciences, it is a different art. Thus, the great and new contribution of OD is in the systemic, integrated, and flexible treatment of what already existed in those sciences but was dispersed, fragmented, or stagnant. The novelty brought by the new OD practice consists of going beyond the classic objectives of greater efficiency and productivity in the company, beyond the maximization of profits or optimization of services, beyond the search for effectiveness, and also the need to ensure organizational health.

OD is at the same time a new art of perfecting the organization, integrating the needs of the company and of the people. It is a new philosophy of administration whose style is renewing and revitalizing; it is a new technology, a practical set of techniques and instruments for planned changes in which psychological and behavioral aspects

must be given due attention.

The DO should not be confused with certain purposes contrary to its nature, however on many occasions, it has been taken wrongly, thus, the DO is not a training course, an emergency solution for moments of crisis, an isolated intervention, and therefore disconnected from the managerial processes, an initiative without continuity, an effort of specialists and other well-intentioned people but without the commitment of the responsible executives, a series of diagnostic meetings without generating solutions and actions, a maneuver to obtain or preserve power, prestige or advantages at the expense of other people, a process to manipulate, harm or punish workers.

OD is ultimately a planned, systematic process that incorporates the principles and practices of organizational behavior (OB) sciences to implement cultural and structural changes in the organization to increase individual and organizational effectiveness and to constantly optimize its functioning at all levels. Finally, OD focuses on organizations, and on making them work better through a total system change.

Organizational Behavior is an academic discipline that emerged from an interdisciplinary body of knowledge to study human behavior in organizations and is part of the integrated structure of OD theories and practices. Thus, OB is a field of study that investigates the behavior, attitudes, and performance of individuals and groups in the organizational environment, as well as the processes and practices that influence the effectiveness of individuals, groups, and organizations.

OB portrays the continuous interaction and reciprocal influence between people and the organization to apply this knowledge to improve the effectiveness of organizations. This involves relying on theories, methods, and principles drawn from various disciplines.

OB is a field that is based primarily on the contributions of psychology, a discipline that deals with the behavior of individuals and its most widely applied branches such as social psychology, which studies the concepts related to group behavior, the interactions between individuals and society to understand the social properties of behavior and clinical psychology, which investigates the elements that harm mental health or cause discomfort to individuals to treat and prevent them. OB is also based on the contributions of sociology, anthropology, organizational sociology, and other disciplines.

OB is an interdisciplinary field that allows us to learn about individuals, groups, structures, and processes and examine the relationships between them, as well as to understand the performance of the organization as an integrated system.

OB is an academic discipline that is highly sensitive to some of the particularities of the organization and its environment and is largely dependent on the people who participate in the organization. OB is essential to understand the organization, whose intrinsic value resides mainly in its intangible assets (which cannot be seen) since these constitute its true wealth and provide the basis for its success. Intangible assets depend on human capital, that is, on the set of talents that act in the organizational context; the effectiveness of organizations is directly dependent on the effectiveness of the people who make them up, and this is where OB arises since it establishes the foundations and general particularities of its operation.

As an academic discipline on what individuals do in organizations and how their behavior impacts their dynamics, OB:

- It is multidisciplinary,
- It is a method to encourage the transmission of ideas, information, and emotions clearly and openly,
- It creates a feedback mechanism to improve working conditions,
- It is a means of applying technologies and methods that support effective decision-making,
- It is a way to evaluate performance at different organizational levels and promote corrective actions.

Plithogeny is one of the most recent theories developed by F. Smarandache [1, 2]. It was created to mathematically model the generalization of classical dialectics where a concept, phenomenon, idea, etc. denoted by $\langle A \rangle$ interacts with its opposite denoted by $\langle \text{anti}A \rangle$. Plithogeny takes into account the dynamic interaction between $\langle A \rangle$, $\langle \text{anti}A \rangle$, and $\langle \text{Neut}A \rangle$, the latter being neither $\langle A \rangle$ nor $\langle \text{anti}A \rangle$. Additionally, it includes the interaction with other concepts, phenomena, ideas, etc., with their opposites or their neuters, $\langle B \rangle$, $\langle \text{Neut}B \rangle$ and $\langle \text{Anti}B \rangle$; $\langle C \rangle$ or $\langle \text{Neut}C \rangle$ or $\langle \text{Anti}C \rangle$, and so on.

Plithogeny allows the modeling of situations closer to the real world. This is why it allows the association of different concepts taken from various cognitive origins, as is the case in this article. Organizational behavior consists of different hierarchical levels such as individual, group, and organizational. Each of them is related to each other in a complex way. So far, Plithogeny theory has been applied mainly to decision-making and Statistics, [3-15].

In this article, we propose to classify the Organizational Behavior within the offices dependent on the Academic Vice-Rectorate of the National Agrarian University of La Selva in Peru. However, we will not make a usual classification, rather we will calculate a degree of belonging to each of the possible classifications. To do so, we use the theory of Plithogenic Sets and the survey carried out on 30 workers in these offices. This is an alternative of the Indeterminate Likert Scale applied to process surveys [16, 17].

The structure of the paper is, the Materials and Methods section follows, where the basic concepts of

organizational behavior and plithogenic sets are explained. The Results section summarizes the results obtained from the study and the procedures followed. At the end, the conclusions of the article are given.

2 Materials and Methods

This section contains the basic and theoretical elements discussed in this article. The sub-section below summarizes the most important definitions of Organizational Behavior.

2.1 Basics of Organizational Behavior

The OB operates on 3 hierarchical levels or planes: the individual level, the group level or level of groups and teams, and the organizational level or system of the organization, so that when studying the OB, the level of analysis used must be identified: behavior at the individual, group, or organizational level.

The levels are described below:

- a. Macroperspective of OB. Also called macroorganizational behavior, it refers to the study of the behavior of the organizational system as a whole (Organizational level).
- b. Meso-organizational Behavior focuses on the behavior of groups and teams in the organization and acts as a link between the other perspectives (Group level).
- c. Microperspective of OB. Also called microorganizational behavior, it analyzes the behavior of the individual (individual level).

OB studies what individuals do in the organization and how their behavior influences the effectiveness of the organization, which is based on the systematic research procedure characteristic of the scientific method. Thus, the three levels operate as independent variables of OB. The study of OB is important for which two approaches are defined:

- The systematic approach is based on the belief that behavior is not circumstantial, on the contrary, it is possible to verify certain consistencies on which people's behavior is based, which allows it to be predictable. The systematic study of behavior means to develop reasonable and accurate predictions by searching for relationships, causes, and effects, basing the conclusions on scientific evidence.
- Evidence-based management (EBM) complements systematic study by basing managerial decisions and organizational practices on the best available scientific certainty, taking management difficulties more scientifically. The manager would pose an administrative problem, then investigate and obtain the best possible evidence, critically assess the information found, and apply the relevant information to the question or case under study. Unfortunately, most managerial provisions are made "on the fly" based on few available studies.

A decision made based on intuition or gut feeling alone is similar to making an investment decision based on only half the data. The effects of relying on intuition are compounded by the fact that we tend to overestimate the accuracy of what we think we know. This is evidenced in various organizational studies, which reveal, for example, that 86% of executives assumed that their organization served its workers well, while only 55% of the latter believed that it did. Many managers hold certain opinions about the state of their organization that are strongly refuted by the reality of empirical evidence.

OB refers to everything related to people in organizations, acting alone or in groups, so one of the most important reasons for studying OB is that certain problems are common among organizations. Therefore, studying and understanding them helps to know the best way to address them. This study includes not only a catalog of situations and problems but also specific support material for managers.

Just as organizations differ from one another, practices within an organization can also vary, whether from one department to another or from one branch to another. Therefore, no OB model is sufficient to represent everything that happens in an organization, but the identification of a particular model can help distinguish the different ways of life of organizations. The choice of a particular model must take into account the philosophy, vision, mission, values, and goals of the organization. In addition, in the face of a changing environment, the selected model must not be static or immutable but must be adapted over time. The four models are the following:

1. Autocratic Model. It obeys power; this is held by those who occupy positions of command to order workers what to do and whoever does not comply will be sanctioned. The dominant orientation is authority, management believes it knows what is best and that workers are obliged to comply with its orders, their salary is low and their performance is equally low or minimal. Later, the combined force of new knowledge about the needs of workers and changes in social values gave rise to the recognition that there were better ways to manage organizational systems.
2. Custody model. In a formal study of workers carried out by managers, it was found that, in a custodial administration, although they did not rebel against their bosses, they held a very poor opinion of them and this opinion was expressed in crises. The bosses caused them insecurity, frustration, and aggression, and, as it was impossible to give free rein to these feelings, they transferred them to their homes and took them out on their

families and neighbors in such a way that the community suffered the consequences of this relationship. It was necessary to make the workers have notable complacency, as well as a higher level of security, thus increasing their enjoyment of their work and generally improving their working life quality. The custody model depends on economic resources to be able to pay salaries and benefits.

3. Supportive model. It depends on leadership rather than power and money. Through leadership, management provides an environment that helps workers grow and provide the organization with what they are capable of doing. Management's orientation is not aimed at simply supporting workers' benefits but at supporting their work performance. As a result, workers have a feeling of involvement and collaboration in the organization's work, abandoning the vision of "them" to adopt that of "us." Supportive behavior does not require financial resources but rather is part of the work lifestyle of managers, of their way of treating others, since their function is to help workers fulfill their work and solve their problems.
4. Collegial model. It is a useful extension of the support model; the term collegial refers to a group of people with a common purpose. This model embodies the concept of a team, it depends on the generation of a feeling of camaraderie in the workers by the management, resulting in them feeling useful and necessary, it is also easy for them to accept and respect the role of the administrators and instead of being seen as bosses, they are considered as collaborators. The administrative orientation is directed towards teamwork, having as a response the responsibility and discipline of the workers who offer quality work and not because of management's demands, on the contrary, they feel obliged to provide high quality.

The collegial and support models are more compatible with the real needs of workers, but it must be taken into account that adopting one model does not mean discarding the others; each organization is unique and therefore has a particular way of management. Managers must evaluate the model used and establish its suitability, as well as remain flexible in the use of new and different models. Making a "revolution" seeking to implement models for which the organization is not prepared would be a very bad decision; on the contrary, helping to improve through a change of culture would be a better goal. Table 1 summarizes the main characteristics of the four models analyzed.

Criterion/Model	Autocratic	Custody	Supportive	Collegial
Model base	Power	Economic resources	Leadership	Association
Administrative guidance	Authority	Money	Support	Teamwork
Orientation of workers	Obedience	Safety and performance	Job performance	Responsible Conduct
Psychological outcome in workers	Dependence on the boss	Organizational dependency	Stake	Self-discipline
Workers' needs met	Subsistence	Security	Category and recognition	Self-realization
Performance result	Minimum	Passive cooperation	Pulse animation	Moderate enthusiasm

Table 1. Adaptation of Keith Davis's of the four OB models.

The motivation theory, also known as the hierarchy of needs expressed by Abraham Maslow, integrates a hierarchy of five needs grouped into lower order needs: physiological, which include physical needs such as hunger, thirst, sex, shelter, among others; security, which encompass care and protection against emotional and physical harm; and higher order needs: social, which include affection, sense of belonging, acceptance and friendship; esteem, with internal factors such as self-respect, autonomy and achievement and external factors such as status, recognition and attention; self-actualization, drive to become what one is capable of being, includes growth and development of one's potential. When a need is sufficiently satisfied, the next in the hierarchy becomes dominant. The four OB models described are closely connected to human needs; the improvement of new models arose from the urgency to solve different needs whose significance dominates a certain moment as observed in Table 2.

	Autocratic	Custody	Supportive	Collegial
Maslow's hierarchy of needs	In order lower	In order lower	In order superior	In order superior
	Physiological (subsistence)	About security	Social and esteem	Self-realization

Table 2. Coherence matrix between Davis's four OB models and Maslow's hierarchy of needs.

2.2 Plithogenic Sets

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For plithogenic sets, we have the following concepts ([1, 2, 8, 18]):

Let U be a universe of discourse, and P a non-empty set of elements, $P \subseteq U$. Let A be a non-empty set of *one-dimensional attributes* $A = \{\alpha_1, \alpha_2, \dots, \alpha_m\}$, $m \geq 1$; and let $\alpha \in A$ be a given attribute whose spectrum of all possible values (or states) is the non-empty set S , where S can be a discrete finite set $S = \{s_1, s_2, \dots, s_l\}$, $1 \leq l < \infty$, or infinitely countable set $S = \{s_1, s_2, \dots, s_\infty\}$, or infinitely uncountable (continuous) set $S =]a, b[$, $a < b$ where $] \dots [$ is an open, semi-open, or closed interval of the set of real numbers or another general set.

Let V be a non-empty subset of S , where V is the range of all attribute values needed by experts for their application. Each element $x \in P$ is characterized by the values of all attributes in $V = \{v_1, v_2, \dots, v_n\}$, for $n \geq 1$.

In the set of attribute values V , in general, there is a dominant attribute value, which is determined by experts in its application. The dominant attribute value means the most important attribute value that experts are interested in.

Each attribute value $v \in V$ has a corresponding *degree of appurtenance* $d(x, v)$ of element x , to the set P , for some given criteria.

The degree of appurtenance can be a *fuzzy degree of appurtenance*, an *intuitionistic degree of appurtenance*, or a *neutrosophic degree of appurtenance* to the plithogenic set.

Therefore, the *degree of appurtenance function* is:

$$\forall x \in P, d: P \times V \rightarrow P([0, 1]^z) \quad (1)$$

So $d(x, v)$ is a subset of $[0, 1]^z$, where $\mathcal{P}([0, 1]^z)$ is the power set of $[0, 1]^z$, where $z = 1$ (fuzzy degree of appurtenance), $z = 2$ (for the intuitionistic degree of appurtenance), or $z = 3$ (for the neutrosophic degree of appurtenance).

Given the cardinal $|V| \geq 1$. Let $c: V \times V \rightarrow [0, 1]$ be the *fuzzy attribute value contradiction degree function* between any two attribute values v_1 and v_2 , denoted by $c(v_1, v_2)$, and satisfying the following axioms:

1. $c(v_1, v_1) = 0$, the degree of contradiction between the same attribute value is zero;
2. $c(v_1, v_2) = c(v_2, v_1)$, commutativity.

One can define a *fuzzy attribute value contradiction degree function* (c as before, which we can denote by c_F to distinguish it from the next two), an *intuitionistic attribute value contradiction degree function* ($c_{IF}: V \times V \rightarrow [0, 1]^2$), or more generally, a *neutrosophic attribute value contradiction degree function* ($c_N: V \times V \rightarrow [0, 1]^3$) can be used by increasing the complexity of the calculation, but also increasing the precision.

We mainly calculate the degree of contradiction between the values of uni-dimensional attributes. For multi-dimensional attribute values, we divide them into corresponding one-dimensional attribute values.

The *attribute value contradiction degree function* helps the plithogenic aggregation operators and the plithogenic inclusion relation (partial order) to obtain a more accurate result.

The attribute value contradiction degree function is designed in each field where a plithogenic set is used according to the application to be solved. If ignored, aggregations still work, but the result may lose precision.

Then (P, a, V, d, c) is called a *plithogenic set*, ([1, 2, 8, 18]):

1. Where " P " is a set, " a " is an attribute (multidimensional in general), " V " is the range of the attribute values, " d " is the degree of appurtenance of the attribute value of each element x to the set P to some given criteria ($x \in P$), and " d " means " d_F " or " d_{IF} " or " d_N ", when it is a fuzzy degree of appurtenance, an intuitionistic degree of appurtenance, or a neutrosophic degree of appurtenance respectively of an element x to the plithogenic set P ;
2. " c " means either " c_F " or " c_{IF} " or " c_N ", when it comes to the fuzzy degree of contradiction, intuitionistic degree of contradiction, or neutrosophic degree of contradiction between the attribute values respectively.

The functions $d(\cdot, \cdot)$ and $c(\cdot, \cdot)$ are defined according to the applications that the experts need to solve.

The notation below is used:

$$x(d(x, V)), d(x, V) = \{d(x, v), \text{ for all } v \in V\}, \forall x \in P.$$

The attribute value contradiction degree function is calculated between each attribute value concerning the dominant attribute value (denoted by v_D) in particular, and with concerning attribute values as well.

The attribute value contradiction degree function c between the attribute values is used in the definition of plithogenic aggregation operators (intersection (AND), union (OR), implication (\Rightarrow), equivalence (\Leftrightarrow), inclusion relation (partial order), and other plithogenic aggregation operators that combine two or more degrees of attribute value acting on the t-norm and the t-conorm, ([1, 2, 8, 18]).

Most plithogenic aggregation operators are linear combinations of the fuzzy t-norm (denoted by Λ_F), and the fuzzy t-conorm (denoted by \vee_F), but nonlinear combinations can also be constructed.

If the t-norm is applied on the dominant attribute value denoted by v_D , and the contradiction between v_D and

v_2 is $c(v_D, v_2)$, then on the attribute value v_2 it is applied:

$$[1 - c(v_D, v_2)] \cdot t_{\text{norm}}(v_D, v_2) + c(v_D, v_2) \cdot t_{\text{conorm}}(v_D, v_2) \quad (2)$$

Or, by using symbols:

$$[1 - c(v_D, v_2)] \cdot (v_D \wedge_D v_2) + c(v_D, v_2) \cdot (v_D \vee_D v_2) \quad (3)$$

Similarly, if the t -conorm is applied on the dominant attribute value denoted by v_D , and the contradiction between v_D and v_2 is $c(v_D, v_2)$, then on the attribute value v_2 it is applied:

$$[1 - c(v_D, v_2)] \cdot t_{\text{conorm}}(v_D, v_2) + c(v_D, v_2) \cdot t_{\text{norm}}(v_D, v_2) \quad (4)$$

Or, by using symbols:

$$[1 - c(v_D, v_2)] \cdot (v_D \vee_D v_2) + c(v_D, v_2) \cdot (v_D \wedge_D v_2) \quad (5)$$

The *Plithogenic Intersection* is defined as:

$$(a_1, a_2, a_3) \wedge_P (b_1, b_2, b_3) = (a_1 \wedge_D b_1, \frac{1}{2}[(a_2 \wedge_D b_2) + (a_2 \vee_D b_2)], a_3 \vee_D b_3) \quad (6)$$

The *Plithogenic Union* is defined as:

$$(a_1, a_2, a_3) \vee_P (b_1, b_2, b_3) = (a_1 \vee_D b_1, \frac{1}{2}[(a_2 \wedge_D b_2) + (a_2 \vee_D b_2)], a_3 \wedge_D b_3) \quad (7)$$

In other words, for what applies to the appurtenance, the opposite applies to the non-appurtenance, while in indeterminacy the average between them applies [19,20].

3 Results

Thirty administrative workers from the group of offices dependent on the Academic Vice-Rectorate of the National Agrarian University of La Selva participated. Each of them was asked to give a series of opinions as shown below:

- A. Basis of your institution's model:
 1. Power,
 2. Economic resources,
 3. Leadership,
 4. Association,
- B. Administrative guidance at your institution:
 5. Authority,
 6. Money,
 7. Support,
 8. Teamwork,
- C. Orientation of workers in your institution:
 9. Obedience,
 10. Safety and performance,
 11. Job performance,
 12. Responsible conduct,
- D. Psychological outcome in your institution's workers:
 13. Dependence on the boss,
 14. Organizational dependency,
 15. Stake,
 16. Self-discipline,
- E. The employee needs to find in your institution:
 17. Subsistence,
 18. Security,
 19. Category and recognition,
 20. Self-realization,
- F. Performance results at your institution:
 21. Minimum,
 22. Passive cooperation,
 23. Pulse animation,
 24. Moderate enthusiasm.

The 30 respondents were asked to rate their institution on the scale below:

Linguistic Value	Associated Single-Valued Neutrosophic Number (SVNN)
Disagree	(0.1,0.1,0.8)
More agree than disagree	(0.55,0.1,0.35)

Agree (0.8,0.1,0.1)

Table 3. The linguistic scale and the Single-Valued Neutrosophic Numbers were used in the survey of the study carried out.

Each of the aspects to be evaluated denoted by the letters A, B, C, D, E, and F are evaluated according to the answers given denoted by 1, 2, 3, ..., 24. They are asked to use the evaluations “Disagree”, “More agree than disagree” and “Agree”, as proposed in Table 3. Let us note that each of the possible responses will have an evaluation.

Each linguistic value is replaced by its corresponding associated Single-Valued Neutrosophic Number in Table 3. Let a_i be the evaluation given by the i th respondent ($i = 1, 2, \dots, 30$) where the 24 responses in SVNN form are denoted by $a_i = (a_{i1}, a_{i2}, \dots, a_{i24})$ and are aggregated using Equation 6 with the t-norm minimum and the t-conorm maximum. This way we obtain the SVNN for each interviewee, see Equation 8:

$$\bar{a}_{ik} = \wedge_{j=0}^5 a_{i(4j+k)} \quad (8)$$

Equation 8 aggregates the respondent's results concerning the autocratic style for $k = 1$, the custodial style for $k = 2$, the supportive style for $k = 3$, and the collegial style for $k = 4$.

The arithmetic mean of these values is then calculated for all respondents, as shown in Equation 9:

$$\bar{\bar{a}}_k = \frac{\sum_{i=1}^{30} \bar{a}_{ik}}{30} \quad (9)$$

To determine the k index that is closest to the maximum option, the following distance formula is calculated:

$$d_k(\bar{\bar{a}}_k) = \sqrt{(T_{\bar{\bar{a}}_k} - 1)^2 + (I_{\bar{\bar{a}}_k})^2 + (F_{\bar{\bar{a}}_k})^2} \quad (10)$$

In this way, the k with the smallest distance is considered the best approximation to the organization model.

Following the steps of the previous algorithm we have the following results that appear in Table 4:

$\bar{\bar{a}}_k$	$d_k(\bar{\bar{a}}_k)$	Ranking
(0.4831,0.1941,0.5831)	0.8030355098001583	4
(0.4382,0.1916,0.5351)	0.7991631935969024	3
(0.5053,0.1147,0.3244)	0.602594009263285	1
(0.5430,0.1403,0.3840)	0.613179492481606	2

Table 4. Results of the evaluations regarding $\bar{\bar{a}}_k$ (Equation 9), $d_k(\bar{\bar{a}}_k)$ (Equation 10), and the ranking.

The organizational model of this entity is evaluated as predominantly Supportive, although it presents characteristics of the other models with little difference, which are, viz. Collegial, Custody, and Autocratic, in that order.

Conclusion

This paper presented a study carried out in the offices of the Academic Vice-Rectorate of the National Agrarian University of La Selva, Peru, regarding the organizational behavior model. We used the Plithogenic Sets tool because it allows us to easily measure components of a system with varied characteristics. According to the results obtained from a survey carried out on 30 workers in these offices, we have that in the first place there is a Supportive Model behavior, followed by a Collegial Model, a Custodial Model, and finally an Autocratic Model. We recommend that managers analyze how to overcome the deficiencies that the presence of lower-order styles such as autocratic and custodial models can bring into the organization's functioning to a considerable degree.

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