Tri-Intersectional Model of Leadership by Values:  
A Fuzzy Multi-Criteria Decision Making Open  
Technology Assessment System  

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Purpose—Nowadays successful organizations need to be masters at leadership by values to play in a constantly changing and transforming environment. But how can leaders and organizations effectively convene strategic and culture development based on values? This paper presents the Tri-Intersectional Model of Leadership by Values (TMLV) in which leaders and organizations can integrate a sustainable strategy, as well as a culture and value-based management system that simultaneously leverages human, financial, and social resources. With its three essential axes of values (economic-pragmatic, emotional-development, and ethical-social) at their intersection points, it allows leaders to focus on the strategy linkages: innovation—intersection between the economic-pragmatic values axis and the emotional-development values axis—allows them to develop sustainable innovations; survival—intersection between the economic-pragmatic values axis and the ethical-social values axis—enhances their organization’s survival; finally, sensibility—intersection between the economic-pragmatic values axis and the ethical-social values axis—makes them more humane and more socially-responsible. The application of the TMLV, using the Fuzzy Multi-Criteria Decision Making Open Technology Assessment System, can be a great inspiration for stimulating and working with values in organizations, as well as allowing leaders to develop a values-based, high-involvement, and performance-oriented culture. Methodology/Approach—This research considers empirical data analysis of the 37 case studies of the EU-Innovate project (http://www.euinnovate.com)—a pioneering initiative to align innovation values to integrate the end user into the process of innovation and entrepreneurship related to a sustainable lifestyle and the green economy in Europe—using a fuzzy multiple-criteria decision making method and open technologies system, such as server-side PHP language, MariaDB Database, fork of MySQL Database Management System, and JavaScript libraries to perform operation directly on the user’s browser. Findings—The application of the TMLV model, considering empirical analysis of the extracted values from the case studies, using the Fuzzy Multi-Criteria Decision Making Open Technology Assessment System, can be a great inspiration for stimulating and working with values in
organizations, as well as allowing leaders to develop suitable strategies and interventions for shaping a sustainable high-performance culture. Research implications—This research can be a starting point for further research to assess the effectiveness of the leadership model based on a decision-making open technology system in any given organization, as well as to invite researchers who have positive passion about working with values to participate in the improvement of this tool. Originality/value—The Tri-Intersectional Model of Leadership by Values using the Fuzzy Multi-Criteria Decision Making Open Technology Assessment System is presented as an evolution in leadership models that may be used to fuel innovation, survival, and a sensibility strategic focus that is necessary to optimize human and organizational performance and deliver effective solutions to the massive array of human, financial, and social problems we face today.

Keywords: leadership by values, Tri-Intersectional Model of Values, economical-emotional-social values, strategic focus, Fuzzy Multiple-Criteria Decision Making Open Technology Assessment System

Introduction

Values-based leadership has become essential for the future of organizations, mainly the capability to share values passionately within the organization to have high impact in strategies and culture process. The acceleration of technological, political, and culture changes and transformations have shown inverted *coeteris paribus* conditions, where value-based management must remain constant while everything else changes, as well as driving values across the organization (Brillo & Boonstra, 2018). But how can leaders and organizations strengthen values within organizations and with their stakeholders, manly the customers? Successful values-based leadership is fully connected with behavior change and a vision of the future, in which leaders must talk about values and walk the genuine values path. The main reason for internalizing values within an organization is related to suitable strategies and interventions for shaping a sustainable high-performance culture.

This paper presents an application of the Tri-Intersectional Model of Leadership by Values, hereby TMLV, portraying the Extracting Configurations of Values System (Fernández, 2019) from the case studies of the EU-InnovatE project (http://www.euinnovate.com), a pioneering initiative to align innovation values to integrate the end user into the process of innovation and entrepreneurship related to a sustainable lifestyle and the green economy in Europe. The TMLV model is an extension and elaboration of both the Management by Sustainable Innovational Values MSIV (Brillo, Dolan, Kawamura, & Fernandez, 2015) and the Management by Values (Dolan, Garcia, & Richley, 2006). The model has three strategic focuses: innovation—intersection between the economic-pragmatic values axis and the emotional-development values axis—which allows them to develop sustainable innovations; survival—intersection between the economic-pragmatic values axis and the ethical-social values axis—which enhances their organization’s survival; and sensibility—intersection between the economic-pragmatic values axis and the ethical-social values axis—which makes them more humane and more socially-responsible.

TMLV is a strategic leadership tool based on a fuzzy multiple-criteria decision making method and open technologies system, such as server-side PHP language, MariaDB Database, fork of MYSQL Database Management System, and JavaScript libraries to perform operation directly on the user’s browser. This tool can be useful for leaders and organizations to embed the values within the organization culture according to each strategic focus: innovation, survival, and sensibility, integrating efficiently vision, mission, strategic objectives, processes, targets, and initiatives.
The case studies comprise the corpus of the EU-InnovatE project and are businesses selected employing a multiple case study design (Yin, 2009) and theoretically sampled following several criteria: (i) The innovation creates economic plus social and/or ecological value, thereby enhancing sustainable lifestyles; (ii) The process, which includes invention and commercialization, is driven by a single user or a group of users; (iii) All phases of the user sustainability innovation process are covered; (iv) It covers geographical European regions: Nordic, Central, Eastern, and Southern Europe; (v) It covers four domains: food, mobility, energy, and living-housing. The 37 cases studies are composed of 17 cases of big firms and 20 cases of entrepreneurship projects. The application of the TMLV model, considering empirical analysis of the extracted values from the case studies, using the Fuzzy Multi-Criteria Decision Making Open Technology Assessment System, can be a great inspiration for stimulating and working with values in organizations, as well as allowing leaders to develop a values-based, high-involvement, and performance-oriented culture.

The Tri-Intersectional Model of Leadership by Values (TLMV)

The TMLV model is an extension and elaboration of both the Management by Sustainable Innovation Values MSIV (Brillo et al., 2015) and the Management by Values (Dolan et al., 2006), configurating a Tri-Intersectional Model, an asymmetrical cultural reengineering to be used as the foundation for developing organization culture that suggests a firm’s vision, mission, strategic objectives, processes, targets, and initiatives circumscribed within the triangle formed by the following three complementary yet orthogonal axes: emotional-developmental, economic-pragmatic, and ethical-social values.

The emotional-developmental values are essential in creating new opportunities for action. These values are related to intrinsic motivation, which moves people to believe in a cause. Autonomy, creativity, enthusiasm, joy, passion, and playfulness are some examples of these values. Without these values, people would be unable to make organization commitments or be creative. The economic-pragmatic values are a set of values related to the criteria of competitiveness, discipline, economic growth, and efficiency, etc. These values guide the planning, quality assurance, and accounting activities in organizations. They are necessary to maintain and unify various organizational subsystems. The ethical-social values represent the way people behave in groups guided by ethical values shared by members of a particular group. These values come from conventions or beliefs about how people should behave in public, at work, and in their relationships; they are associated with values such as commitment, consciousness, generosity, respect for people, etc. It is important to point out that these values are manifested by actions more than words.

With its three essential axes of values (economic-pragmatic, emotional-development, and ethical-social) at their intersection points, it allows leaders to focus on the strategy linkages: innovation—intersection between the economic-pragmatic values axis and the emotional-development values axis—which allows them to develop sustainable innovations; survival—intersection between the economic-pragmatic values axis and the ethical-social values axis—which enhances their organization survival; finally, sensibility—intersection between the economic-pragmatic values axis and the ethical-social values axis—which makes them more humane and more socially-responsible.

TLMV Innovation Strategic Focus

The TLMV innovation strategic focus is in line with the Management by Sustainable Innovation Values model—MBSIV (Brillo et al., 2015), which is an extension and elaboration of both the Management by Values
(Dolan et al., 2006) and the Coaching by Values concepts (Dolan, 2011). The MBSIV model has been fundamental to address complexity within organizations of the 21st century, strengthening an organization’s capabilities to develop a culture for innovation. Therefore, when designing an organizational culture for innovation, it is essential that people are able to do what they do different and best in their jobs. The TLMV innovation strategic focus delineates a process for alignment and realignment of the three axes of values (emotional-developmental, economic-pragmatic, and ethical-social) at their intersection points, which allows leaders to focus on innovation strategic linkage (40%), which allows them to lead to great innovations, while keeping the sensitivity and survival linkages in an adequate level of 30%. Figure 1 shows the TLMV innovation strategic focus.

**TLMV Survival Strategic Focus**

The TLMV survival strategic focus is also an extension and elaboration of the Management by Sustainable Innovational Values model—MBSIV (Brillo et al., 2015). It suggests an organizational shape for achieving survival strategies and strengthening an organization’s capabilities to develop a culture for survival. Therefore, when designing, it is essential that people are able to do their jobs more efficiently. The TLMV survival strategic focus delineates a process for alignment and realignment of the three axes of values (emotional-developmental, economic-pragmatic, and ethical-social) at their intersection points, which allows leaders to focus on survival strategic linkage (40%), which allows them to lead to enhancing their organization survival, while keeping the sensitivity and innovation linkages in an adequate level of 30%. Figure 2 shows the TLMV survival strategic focus.

**TLMV Sensibility Strategic Focus**

The TLMV sensibility strategic focus is also an extension and elaboration of the Management by Sustainable Innovational Values model—MBSIV (Brillo et al., 2015). It suggests an organizational shape for achieving sensibility strategies and strengthening an organization’s capabilities to develop a culture for sensibility. Therefore, when designing, it is essential that people are able to do their jobs more humane and more socially-responsible. The TLMV survival strategic focus delineates a process for alignment and realignment of the three axes of values (emotional-developmental, economic-pragmatic, and ethical-social) at their intersection points, which allows leaders to focus on sensibility strategic linkage (40%), while keeping the
innovation and survival linkages in an adequate level of 30%. Figure 3 shows the TLMV sensibility strategic focus.

**Methodology**

To address human behavior in decision making means to tackle something intangible, yet we know that even intangible things can be measured through other methods than the classical mathematical ones. Unlike probability theory, which addresses random variables that depend on future uncertain events, the fuzzy set theory that is employed in this work operates with nebulous variables, which are vaguely understandable and, nonetheless, are bound to occur with certainty. Using fuzzy logic, we expand the application of mathematical concepts from a defined to an undefined domain, making it possible to better represent vague and uncertain concepts as well as to serve as a basis for qualitative modeling that addresses linguistic variables, including verbal expressions that synthesize thoughts, feelings, and emotions (Ross, 2004).
The TMLV methodology is an extension and elaboration of both Methodology for Hierarchization of Competences Model (Brillo & Cosenza, 2013)—fast decision making algorithm applied for quantifying the impact of the supply and demand of the competences in Brazilian’s organization and the Managing by Sustainable Innovational Values—MSIV (Brillo et al., 2015)—asymmetric culture reengineering model of values to embed user innovators and user entrepreneurs for aligning an organization’s vision, mission, strategic objectives, processes, targets and initiatives—to build the Fuzzy Multi-Criteria Decision Making Open Technology Assessment System for helping leaders, managers, and their organizations facing the management challenges. Figure 4 provides a schematic view of the Fuzzy Multi-Criteria Decision Making Open Technology Assessment System.

**Step 1 Triaxial Model of Values Configuration**

The raters pick values from a random pool of 30 values and give them integer numbers, assigning a total of 10 points. So, if they give eight points to value A, they can only assign the rest of the two points either to a single other value (B) or to two different values (C and D) with one point each. The 30 values come from a theoretical model called Triaxial Model of Values (Dolan et al., 2006) and are organized in three groups, called axes, namely economic-pragmatic values, emotional-developmental values, and ethical-social values. Figure 5 shows a table with the 30 values.

**Step 2 TMLV Configuration**

With the Triaxial Model of Values configuration in its three essential axes of values (economic-pragmatic, emotional-development, and ethical-social), the TMLV configuration is obtained from the arithmetic mean of the Triaxial Model of Values at their intersection points. It allows focusing on the linkages: innovation—intersection between the economic-pragmatic values axis and the emotional-development values axis; survival—intersection between the economic-pragmatic values axis and the ethical-social values axis; and sensibility—intersection between the economic-pragmatic values axis and the ethical-social values axis.

**Step 3 Mathematical Analysis**

The method is defined for the model where A and B are binary matrices representing, respectively, the rater’s TMLV configuration (x% innovation linkage, y% survival linkage, and z% sensitivity linkage, where x% + y% + z% = 100%) and the rater’s Expertise Level, as follows:

\[ A = (a_{ij})_{mxn} \quad B = (b_{jk})_{mxn} \]
where:
  \( h \) = raters;
  \( m \) = rater’s Tri-Intersectional Model configuration;
  \( n \) = rater’s expertise level.

Define \( R \) as the set of raters’ TMLV configuration. Then, the fuzzy set \( \tilde{A} \) in \( r \) is a set of ordered pairs:

\[
\tilde{A} = \{(r, \mu_{\tilde{A}}(r))/r \in R\}.
\]

The fuzzy set \( \tilde{A} \) represents the rater’s strategic focus preference. Then, matrix \( A = (\mu_{\tilde{A}})_{h \times m} \) where \( \mu_{\tilde{A}}(r) \) is the membership function according to the following strategic focus:

- Innovation,
- Survival,
- Sensitivity.

In the same way, the fuzzy set \( \tilde{B} = \{(r, \mu_{\tilde{B}}(r))/f \in R\} \) represents the rater’s expertise level matrix \( B \), where \( \mu_{\tilde{B}}(r) \) is the membership function represented by the level of expertise of the rates, according to the following scale:

- High,
- Middle,
- Low.
The matrix $\tilde{A}$ is the strategic focus matrix, in which the fuzzy set does not contain the set of R, but shows the $r_i$’s strategic focus preference, which belongs to the fuzzy set $B$ defining the relation to the scale high, middle, and low.

The matrix $B$ containing the $r_i$’s satisfies the fuzzy set by approximation. Then, $r_1$ related to $\tilde{A}$ is not necessarily equal to the $r_1$ available at $B$. Alternatively, $A$ assumes the elements of $B$.

Define $A = \{a_i/i = 1, 2, ..., m\}$ as the set of rater’s Tri-Intersectional Model with different configurations according to their preferred strategic focus, showed in Figure 6.

![Figure 6. Rater’s Tri-Intersectional Model configuration.](image)

Where $A_1, A_2, ..., A_m$ is the set of raters, and $W_1, W_2, W_n$ is their preferred strategic focus.

Define $B = \{b_k/k = 1, 2, ..., m\}$ as the set of rater’s expertise level, where $R = \{r_k/k = 1, 2, ..., n\}$ represents the set of rater’s Tri-Intersectional Model of Values, showed in Figure 7.

![Figure 7. Rater’s expertise level.](image)

Where, $B_1, B_2, ..., B_m$ is the rater’s expert level; $r_1, r_2, ..., r_n$ is the raters’ TMLV configuration; $W_1, W_2, ..., W_n$ represents the rater’s preferred strategic focus; and, $b_{jk}$ is the fuzzy coefficient of $k$ in relation to the factor $j$.

Define $C = A \otimes B = (c_{ik})_{m \times n}$, the matrix representing the TMLV configuration of the set of rate’s, such that $\max_i \max_k \{c_{ik}\} = \tilde{c}_i$ indicates the best configuration $k$; and, $\max_k \{c_{ik}\} = \tilde{c}_k$ indicates the best strategy focus for the level of expertise $i$.

Define $D$ a set and $M = \{0, 1\}$ its linked membership set, that is, $\tilde{A}$ and $\tilde{B}$ are two fuzzy subsets of $D$.

The algebraic product of $\tilde{A} \in \tilde{B}$ is defined as $\tilde{A} \cdot \tilde{B}$, then:

$\forall r \in D: \mu_{A \cdot B}(r) = \mu_A(r) \cdot \mu_B(r)$. 

In the same way, the algebraic sum of $\tilde{A} + \tilde{B}$ is represented by:

$\forall r \in D: \mu_{A + B}(r) = \mu_A(r) + \mu_B(r) - \mu_A(r) \cdot \mu_B(r)$. 

Mathematically more rigorous than the concept of asymmetric distance, the COPPE/Cosenza model, for two generic elements $a_{ij}$ and $b_{jk}$, defines the product $a_{ij} \otimes b_{jk}$ as the following binary operation, showed in Figure 8.

<table>
<thead>
<tr>
<th>Rater’s expertise level (E)</th>
<th>$a_{ij} \otimes b_{jk}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMLV configuration (T)</td>
<td></td>
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<tr>
<td>0</td>
<td>0</td>
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<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>$0^+$</td>
<td>$0^{++}$</td>
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</tbody>
</table>

Figure 8. COOPE/Cosenza binary operation model.

Where $c_{ik}$ is the fuzzy coefficient that represents the rater’s expertise level $k$ in relation to rater’s TMLV configuration $i$. This coefficient is the result of a crisp operation of two modalities, where: $0^{-} = 1/n!$; and, $0^{++} = 1/n$; where $n$ is the number of raters.

Figure 9 shows some examples of expert levels and strategic focus to some rater’s TMLV configuration $i$.

<table>
<thead>
<tr>
<th>Rater’s TMLV configuration</th>
<th>$b_{jk}$</th>
<th>$a_{ij}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>B2</td>
<td>B3</td>
</tr>
<tr>
<td>r1</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>r2</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>r3</td>
<td>Middle</td>
<td>High</td>
</tr>
<tr>
<td>r4</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>r5</td>
<td>Middle</td>
<td>Low</td>
</tr>
<tr>
<td>r6</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>r7</td>
<td>Middle</td>
<td>Middle</td>
</tr>
</tbody>
</table>

Figure 9. Examples expert level and strategic focus of the TMLV configuration.

Where $a_{ij}$ is the fuzzy coefficient that results from the rater’s strategic focus $j$ in relation to rater’s TMLV configuration $i$; and $b_{jk}$ is the fuzzy coefficient that results from the rater’s strategic focus $j$ in relation to the rater’s expertise level $k$.

Define the membership functions:
The operations $O_T \otimes O_E \neq 0$, and $O_T \otimes 1_E \neq 0$ meet the assumptions of the proposed methodology, considering the balance between the rater’s TMLV configuration and their expertise level.

**EU-InnovatE Case Studies**

EU-InnovatE was the name given to a three-year research project between 2013 and 2016 to develop a new vision of a sustainable lifestyle in Europe. It was a pioneering initiative to align innovation values to integrate the end user into the process of innovation and entrepreneurship related to a sustainable lifestyle and green economy in Europe. It has investigated the creative, innovative, and entrepreneurial roles of users in the development of sustainable innovation products, services, and processes. The EU-innovatE Project selected 37 cases (17 big firms and 20 cases of entrepreneurship projects) representing the best practices in the European market adhering to the sustainable open innovation philosophy.

The case studies comprise the corpus of the EU-InnovatE project and are businesses selected employing a multiple case study design (Yin, 2009) and theoretically sampled following several criteria: (i) The innovation creates economic plus social and/or ecological value, thereby enhancing sustainable lifestyles; (ii) The process, which includes invention and commercialization, is driven by a single user or a group of users; (iii) All phases of the user sustainability innovation process are covered; (iv) It covers geographical European regions: Nordic, Central, Eastern, and Southern Europe; (v) It covers four domains: energy, lifestyle-housing, mobility, and food.

We apply the TMLV model in the case studies considering empirical analysis of the data from the Extracting Configurations of Values System (Fernández, 2019), using the Fuzzy Multi-Criteria Decision Making Open Technology Assessment System. As a result of the data collection from the TMLV configurations, a dataset has been processed with a total of 1,305 observations for each of the specific 30 possible values asked, for different 15 raters and 37 case studies. Figures 10, 11, 12, and 13 present the results.
Figure 10. TMLV configurations versus configurations adjusted to strategic focus Innovation: Domain Energy.
<table>
<thead>
<tr>
<th>Country</th>
<th>Diagram 1</th>
<th>Diagram 2</th>
<th>Diagram 3</th>
<th>Diagram 4</th>
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<td><img src="image19" alt="Diagram" /></td>
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**Figure 11.** TMLV configurations versus configurations adjusted to strategic focus Innovation: Domain Lifestyle-Housing.

<table>
<thead>
<tr>
<th>Case code</th>
<th>Country</th>
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<th>TMLV adjusted to strategic focus Innovation</th>
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Figure 12. TMLV configurations versus configurations adjusted to strategic focus Innovation: Domain Mobility.

<table>
<thead>
<tr>
<th>Case code</th>
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*Figure 13. TMLV configurations versus configurations adjusted to strategic focus Innovation: Domain Food.*

**Conclusion**

The Tri-Intersectional Model of Leadership by Values (TMLV) using the Fuzzy Multi-Criteria Decision Making Open Technology Assessment System is a strategic leadership tool that can help successful leaders and
organizations to be masters in convening strategic and culture development based on values to play in a constantly changing and transforming environment. A critical success factor of TMLV is the development of an environment of values-based leadership fully connected with behavior change and a vision of the future, in which leaders must talk about values and walk the genuine values path. Through the TMLV strategic focus: innovation, survival, and sensibility, leaders and organizations can integrate efficiently their vision, mission, strategic objectives, processes, targets, and initiatives, embedding values within organizations to co-create strategies and interventions for shaping a sustainable high-involvement and performance-oriented culture.

The application of the TMLV model, considering empirical analysis of the extracted values from the EU-InnovatE project case studies, using the Fuzzy Multi-Criteria Decision Making Open Technology Assessment System, can be a great inspiration for leaders and organizations to stimulate and work with values, as well as expand the sourcing of ideas and practice beyond the walls of their organizations, while integrating the inputs of stakeholders, mainly the end users. With its three essential axes of values (economic-pragmatic, emotional-development, and ethical-social) at their intersection points, the TMLV allows leaders to focus on the strategy linkages: innovation—intersection between the economic-pragmatic values axis and the emotional-development values axis which allows them to develop sustainable innovations; survival—intersection between the economic-pragmatic values axis and the ethical-social values axis which enhances their organization survival; and sensibility—intersection between the economic-pragmatic values axis and the ethical-social values axis which makes them more humane and more socially-responsible. We thank the EU-InnovatE project that inspired us to do this research paper and would like to invite everyone who has positive passion about working with values to participate in the improvement of this assessment system available at the link https://joaobrillo.com/?page_id=82&lang=en.

References


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