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Optimizing Strategic Transformation with EFQM Model: A Contingency Theory Perspective

Yiğit Çağlar
Başkent University, Ankara, Türkiye
A. Kadir Varoğlu
Başkent University, Ankara, Türkiye

Abstract

Background: The EFQM Model, launched by the European Foundation for Quality Management (EFQM), is widely adopted by transforming organizations. Conducting research with an academic perspective on these models is crucial to comprehend their potential fully. While Contingency Theory has not yet gained widespread recognition for this purpose, it can play a fundamental role in shaping organizations' transformational domains. **Objectives:** To evaluate the feasibility of the EFQM Model in transformation by integrating theoretical concepts with practical applications across the Environment, Size, Technology, and Strategy domains while minimizing ESG risks. **Methods/Approach:** Quantitative analysis, employing Linear Programming (LP), is utilized to explore the interaction between 25 sub-criteria derived from EFQM and contingency theory, with data from 50 participants being analysed using operational research-based LP optimization and sensitivity analysis. **Results:** The EFQM Model showcases feasibility in managing ESG risks and driving transformations with above-average success rates in the case study. Notably, the "Size" transformation domain plays a vital role in strategic transformations, alongside other sub-criteria, as indicated by various sensitivity analyses. **Conclusions:** The EFQM criteria' methodological approach closely aligns with the transformation perspective of contingency theory, holding potential to enhance future business system research.

Keywords: strategic transformation; contingency theory; sustainability; EFQM

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Introduction

In complex and ambiguous business conditions, organizations are increasingly compelled to undergo strategic transformations to thrive and align with the shifting paradigms of sustainability expectations. This study initiates a detailed exploration of the EFQM Model, critically assessing its potential as a catalyst for such transformative attempts. The research emphasizes sustainability, an essential component in the evolution from industrial advancement to societal enhancement. It suggests that the core of modern organizational success involves embedding sustainability extensively within strategic planning frameworks.

At the centre of this research is a multidimensional analysis to understand how the EFQM Model facilitates organizations in guiding the intricacies of strategic transformation. Using an extensive methodological framework that combines qualitative insights with quantitative data, the study evaluates the model's impact on fostering sustainable strategic transformations. The study examines the model's criteria and their implications on ESG risk dimensions alongside considerations for organizational outcomes.

Additionally, this study highlights the complex link between an organization's scale and its adoption of the EFQM Model. It argues for a tailored approach to achieving business excellence that accounts for different organizations' unique characteristics. This approach aims to create methods that balance high standards with their practical application in a changing business environment.

Projecting the findings, this research supports the EFQM Model as a comprehensive instrument that enables organizations to coordinate their functional practices with objectives aimed at strategic transformation. It is anticipated that the insights derived from this analysis will contribute significantly to the academic discourse on strategic and quality transformations, offering practical guidance for organizations guiding the modern business view with agility and foresight.

Exploring the EFQM Model's role in sustainable strategic transformation presents a broader inquiry into how organizations can achieve excellence in an era focused on sustainability. This research outlines a comprehensive framework for enhancing transformation, thus linking abstract ideas and their real-world execution. Examining Contingency theory alongside mathematical models can help organizations understand how the EFQM Model guidelines facilitate transformation while lowering ESG risks. Additionally, through these analyses, it is possible to identify which dimension of transformation is more significant and to measure sensitivities. The EFQM Model has the potential to help guide these complex changes, aiming not just to meet but also to go beyond quality standards in becoming forward-thinking and responsible organizations.

Strategic and Theoretical Perspective

In academic discussions, researchers explore how organizations change using various terms and theories. The literature reveals a divergence in the consistency of terminological usage, with several studies opting for semantically related terms instead of identical headings. This variation highlights the insufficiency of a uniform taxonomy within the scholarly exploration of organizational transformation, thus insightfully clarifying the complexity and multidisciplinary nature required for a comprehensive understanding of transformational processes. Strategies are critical in shaping the path of organizational objectives. This dynamic interaction is intricately intertwined with governance mechanisms, emphasizing the requirements of accountability, value creation, strategic orientation, and meticulous monitoring to realize the organization's explicit ambitions (Mintzberg & Waters, 1985). The inclination

toward adaptive strategies is accentuated in the context of environmental volatility, heralding a shift towards a simplified expression of organizational aspirations and methodologies over time.

The development is further supported by adopting processes and a culture that values change (Miller, 1992; Dorval et al., 2019). This highlights the crucial importance of flexibility in responding to external challenges that significantly impact organizations' strategic plans (Salancik & Pfeffer, 1977). Mintzberg's (1987) strategic classification, known as the "5P," clarifies the intricate nature of strategic planning. These strategic approaches emphasize the significance of adopting change to guide strategic success. Implementing the EFQM Model within organizational contexts has the potential to reveal its significant influence on strategic outcomes. This influence is demonstrated through the model's ability to align the corporate vision and market orientation with strategic requirements, enhancing organizational performance and adaptability. (Janatyan et al., 2020; George, 2020).

The EFQM Model's potential impact on strategic capabilities supports a sophisticated interpretation of strategic frameworks in enhancing organizational performance (Ciranoğlu, 2018). Furthermore, strategic transformation, prompted by crises and environmental shifts, requires a smart balance between internal competencies and external changes. This necessity emphasizes the importance of sustainability as a core objective, supported by a body of literature endorsing an integrated approach to strategic change. Researched approaches highlight the critical role of leadership and the development of organizational competencies aligned with sustainability and adaptability principles (Johnson et al., 2012; Nutt & Backoff, 1997; Hensmans et al., 2012; McIvor & McHugh, 2000). Given the literature's evident lack of a unified taxonomy for transformation, integrating contingency theory into the study of organizational transformation becomes especially relevant. This theoretical perspective facilitates an investigation of the contingent aspects of strategic management practices, providing a structured framework to address the complex challenges associated with efforts to transform organizations.

Sustainable Transformation with Contingency Theory

In academic discussions, organizational transformation includes various terms and theories, primarily analyzing various variables.

Numerous studies on the EFQM Model and Contingency Theory collectively provide fundamental insights into how these frameworks enhance organizational performance. Research indicates that organizational size significantly influences the adoption and impact of the EFQM model. Large organizations and SMEs exhibit different levels of EFQM adoption, with firm size affecting the relationship between EFQM enablers and performance outcomes (Escrig & Menezes, 2016). In SMEs, Quality Management (QM) practices must be strategically aligned with contingency variables like strategy, culture, lifecycle, and customer focus. This alignment is crucial for achieving optimal performance and is highly contingent on the specific environmental context (McAdam et al., 2016). Total Quality Management (TQM) practices significantly impact employee outcomes and performance, with environmental uncertainty playing a critical role. Tailoring TQM practices to the specific environmental context maximizes their effectiveness (Yazdani, 2022). Moreover, relationships between firm size, TQM duration, unionization, and industry context significantly influence TQM implementation. These contingency factors moderate the effects of TQM practices on organizational performance, indicating the necessity of adapting TQM to specific organizational contexts (Jayaram et al., 2010). The historical evolution of TQM shows its convergence with various management

theories. The core values and components of TQM align significantly with several management theories, demonstrating TQM's broad applicability and integration into modern management practices (Dahlgaard-Park et al., 2018). The resource-based view underpins the EFQM model, identifying key resources and capabilities that generate competitive advantages, thus highlighting the model's effectiveness in leveraging organizational resources for sustained excellence (Ruiz-Carrillo & Fernández-Ortiz, 2005). Research has shown that EFQM enablers significantly contribute to business performance, with innovation acting as a partial mediator, underscoring the importance of integrating QM and innovation (Kafetzopoulos et al., 2019).

Research demonstrates inconsistent use of terms, with many studies opting for similar but not identical terms. This inconsistency highlights the lack of standardized terms for studying organizational transformation. Given this necessity, contingency theory highlights the subject's complexity and the need for knowledge from diverse fields to understand transformation processes fully.

Additionally, the role of ESG-level rankings becomes critical in guiding organizational and investor decision-making processes (Dorfleitner et al., 2015). Despite anticipated societal benefits, ESG investments often fall short of investor expectations, prompting inquiries into the efficiency of sustainability-focused attempts (Cornell, 2020). Discussions surrounding sustainability highlight the necessity for a strategic framework that ensures management alignment with sustainability goals and facilitates a comprehensive evaluation of organizational processes and structures (Abson et al., 2017). Researchers such as Olsson et al. (2014) and Salomaa and Juhola (2020) endorse a multidimensional approach to sustainable transformation, acknowledging the unforeseen impact of global events as drivers of change.

In a view marked by volatility and complexity, the transition from the "VUCA: Volatile, Uncertain, Complex, Ambiguous" framework to the "BANI: Brittle, Anxious, Non-linear, Incomprehensible" paradigm suggests a strategic shift towards resilience (Mack & Khare, 2016). Contingency theory focuses on strategic adaptability and alignment with environmental conditions (Woodward, 1965; Aldrich, 1972; Chandler, 1962; Lundberg & Thompson, 1967; Donaldson, 2006). Alongside insights from chaos and complexity theories (Bechtold, 1997), it offers perspectives on organizational resilience. Strategic management literature, rich in strategies for guiding environmental uncertainties, highlights the importance of dynamic capabilities, learning, and adaptation for sustainable competitive advantage (Mintzberg & Waters, 1985; Barney, 1991). These strategic frameworks emphasize the critical role of innovation and strategic foresight in securing organizational success in an evolving view (Wheelen et al., 2017).

Integrating environment, technology, size, and strategy transformation domains within the EFQM Model highlights the framework's adaptability to the evolving organizational view. By recognizing the importance of aligning with external pressures, fostering innovation, and using strategic foresight, the EFQM Model offers a robust foundation for organizations seeking sustainability and competitive advantage in today's volatile and uncertain environment.

Excellence covers many themes, from quality management to sustainability and transformation. Overlooked strategic relationships often lack structured management, emphasizing the need for a vision of excellence. The emergence of Quality 4.0 highlights the significance of managing processes, continuously improving, and designing products/services. This encourages managers to become "successful strategists" to guarantee organizational success and stakeholder satisfaction (Ali & Johl, 2022). Standardizing sustainable strategy and governance is critical for

organizations oriented towards transformation, as discussed by Steffek and Wegmann (2021), who note the broader governance implications of "ISO 37000 - Governance of Organizations"—for example, Rusjan and Alić. (2010) explore the social sustainability aspects of Quality Management Systems (QMS), whereas Souza et al. (2021) illustrate the role of QMS in facilitating the convergence of technology, quality, and personnel within the context of Industry 4.0, highlighting the essential nature of sustainability-driven changes.

Davis et al. (2010) examine how rising risks and uncertainties challenge strategic planning and stakeholder interactions for businesses. Similarly, Balbastre-Benavent and Canet-Giner (2011) research the EFQM Model's role in fostering comprehensive strategy formulation techniques. Further, Revuelto-Taboada et al. (2011) examine the model's impact on facilitating strategic transformation.

Furthermore, Setiawan and Purba (2021) endorse the strategic relevance of various excellence frameworks, and Fonseca (2021) evaluates the effectiveness of quality awards, emphasizing comprehensive approaches to quality management. Garafonova et al. (2019) examine current models of excellence, providing organizations with strategic alternatives for transformation. Rosenbaum et al. (2018) highlight the need to identify gaps in existing studies and propose solutions. They emphasize the importance of collaboration and methodological diversity in enhancing the EFQM Model's research quality. Plachy and Smunt (2022) also discuss the potential for organizational failure when employees resist collaboration within accepted strategic frameworks. Achieving sustainable strategic transformation necessitates focusing on excellence beyond quality management, integrating internal and external environmental considerations, and applying contingency in strategic management.

Review of the EFQM Model from a Transformation Perspective

The EFQM Model has been developed to adapt to modern challenges and trends, providing a flexible framework for organizational improvement through extensive collaboration. This approach is based on the EFQM Model's "RADAR" logic, designed to assist in self-assessment and support organizational development. This article examines the model's criteria from the perspective of the EFQM Model's contribution to strategic transformation, rather than providing an alternative to evaluating an organization with the RADAR approach. The model covers three main dimensions: Direction, Execution, and Results. Direction sets the strategic intent by defining the organization's purpose, vision, and culture, laying the foundation for effective leadership and future initiatives. Execution focuses on translating these strategic directives into action through stakeholder engagement and sustainable practices, ensuring the realization of organizational objectives. Results evaluation measures the organization's performance against goals, assessing effectiveness and stakeholder impact to drive continuous improvement. (EFQM, 2019).

From an academic perspective, this research investigates whether the EFQM Model supports its contribution to strategic transformation when examined in terms of transformation domains. Thus, examining the EFQM Model can be valuable for achieving sustainable strategic transformations, offering a framework for resilience in today's "VUCA" environment. The extent of its contribution is a primary focus of this study, aiming to understand its role and effectiveness in promoting organizational excellence and adaptability. To enhance understanding, this article offers a general explanation for each criterion below. While not as detailed as the descriptions in the booklet, the information is sufficiently accessible through open sources (EFQM, 2019).

Criterion 1: Purpose, Vision & Strategy. Criterion 1 of the EFQM Model examines an organization's mission, vision, and strategy, evaluating its alignment with available resources, goals, and objectives. Organizations that adopt this criterion transcend mere planning and establish systems to implement strategic plans effectively. This criterion is closely connected with strategic transformation as it furnishes a framework to evaluate and reinforce the organization's capacity to define and communicate its mission, vision, and strategy. Consequently, strategic planning should be iterative, facilitating swift adjustments to evolving environmental conditions and stakeholder expectations.

Criterion 2: Organizational Culture & Leadership. Criterion 2 evaluates an organization's culture and the efficiency of its leadership in upholding its vision, values, and strategy. It assesses the organization's ability to cultivate an environment conducive to innovation, continuous development, and excellence while nurturing leaders capable of inspiring teams to achieve organizational goals. Organizational culture covers a unique set of beliefs and traditions that shape interactions within the organization and with external stakeholders over time. An inseparable part of strategic transformation, Criterion 2 provides a framework to enhance organizational culture and leadership, both essential for successful strategic transformations. Committed leadership, incorporating sustainability into decision-making processes, ensures the organization's resilience and long life. By integrating sustainability concepts into corporate culture and leadership practices, organizations can achieve long-term profitability while mitigating adverse environmental and societal impacts. This criterion highlights the importance of balancing core values with cultural transformations to meet evolving ESG criteria.

Criterion 3: Engaging Stakeholders. Criterion 3 evaluates an organization's capacity to comprehend and effectively communicate with its stakeholders, fostering credibility and trust. Organizations enhance their transformation and sustainability processes by recognizing the significance of critical stakeholders and integrating their perspectives into decision-making. For enduring strategic change, organizations must consider stakeholders' economic interests and long-term influence. Engaging stakeholders entails soliciting their involvement in decisions aligned with their interests. By involving stakeholders in sustainability discussions, organizations can ensure that decisions reflect the long-term interests of all stakeholders, including environmental and societal concerns. Stakeholder engagement, as suggested by the OR model, demonstrates sensitivity to societal pressures, emphasizing the need to secure ongoing support. The academic viewpoint stresses adapting engagement strategies to maintain stakeholder trust and meet the social obligations embedded within ESG goals. This may necessitate adjusting engagement efforts to enhance transparency and accountability.

Criterion 4: Creating Sustainable Value. Criterion 4 evaluates an organization's capability to generate value for stakeholders while considering immediate and long-term perspectives. Sustainable solutions are imperative to preserving an organization's performance, managing operations and profitability, and mitigating adverse environmental and societal impacts. Sustainable value creation is crucial for lasting success and financial health, and it promotes economic, social, and environmental benefits for the organization and its stakeholders. By integrating sustainability into value-creation attempts, organizations ensure long-term success while mitigating adverse environmental and societal effects. Organizations must innovate continuously to ensure that products and services contribute to environmental sustainability while meeting customer needs and expectations.

Criterion 5: Driving Performance & Transformation. Criterion 5 assesses how effectively an organization manages and implements change and utilizes resources to improve performance and achieve strategic goals. For example, suppose an organization seeks to enhance its long-term sustainability and drive performance. In that case, it must manage its operations and profitability over time while minimizing adverse environmental and societal effects. Moreover, organizations must change how they use innovation, technology, knowledge, and resources, focusing on sustainability. Implementing organizational changes to enhance performance and achieve goals is crucial for driving performance and transformation. By incorporating sustainability issues into their efforts to promote performance and transformation, organizations may ensure long-term success while mitigating adverse environmental and societal consequences. This flexible and adaptable strategic approach allows organizations to capitalize on emerging technologies and sustain a competitive advantage.

Criterion 6: Stakeholder Perceptions. Criterion 6 focuses on the stakeholders. Organizational success, resulting from considering feedback from key stakeholders, is essential to transformation. Additionally, if an organization is perceived to disregard stakeholders' demands and concerns or to engage in behaviours harmful to society or the environment, it may face negative perceptions and consequences. This highlights the importance of regular stakeholder engagement, robust communication, and a willingness to address changing requirements and priorities. Adapting to changes in this area is crucial for maintaining a positive ESG and aligning with stakeholder values.

Criterion 7: Strategic & Operational Performance. Criterion 7 evaluates an organization's overall performance, considering financial and non-financial data and its competitiveness compared to peers and industry benchmarks. Prioritizing sustainability in operations and decision-making offers various benefits, including improved financial performance, customer satisfaction, reputation, and brand value.

Incorporating sustainability into strategic and operational decision-making can enhance performance in multiple ways. A strategic focus on operational efficiency and effectiveness contributes to improved ESG performance and long-term sustainability and resilience.

Methodology

This research attempts to refine the methodological completeness of investigating the impact of EFQM Model criteria on ESG outcomes within transformation domains. A combined approach integrating a linear programming model with organizational management theories is adopted to accomplish this. The methodology progresses through structured phases, smoothly combining quantitative assessments with strategic management insights to clarify the critical role of EFQM Model criteria in enhancing ESG effectiveness.

Modelling

The developed mathematical model is a Binary Linear Programming (BLP) formulation, a specialized subset of Linear Programming (LP) using binary decision variables (0 or 1). The mathematical model implements the EFQM Model by incorporating a set of 25 sub-criteria mapped under seven main criteria. These are associated with different transformation domains: Environment, Technology, Size, and Strategy. The model's objective function seeks to minimize the ESG risk score while ensuring that the chosen criteria meet specified maturity levels (62 points out of 125 points) across the transformation domains. This adaptation process allows the EFQM Model to be

precisely tuned to match the organization's distinct growth objectives and strategic priorities, facilitating a tailored approach to achieving transformational success.

Data Collection

The sample comprises 50 participants. We used a convenience sampling technique and gathered data through questionnaires. All participants volunteered without specific requirements. The study was conducted for academic purposes and aimed to provide insights about the model, without drawing any official conclusions. Initially, the EFQM Model's seven criteria are divided into 25 sub-criteria. These sub-criteria are evaluated across four transformation domains, capturing the multifaceted core of organizational transformation. Employing a Likert scale that spans from 1 to 5, with 1 indicating "Very Low Contribution," 2 meaning "Low Contribution," 3 interpreted as "Moderate Contribution," 4 signifying "High Contribution," and 5 expressing "Very High Contribution" for assessment purposes, participants render judgments on the relative significance of each sub-criterion within the transformative ambit. Through a survey administered to 50 participants, diverse insights are aggregated, reflecting a collective evaluation of the impact of these sub-criteria on transformation efforts. In this survey, participants were asked to evaluate each sub-criterion within the framework of four different transformation domains—environment, technology, size, and strategy—and ESG risk scores using the Likert scale.

Data Synthesis

Before optimization, values obtained from surveys are subjected to statistical operations, where means and standard deviations are calculated using two matrices. Subsequently, the collected data are synthesized into a carefully structured linear optimization model aligned with principles from operations research (OR). This model, formulated by incorporating the two matrices, aims to minimize the ESG risk associated with the EFQM Model criteria while following transformational constraints by contingency theory principles. The ESG risk score is calculated using the environmental, social, and governance impact average. This model establishes a quantitative foundation for identifying the EFQM Model criteria and sub-criteria that are critically important for minimizing ESG risk within the scope of transformation.

Matrix Development

A set of 25 sub-criteria separated from the EFQM Model criteria was utilized, creating two matrices. The first matrix assesses 25 sub-criteria for ESG risks, while the second incorporates them alongside four transformation domains of Contingency Theory. The hypothesis investigated in this study, rooted in the principles of linear programming and guided by contingency theory, offers a new perspective for organizations. The methodology holds practical significance, guiding organizations in understanding the importance of the EFQM Model for sustainable and socially responsible transformation initiatives.

- Hypothesis**:** Strategic adoption of the EFQM Model, aligned with contingency theory, can feasibly enhance organizational transformation outcomes beyond average maturity levels and minimize ESG risks.

The hypothesis was tested through empirical examination using OR methodology. This involved outlining a Feasible Solution Area, with subsequent explorations to clarify optimal solution directions. This analytical effort will transition into conducting sensitivity analyses after constructing a mathematical framework. These analyses serve as a critical mechanism for examining the resilience and adaptability of the model. Additionally, sensitivity analysis identifies critical factors exerting significant influence

on the outcome, thereby facilitating an assessment of the model's responsiveness to alterations in these variables. In summary, this study is designed to contribute through a detailed examination facilitated by OR-oriented analysis and sensitivity tests to validate the hypothesis regarding the effectiveness of the proposed organizational strategy or process. Enriching academic discourse and practical application by modelling and defining parameters, this study focuses on ESG risks in combination with the EFQM Model.

Parameters and Operational Research Structure

The developed model uses 25 sub-criteria to cover the seven criteria outlined in the EFQM Model. The tables created with the systematic parameters integrated into the operations research model include parameters related to transformation areas and parameters derived from EFQM Model criteria sub-criteria. Transformation domains are shown in Tables 1 and 2.

Table 1
Sub and main criteria of EFQM (EFQM, 2019)

EFQM Criterion	(i)	Description
1.1	1	Define Purpose & Vision
1.2	2	Identify & Understand Stakeholders' Needs
1.3	3	Understand the Ecosystem, own Capabilities, Major Challenges
1.4	4	Develop Strategy
1.5	5	Design and implement a Governance & Performance Management System
2.1	6	Steer the Organisation's Culture and nurture Values
2.2	7	Create the Conditions for Realising Change
2.3	8	Enable Creativity & Innovation
2.4	9	Unite Behind & Engage in Purpose, Vision & Strategy
3.1	10	Customers: Build Sustainable Relationships
3.2	11	People: Attract, Engage, Develop, Retain
3.3	12	Business & Governing Stakeholders – Secure & Sustain Ongoing Support
3.4	13	Society: Contribute to Development, Well-Being, Prosperity
3.5	14	Partners & Suppliers: Build Relationships & Ensure Support for Creating Sustainable Value
4.1	15	Design the Value & How it is Created
4.2	16	Communicate & Sell the Value
4.3	17	Deliver the Value
4.4	18	Define and Implement the Overall Experience
5.1	19	Drive Performance & Manage Risk
5.2	20	Transform the Organisation for the Future
5.3	21	Drive Innovation & Utilise Technology
5.4	22	Leverage Data, Information & Knowledge
5.5	23	Manage Assets & Resources
6	24	Stakeholder Perceptions
7	25	Strategic & Operational Performance

Note: For comprehensive details, it is recommended that you access the latest and full version of the EFQM Model. This approach applies equally to Tables 3 and 4.
Source: Authors' work

Table 2
Transformation Domains with Respect to Contingency Theory (Woodward, 1965)

Transformation Domain (j)	Description
1	Environment
2	Technology
3	Size
4	Strategy

Note: This article suggests examining transformation through these domains, drawing inspiration from the referenced source.
Source: Authors' work

There are 25 sub-criteria of the OR Model derived from 7 main criteria of the EFQM Model. The first main criterion is examined under five sub-criteria, the second main criterion is examined under four sub-criteria, the third main heading is examined under five sub-criteria, the fourth main criterion is examined under four subheadings, and the fifth main criterion is examined under five sub-criteria. The sixth and seventh main criteria do not have sub-criteria.

There are four domain ranges:

- **I:** Number of EFQM Model Criteria, $\boldsymbol{I} \in \boldsymbol{Z}^{+}$ (I:1…25) (1)
- **J:** Number of Transformation Domain, $\boldsymbol{J} \in \boldsymbol{Z}^{+}$ (J:1…4) (2)
- **P:** Impact Factor Scale, $\boldsymbol{P} \in \boldsymbol{Z}\ [\mathbf{1}-\mathbf{5}]$ (3)
- **D**: Average Set of ESG Scores of EFQM Model Criteria, $\boldsymbol{D} \in \boldsymbol{R}^{+}$ (4)

Parameters:

- $\mathbf{p_{ij}}$: Impact Factor Matrix, $\mathbf{p_{ij}} \in$ P, $\mathbf{p_{ij}} = \{\mathbf{1,2,3,4,5}\}$ ≤ i ≤ I, 1 ≤ j ≤ J (5)
- $\mathbf{d_i}$: Average ((E,S,G)) risk score of EFQM Model Criterion number i, $\mathbf{d_i} \in$ D, $\mathbf{d_i} \geq 0$, 1 ≤ i ≤ I (6)
- **M:** Maturity Level of EFQM Model (Average transformation success assumed as 62,00. Max Score is 125,00 in this OR Model. $125 \geq \boldsymbol{M}$) (7)

Decision Variables:

- $\boldsymbol{X_i}$: Whether EFQM Model Sub-Criterion number i is selected or not, $\boldsymbol{X_i} = \{\mathbf{0,1}\}$ (8)

Subject to:

- Constraint Set: $\sum_i \boldsymbol{p_{ij}} * \boldsymbol{X_i} \geq \boldsymbol{M}$ i ∈ I, j: ∀ ∈ J (9)

  Treatment rate applied for each Transformation Domain, there are 4 constraints related with decided Maturity Level of EFQM Model: constraint c1 for j=1, constraint c2 for j=2, constraint c3 for j=3, constraint c4 for j=4

Objective Function:

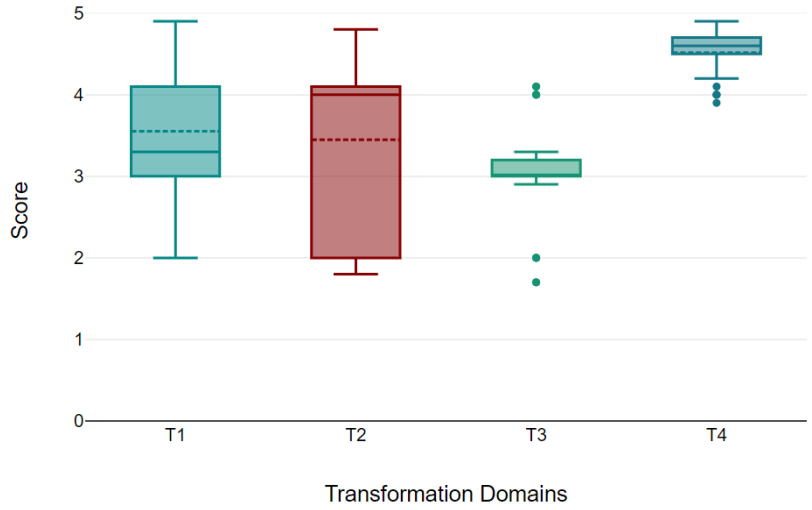
- Z: min $\{\sum_i (\boldsymbol{X_i} * \boldsymbol{d_i})\}$ (10)

  Minimize the ESG risk score while selecting EFQM Model sub-criterion that address the maturity level requirements of transformation domains.

Results

In this study, the OR model uses descriptive statistics from surveys completed by 50 participants with experience in EFQM Model analysis. These surveys were conducted using a 1-5 Likert scale, resulting in a scoring matrix (p_ij); Subsequently, a master score matrix was derived by averaging the scores. Additionally, standard deviations and mean scores for each main category in the innovation transformation domain were calculated as detailed in Tables 3 and 4. Also, as shown in Figure 1, the boxplot displays survey scores across four defined transformation domains: Environment (T1), Technology (T2), Size (T3), and Strategy (T4). The Environment and Technology domains show a wider dispersion of scores, with higher median values, suggesting significant variance in perceptions or impacts related to these areas. The domains for Size and Strategy reveal more concentrated score distributions with lower medians, indicating a more uniform response among participants.

Figure 1
Box plot of transformation domains



Source: Authors' work

Table 3
Means of each main creation transformation domain score

	Transformation domains			
Criterions	**Environment**	**Technology**	**Size**	**Strategy**
Purpose, Vision & Strategy	4,16	3,00	2.80	4,57
Organisational Culture & Leadership	2,75	3,18	3,00	4,45
Engaging Stakeholders	3,92	2,60	3,03	4,12
Creating Sustainable Value	3,20	4,28	2,45	4,65
Driving Performance & Transformation	3,14	4,46	3,44	4,82
Stakeholder Perceptions	4,10	2,00	3,00	4,10
Strategic & Operational Performance	4,70	4,10	4,10	4,90

Source: Authors' work

Table 4
Standard Deviation of each main criterion transformation domain score

	Transformation domain			
Criterions	**Environment**	**Technology**	**Size**	**Strategy**
Purpose, Vision & Strategy	1,13	1,40	1,35	0,74
Organisational Culture & Leadership	1,28	1,56	1,42	0,85
Engaging Stakeholders	1,06	1,17	1,37	0,94
Creating Sustainable Value	0,95	0,81	1,12	0,61
Driving Performance & Transformation	1,08	0,67	0,92	0,38
Stakeholder Perceptions	0,70	1,00	0,78	0,70
Strategic & Operational Performance	0,46	0,70	0,70	0,30

Source: Authors' work

This OR problem was solved using 25 binary decision variables (formula 8) and IBM ILOG CPLEX Optimization Studio. The primary purpose of the model is to minimize (formula 10) the ESG risk score (formula 4 and formula 6) while selecting an EFQM Model Criterion (formula 1) that can treat the maturity level requirements (formula 7 and formula 9) of transformation domains (formula 2) with impact factors (formula 3 and formula 5). This ability allows problem decision-makers to provide minimum ESG risk with an optimal solution set.

As a result of the solution process, the model was solved in 2,14 seconds, and an objective function result of 73,70 was obtained. The proposed model appears to reach an optimum solution under given constraints. Decision variables and their values are given in Table 5. It turns out that the mentioned decision variables have a critical role in covering the criteria processes and covering them at low risk. The mathematical model incorporates binary decision variables (Xi), including EFQM Model sub-criteria. The coefficients of these variables (di) relate directly to the ESG risk scores associated with each criterion.

Table 5
Output of Model: Decision Variables

i	Output Value
1	0
2	1
3	1
4	1
5	0
6	1
7	1
8	1
9	0
10	1
11	1
12	1
13	0
14	1

15	1
16	0
17	1
18	0
19	1
20	1
21	1
22	1
23	1
24	1
25	1

Note: (index ϵ {1..25})
Source: Authors' work

After assigning the value of 1 to the decision variables, an optimal solution, namely a feasible solution, was realized. The hypothesis was not rejected. In the next step, a sensitivity analysis will be conducted.

Sensitivity Analysis

Sensitivity analysis provides insights to decision-makers about the importance of transformational domains such as Environment, Technology, Size, and Strategy. In sensitivity analysis, the term "Dual Price" (Shadow Price) reports how a unit change in a constraint's right-hand side effects the objective function's optimum value. "Lower Bound" and "Upper Bound" values denote the maximum amount by which a constraint's right-hand side value can be decreased or increased, showing the flexibility of the constraint on the model's solution. The sensitivity analysis outputs after solving the OR problem are shown in Table 6.

Table 6
Sensitivity Analysis of Right-Hand Side

Transformation Domain Name	Constraint Name	Dual Price	Lower Bound	Current Value	Upper Bound
Environment	c1	0	-∞	62	67
Technology	c2	0	-∞	62	69
Size	c3	1,44	62	62	65
Strategy	c4	0	-∞	62	90

Source: Authors' work

In the context of the model, constraints of transformation domains are measured not only by their singular performance but also by their contribution to the organization's transformation across the four domains: Environment, Technology, Size, and Strategy.

- *Environment (c1):* Criterion "Understand the Ecosystem, own Capabilities & Major Challenges" reflects an organization's environmental awareness. The model's output, showing a non-restrictive boundary for environmental transformation, suggests an opportunity for the organization to scale environmental efforts, potentially expanding into greener operations without adversely impacting the maturity level constraints. The sensitivity analysis reported that the current state of the environmental domain is not under immediate pressure (Dual Price is 0), suggesting there may be capacity for the organization to increase its environmental initiatives or adjust its approach without significantly affecting the model's output.
- *Technology (c2):* The sub-criterion "Enable Creativity & Innovation" and "Drive

Innovation & Utilise Technology" highlight the importance of technological agility in reducing ESG risk. The sensitivity analysis suggests that technological advances could be leveraged more aggressively to improve operational efficiency and ESG scoring, highlighting an area of potential strategic investment. The model's sensitivity analysis, indicating no immediate cost pressure within the technological domain, suggests a strategic flexibility where technological advancements can be pursued more aggressively to enhance ESG performance without exceeding the model's upper limits.

- *Size (c3):* The "Manage Assets & Resources" criterion is critical for size considerations. Given the tight constraint and direct ESG impact, as evidenced by a significant dual price, strategic decisions regarding expansion or downsizing should be carefully evaluated. The size directly correlates with operational footprints and governance structures, impacting both social and environmental aspects of ESG. Regarding changes in the c3 constraint, its non-zero Dual Price indicates its importance to the model's solution. The sensitivity analysis reveals this domain as a tight constraint with an optimistic Dual Price, suggesting that any organizational size changes will likely significantly impact the ESG risk score. This implies that strategic growth or downsizing must be managed precisely to ensure alignment with the desired EFQM Model maturity level without escalating ESG risks.
- *Strategy (c4):* Core strategic criteria such as "Define Purpose & Vision" set the foundational direction for the organization's ESG goals. With strategic flexibility reported by the sensitivity analysis, there is room for aligning the strategic EFQM Model criteria more closely with ESG goals without encountering constraints, suggesting a strategic opportunity to strengthen ESG performance. Given the lack of immediate cost pressure in the sensitivity analysis, there is an opportunity to refine the strategic objectives further, optimize the allocation of resources, and enhance stakeholder engagement (as reflected in sub-criterion such as "Identify & Understand Stakeholders Needs") without negatively impacting the model's constraints. The broad upper bound suggests flexibility and potential for strategic initiatives to enhance the ESG profile.

Changes in the maturity level expectations were examined to determine the constraints of each transformation domain. OR Model sensitivity analysis for constraints has been performed, and the data are shown in Table 6. Any change in the c3 constraint can directly affect the model's optimal solution. Whether or nonbinding of this constraint could lead directly to changes in the value of the objective function. The sensitivity analysis assesses the model's resilience against various scenarios and uncertainties, identifies critical constraints and inputs, and pinpoints opportunities for further model improvement. This analysis provides decision-makers with valuable insights into how sensitive the model's outputs are to changes in specific inputs, facilitating more informed decision-making. Transformation Domain 3 (Size) is very tight and impacts ESG risk directly; therefore, organizations trying to achieve the EFQM Model have to care about their changes in size. Changes in the coefficients of decision variables that significantly affect the objective function were analyzed. The examination showed how the model responds to adjustments in its parameters, and these findings are presented in Table 7.

Table 7
Sensitivity Analysis of Coefficients

Variable Constraints	Output Value	Reduced Cost	Lower Bound	Current Value	Upper Bound
d_1	0	**0**	2,89	4,33	+∞
d_2	1	**0**	-∞	4	4,33
d_3	1	**0**	-∞	4	4,33
d_4	1	**0**	-∞	4	4,33
d_5	0	**0**	4	4,33	5,5
d_6	1	**0**	-∞	3,67	5,78
d_7	1	**0**	-∞	3,67	4,33
d_8	1	**0**	-∞	4	4,33
d_9	0	**0**	2,89	3,67	+∞
d_{10}	1	**0**	-∞	3,67	4,33
d_{11}	1	**0**	-∞	3,67	5,78
d_{12}	1	**0**	-∞	3,67	4,33
d_{13}	0	**0**	2,89	4	+∞
d_{14}	1	**0**	-∞	4	4,33
d_{15}	1	**0**	-∞	3,67	4,33
d_{16}	0	**0**	2,89	3,67	+∞
d_{17}	1	**0**	-∞	3,67	4,33
d_{18}	0	**0**	2,89	3,67	+∞
d_{19}	1	**0**	-∞	4	5,78
d_{20}	1	**0**	-∞	4	4,33
d_{21}	1	**0**	-∞	4	4,33
d_{22}	1	**0**	-∞	4	4,33
d_{23}	1	**0**	-∞	4	5,78
d_{24}	1	**0**	-∞	4	4,33
d_{25}	1	**0**	-∞	4	5,78

Source: Authors' work

Understanding how changes in units of the decision variable coefficients the objective function highlights the importance of risk reduction. For example, the reduced cost value for the d1 (defining purpose and vision) coefficient is 0, indicating that the impact of d1 on the objective function in the current solution is already optimal. However, the "Current" value of d1 is 4,33, the "Lower Bound" value can decrease to 2,89, and the "Upper Bound" value can theoretically increase indefinitely. This means that reducing the value of the d1 coefficient within a specific range will not significantly affect the objective function, but increasing it can provide infinite benefits.

In contrast, the reduced cost value for the d2 (identifying and understanding stakeholders' needs) coefficient is also 0. However, this variable's "Lower Bound" value indicates an infinite decrease, meaning that, theoretically, reducing its value will not disturb the model's optimality. Since the "Current" value is 4,00 and the "Upper Bound" value is 4,33, the potential for increasing d2 is limited. This shows that small increases in the current value of d2 will have a limited effect on the objective function.

Such analyses help understand the impact of each decision variable on the model for making improvements while maintaining the delicate balance of the model. For instance, the "Current" value for the d5 coefficient can be increased from 4,33 to 5,50. This indicates that increasing d5 could enhance the model's performance.

The model outputs emphasize specific EFQM Model criteria, with high coefficient

values signaling their critical importance to the organization's ESG strategy. For example, criteria related to "Develop Strategy" and "Manage Assets & Resources" are highlighted as areas of significant influence on the organization's ESG outcomes. Conducting sensitivity analyses on both the coefficients of the objective function and the values of the constraints' right-hand side (RHS) contributes to refining this strategic perspective. They highlight the flexibility and constraints within the organizational strategy concerning ESG risk management. For instance, the sensitivity regarding the Size domain indicates a direct and substantial impact on ESG risk, underscoring the strategic importance of organizational scalability and structural adaptability. This strategic alignment is crucial for guiding the complexities of ESG risk management.

Prioritizing specific EFQM Model criteria strategically highlights the organization's reliance on external resources while proposing positive strategies to impact the environment. Incorporating perspectives from governance and strategic management literature, the analysis recognizes the complementary nature of these disciplines in achieving organizational objectives. The model's outputs, endorsing clear accountability and value creation through strategic EFQM Model criteria deployment, reflect a governance model emphasizing strategic adaptability and comprehensive monitoring to achieve ESG objectives.

Sensitivity analysis provides a detailed assessment of how each decision variable influences the model's capacity to adjust to different parameter variations. This examination is critically important for enhancing the model's performance and developing optimization strategies to achieve the maturity of the EFQM Model with minimum ESG risk. Analyzing each decision variable presents potential opportunities for further model improvement and facilitates strategic decision-making. Integrating the OR model's data-centric insights with established academic theories offers an understanding of strategic management in the context of ESG considerations. This analysis highlights the significance of strategic transformation in managing ESG risks and leveraging the EFQM MThis study's hypothesistion success, illustrating the contribution of integrating OR model insights with academic theories toward understanding strategic management within the ESG framework.

ESG considerations influence and shape strategic evolution. Organizations must balance deliberate strategic planning with the capacity for emergent strategy realization. This balance is key to fostering an organizational culture that is adaptable, resilient, and aligned with the principles of effective governance and strategic management, thereby achieving sustainable transformation and excellence in alignment with the EFQM Model.

In conclusion, integrating sensitivity results from the OR model with academic research provides a deeper understanding of the strategic importance of EFQM Model criteria within the ESG framework. Organizations must consider the sensitivity of these criteria to external pressures and internal capabilities, adapting strategies and operations to create a sustainable competitive advantage while meeting ESG requirements. This approach aligns the effectiveness of transformation with strategic management theories, ensuring a resilient response.

Discussion

The OR model reveals the EFQM's potential impact on an organization's strategic transformation with considerations for Environmental, Social, and Governance (ESG) risks. High coefficients on variables such as d4 (Develop Strategy) and d23 (Manage Assets & Resources) highlight a significant alignment with strategic and

governance aspects. The sensitivity analysis outcomes indicate each domain's degrees of influence and constraint. The dual price for the Size constraint (c3) suggests a brittle sensitivity, where organizational scale and structure adaptations require careful management to mitigate ESG risks. The sensitivity analysis provides dual prices for each constraint, giving insight into the marginal value or cost of relaxing or tightening each constraint. A non-zero dual price, as observed for the Size constraint (c3), is particularly revealing. It indicates that relaxing the constraint by one unit will increase the objective function value by the dual price amount, signaling the tightness of this constraint. This suggests that, within the operational framework, changes to the Size domain directly influence ESG risk, aligning with the EFQM Model criterion related to managing assets and resources (d23).

Given the model's constraints, the optimized selection of these variables aims to minimize the ESG risk score while satisfying maturity level requirements across the transformation domains. Also, the variables with the highest coefficients, which were selected (set to 1), can be considered areas of significant ESG impact and strategic focus. Variables such as d1 (Define Purpose & Vision), d2 (Identify & Understand Stakeholder Needs), d4 (Develop Strategy), and others with current values indicating high relevance (e.g., 4,33 and 4,00) suggest a strong alignment with the organization's ESG strategic requirements.

Conclusion

In concluding this study, which was conducted using an academic approach and the OR model, it is apparent that the EFQM Model is instrumental in steering strategic transformations toward ESG risk reduction within the contingency theory transformation domains.

The conditions of today's competitive landscape necessitate a paradigm shift in strategic thinking to support adaptability within the constraints of limited resources. Organizations need such frameworks to apply theory to practice in the transformation process.

The findings of this study align with existing literature, highlighting the EFQM Model's significant role in strategic transformation and ESG risk management. This study, similar to prior research, supports the EFQM Model's compatibility with various strategic management theories and broad applicability. For example, Escrig and Menezes (2016) emphasize the influence of organizational size on the effectiveness of the EFQM Model, a conclusion also supported by this study. Furthermore, this study also reveals the critical role of ESG factors in decision-making, similar to the approach demonstrated by Dorfleitner et al. (2015) and Cornell (2020), demonstrating how the EFQM Model can mitigate ESG risks while achieving strategic transformation goals.

As detailed in the study, the strategic transformation processes are influenced significantly by integrating the EFQM Model's seven main criteria with the ESG dimensions. The OR model's sensitivity analysis has highlighted the details of this transformation, showing how important each EFQM Model criterion is from a contingency theory perspective. This study finds that the EFQM Model could be beneficial in this change, providing a strong framework that supports organizations in succeeding. The model has the potential to provide a pathway for embedding sustainable practices across all organizational operations, thus aligning with the evolving societal values and expectations.

The insights from the OR model confirm that the EFQM Model fosters excellence by encouraging continuous improvement, innovation, and stakeholder engagement. These findings support the hypothesis that implementing strategies to

enhance ESG performance positively contributes to sustainable strategic transformation.

Therefore, in line with the theories and models discussed throughout the study, the EFQM Model transcends its role as a mere instrument for evaluating quality management. Instead, it emerges as a strategic resource that supports an organization's pursuit of excellence by harmonizing operational performance with sustainable principles and strategic goals. This alignment is critical for organizations seeking to create long-term value and ensure resilience in the face of change.

Exploring the EFQM Model criteria through the perspective of an OR model, particularly when integrated with the strategic requirements of ESG considerations across the four transformation domains—Environment, Technology, Size, and Strategy—provides profound insights into the approach organizations can adopt towards strategic transformation. While the specific results of the OR model are not delineated here, a conceptual interpretation suggests that organizations demonstrating strength in criteria such as "Purpose, Vision & Strategy" and "Organizational Culture & Leadership" are likely well-equipped to manage the complexities of the environment, characterized by its emphasis on sustainability and ethical governance. According to the modeling, the hypothesis was not rejected, and the EFQM Model's contribution to transformation was deemed feasible. In the analyses of the optimal solution, "Size" was identified as the most significant domain of transformation. Sensitivity analyses within these domains highlight the critical nature of adaptability and strategic foresight in resource allocation and stakeholder engagement, highlighting areas of vulnerability and opportunity alike.

The hypothesis of this study supports the effectiveness of the EFQM Model in guiding organizations toward strategic transformations while minimizing ESG risks. Future work can focus on the model's competency across diverse organizations through case studies in various transformation domains, such as culture and digitalization, drawing on theories like resource dependency, organizational ecology, and organizational networks. The Contingency Theory perspective of this study could serve as a milestone for subsequent research endeavors.

The limitations of this study are primarily associated with its convenience sample size of 50 participants, which limits the generalizability of the findings, and its focus on specific transformation domains that may not fully capture emerging trends in organizational transformations. Future research should aim to expand the sample size and include a diverse array of expert participants from various industries to enhance the robustness and applicability of the results. Additionally, it would be advantageous to extend the research scope to encompass new domains such as technology leadership and sustainable performance improvement, which are increasingly critical in today's rapidly changing technological and environmental contexts. Furthermore, future studies could benefit from researching to evaluate the long-term effects of the EFQM Model, particularly its 2025 version launched at the EFQM Forum 2024 in Istanbul. Incorporating stochastic OR methods could also provide more nuanced insights into the model's adaptability and effectiveness under varying conditions and uncertainties.

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About the authors

Yiğit Çağlar specializes in risk, quality, project, and strategic management, bringing nearly a decade of professional experience. He has managed multinational volunteer projects and worked at leading global companies. He has established units and teams aligned with organizational needs within his areas of specialization and continues to contribute to one of Türkiye's foremost defense industry companies. Yiğit holds a bachelor's degree in industrial engineering, complemented by master's degrees in Business Administration (MBA), Industrial Engineering (MSc), and ETRA (MSc). He also holds internationally recognized certifications, including SAFe SPC®, PMP®, CRMP®, COSO®, AS/ISO QMS®, and EFQM®. Additionally, he serves as a referee for academic organizations such as AOM. Currently, he is pursuing a PhD in Business Administration at Başkent University with a full scholarship. The author can be contacted at **yigit.caglar@yahoo.com**

Prof. Dr. Mehmet Abdülkadir Varoğlu holds various managerial positions at Başkent University and within its Business Administration Program and has a PhD in Management and Organization from Ankara University. Since beginning his journey in the field of Business Administration with an undergraduate degree from the Military Academy in 1979, followed by a master's degree in business administration from Middle East Technical University in 1985, he has made significant contributions to the discipline. He is credited with authoring or contributing to at least 27 books, publishing 20 articles, and presenting in 52 conference proceedings. The author can be contacted at **kvaroglu@baskent.edu.tr**