

Exploring Interconnections of Digital Marketing Risks: A Causal Modeling Approach

Ioana-Alexandra DINU

National University of Science and Technology Politehnica Bucharest, Bucharest, Romania

ORCID ID: 0009-0004-1596-079X

e-mail address: dinuioanalexandra99@gmail.com

Roxana-Mariana NECHITA*

*National Institute of Research and Development in Mechatronics and Measurement Technique,
Bucharest, Romania*

National University of Science and Technology Politehnica Bucharest, Bucharest, Romania

ORCID ID: 0009-0004-7556-5572

**Corresponding author, e-mail address: roxana.nechita2000@gmail.com*

Iuliana GRECU

National University of Science and Technology Politehnica Bucharest, Bucharest, Romania

Best Paint Distribution SRL, Bucharest, Romania

ORCID ID: 0000-0001-5440-9520

e-mail address: iuliana.grecu@upb.ro

Dana-Corina DESELNICU

National University of Science and Technology Politehnica Bucharest, Bucharest, Romania

ORCID ID: 0000-0002-9682-2572

e-mail address: dana.deselnicu@upb.ro

Abstract. *This paper, as a continuation of previous work on risk management in digital marketing, presents a detailed methodology for analyzing the interdependencies among identified digital marketing risks. Building upon a prior risk identification and assessment framework, this study proposes the application of the Decision-Making Trial and Evaluation Laboratory method to uncover the complex causal relationships and influence dynamics between these risks. By focusing on the interconnected nature of risks such as non-competitive products, missing data, falling behind competition, loss of digital visibility, cybersecurity compromised, fall in sales, customer migration, brand image damage, brand image enhancement, and investing to generate sales, this research aims to provide a structured approach to understanding their systemic interactions. The methodology outlined herein will guide future data collection from marketing experts, facilitating a comprehensive analysis that can inform more effective and proactive risk mitigation strategies in the dynamic digital marketing landscape.*

Keywords: risk management, digital marketing, interconnected risks, DEMATEL, causal relationships, mitigation strategies.

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Introduction

In the contemporary business environment, characterized by rapid technological advancements (Febrian et al., 2024) and evolving consumer behaviors, digital marketing has become an indispensable strategic tool for organizations (Istocescu, 2022). However, this dynamic landscape also exposes marketing departments to a multitude of inherent risks. Effective risk management, encompassing identification, analysis, assessment, and the development of response strategies, is crucial for achieving organizational objectives and maintaining competitiveness.

Previous research (Grecu et al., 2024) has successfully identified and cataloged specific risks in digital marketing, assessing them using methods such as the risk index and risk matrix, which measure probability of occurrence and potential impact. While these methods provide valuable insights into individual risk profiles, they often fall short in capturing the intricate web of interdependencies that exist among various risks. In reality, risks rarely occur in isolation; the manifestation of one risk can often influence or trigger others, leading to cascading effects that can amplify their overall impact on an organization. Understanding these causal relationships and the extent of their influence is paramount for developing holistic and truly effective risk mitigation strategies.

To address this critical gap, this study proposes the application of the Decision-Making Trial and Evaluation Laboratory (DEMATEL) method. DEMATEL is a robust multi-attribute decision-making (MADM) tool specifically designed to model causal relationships and quantify the paths of influence between variables within a complex system. Developed by the Battelle Geneva Foundation, it enables researchers to identify the most influential causal factors and dependent variables by constructing a structured map of interactions. This methodology has been widely applied in various fields to examine sustainability and transformation-related challenges, demonstrating its ability to model causal relationships and quantify the influence of system variables, especially in nonlinear systems with feedback loops.

The primary objective of this research is to apply the DEMATEL method to model the structural interdependencies among the critical risks identified in digital marketing. By distinguishing between influential (causal) and receptive (effect) risks, this study aims to provide a prioritization framework that supports strategic planning processes and enables targeted interventions based on systemic levers.

Theoretical Framework

The digital marketing landscape is inherently dynamic and complex. It is characterised by rapid technological evolution, changing consumer behaviour and intense competition. Within this environment, organisations face myriad risks that can significantly impact their strategic objectives. These risks are not isolated entities; they are often interconnected, forming a complex web of causal relationships where the manifestation of one risk can influence or trigger others. Effective risk management in digital marketing therefore necessitates identifying and assessing individual risks, as well as understanding their interdependencies.

Previous research (Grecu et al., 2024) has established a foundational understanding of specific digital marketing risks by categorising them and assessing their individual probabilities and impacts. Building on this, this study focuses on ten critical factors — encompassing both risks and strategic actions — whose interrelationships are vital for a holistic risk management approach. These factors, as identified and outlined in prior work, are fundamental to navigating the uncertainties of the digital marketing domain.

This study examines the factors identified by Grecu et al. (2024) in their ongoing research, as detailed in Table 1.

Table 1. Identifying the specific risks of digital marketing

Symbol	Risk	Type of risk
R1	Non-competitive products	Hazard
R2	Missing data	Hazard
R3	Falling behind competition	Hazard
R4	Loss of digital visibility	Hazard
R5	Cybersecurity compromised	Hazard
R6	Fall in sales	Control
R7	Customer migration	Control
R8	Brand image damage, loss of customer trust	Hazard
R9	Brand image enhancement	Speculative
R10	Investing to generate sales	Speculative

Source: (Grecu et al., 2024)

A detailed description has been provided for each risk to ensure all study participants fully understand the factors and their relevance (Table 2).

Table 2. Identifying the specific risks of digital marketing

Symbol	Short Description	References
R1	Products/services fail to meet market demands or consumer preferences, being less appealing than competitors' offerings, quickly exposed through online reviews.	(Burtescu, 2022); (Sipińska & Sadowska, 2022); (Deselnicu et al., 2018)
R2	Inadequacies in data collection, management, or analysis, resulting in incomplete/inaccurate information about consumer behavior or campaign performance.	(Ionescu et al., 2024); (Țucă et al., 2024)
R3	Failure to keep pace with competitors' innovation, digital strategy, or market adaptation (e.g., AI technologies, new channels).	(Simion & Popescu, 2023); (Fekete, 2012)
R4	Decline in online presence and discoverability (SEO ranking, social media reach, engagement) due to ineffective strategies or algorithm changes.	(Grecu et al., 2024)
R5	Successful cyber-attacks that compromise digital assets, leading to financial losses, severe reputational damage, and marketing operation disruption.	(Rolea et al., 2024); (Burtescu, 2022)
R6	A quantifiable decline in revenue generated via digital channels, often a lagging indicator of the cumulative impact of	(Grecu et al., 2024)

	other risks (R1, R4, R7).	
R7	Existing customers shifting loyalty to a competitor due to negative online experiences, superior competitor offerings, or lack of personalization (linked to R2).	(Kanchanapoom & Chongwatpol, 2023); (Pirvu et al., 2024)
R8	Severe damage to reputation and erosion of consumer confidence, triggered by negative reviews, PR crises, privacy breaches (R5), or ethical failures.	(Shao et al., 2024)
R9	Proactive strategic effort aimed at improving brand perception and recognition (CSR, positive PR, high-quality content).	(Tahir et al., 2024)
R10	Specific financial allocations (promotional campaigns, targeted ads, launches) aimed directly at boosting sales performance.	(Lou et al., 2024)

All risk factors form a dynamic, interconnected system. Failure in one area rapidly impacts others: Cybersecurity (R5) failure leads to brand damage (R8), migration (R7), and sales decline (R6). Missing data (R2) causes non-competitive products (R1) and visibility loss (R4), which also drive R7 and R6. Falling behind (R3) links directly to R2, R1, R4, and R6. Critically, proactive strategies like investment (R10) and brand enhancement (R9) only succeed if core risks (R1-R7) are effectively managed..

Understanding these multi-directional influences is essential for effective strategic planning (Gâdoi, 2022). Traditional risk assessment methods often provide a static view (Estiri et al., 2021), focusing on individual risk scores. However, the DEMATEL method offers a dynamic approach by mapping these causal relationships, thereby distinguishing between "cause" and "effect" factors within the system. This allows decision-makers to identify the root causes of problems and the most influential levers for intervention, enabling a more targeted and efficient allocation of resources (Sun, 2021) for risk mitigation.

Methodology

This qualitative research study will use the DEMATEL methodology to analyse the interdependencies between the identified digital marketing risks. This approach relies on the expertise of professionals with extensive experience in the field, enabling in-depth insights into complex relationships to be gained. The expert panel for this study will consist of four professionals from the marketing department. These experts will be deliberately selected based on their direct managerial experience in digital marketing and their understanding of the specific risks and strategic initiatives within a research context. Their contribution will be instrumental in assessing the interactions between the critical factors involved in digital marketing risk management.

Data collection will be conducted using a structured questionnaire, presented in the form of a direct relationship matrix. Each respondent will be asked to assess the degree of direct influence between all pairs of factors (risks and actions) identified in Section 2. Given the ten factors, this will involve a total of 100 pair assessments. A five-point scale will be employed for these assessments: 0 – no influence; 1 – low influence; 2 – moderate influence; 3 – strong influence; 4 – very strong influence.

These assessments will serve as the input for the subsequent DEMATEL analysis, which will reveal the cause-and-effect relationships crucial for strategic decision-making in digital marketing risk management.

In the initial phase, an average direct-relation matrix A is constructed from the collective expert scores. This matrix quantifies the direct influence each factor exerts on another. Subsequently, this matrix A is normalized to derive the direct-relation matrix (Y), ensuring consistency for further calculations.

$$Y = A \cdot k \quad (1)$$

$$\text{Where: } A = \begin{bmatrix} 0 & a_{12} & \dots & a_{1j} & \dots & a_{1n} \\ a_{21} & 0 & \dots & a_{2j} & \dots & a_{2n} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ a_{i1} & a_{i2} & \dots & a_{ij} & \dots & a_{in} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ a_{n1} & a_{n2} & \dots & a_{nj} & \dots & 0 \end{bmatrix} \quad (2)$$

$$k = \frac{1}{\max_{1 \leq i \leq n} \left(\sum_{j=1}^n a_{ij} \right)} \quad (i, j = 1, 2, \dots, n) \quad (3)$$

Here, 'n' signifies the total number of factors under investigation (set at 10 in this study). Once the normalized direct-relation matrix (Y) is obtained, the next step involves computing the total influence matrix (T). This comprehensive matrix captures both the direct and indirect impacts that each factor has on the others within the system.

$$M_{INV} = (I - Y)^{-1} \quad (4)$$

To calculate the T matrix, the inverse of the difference between the identity matrix (I) and the normalized direct-relation matrix (Y) is first determined:

$$T = Y \cdot (I - A)^{-1} \quad (5)$$

The resulting T matrix effectively integrates both direct and indirect influences between factors, providing a comprehensive understanding of the system's interdependencies. A significance threshold (α) is then established using the subsequent formula to interpret and filter these influences.

$$\alpha = \frac{\sum_{i=1}^n \sum_{j=1}^n [t_{ij}]}{N} \quad (6)$$

Where $N = n^2$, this represents the total number of possible relationships between the factors in the matrix T .

Once the total influence matrix T is calculated, two crucial scores are then derived for each factor.

In this context, 'N' represents the total number of factors, and t_{ij} denotes an individual entry within the total influence matrix T . After calculating the total influence matrix T , two primary metrics are determined for each factor: the impact score (D_i), which measures the cumulative influence a factor exerts on all other factors, and the causality score (R_j), which reflects the total influence a factor receives from the others.

The impact score D_i for each factor is calculated as the sum of its influence on all other factors:

$$D_i = \left[\sum_{j=1}^n t_{ij} \right]_{nx1} = [t_i]_{nx1'} \quad (8)$$

Where $j \in \{1, 2, \dots, n\}$.

The causal score R_j for each factor is calculated as the sum of the influence of the factors on it:

$$R_j = \left[\sum_{i=1}^n t_{ij} \right]_{1xn} = [t_j]_{nx1'} \quad (8)$$

Where $j \in \{1, 2, \dots, n\}$.

Results

After completing the DEMATEL methodology, the normalized direct relations matrix (Table 2) and the total influence matrix (Table 3) were generated to illustrate the interdependencies among the identified digital marketing risks.

The normalized direct relations matrix quantifies the direct influence each factor exerts on another, serving as the foundational input from the expert assessments.

Subsequently, the total influence matrix, shown in Table 3, captures both the direct and indirect impacts that each factor has on the others within the system. A significance threshold (α) of 0.355 was established to interpret and filter these influences (Figure 1), with factors exhibiting significant influence highlighted.

Table 3. Total influence matrix highlighting (*) factors with significant influence ($\alpha > 0.358$)

Factor	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
R1	0.261	0.266	0.332	0.342	0.260	0.375*	0.376	0.401	0.197	0.276
R2	0.364*	0.225	0.365*	0.389*	0.267*	0.381*	0.383	0.426*	0.265*	0.297*
R3	0.423*	0.327*	0.310	0.429*	0.312*	0.452	0.441	0.473	0.314*	0.352
R4	0.380*	0.301*	0.394*	0.314	0.308*	0.407	0.445	0.462*	0.305*	0.332*
R5	0.405*	0.338*	0.391*	0.396*	0.245	0.425	0.434	0.481*	0.303	0.355
R6	0.395*	0.309*	0.374	0.393*	0.302*	0.331	0.446	0.471	0.304	0.340*
R7	0.380*	0.317	0.380	0.378	0.295	0.421	0.331	0.446	0.291	0.326
R8	0.446*	0.347*	0.411	0.438*	0.339	0.462	0.480	0.401	0.333	0.373
R9	0.314*	0.322	0.392*	0.412*	0.306	0.404	0.436	0.480	0.230	0.324
R10	0.323*	0.247*	0.360	0.366*	0.271	0.373	0.374	0.415	0.226	0.230

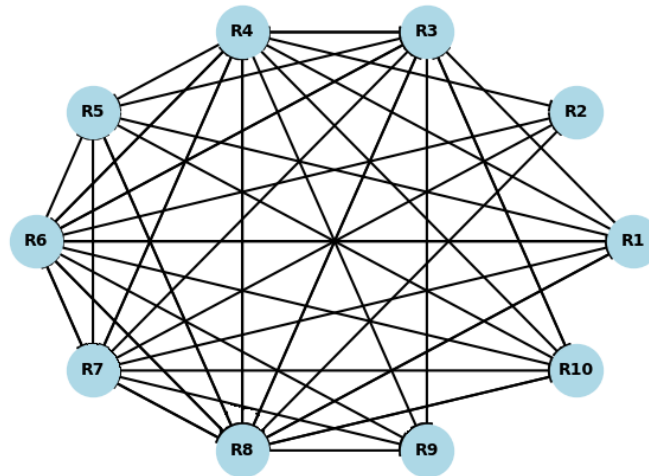


Figure 1. Directed graph of dominant factor interactions (threshold $\alpha > 0.358$)

After computing the total influence matrix (T), two essential scores are derived for each factor: the impact score (D_i), which quantifies the cumulative influence a factor exerts on others, and the causality score (R_j), which measures the total influence a factor receives. These scores, along with each factor's dominant characteristic (cause or effect), are presented in Table 4.

Table 4. Assessment of the influence and causality of factors.

Factor	D	R	D+R	D-R	Dominant characteristic
R1	2.856	4.097	6.953	-1.241	Effect
R2	3.548	3.291	6.840	0.256	Cause
R3	3.398	3.061	6.459	0.337	Cause
R4	3.770	3.383	7.153	0.387	Cause
R5	3.359	3.136	6.496	0.223	Cause
R6	3.180	3.858	7.038	-0.677	Effect
R7	2.945	2.361	5.307	0.584	Cause
R8	2.948	2.931	5.879	0.016	Cause
R9	2.837	2.941	5.778	-0.103	Effect
R10	3.193	2.975	6.168	0.217	Cause

Table 4, "Assessment of the influence and causality of factors," clearly distinguishes between "cause" and "effect" factors based on their D_i and R_j values. This assessment is crucial for identifying the root causes of problems and the most influential levers for intervention within the digital marketing risk system. For instance, factors with a positive $D - R$ value are classified as "Cause" factors, indicating they exert more influence than they receive, while those with a negative $D - R$ value are classified as "Effect" factors, meaning they are more influenced by others.

The analysis provided a structured understanding of the systemic interactions among risks (R1-R10), clearly distinguishing between influential (causal) and receptive (effect) factors. This distinction supports strategic planning by enabling targeted interventions based on the system's core levers.

Conclusion

This study applied the DEMATEL method to dynamically analyze digital marketing risks, moving beyond static risk scores to map cause-and-effect relationships. The analysis identified two distinct groups of factors. The 'causal' risks—R2, R3, R4, R5, R7, R8, and R10—are the most influential levers, exerting more influence than they receive. Notably, customer migration (R7) and loss of digital visibility (R4) are the strongest drivers, suggesting that a company's ability to retain customers and maintain its online presence are foundational to controlling the entire risk system. Conversely, the 'effect' risks—R1 (non-competitive products), R6 (fall in sales), and R9—are primarily consequences, being highly susceptible to influence from others. This distinction is crucial for strategy: decision-makers should allocate resources to the root causes (e.g., R7 and R4) rather than just treating symptoms like the sales decline (R6) or R1. While this structured approach offers significant practical implications for effective resource allocation and proactive mitigation, the limitation is the small sample size, as data was collected from only four marketing professionals, restricting the generalizability of the findings. Future research should expand the expert panel and explore quantitative modeling to enhance robustness.

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