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Model of Information Dissemination in the Context of Reputation Formation of an Auditing Company: Official Sources or "Word of Mouth"?

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Abstract. *The reputation of auditing firms is of paramount importance in ensuring trust and confidence in financial markets. This article investigates the information dissemination model and its impact on the reputation formation of auditing companies, focusing on the choice between official sources (formal channels, corporate communications, regulatory disclosures, etc.) and word-of-mouth mechanisms (informal channels, client recommendations, corporate gossip, etc.). The research reveals the complex dynamics between formal and informal information dissemination strategies (official sources provide trust and transparency, while word-of-mouth mechanisms offer detailed information and trust) and their implications for reputation management in the auditing industry. The relevance of this research problem lies in the critical role of auditing firms in supporting transparency and honesty in financial reporting, especially after corporate scandals and regulatory scrutiny. The primary aim of this research is to understand the relative effectiveness of different information dissemination models in shaping the reputation of auditing companies. The choice of research subject is justified by the significant influence of auditing firms on financial markets, corporate governance, and investor trust. Using VOSviewer 1.6.16 software, the article conducts a bibliometric analysis of English-language articles and conference abstracts indexed in the Scopus database from 2007 to 2023 (1177 publications) using the keywords "Reputation" and "Auditing Firm." The analysis confirms the increasing scholarly interest in this topic and identifies 8 thematic clusters, the largest of which combines corporate, image, and social reputation with stability and consistency. The empirical part of the research involves constructing a polygamous model similar to the SIR model, which describes the behavior of three groups of subjects depending on the presence of information and actions regarding its dissemination (active, passive, neutral). The article models the intensity of changes in the number of group members considering various phenomenological parameters (e.g., intensity of communicative processes between groups, structure of social system connections, mathematical expectation of time required for a subject to transition from one group to another, etc.). The results of this research have practical implications for auditing firms, regulatory bodies, and stakeholders in the financial sector. By understanding the relative strengths and weaknesses of different information dissemination models, auditing firms can adapt their communication strategies to effectively enhance their reputation. This research contributes to the ongoing discourse on reputation management and trust-building in financial markets.*

Keywords: corporate reputation, auditing firms, information dissemination.

JEL Classification: M100, M40, C10.

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Introduction

In the modern business environment, the reputation of an auditing firm plays a crucial role in its success and stability. Since trust is a cornerstone of effective business relations, maintaining a positive reputation is essential for auditing companies to attract clients, investors, and stakeholders. However, various factors influence reputation formation, including the dissemination of information through official channels and informal methods such as word of mouth or the so-called "grapevine."

This article explores the dynamics of information dissemination in the context of forming the reputation of auditing firms, with a particular emphasis on the contrast between official sources and informal channels. By investigating this phenomenon, we aim to shed light on the mechanisms of forming approaches to the concept of reputation in the auditing industry and provide an understanding of effective reputation management strategies.

The relevance of this research is underscored by the growing importance of reputation management in the auditing sector, where trust and reliability are paramount. As auditing firms operate in a highly competitive and regulated environment, understanding how information spreads and influences perception can serve as a valuable guide for firms seeking to enhance their reputation and maintain a competitive edge.

Despite numerous studies in the field of information management, the social interaction of agents disseminating information remains an active research focus. Considering the diversity of social systems and disseminated information is crucial in the analysis, as it can vary depending on the context. This approach forms the basis for building mathematical models that investigate the interaction of agents and the impact of information. As an example, one can point to the presence and/or intensity of opportunistic behavior by certain agents as an indicator dependent on the factors mentioned above. Therefore, the created mathematical models are largely based on generalized notions of connections between agents, their nature, and intensity, with the development of the corresponding system explored in the context of numerical indicators by which they are assessed. Approaches that have proven effective in building similar models are derived from physics, particularly from synergetics. A similar approach will be applied further within the framework of this study.

Through an analysis of the current state of the problem and a review of relevant literature, this research aims to elucidate the complexities of reputation formation in the auditing industry. By identifying the factors that shape perception and investigating the interaction between official and unofficial sources of information, we seek to contribute to a deeper understanding of reputation management practices in auditing firms.

Furthermore, this study aims to underscore the scientific and practical significance of its findings. By examining the mechanisms of reputation formation, we can offer effective recommendations to auditing firms for enhancing their reputation and strengthening client relationships. Additionally, by elucidating the role of information dissemination in reputation management, this research may serve as a foundation for broader discussions on corporate communication strategies and contribute to knowledge development in the field of business management.

Literature Review

The main scientific studies in the audit field (Moizer, 1997; Caruana and Chircop, 2000; Moizer et al., 2004) were based on the analysis of the reputation and image of audit firms, which are supported by different groups of agents. Because a positive reputation ultimately allows you to have a number of advantages that lead to an increase in the effectiveness of the company's activities. supported by different audiences. A positive reputation can lead to a number of beneficial consequences, which ultimately contribute to increasing the efficiency of the company's activities.

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In the contemporary economic context, corporate reputation, considered as an intangible asset (Martinez Leon and Olmedo Sifuentes, 2010), is a key factor for the success of organizations. Given that reputation constitutes an intangible asset and a source of competitive advantage, contributing to the development and survival of businesses (Martinez Leon and Olmedo Sifuentes, 2010), the interest of professionals and researchers in this matter has increased. This reflects the significant role that reputation plays in business management (Chun, 2005). Reputation usually consists of a skewed distribution of perceptions with a greater or lesser degree of conformity among members of an interest group, which is a consequence of the spread of information and its influence (Bromley D.B., 2000). Moreover, it has become a crucial issue in the auditing field since clients and users of these companies can be highly sensitive to reputation. In this context, companies with a more established status in the markets are generally more interested in attracting auditors with high reputations, aligning with their efforts to build and maintain their own reputation in the realm of reliable financial reporting (Barton, 2005).

Another aspect worth considering is the management style of these companies, as it reflects their corporate reputation. Therefore, analyzing the developed management style is necessary. Finally, it is essential to note that the fees received by firms depend on their reputation among consumers (Moizer, 1997), impacting their communication with clients and financial results.

It is also noteworthy that the reputation of an organization is based on the perceptions of various "collectives" of people (Bromley, 2002); essentially, it is intersubjective. Reputation can also be inertial (Fombrun and Van Riel, 1997), meaning that maintaining a good reputation can be a prudent business decision as it can help withstand future reputation shocks. At the same time, Scott and Walsh (2005) point out that reputation requires "time to create, cannot be brought and is easily damaged." Additionally, reputation depends on context; different organizations will have different reputational characteristics depending on the details of their situation (Deephouse and Carter, 2005). Thus, reputation, while intuitively appealing, is a complex organizational characteristic, influencing how it can be formally studied.

An important aspect in understanding the concept of reputation is attributed to information. Information ranks among the top 3 organizational priorities for companies (Capgemini, 2008) and is considered a strategic asset by 85 percent of respondents surveyed by Harvard Business Review Analytic Services (2010). Information is a key resource for managing business models. In the modern economy, the shift in the paradigm of production, distribution, and consumption of goods and services occurs through the influence of large volumes of data and predictive analysis (Blasé and Rao, 2013; Schweizer and Wijnberg, 1999). Organizations need to effectively systematize and control the use of information to achieve their goals (Rogalski, 2006). Information management is defined as a set of organizational, cultural, and strategic factors that enable optimizing information management processes within an organization (Dandago and Rufai, 2012). This term often overlaps with others, such as information resource management, IT management, or information policy (Choo, 2002). Information management is defined as the process of making the right decisions at the right time based on accurate information (Thieto, 2013).

The necessity of effective information management to achieve the strategic goals of an organization is recognized as an important aspect of reputation. According to Harvard Business Review Analytic Services (2010), 85% of respondents consider information a strategic asset, emphasizing its crucial role in modern business.

In the contemporary economy, the processing of large volumes of data and predictive analysis defines the shift in the paradigm of production, distribution, and consumption of goods and services. Organizations need to efficiently organize and control the use of information to achieve their strategic goals (Rogalski, 2006).

Information management, or management of information resources, encompasses a set of organizational, cultural, and strategic factors. This allows optimizing information management processes within an organization (Dandago and Rufai, 2012), defining it as the process of making the right decisions based on accurate information (Thieto, 2013).

The VOSviewer 1.6.16 software was used as a tool for bibliographic analysis.

The primary data source chosen was the Scopus database. The search for scientific literature was conducted using search strategies based on titles, abstracts, and author keywords with the keyword "reputation." A time frame of 16 years was established, considering literature published from 2007 to 2023. Only articles written

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in English were included for bibliometric analysis. Additionally, limitations were set regarding the scope of the studies (focused on publications with an economic component relevant to sustainable economic development). Consequently, with all these constraints, 1177 publications were selected for further examination.

To obtain a more comprehensive analysis, the VOSviewer 1.6.16 software was utilized for mapping and visualizing bibliometric networks of scientific publications. All data used in this work were obtained from publicly available databases, eliminating the need for ethical committee approval or informed consent.

With the aim of identifying key determinants influencing the spread of information in the context of forming the reputation of an auditing company and understanding the main trends in scientific research in this direction, we conducted an analysis of the scholarly interest in the concept of "reputation" in accordance with the sequence outlined in Table 1.

Table 1. Stages of the literature search and selection process

Stage	Filters	Scopus Database
Stage 1 Data Collection		
Choice of suitable information sources	Scopus Database	-
Identification of search field in the database	Title, abstract, keywords	-
Identification of search keywords	Reputation, auditing company	1,555 publications
Stage 2 Data screening		
Identification of publication type	Journal articles and conference papers only; books and chapters of books excluded	1 366 publications
Choice of the language	English	1 333 publications
Choice of the field of publication	Social Sciences; Business, Management, and Accounting; Economics, Econometrics, and Finance; Environmental Science; Decision Sciences; Multidisciplinary	1 267 publications
Identification of the publication's time limits	2007-2023 (the number of publications exceeds 10 per year)	1 177 publications
Stage 3 Bibliometric analysis		
Tools	VOSviewer 1.6.16, Microsoft Excel	Visualization maps, charts, tables

Source: compiled by the authors.

To ensure the comprehensiveness and integrity of the study, the search field "title, abstract, keywords" was used. Since the research topic is quite popular and has a multidisciplinary nature, restrictions were applied to select relevant materials for bibliometric analysis. Thus, only articles written in English were selected for further review.

Additionally, limitations were imposed on the scope of the study (focusing on publications containing an economic component) and the publication date. The check also confirmed that all publications corresponded to the research problem. Therefore, considering all restrictions, 1177 publications were selected for further analysis.

Analyzing the publication activity, there is an observable growth in the number of publications and citations on this topic. Considering both the number of publications and the citation impact, it can be stated that there is a continuing trend of increasing scholarly interest in this subject. The comparison of subject areas in researching reputation is illustrated in Figure 1. The results indicate a prevalence of management, business, economics, econometrics, finance, and social sciences. There is also a tendency for an increase in their numbers, confirming the interdisciplinary nature of the research topic.

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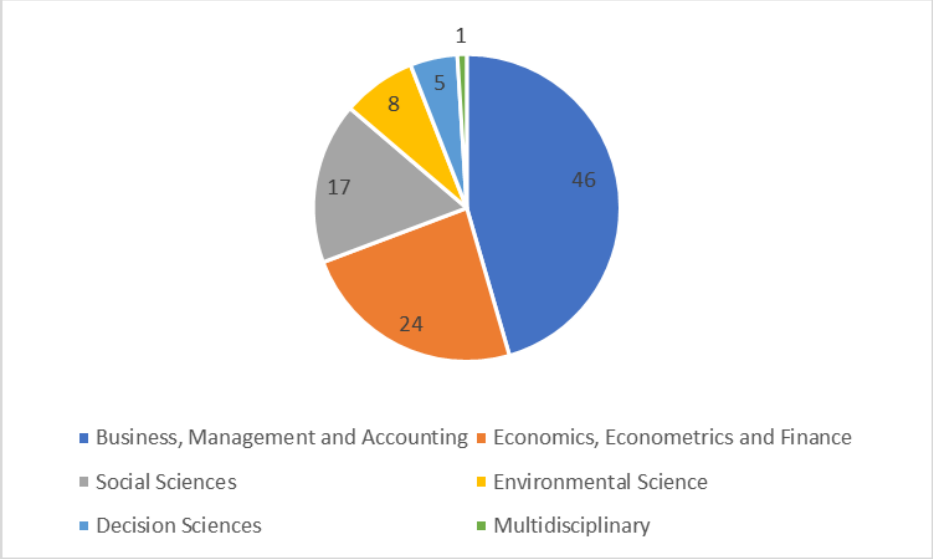

Figure 1. List of subject areas in the study of the reputation issue

It is worth noting that the topic is highly relevant, as evidenced by the significant citation impact of publications. Among the top 10 most cited publications, 7 have been cited more than 500 times (Table 2), further emphasizing the presence of scholarly discourse and the relevance of the issue.

Table 2. Most cited publications

	Document title	Authors	Source	Year	Citations
1	A trust-based consumer decision-making model in electronic commerce: The role of trust, perceived risk, and their antecedents	Kim, D.J., Ferrin, D.L., Rao, H.R.	Decision Support Systems, 44(2), pp. 544–564	2008	2,233
2	The Impact of Board Diversity and Gender Composition on Corporate Social Responsibility and Firm Reputation	Bear, S., Rahman, N., Post, C.	Journal of Business Ethics, 97(2), pp. 207–221	2010	1,149
3	Assurance on sustainability reports: An international comparison	Sìmnett, R., Vanstraelen, A., Chua, W.F.	Accounting Review, 84(3), pp. 937–967	2009	796
4	The cost to firms of cooking the books	Karpoff, J.M., Lee, D.S., Martin, G.S.	Journal of Financial and Quantitative Analysis, 43(3), pp. 581–611	2008	701
5	Corporate social reporting and reputation risk management	Bebbington, J., Larrinaga, C., Moneva, J.M.	Accounting, Auditing & Accountability Journal, 21(3), pp. 337–361	2008	524
6	A tale of two assets: The effects of firm reputation and celebrity on earnings surprises and Investors' reactions	Pfarrer, M., Pollock, T., Rindova, V.	Academy of management Journal, 53(5), pp. 1131–1152	2010	507
7	Factors influencing social responsibility disclosure by Portuguese companies	Branco, M.C., Rodrigues, L.L.	Journal of Business Ethics, 83(4), pp. 685–701	2008	505
8	Do actions speak louder than words? An empirical investigation of corporate environmental reputation	Cho, C.H., Guidry, R.P., Hageman, A.M., Patten, D.M.	Accounting, Organizations and Society, 37(1), pp. 14–25	2012	380
9	Keeping up Appearances: Reputational Threat and Impression Management after Social Movement Boycotts	McDonnell, M.-H., King, B.	Administrative Science Quarterly, 58(3), pp. 387–419	2013	371
10	Green Product Innovation: Where we are and Where we are Going	Dangelico, R.M.	Business Strategy and the Environment, 25(8), pp. 560–576	2016	364

Though Kim, D.J., Ferrin, D.L., Rao, H.R. (2008) in their work analyzed and demonstrated that consumers' trust propensity, concerns about confidentiality, security, information quality, and company reputation strongly influence consumer trust and decision-making.

Bebbington, J., Larrinaga, C., Moneva, J.M. (2008) investigated the interpretation of the concepts of reputation, reputational risk, and their interconnection with corporate social responsibility reports.

Pfarrer, M. D., Pollock, T. G., & Rindova, V. P. (2010) compared the effects of two intangible assets - firm reputation and celebrity - on the likelihood that a firm announces a positive or negative earnings surprise, and investors' reactions to these surprises. Since the issue of firm reputation has a significant impact on its activities.

Some research directions analyze the concept of reputation in the context of Corporate Social Responsibility (CSR) implementation. In particular, Cho, C.H., Guidry, R.P., Hageman, A.M., Patten, D.M. (2012) consider the environmental aspect, tracking the extent to which companies' environmental indicators are reflected in the perception of their environmental reputation and whether the disclosure of environmental information serves as a mediator for negative aspects of worsening environmental performance associated with such assessments. Bear, S., Rahman, N., Post, C. (2010) explore the gender aspect, analyzing and ranking Corporate Social Responsibility (CSR) as positively impacting reputation and mediating the relationship between the number of women on the board and corporate reputation.

McDonnell, M.-H., King, B. (2013) investigated the issue of boycotts and how the company's reputation affects the magnitude of losses incurred.

For a more detailed analysis of the focus of scientific research using VOSviewer 1.6.16 software, 8 clusters were formed (Fig. 2), which unite concepts based on the principle of substantive proximity.

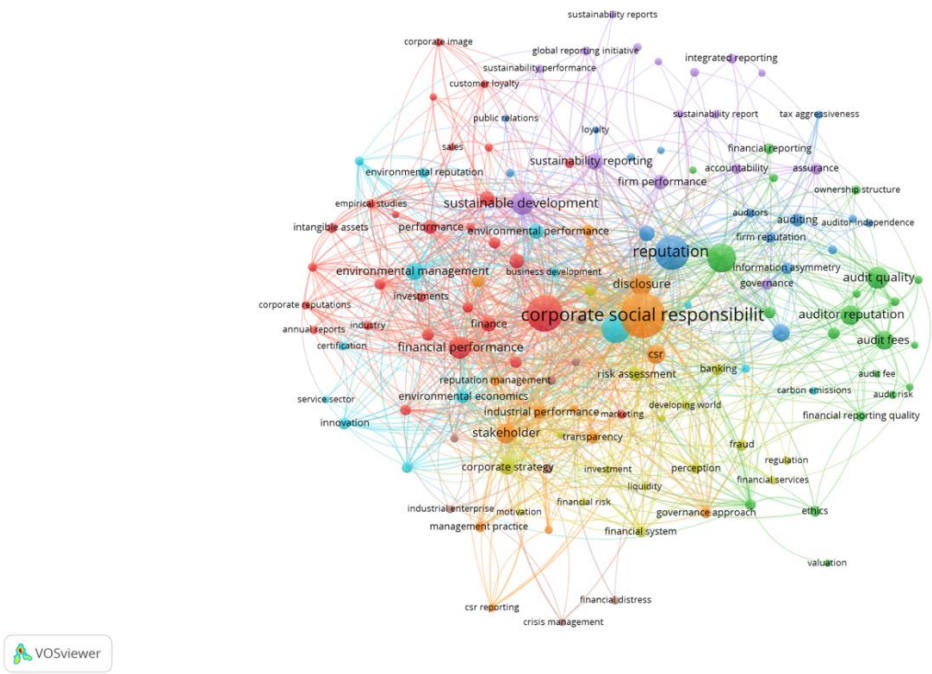

Figure 2. Research Directions Identified Using VOSviewer 1.6.16 Software

Source: compiled by authors using VOSviewer 1.6.16 Software.

The most prominent cluster, represented by the red color, includes 28 key terms and is formed by studies on corporate reputation. Notable concepts within this cluster include "social reputation," "risk management," "stability," "management," "image reputation," "communication, annual reporting," "sustainable development," "intellectual capital," and "customer loyalty," among others.

The second (green) cluster, comprising 21 key terms, focuses on the quality of audit. Research within this cluster is associated with evaluating the effectiveness of audit activities, identifying and rectifying audit errors, studying audit risks and their impact on financial reporting, and analyzing factors influencing the audit process and its outcomes. This includes considerations such as auditor selection, the reputation of audit firms, and adherence to ethical standards. Additionally, research is directed towards understanding the influence of the

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Big Four audit firms and boards of directors on the audit market, its competitive situation, reputation, and corporate social behavior.

The third (blue) cluster, the third largest, primarily revolves around the concept of "reputation." It encompasses 16 key terms related to the study of reputation through the analysis of audit-related concepts, auditor independence, firm reputation, informational asymmetry, leadership qualities, and relationships, among others.

The yellow cluster is associated with research on corporate strategy and everything related to financial risks, crises, services, and the financial system as a whole.

The purple cluster is oriented towards research in the field of sustainable development and reporting.

The orange cluster is related to the disclosure of concepts associated with the environment, specifically with economics, management, reputation, and production.

The blue cluster investigates corporate social responsibility. It's worth noting that the concepts revealed in the "dark yellow" cluster overlap with the blue cluster, as they explore the notions of corporate social and financial productivity.

Overall, most research is dedicated to the following key aspects: corporate reputation and risk management, the quality of audit performance and its impact on reputation, corporate social responsibility, sustainable development, financial risks, crises, and their management. However, it is worth noting that despite such a broad spectrum of research in this direction, there is limited focus on the specific issue of information dissemination in the context of forming the reputation of an auditing company.

Metodology

The approach to be used in the study involves creating a polygamist model similar to the SIR model. The social system under investigation is assumed to be homogeneous within each group of agents. Within the system, there are representatives from two groups:

1. Those who receive information exclusively through interaction with other agents.
2. Those who can obtain information from conditional official sources.

It is assumed that subjects from the second group will contribute to the spread of information among subjects of the first group. Opportunistic behavior is not considered, or the proportion of agents with opportunistic behavior is small enough to be negligible. It is also assumed that over time, a subject may stop spreading information and eventually forget it.

Subjects from both groups can be in one of the following states:

- Neutral (N): The subject is not a carrier of the given information and does not spread it, as they are not aware of it or have forgotten it, but they are ready to accept and disseminate it.
- Active (A): The subject is a carrier of information and actively spreads it.
- Passive (P): The subject is a carrier of information but does not spread it.
- Subjects from both groups freely and evenly interact with each other.

The transition laws for members of the groups between states are described as follows:

- Neutral to Active (for the first group, the transition probability is proportional to the total number of subjects in active and neutral states, and for the second group, it depends on the intensity of information spread through official sources).
- Active to Passive (over time, a subject may stop spreading information but remains a carrier).
- Passive to Neutral (over time, a subject tends to forget information).

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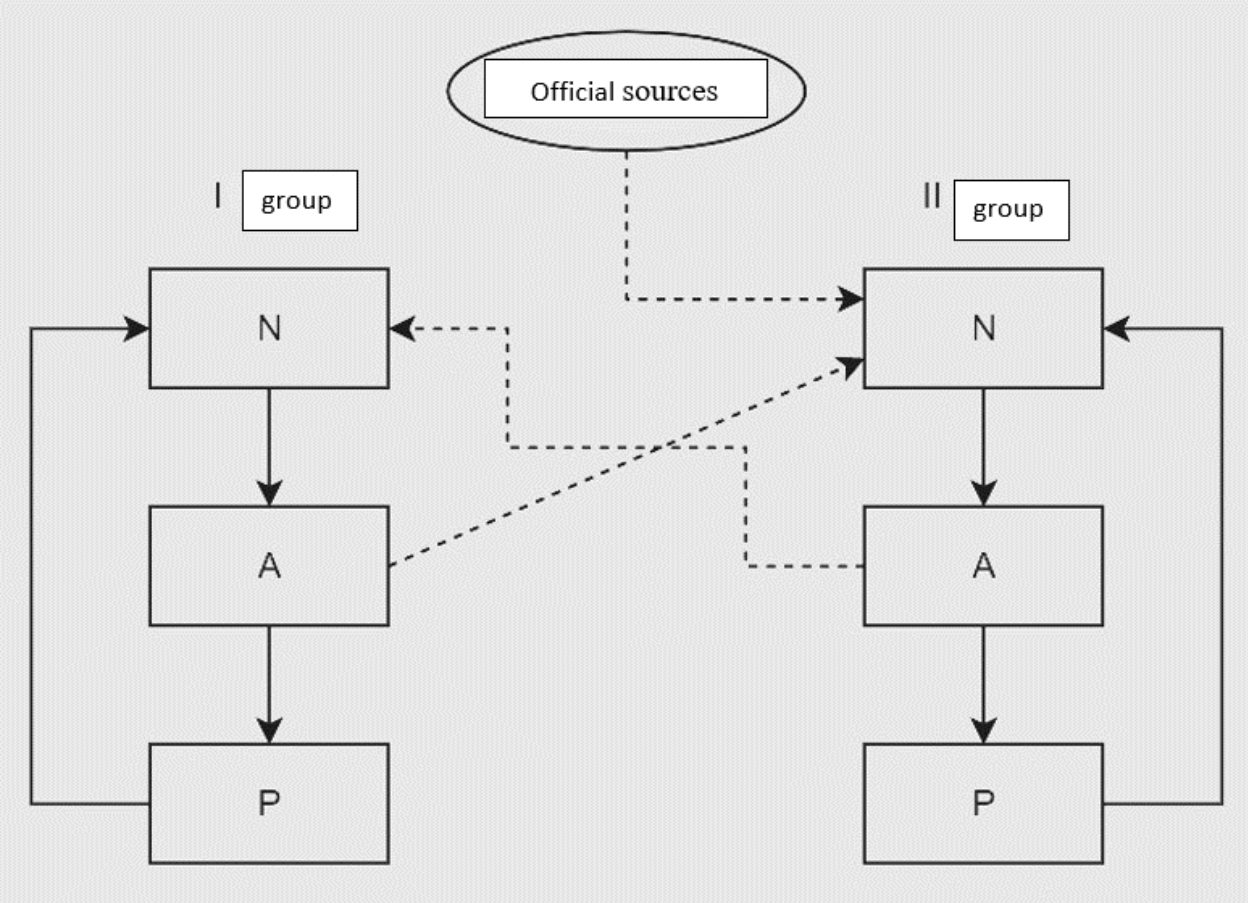
The transition diagram can be described schematically (Fig.3).



Neutral (N) - The subject is not a carrier of the given information and does not spread it, as they are not aware of it or have forgotten it, but they are ready to accept and disseminate it. Active (A)- The subject is a carrier of information and actively spreads it. Passive (P)- The subject is a carrier of information but does not spread it.

Figure 3. Graph of state changes of subjects

Source: compiled by authors.

The intensity of the change in the number of group members is characterized by the derivative with respect to time of the corresponding indicator. Since the number of subjects in different states changes over time, the number of subjects in each state of each group is a function of time t. For the first group – $N_1(t)$, $A_1(t)$, $P_1(t)$, second – $N_2(t)$, $A_2(t)$, $P_2(t)$. Assuming the total number of subjects is M ($M = const$), we obtain the necessary condition:

$$N_1(t) + A_1(t) + P_1(t) + N_2(t) + A_2(t) + P_2(t) = M \quad (1)$$

where

N - the subject is not a carrier of the given information and does not spread it, as they are not aware of it or have forgotten it, but they are ready to accept and disseminate it

A- the subject is a carrier of information and actively spreads it

P- the subject is a carrier of information but does not spread it

M - the total number of subjects, M=const

t - the number of subjects in each state of each group is a function of time

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In addition, let's introduce the function $Q(t)$ the intensity of change in the number of group members is characterized by the derivative over time of the corresponding indicator. Since the number of subjects in different states changes over time.

$$\frac{dN_1}{dt} = k_8 P_1 - k_1 N_1 A_1 \cdot \frac{N_1}{N_1 + N_2} - k_2 N_1 A_2 \cdot \frac{N_1}{N_1 + N_2} \quad (2)$$

$$\frac{dN_2}{dt} = k_9 P_2 - k_3 N_2 Q - k_4 N_2 A_1 \cdot \frac{N_2}{N_1 + N_2} - k_5 N_2 A_2 \cdot \frac{N_2}{N_1 + N_2} \quad (3)$$

$$\frac{dA_1}{dt} = k_1 N_1 A_1 \cdot \frac{N_1}{N_1 + N_2} + k_2 N_1 A_2 \cdot \frac{N_1}{N_1 + N_2} - k_6 A_1 \quad (4)$$

$$\frac{dA_2}{dt} = k_3 N_2 Q + k_4 N_2 A_1 \cdot \frac{N_2}{N_1 + N_2} + k_5 N_2 A_2 \cdot \frac{N_1}{N_1 + N_2} - k_7 A_2 \quad (5)$$

$$\frac{dP_1}{dt} = k_6 A_1 - k_8 P_1 \quad (6)$$

$$\frac{dP_2}{dt} = k_7 A_2 - k_9 P_2 \quad (7)$$

where

N - the subject is not a carrier of the given information and does not spread it, as they are not aware of it or have forgotten it, but they are ready to accept and disseminate it

A- the subject is a carrier of information and actively spreads it

B- P- the subject is a carrier of information but does not spread it

k_n - (where $n = 1,2, \dots 9$) denotes the phenomenological parameters

t - the number of subjects in each state of each group is a function of time

In equasions (2) – (7) over k_n (where $n = 1,2, \dots 9$) denotes the phenomenological parameters.

In equasions (2) – (5) parts $\frac{N_1}{N_1+N_2}$, $\frac{N_2}{N_1+N_2}$ needs to be introduced because the "attention" of subjects in the active state is distributed to subjects in the neutral state according to the share of subjects in their group in the total number of subjects in the neutral state.

Through the large number of phenomenological parameters, there is a need to make certain simplifications. In particular, let's assume that communication processes between groups occur with approximately the same intensity. Thus, let's accept $k_1 \approx k_2 \approx k_4 \approx k_5 \approx l_1$. Let's consider the transition intensity from an active to a passive state to be almost the same ($k_6 \approx k_7 \approx l_2$), and also the transition intensity from a passive to a neutral state ($k_8 \approx k_9 \approx l_3$).

It is worth noting the coefficients l_2, l_3 depend, according to the model's assumptions, on the mathematical expectation of the time it takes for a subject to transition from one state to another. For example, if over some time a subject T, if a subject transitions from an active state to a passive state with a probability p, than l_2 one can define it as the mathematical expectation of the transition, or $\frac{T}{p}$. Similar considerations are applicable to determine l_3. Determination of the l_1 is more complex and requires detailed research into the structure of social system connections.

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Let's assume $\tau = k_3 t$ and consider $N_1(t) = Mn_1(\tau)$, $A_1(t) = Ma_1(\tau)$, $P_1(t) = Mp_1(\tau)$, $N_2(t) = Mn_2(\tau)$, $A_2(t) = Ma_2(\tau)$, $P_2(t) = Mp_2 Q(t) = q(\tau)$.

Then system (2) – (7) transforms into system (8) – (13):

$$\frac{dn_1}{d\tau} = \gamma p_1 - \alpha \frac{n_1^2}{n_1 + n_2}(a_1 + a_2) \tag{8}$$

$$\frac{dn_2}{d\tau} = \gamma p_2 - q n_2 - \alpha \frac{n_2^2}{n_1 + n_2}(a_1 + a_2) \tag{9}$$

$$\frac{da_1}{d\tau} = \alpha \frac{n_1^2}{n_1 + n_2}(a_1 + a_2) - \beta a_1 \tag{10}$$

$$\frac{da_2}{d\tau} = q n_2 + \alpha \frac{n_2^2}{n_1 + n_2}(a_1 + a_2) - \beta a_2 \tag{11}$$

$$\frac{dp_1}{d\tau} = \beta a_1 - \gamma p_1 \tag{12}$$

$$\frac{dp_2}{d\tau} = \beta a_2 - \gamma p_2 \tag{13}$$

where

$\alpha = \frac{Ml_1}{k_3}$ - the intensity of transition from neutral to active state

$\beta = \frac{l_2}{k_3}$ - the intensity of transition from active to passive state

$\gamma = \frac{l_3}{k_3}$ - the intensity of transition from passive to neutral state

Here $\alpha = \frac{Ml_1}{k_3}$ (coefficient characterizing the intensity of transition from neutral to active state), $\beta = \frac{l_2}{k_3}$ (coefficient characterizing the intensity of transition from active to passive state), $\gamma = \frac{l_3}{k_3}$ (coefficient characterizing the intensity of transition from passive to neutral state). At the same time, constraint (1) takes the form:

$$n_1(t) + a_1(t) + p_1(t) + n_2(t) + a_2(t) + p_2(t) = 1 \tag{14}$$

Therefore, the number of phenomenological parameters has been reduced from nine to three. Let's proceed to the analysis of this model.

Results and Discussion

The system (8) – (13) can be solved numerically. The existence of an analytical solution for this system is not verified within the scope of this work. In the further analysis, we will consider the solution as a constant q.

In the context of the study, our interest lies in the stationary state to which the system converges. To find this, we will solve the system of equations.

$$\gamma p_1 - \alpha \frac{n_1^2}{n_1 + n_2}(a_1 + a_2) = 0 \tag{15}$$

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$$\gamma p_2 - q n_2 - \alpha \frac{n_2^2}{n_1 + n_2}(a_1 + a_2) = 0 \quad (16)$$

$$\alpha \frac{n_1^2}{n_1 + n_2}(a_1 + a_2) - \beta a_1 = 0 \quad (17)$$

$$q n_2 + \alpha \frac{n_2^2}{n_1 + n_2}(a_1 + a_2) - \beta a_2 = 0 \quad (18)$$

$$\beta a_1 - \gamma p_1 = 0 \quad (19)$$

$$\beta a_2 - \gamma p_2 = 0 \quad (20)$$

where

$\alpha = \frac{Ml_1}{k_3}$ - the intensity of transition from neutral to active state

$\beta = \frac{l_2}{k_3}$ - the intensity of transition from active to passive state

$\gamma = \frac{l_3}{k_3}$ - the intensity of transition from passive to neutral state

The following results were obtained:

$$a_1 = \frac{\alpha q n_1^2 n_2}{\beta\left(\beta(n_1 + n_2) - \alpha(n_1^2 + n_2^2)\right)} \quad (21)$$

$$a_2 = \frac{\beta q n_2 (n_1 + n_2) - \alpha q n_1^2 n_2}{\beta\left(\beta(n_1 + n_2) - \alpha(n_1^2 + n_2^2)\right)} \quad (22)$$

$$p_1 = \frac{\alpha q n_1^2 n_2}{\gamma\left(\beta(n_1 + n_2) - \alpha(n_1^2 + n_2^2)\right)} \quad (23)$$

$$p_2 = \frac{\beta q n_2 (n_1 + n_2) - \alpha q n_1^2 n_2}{\gamma\left(\beta(n_1 + n_2) - \alpha(n_1^2 + n_2^2)\right)} \quad (24)$$

where

$\alpha = \frac{Ml_1}{k_3}$ - the intensity of transition from neutral to active state

$\beta = \frac{l_2}{k_3}$ - the intensity of transition from active to passive state

$\gamma = \frac{l_3}{k_3}$ - the intensity of transition from passive to neutral state

At the same time, additional calculations are required to determine n_1 and n_2 in the equilibrium position. Without doing this, certain conclusions can also be drawn. If $\beta > \gamma$, than $p_{1,2} > a_{1,2}$ and vice versa. If $\beta = \gamma$, than $p_{1,2} = a_{1,2}$.

Having $\alpha > 0$, $\beta > 0$, $\gamma > 0$, $q > 0$, let's consider the constraints for the number of subjects in each state according to the model assumption n_1 and n_2 at the equilibrium point (25) – (29).

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$$\beta(n_1 + n_2) - \alpha(n_1^2 + n_2^2) > 0 \quad (25)$$

$$\beta(n_1 + n_2) - \alpha n_1^2 \geq 0 \quad (26)$$

$$n_1 \geq 0 \quad (27)$$

$$n_2 \geq 0 \quad (28)$$

$$n_1 + n_2 \leq 1 \quad (29)$$

In this case, it is sufficient to consider only (25) – (29) without (26) since (26) is a consequence of (25). Therefore, (25) represents an inner region of a circle with radius $\frac{\beta}{\alpha\sqrt{2}}$ with a center at the point. $\left(\frac{\beta}{2\alpha}, \frac{\beta}{2\alpha}\right)$. It is worth noting that this implies, among other things, the impossibility of the case $n_1 = n_2 = 0$. (27) – (29) forms an isosceles right-angled triangle with legs equal to 1 and lying on the coordinate axes (orthocentric system). The solution to the system of inequalities is the area where the two obtained figures intersect. An example is shown in Fig. 4:

Figure 4. Set of possible values (n_1, n_2) for $\alpha = 1, \beta = 0.1$

Source: Compiled by authors.

Thus, the phase trajectory for (n_1, n_2) is within the bounds of the black triangle, and the equilibrium point, if the system reaches it, is within the bounds of the purple region. Let's construct several phase trajectories corresponding to different initial values. (n_1, n_2) (fig. 5,6):

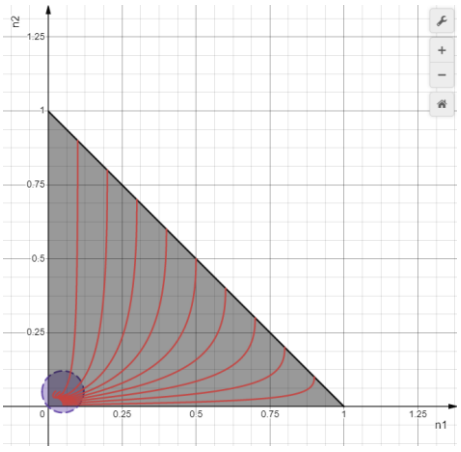

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Figure 5. Phase trajectories for (n_1, n_2)

Source: Compiled by authors.

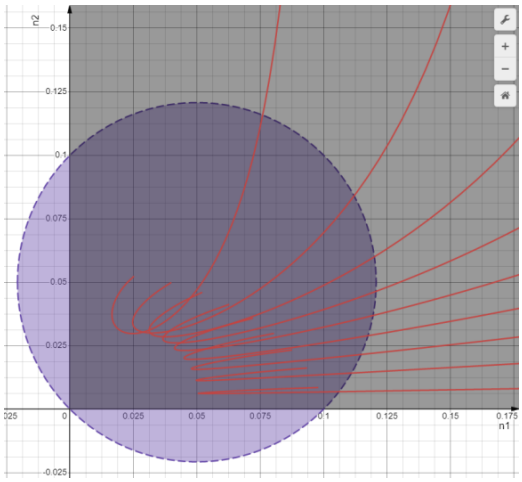

Figure 6. Phase trajectories for (n_1, n_2) (enlargement)

Source: Compiled by authors.

The system is stable, but its equilibrium position depends, in addition to the parameters, on the initial values of and . The dynamics of the indicators are shown in Fig. 7:

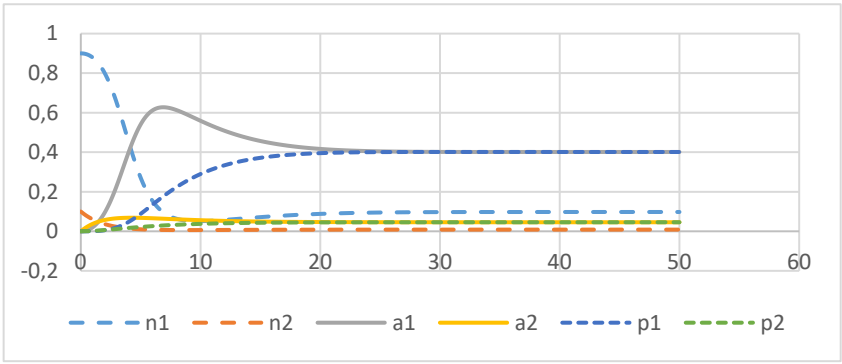

Figure 7. Dynamics of system indicators with $\alpha = 1$, $\beta = \gamma = 0.1$, $q = 0.5$, $n_1(0) = 0.9$, $n_2(0) = 0.1$, $a_1(0) = a_2(0) = p_1(0) = p_2(0) = 0$

Source: Compiled by authors.

Conclusion and Recommendations

The reputation of auditing firms emerges as a key factor in ensuring trust and confidence in financial markets. This article investigates the influence of information dissemination models on the formation of auditing companies' reputation, with a particular focus on the choice between official and unofficial communication channels. The authors demonstrate the complex dynamics between these strategies and their impact on reputation management in the auditing industry.

The research underscores the relevance of the issue in light of the critical role auditing firms play in ensuring transparency and honesty in financial reporting, especially amidst corporate scandals and regulatory oversight. The primary objective is to understand the effectiveness of various information dissemination models in shaping the reputation of auditing companies.

A bibliometric analysis is employed to confirm the increasing scholarly interest in this topic and identify key thematic clusters. The empirical part of the research aims to construct a model describing the behavior of subjects in the context of information dissemination.

The model of information spread was proposed and partially investigated during the research, incorporating the possibility of information dissemination simultaneously through official sources and via the so-called "word of mouth." The presence of a population group that does not follow the news and official sources is

also considered. The model allows for the exploration of different scenarios by changing the intensity of population awareness.

From the study of the model, it becomes evident that over time, such systems reach certain equilibrium levels. Therefore, the values at the equilibrium point are crucial, along with the time it takes to achieve this equilibrium.

It is worth noting that this model is not unique and can be modified according to the purpose of information dissemination and the nature of the information being spread. For example, in the case of spreading information about a specific event, the investigation of the stationary state may not be essential since the focus might be on peak function values and the time of their occurrence. Consequently, the passive state can be omitted in such scenarios.

Future plans involve a more in-depth exploration of this model, considering the possible heterogeneity of the information dissemination environment.

The obtained results have practical significance for auditing firms, regulatory bodies, and stakeholders in the financial sector. Understanding the strengths and weaknesses of different information dissemination models allows auditing firms to adapt their communication strategies to enhance their reputation and maintain trust in financial markets.

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1/0638/23 Reputationial risk of an auditing company as a reflection of the sentiment on Twitter.

Author Contributions

Conceptualization: R. D., J.U.; Data curation: J. U.; Formal analysis: R. D.; Investigation: R. D.; Methodology: J. U.; Project administration: Z. O.; Supervision: Z. O.; Validation: Z. O.; Visualization: R. D.; Writing – original draft: J.U.; Writing – review & editing: Z. O.

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