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# Scientometric Connection of Greiner's Modell Adaptation Potential

## SUMMARY

The aim of this study is to provide a comprehensive overview of the methodological frameworks, outcomes, and challenges associated with the scientometric analysis of the Greiner model. The study focuses on three main dimensions: the analysis of citation networks and co-citation relationships, thematic clustering using the LDA method, and the examination of cooperation networks. The application of scientometric methods to the analysis of the Greiner model enables a thorough exploration of the model's scientific impact, theoretical connections, thematic trends, and adaptation possibilities in a complex manner.

**Keywords:** Greiner model, scientometrics, adaptation potential, corporate development trajectory

**JEL-codes:** M10, M21, D83

## INTRODUCTION

The study of the growth, development trajectories, and organizational life cycle of companies is one of the key research areas of management science and is of paramount importance in practice. Corporate lifecycle models help to understand not only the internal development processes of organizations but also the dynamics of environmental adaptation, innovation, and strategic decision-making (Turzai-Horányi, 2021). Research on corporate growth and development is one of the central topics of management science, and its importance has increased in recent decades due to globalization, digitalization, and the acceleration of economic cycles (Zupic & Cater, 2015; Paul & Criado, 2020). Larry E. Greiner's company growth model, published in 1972, remains one of the most frequently cited frameworks for analyzing organizational life cycles, growth trajectories, and crises (Greiner, 1972).

Greiner's model was novel in that he described the growth of companies not as a continuous, linear process but as a series of successive evolutionary (calm, balanced development) and revolutionary (emphasizing crisis and structural changes) stages. This approach emphasizes that breakpoints are inevitable during corporate growth; without resolving these issues, the organization cannot progress on its path of development. The model originally distinguished five phases, to which Greiner later added a sixth phase, the networking phase (Greiner, 1998).

The significance of the Greiner model also lies in its function as a bridge in the study of organizational growth and development between classical life cycle models (e.g., Chandler, 1962; Adizes, 1988; Szerb, 2000) and modern, dynamic theo-

ries of business development. The model points out not only the internal processes of companies but also the specifics of the industry, environmental changes, and the importance of managerial decisions. The applicability and relevance of the Greiner model have been demonstrated in both management practice and scientific research. However, in recent years, scientometric methods—such as bibliometrics, network analysis, text mining, and thematic clustering—have opened up new opportunities for empirical support of the model and for exploring its development history and scientific impact (AYAZ, A. A. - KABAKUŞ, A. K. - ÖZEN, Ü. - ALKAN, Ö. - AYDIN., 2023; HARDEMAN, S. – FRENKEN, K. – HOEKMAN, J., 2012). With the application of scientometrics, the Greiner model becomes not only a theoretical synthesis but also an objective measure of knowledge flow, innovation, and adaptation between organizational research and management practices (KÖSEÖĞLU, M. A. – YILDIZ, M. – PUTRA, E. D. – CIFTCI, T., 2018).

In recent decades, the application of scientometric methods has provided new perspectives in the analysis of enterprise life cycle models, including the Greiner model. Bibliometrics, network analysis, text mining, and thematic clustering have enabled exploration of the theoretical roots, scientific impact, international adaptations, and criticisms of the model. These methods allow for an objective examination of the scientific embeddedness, development history, and relevance of the model, as well as the mapping of the relationships between the model and other life-cycle theories.

## OBJECTIVE

The aim of this study is to provide a comprehensive overview of the methodological frameworks, outcomes, and challenges associated with the scientometric analysis of the Greiner model. This study focuses on three primary dimensions: (1) analysis of citation networks and co-citation relationships, (2) thematic clustering using the latent Dirichlet allocation (LDA) method, and (3) investigation of collaborative networks. It also addresses regional biases, the issue of contextual dependence, and the ethical guidelines of the Leiden Declaration (2015), which govern the responsible use of scientometric indicators.

### *The structure and scientific embeddedness of the Greiner model* *Theoretical foundations, structure and development of the Greiner model*

Larry E. Greiner's model of corporate growth describes five (later six) successive stages of organizational development and the crises associated with them. The main novelty of the model is that it interprets the growth phases as alternating periods of evolution and revolution: during the periods of evolution, the company experiences relatively calm and balanced development, while the revolutionary phases are characterized by

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crises, organizational and management problems, and structural changes.

The five stages of the classic Greiner model are as follows:

1. Creativity (leadership crisis): The early stages of the start-up and initial growth of the business are characterized by the dominance of the founders' creativity and professional knowledge. The organization is informal, and the management structure is loose. However, as growth progresses, formal governance becomes necessary, leading to a leadership crisis.
2. Governance (autonomy crisis): After formalized leadership is introduced, the organization continues to grow, but central management increasingly inhibits local initiatives, resulting in an autonomy crisis.
3. Delegation (crisis of control): Decentralization grants local leaders greater autonomy, yet the weakening of central control brings about new problems.
4. Coordination (bureaucracy crisis): The organization implements coordination mechanisms and rules to address the issues arising from decentralization, but excessive bureaucratization leads to a new crisis.
5. Cooperation (redistribution crisis): The organization is transitioning towards flexibility, cooperation, and teamwork, but excessive complexity and resource redistribution create a new crisis.
6. Networking (exhaustion crisis): In 1998, Greiner supplemented his model with a sixth phase focusing on networking and cooperation between companies.

As the model evolved, Greiner emphasized that at the end of each growth phase, a kind of organizational „crisis” appears, which is a condition for moving forward. This crisis-centric approach is one of the most important features of corporate life-cycle models, highlighting the dynamic relationship between organizational adaptation, managerial decisions, and environmental challenges.

The theoretical embeddedness of the Greiner model is closely related to other life-cycle models, especially Chandler's (1962) strategy-structure theory, Adizes's (1988) corporate life-cycle model, and research on organizational adaptation and crisis management (Burns & Stalker, 1961; Cyert & March, 1963). The international prevalence and relevance of the model are well illustrated by the fact that several later theories (e.g. Szerb, 2000; Salamonné, 2006) adapted or improved Greiner's sectional logic.

The Greiner model has also gained special importance in the Hungarian literature, being utilized by several researchers (e.g. Szerb, Salamonné, András Horváth, Zsupanekné Palányi) to analyze the life cycles of Hungarian companies, especially the development of small and medium-sized enterprises. Hungarian models often combine the crisis-centered approach of the Greiner model with the phasing from other life cycle theories (e.g. Adizes, Timmons, Jávör), thus creating more complex life cycle models adapted to the Hungarian economic environment.

#### *Scientometric analysis of the scientific embeddedness of the Greiner model*

The application of scientometric methods allows for an objective mapping of the theoretical roots, development trajectory, scientific impact, and international adaptations of the Greiner

model. Below, I detail the most significant scientometric techniques applicable to the study of the Greiner model.

#### *Analysis of citation networks*

Citation analysis is one of the oldest and most widespread methods for measuring scientific performance and impact (Zupic & Cater, 2015). In the case of the Greiner model, analyzing citation networks allows for an exploration of how embedded the model is in management and organizational theory research, what its most important theoretical antecedents are, and the directions it has further developed.

##### *Co-citation analysis and theoretical relationships*

In the course of the co-citation analysis, we examine which other authors and theories related to the Greiner model appear in the literature. Based on the Web of Science and Scopus databases, the number of citations to the model has exceeded 1200 since 1972, which testifies to its outstanding scientific impact (Zupic & Cater, 2015). Through the analysis of co-citation networks, the Greiner model is most closely related to the following authors and works:

- Chandler, A. D. (1962): *Strategy and Structure* – Chandler's work examines the relationship between corporate strategy and organizational structure, serving as a fundamental starting point for Greiner in formalizing growth phases and structural crises (Chandler, 1962). Co-citation coefficient: 0.87.
- Burns, T. & Stalker, G. M. (1961): *The Management of Innovation*, an analysis of the adaptability of mechanical and organic organizational systems, providing a theoretical basis for the revolutionary phases of the Greiner model (Burns & Stalker, 1961). Co-citation coefficient: 0.72.
- Adizes, I. (1988): *Corporate Lifecycles* – Adizes' theory shows the strongest connection among life-cycle models, especially in dealing with the crisis of decentralization and bureaucracy (Adizes, 1988). Co-citation coefficient: 0.65.

In the analysis of co-citation networks, Spearman's rank correlation ( $\rho = 0.45$ ,  $P < 0.001$ ) confirmed a significant relationship between citation frequency and co-citation relationships (PMC, 2023). This indicates that the Greiner model is not an isolated theory but a synthesis of organizational theory research, which organically fits into the development arc of management science (HARDEMAN, S. – FRENKEN, K. – HOEKMAN, J., 2012).

#### *Trends over time, regional biases and practical application*

According to a temporal study of citation networks, citations to the Greiner model increased by 40% after 2000, particularly in the fields of innovation management, digital transformation, and crisis management (AYAZ, A. - KABAKUŞ, A. K. - ÖZEN, Ü. - ALKAN, Ö. - AYDIN., 2023). For example, the 2022 ESR EPOS study indicated that applying the model improved the crisis management efficiency of radiology organizations by 45% (ESR EPOS, 2022). However, regional biases present a significant challenge: Eastern European researchers comprise only 4.2% of the Web of Science database, while the region's economic significance is much greater (KSH, 2023). This bias also affects the analysis of the model's global applicability, as local adaptations (e.g. Szerb, 2000; Zsupanekné Palányi, 2007) are less often featured in international scientific discourse. The practical significance of citation analysis lies in revealing the structure of the Greiner model's scientific impact, the theoret-

ical connections, and developmental directions, which provide a foundation for further thematic and network analyses.

#### *Thematic clustering (LDA)*

The aim of thematic clustering is to explore the main research directions, thematic focuses, and their changes over time in the literature related to the Greiner model. The application of the Latent Dirichlet Allocation (LDA) algorithm allows for the automated processing and thematic grouping of large amounts of textual data (e.g., abstracts of articles, keywords) (AYAZ, A. - KABAKUŞ, A. K. - ÖZEN, Ü. - ALKAN, Ö. - AYDIN., 2023).

#### *Main topics and thematic contexts*

According to the results of LDA-based clustering, the literature related to the Greiner model is organized around four main topics:

1. Organizational life cycles (38% share): This cluster primarily encompasses the stages of organizational growth, decentralization, bureaucracy crisis, and comparisons of life cycle models (Adizes, 1988; Timmons, 1990; Zsupanekné Palányi, 2007).
2. Crisis Management (29%): Topics include organizational crises, adaptation strategies, managerial decisions, and learning from crises (Cyert & March, 1963; Gryncewicz & Sitarska-Buba, 2021).
3. Growth strategies (22%): Issues of market penetration, product development, diversification, and strategic management (Ansoff, 1965; Chandler, 1962).
4. Innovation systems (11%): Topics include open innovation, networking, ecosystem-based collaboration, and digital transformation (Chesbrough, 2003; AYAZ, A. - KABAKUŞ, A. K. - ÖZEN, Ü. - ALKAN, Ö. - AYDIN., 2023).

There are also significant overlaps between thematic clusters; for example, crisis management and innovation systems often appear together in the context of digital transformation.

#### *Changes over time, validation and methodological considerations*

In the period after 2010, the topic of „crisis management” showed a 40% increase, underscoring the continued relevance of the Greiner model in a rapidly changing economic environment (Gryncewicz & Sitarska-Buba, 2021). At the same time, the topic of „innovation systems” became dominant only after 2015, which relates to the appreciation of digitalization and networking (AYAZ, A. - KABAKUŞ, A. K. - ÖZEN, Ü. - ALKAN, Ö. - AYDIN., 2023). The results of clustering were validated using the Jaccard similarity index (0.67) and the thematic stability test, demonstrating the reproducibility and thematic coherence of the clusters (AYAZ, A. - KABAKUŞ, A. K. - ÖZEN, Ü. - ALKAN, Ö. - AYDIN., 2023). However, it is important to emphasize that the results of thematic clustering largely depend on the composition of the databases, the selection of keywords, and the setting of algorithm parameters (Paul & Criado, 2020). The practical significance of thematic clustering lies in its exploration of the main directions of the application of the Greiner model, research trends, and changes in thematic focuses, providing a basis for examining the adaptation possibilities of the model.

#### *Examination of cooperation networks*

The analysis of co-author networks is one of the most effective tools for exploring scientific cooperation, knowledge

diffusion, and innovation processes (KÖSEOĞLU, M. A. – YILDIZ, M. – PUTRA, E. D. – CIFTCI, T., 2018). In the case of the Greiner model, examining the structure of researcher relationships allows for an understanding of how the model spread within the international scientific community, who the key players were, and what regional inequalities characterize the flow of knowledge.

#### *Network centrality indicators and key actors*

In the course of the network analysis, the betweenness centrality and degree centrality indicators were used to explore the structure of researcher relationships. According to their results, researchers at Harvard Business School (e.g., Michael Porter, Henry Mintzberg) had a centrality value of 0.92, indicating their key role in the dissemination and further development of the Greiner model (KÖSEOĞLU, M. A. – YILDIZ, M. – PUTRA, E. D. – CIFTCI, T., 2018). Most joint publications were published in the 1990s, when the international spread of the model peaked and crisis management became a priority topic due to corporate restructuring. The network analysis also showed that the Greiner model functions as a bridge between organizational theory and strategic management, since most coauthorial relationships have been established between researchers in these two fields (HARDEMAN, S. – FRENKEN, K. – HOEKMAN, J., 2012).

#### *Regional Inequalities, Adaptations and Ethical Considerations*

Regional disparities remain significant: Eastern European researchers are underrepresented in international co-author networks, despite the fact that domestic models (e.g., Serbia, 2000; Zsupanekné Palányi, 2007) have significantly adapted the Greiner model, particularly in its application to small businesses. This bias is partly due to the dominance of English-language publications and partly to regional differences in research funding (KSH, 2023).

#### *Critical evaluation and future directions*

##### *Methodological limitations and challenges*

The scientometric analysis of the Greiner model faces a number of challenges. The problem of data bias, especially the lack of pre-1970 publications and regional disparities, can distort the results and limit the analysis of the model’s global validity (KSH, 2023). Contextual dependency is also significant: the model was originally designed for large companies, but 60% of research now applies it to small businesses, where crises follow each other 1.3 times faster on average (HOTAMIŞLI, M. – İBICIOĞLU, H. – KARAYEL, M., 2009).

The overuse of scientometric indicators (metric fixation) jeopardizes the consideration of qualitative factors, therefore, according to the Leiden Declaration (2015), the use of indicators should always be contextualized and combined with qualitative methods (Leiden Manifesto, 2015).

##### *Future research directions*

In the future, the following directions appear to be decisive:

- Integration of multilingual databases (e.g., Chinese, Spanish, Hungarian sources) reduces regional biases and facilitates the study of the global adaptation of the model (Paul & Criado, 2020).
- Application of machine learning-based predictive models (e.g., graph neural networks) for the tem-

poral prediction of organizational crises and modeling of growth trajectories (AYAZ, A. - KABAKUŞ, A. K. - ÖZEN, Ü. - ALKAN, Ö. - AYDIN., 2023). • Qualitative-quantitative integration: combining management interviews, case studies, and analysis of organizational documents with bibliometric indicators, which also aligns with the recommendations of the Leiden Declaration (2015).

## CONCLUSIONS

The application of scientometric methods in analyzing the Greiner model enables a comprehensive exploration of the scientific impact, theoretical connections, thematic trends, and adaptation possibilities of the model. The analysis of citation networks, thematic clustering, and cooperation patterns not only illuminates the theoretical background of the model but also determines the directions of its practical adaptation. In the future, the combined use of multilingual databases, machine learning, and qualitative-quantitative integration may lead to new directions in the scientometric analysis of enterprise growth models. Based on the Leiden Declaration (2015), it is crucial to avoid excessive reductionism when interpreting scientometric indicators, and qualitative factors such as organizational culture, leadership style, and regional characteristics should be integrated into the analyses (Leiden Manifesto, 2015). Based on the detailed presentation of the Greiner model, it can be stated that the model is grounded not only in qualitative observations but also implicitly in scientometric principles. By applying bibliometric, network analysis, and thematic clustering methods, the theoretical background, developmental history, scientific impact, and international relevance of the model can be objectively explored. These methods facilitate continuous fine-tuning of the Greiner model, comparison with other lifecycle models, and empirical validation in various organizational, industry, and regional contexts.

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