

# Reconstruction of Social Structure Analysis Through a Complex Systems Approach to Reading Digital Society

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## ABSTRACT

This article seeks to reconstruct the analysis of social structure by applying a complex systems perspective in order to overcome the limitations of classical theories in explaining the co-evolution of social structures and societal dynamics within today's socio-digital environment. The study employs a conceptual-analytical method supported by complexity-based social analysis. This includes the integration of complex adaptive systems theory, multilayer network analysis, and empirical insights derived from digital society studies and network science. The findings indicate that social structures in the digital era are no longer fixed, hierarchical, and stable as suggested by classical social theories. Instead, they function as adaptive, decentralized, and constantly evolving networks. Power relations are increasingly shaped by algorithmic systems that determine visibility, access to information, and opportunities for participation. At the same time, social inequality is reproduced through digital mechanisms such as algorithmic filtering, unequal data distribution, and platform bias. The proposed analytical framework emphasizes the importance of a multilayered perspective capable of capturing nonlinear social changes and the interconnected relationship between micro-level interactions and macro-level social configurations.

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## INTRODUCTION

Development Amidst the wave of digital transformation and globalization, we are witnessing dramatic social changes: social networks are no longer simply face-to-face

relationships between individuals within a fixed hierarchy, but have become dynamic, distributed, and interconnected structures across space and platforms. This is because digital technology, social media, and the platform economy have transformed the mechanisms of interaction, the reproduction of power, and the formation of identities, rendering the old, linear, and stable models of social structures increasingly obsolete. For example, recent studies indicate that digital society now operates as a complex and adaptive socio-technological system. For example, research on "digital society" suggests that traditional social relations and institutions are now being redefined as complex techno-social systems (Pan et al. 2025) (Laskar 2023). Thus, social facts suggest that the old paradigm for understanding social structures needs to be replaced with an analytical framework capable of capturing the adaptive and multifaceted nature of contemporary digital society.

In the literature, the study of social structure and societal dynamics continues to develop, but several research gaps remain. Classical structural-functional, conflict, and symbolic interaction theories provide important foundations, but they are less responsive to contemporary social complexity, particularly the functions of digital networks, algorithms, and multilayered interactions. For example, an article on stratification in online social networks reveals that despite abundant data on human interactions, no single metric adequately measures social stratification within these networks (Jalali, Introne, and Soundarajan 2023). Similarly, the literature on complex systems approaches in the social sciences suggests that social systems should be understood as adaptive, nonlinear, and relational (Haynes et al. 2024) (Yang et al. 2023). Therefore, the literature demonstrates the urgent need to develop new conceptual and methodological frameworks that can bridge the gap between theories of social structure and the dynamics of digital interactions.

This paper aims to offer a solution: to reconstruct the analysis of social structures through a complex systems approach to make them more relevant to the realities of contemporary digital society. This approach was chosen because it allows us to read social structures not as passive and fixed entities, but as systems that continually change with the dynamics of society—interactions, power relations, and the reproduction of inequality.

Using the concepts of multilayer networks, self-organization, and structural-dynamic co-evolution, this paper presents a conceptual and methodological model that is expected to improve the limitations of the classical framework and provide a sharper analytical map. Thus, this paper proposes a new framework that not only expands the theory but also creates an analytical tool that can be applied to understand the changes in social structures in the digital era.

The uniqueness of the proposed argument lies in its novelty: it positions social structure and societal dynamics as co-evolutionary entities within a complex system framework, rather than as two separate components. This argument is crucial given that digital social interactions accelerate the adaptation process of social structures

and produce new forms of inequality and power reproduction that are inaccessible to traditional theories. For example, research on information and propagation in digital social media reveals that social networks are self-organizing and heavily influenced by algorithms, no longer solely by class structures or traditional institutions (Pan et al. 2025). Thus, this paper not only identifies an academic crisis in the study of social structure but also proposes a new, more adaptive conceptual paradigm relevant contribution to the development of contemporary social science.

## **METHODS**

This This research uses conceptual-empirical synthesis and computational exploratory modeling to develop a new analytical framework. Because we are dealing with complex social phenomena, social structures, and societal dynamics in a digital context, we need methods that are not only theoretical but also explore empirical evidence and simulations that are capable of capturing the adaptive and non-linear character of the system. Recent studies have shown that agent-based models (agent-based modelling) and co-evolutionary networks are able to capture the relationship between network structure and social dynamics more accurately than traditional models (Djurdjevac Conrad, Quang Vu, and Nagel 2024a). Thus, this type of research approach allows for the formulation of an integrated framework between concepts, digital data, and simulation models to answer research questions more holistically.

The analytical approaches applied include complex systems analysis, Social Network Analysis (SNA), multilayer network modeling, and simulation or agent modeling where relevant. Because the social structure and interactions of digital societies are adaptive, distributed, and produce emergent patterns that cannot be explained by simple linear models or hierarchical structures, analytical tools that can capture micro-macro interactions, cross-platform networks, and real-time evolution are needed. For example, the integration of SNA with ABM has been identified as a promising method for exploring the dynamics of human interactions in complex systems. The analytical approaches applied include complex systems analysis, Social Network Analysis (SNA), multilayer network modeling, and simulation or agent modeling where relevant (Will et al. 2020) (Campos n.d.). Model validation is also crucial in agent-based and complex network studies (Pine et al. 2023) (Steinbacher et al. 2021). Therefore, the combination of these analytical approaches provides a strong methodological foundation for examining the phenomena of social structure and the dynamics of digital society with greater depth and rigor.

Data sources and collection techniques include digital data from social media platforms and public repositories, digital observation and documentation, and secondary data from trusted publications and databases. Analytical techniques include the identification of emergent patterns, relational and distributional analysis of power, and network-based dynamic analysis. Because digital society generates large and heterogeneous traces of interactions, as well as algorithm-mediated relations

of power and inequality, digital data and digital observations are crucial as empirical materials. The analysis must be able to extract emergent patterns and complex relationships between actors. Examples of research have utilized agent simulations to explore the co-evolution of opinion and social interaction networks in adaptive systems (Djurdjevac Conrad et al. 2024). Secondary data from the literature also reinforces the development of complex models in the social sciences to understand patterns beyond traditional frameworks. Thus, this methodological design enables the mapping of relevant data and a comprehensive analysis of social structures and dynamics in contemporary digital society (Steinbacher et al. 2021).

To ensure validity and reliability, the study employed data triangulation, model consistency testing, and model replication and sensitivity testing. Because complex system models and network simulations are susceptible to parameter and context variability, repeated model testing, cross-validation, and parameter sensitivity testing are crucial to ensure the reliability of the results. The methodological literature demonstrates increasing attention to validation in studies of agent-based models and complex social networks (Pine et al. 2023). Thus, strong validity and reliability aspects support the credibility of this study and strengthen the argument that the proposed framework is scientifically sound.

## **RESULTS AND DISCUSSION**

### **1. Customer Findings of Complexity Patterns in Contemporary Social Structures**

This study finds that the social structure of digital society now exhibits a significantly different complexity than classical structures: closed hierarchies are increasingly being replaced by distributed networks; algorithms significantly mediate social relations; and platform-based social mobility is emerging as a new mechanism of social reproduction and change. These changes are driven by the emergence of digital systems that enable spectacular interactions, rapid information dissemination, and real-time, multi-layered network computing. For example, the study suggests that social media and platform algorithms form a feedback loop between human motivation and the algorithmic mechanisms that influence social interactions (Metzler and Garcia 2024). In addition, the analysis of the entropy structure of social networks shows that the structure provides signs of macroscopic evolution that can only be captured through the framework of complex systems (Li et al. 2024). Thus, the results of the study summarize that contemporary social structures are no longer static hierarchical systems, but rather adaptive, distributed, and continuously reproduced systems in digital environments. The use of lowercase and alphabetic letters for list numbering.

These findings suggest a need for a reinterpretation of the concept of "social structure," which has been dominant in the social sciences. If we continue to use the framework of hierarchy and stability, we fail to understand the current reality, where distributed networks and platform algorithms rapidly modify social relations. A

concrete example: research shows that social media algorithms create unexpected patterns of preference, visibility, and influence, so that power relations no longer reside solely in traditional institutions, but also in algorithmic nodes and platform networks (Brady et al. 2023) (Metzler and Garcia 2024). Therefore, this reinterpretation emphasizes that social structure must be understood as a complex, constantly changing system, not simply as a fixed social layer that serves as the basis for analysis.

One important implication of these findings is the dislocation of the positions of traditional social actors and institutions within distributed networks. As mechanisms of power, status, and social mobility are increasingly influenced by algorithms and platform networks, once-dominant institutions are being repositioned. For example, platform-based social mobility allows previously marginalized social actors to gain previously unimaginable visibility and connections, while formal institutions can lose control over their social interaction networks. Research on user mobility in online networks shows that users move across virtual social classes with different effects than traditional physical mobility (Wang et al. 2022) (Wang et al. 2021). Thus, this dislocation demands that we recognize that the orientation of social structures has shifted—institutions are no longer single centers, but rather nodes in broader, more dynamic networks.

This phenomenon also involves a process of "de-authorization," or the weakening of single authority within contemporary social structures. As algorithms and platform networks take over functions—regulation, visibility, and access to social resources—traditional authority structures such as bureaucracy, organizational hierarchies, or formal social institutions become relatively decentralized. One study suggests that platform algorithms influence social interactions through feedback loops between human motivation and the optimization of digital engagement—meaning algorithms become new mediators of social power (Metzler and Garcia 2024). Therefore, this de-authorization suggests that social structures are now shaped and maintained not only by human institutions, but also by platform networks and algorithms operating behind the scenes.

When compared to classical models of social structure, the research findings reveal substantive differences in how we understand social relations and inequality. While classical models view social structures as multilevel, stable, and institutionally oriented systems, current findings portray structures as adaptive, multipolar, and platform-based networks. For example, the literature on computational social science emphasizes that data aggregation processes and interaction media shape the network structures we observe—suggesting that data and media are not simply tools, but are part of the structure itself (Xu 2023). Thus, this comparison emphasizes that older frameworks need to be updated to be relevant to contemporary dynamics; otherwise, analyses of social structure will remain outdated. 5 mm for left indentation.

Based on these findings, methodological and conceptual actions are needed to strengthen the study of social structure in the digital era. Without updated analytical

and methodological frameworks, social research will continue to lag behind increasingly complex and rapidly changing phenomena. Recommendations include: adopting a complex systems approach in social studies; using social network analysis, multilayer network modeling, and agent simulation; collecting digital platform data and dynamic network observation; and incorporating algorithms as part of social structure analysis. A special issue states that theoretical and computational approaches are encouraged to address the challenges of increasingly complex social systems (Xu 2023). Thus, these actions not only enrich the science of social structure but also provide a foundation for relevant, responsive, and accurate social science research in mapping the dynamics of contemporary digital society.

## **2. Evolution of Structure and Dynamics in Socio Digital Space**

The results of the study show that socio-digital dynamics work as a process-co-evolution between agents and structures that occur in real time: user behavior, platform design, and algorithms mutually modify each other, forming new configurations of power and inequality. This means that structures are no longer simply static "containers," but move and change with each interaction, while agents continually adapt their social strategies to algorithmic logic. The study of co-evolving networks in the context of opinion and social interaction, for example, shows how social networks and public opinion change simultaneously in the digital media ecosystem, making it difficult to read as a purely one-way influence (Chaos: Co-evolving networks for opinion and social dynamics, (Djurdjevic Conrad, Quang Vu, and Nagel 2024b)). Thus, the main findings confirm that the socio-digital space is an arena where social structures and dynamics can no longer be separated, but rather shape each other in an ongoing evolutionary process.

These findings call for a reinterpretation of the concepts of social structure and power: previously understood primarily through institutions, class, and formal positions, they now need to be read through algorithmic logic and platform architecture. (R) Because, in digital spaces, symbolic power arises not only from traditional social status, but also from the ability to control or adapt to the algorithmic mechanisms that regulate visibility and the distribution of attention. (E) Lundahl (2021) introduces the concept algorithmic meta-capital to explain how algorithms act as a form of capital that can convert and organize other capital in media consumption (Lundahl 2022). Similarly, (Gilbert et al. 2023) shows how digital platforms organize public "immaturity" and produce platform power which is socio-symbolic. Therefore, social structures in the digital era need to be reinterpreted as networks of power mediated by algorithms, not simply as fixed arrangements of social positions.

Within this framework, research also reveals the dislocation of the positions of actors and social groups due to digital mechanisms such as visibility bias, algorithmic sorting, and data asymmetry. Dislocation occurs when algorithms shift who appears important, credible, and worthy of being heard, thereby changing the map of social representation without actors or institutions always realizing it. The study of

structural racism in tech demonstrates how platforms and algorithms can reproduce structural racism through search results, content moderation, and systemic designs that disadvantage vulnerable groups (Noble et al. 2025). On the other hand, research on “social media harms as a trilemma” confirms that network asymmetry, algorithmic logic, and platform design drive unequal distribution of information and trust (Cheong 2023). Thus, social positions in digital spaces do not simply perpetuate old structures but shift and dislocate through the opaque operation of algorithms.

This process is intertwined with what can be called deauthorization: the weakening of traditional authority while simultaneously strengthening algorithmic and platform authority. As algorithms determine what appears on the homepage, who is recommended, and what content is deemed relevant, symbolic authority shifts from formal institutions to the computational logic of a handful of technology corporations. The literature on algorithmic logic in digital capitalism shows how algorithms play a role in reinforcing power asymmetries and social exclusion in both digital and non-digital realms (Prodnik, 2021). At the micro level, studies on algorithmic bias in various domains—from advertising and recruitment to healthcare and education—have noted that decision automation often widens existing inequalities (Agarwal et al. 2023). Therefore, contemporary social authority cannot be understood without acknowledging the algorithmic dominance that governs who is seen, trusted, and accessed.

Compared to the classical framework, the research confirms that the reproduction mechanisms of inequality now operate through much more subtle yet systematic digital channels. While previously inequality was primarily explained by access to education, economic capital, or formal status, we now need to add the dimensions of algorithmic visibility and recommendation bias as new structural variables. A systematic review of algorithmic fairness shows that recommendation systems that rely heavily on historical data easily reinforce existing biases and result in an unfair distribution of benefits (Li et al. 2023). Sociological analysis of “algorithms and social inequality” also confirms that algorithmic sorting processes have the potential to exacerbate the vulnerability of marginalized groups (Bhatal 2012). Thus, social inequality in the digital age is not simply inherited from old structures but reproduced and modulated through digital mechanisms that appear technical but are fraught with political dimensions.

Based on these findings, action plans and recommendations for change need to be directed at two levels: theory development and policy/platform intervention. Without conceptual and regulatory updates, the co-evolution of structures and dynamics in the socio-digital space will continue to produce configurations of power and inequality that are difficult to control. (E) At the theoretical level, a more systematic integration is needed between the complex systems approach, Bourdieu's symbolic capital studies, and the literature on algorithmic fairness. At the practical level, studies on perceptions of justice in algorithmic decision-making emphasizes the importance of

human-centric and participatory design in developing automated systems (Starke et al. 2021). Meanwhile, research on "data capital" demonstrates the need for critical awareness and regulation of how data is processed into new symbolic capital in consumption. Therefore, the main recommendation of this paper is to develop a regulatory, ethical, and research methodology framework that explicitly recognizes the co-evolution of structure and dynamics, while simultaneously intervening in digital mechanisms that reproduce inequality, so that socio-digital spaces become more just and socially reflective (e.g., fragmentation, digital exclusion, or the concentration of platform power). Thus, new analytical models do not cease to be conceptual innovations, but become practical foundations for reading, critiquing, and improving social structures in the socio-digital era.

### **3. Analytical Model Reconstruction**

This research successfully presents a new analytical model based on complex systems principles for understanding social structure and societal dynamics in a digital context. Because classical models are limited in capturing layered relationships, real-time dynamics, and the interplay of micro-macro interactions, a framework that integrates multilayer networks, agent adaptation, and structural evolution is needed. As evidence, a recent study using a multilayer network framework to model the evolution and resilience of multimodal social networks demonstrated that the model is effective in mapping intra- and inter-layer interactions as well as temporal changes (Bonifazi et al. 2023a). Thus, this new model summarizes the main methodological and conceptual innovations that strengthen the analysis of social structure and societal dynamics in the digital era.

This model encourages a conceptual reinterpretation of what is meant by "social structure" and how societal dynamics operate. Because structures can no longer be assumed to be static or simply hierarchical entities—but rather adaptive networks that continually transform through the interactions of agents and algorithms—the meaning of structure must be expanded. The growing emphasis in the literature on complex networks and social network analysis as new paradigms in sociology demonstrates that the complexity approach has become a key driver in understanding modern social systems (Wang, Ning, and Gao 2024). Therefore, this reinterpretation is crucial to ensure that social structure theory remains relevant and capable of explaining contemporary social phenomena.

This model creates a dislocation in the methodological and theoretical orientations toward the study of social structure. As the focus shifts from a single-layer, linear, institutional model to a multilayer model that captures complex interactions, traditional research positions are displaced. A concrete example: the multilayer network framework enables the analysis of network resilience. social impact on intra-layer and inter-layer disturbances, which shows that social structures are not only formed by formal institutions, but by heterogeneous networks and interdependencies (Bonifazi et al. 2023b). Thus, this dislocation suggests that social structure research

must reposition itself methodologically and conceptually to avoid becoming outdated.

The use of complex systems models marks a process of de-authorization of classical models in the study of social structure. As classical models relying on hierarchy, stability, and formal institutions are no longer sufficient, explanatory authority shifts to new analytical frameworks capable of addressing non-deterministic, emergent, and adaptive factors. One article reveals that social network analysis using a new approach can improve community detection and uncover hidden structures that traditional models miss (Pine et al. 2023). Thus, new models weaken the dominance of older frameworks and make room for more dynamic and contextual approaches.

Compared with classical models of social structure, complex systems-based models have several significant advantages. Because classical models focus on linear variables and institutional regularities, while digital social reality encompasses interlayered relations, real-time adaptation, and network feedback, classical models cannot address these complexities. As evidence, the literature on multilayer networks emphasizes that multimodal social networks and relational evolution can only be explained through multilayer structures, demonstrating the inadequacy of single-layer models (Bonifazi et al. 2023b). Thus, the advantages of complex systems models are clear: they do not negate classical models, but rather complement them with a richer and more relevant analytical lens for contemporary digital society.

Based on the reconstruction of this analytical model, strategic recommendations should be directed at developing theories, methods, and practices for studying social structure and societal dynamics. Without structural changes in research approaches, the social sciences risk being left behind in understanding rapidly changing and complex digital societies. For example, the development of multilayer network frameworks and the application of complex systems analysis in modern social research have been recommended by several studies as important steps forward (Pine et al. 2023) (Bonifazi et al. 2023b). Therefore, it is recommended that the academic community expand the adoption of complex systems models, strengthen multilayer analysis capacities, and integrate computational and simulation methods to make knowledge production on social structure and societal dynamics more responsive, precise, and innovative.

#### **4. Critical Discussion**

The complexity model necessitates a reinterpretation of the concepts of social structure and societal dynamics. Because today's social structures are shaped not only by formal institutions and direct relationships between individuals, but also by algorithms, digital platforms, and invisible multilayered networks, traditional analytical frameworks must be expanded. For example, a study examining digital division and social stratification on social media platforms in China found that socio-technical factors (platform affordance) have a strong influence on digital stratification

that cannot be explained solely by classical social structure (Pan et al. 2025). Therefore, this conceptual reinterpretation is crucial for maintaining the relevance of social structure theory and understanding the dynamics of digital society.

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This model also demonstrates a dislocation in the analytical and theoretical positions of the study of social structure. While classical models often place institutions and social classes as the primary focus, in digital societies actors, platforms, and algorithms also shape structures—the center of analysis shifts. A multi-country study of social media user experiences shows that social media use brings paradoxes—convenience vs. privacy, trust vs. suspicion—that reveal social transformations not captured by traditional frameworks. (“Dialectics of Complexity: A Five-Country Examination of Lived Experience with Social Media” (Masullo, Riedl, and Tenenboim 2020). Thus, this dislocation leads to a shift in focus from institutions to networks, from class to connectivity, and from stability to dynamic change.

The analysis process also presents a form of de-authorization of the dominance of classical models in social science. Because the old model maintains a single explanation that relies on hierarchy and formal structure, while the complexity framework opens up space for multiple agents, informal connections, and algorithms as actors—the explanatory authority shifts. In the literature linking digital technology and social transformation, it is found that systemic communication structures (not just human actors) play a large role in shaping social reality. (“Reimagining Sociality in the Digital Age: Transcending the Interaction/Society Dichotomy”. Therefore, this de-authorization marks the end of the dominance of the “structure as a fixed framework” approach and the beginning of a more open, adaptive, and plural approach.

Compared to classical models, complexity-based models have substantial advantages in understanding contemporary social structures. While classical models are good at mapping formal structures and explaining mobility within a stable framework, they are less able to account for digital networks, algorithmic interactions, and multilayeredness while complexity models can capture all of these. For example, a literature analysis shows that studies Research on social media and network complexity has successfully identified non-linear and unexpected patterns of structural evolution. (“Social Media Use and the Challenge of Complexity: Evidence

from the Business Context”) (Martín-Rojas et al. 2021). Thus, this comparison confirms that the complexity model is not only an alternative, but a significant conceptual improvement over the classical model for the digital age.

Based on this critical discussion, strategic action steps are needed to bridge the gap between classical approaches and contemporary analytical needs. Because without the adoption of more relevant analytical models, the study of social structures will continue to lag behind in understanding digital transformation and its social consequences—from digital inequality to changing power relations. As recommendations: (1) integrate complex systems theory in the social science curriculum; (2) use multilayer network methods and simulations for empirical analysis; (3) encourage interdisciplinary collaboration (sociology, network science, social computing) to map digital social dynamics; (4) invite policymakers to understand digital structures as adaptive systems. Recent bibliometric studies highlight that research on digital society and social conflicts continues to grow and requires a new framework. (“Digital Society and Social Conflicts: A Science Map of the Field”) (Madina et al., 2024), Therefore, this recommendation emphasizes that methodological and conceptual transformations must be carried out immediately so that studies of social structures and societal dynamics can remain relevant, reflective, and impactful in the socio-digital era.

## CONCLUSION

Based This research answers the research problem by demonstrating that the complex systems approach is able to explain the co-evolution between social structures and societal dynamics in a socio-digital context more accurately than classical models. This occurs because the complexity approach allows mapping of real-time interactions, multi-layered networks, and agent-algorithm relationships that cannot be captured by traditional linear frameworks. Various findings indicate that digital social structures now operate through feedback loops between user behavior, platform design, and algorithms, so that the structure is no longer stable but continues to change and develop. Thus, the research problem is answered by proving that the complexity approach provides a relevant, adaptive analytical framework that is able to interpret digital social dynamics coherently.

The most important finding of this research is that modern social structures are distributed, adaptive, and digitally reproduced, not static entities as assumed by classical theory. The research demonstrates that power, inequality, and identity are shaped not only through institutions but also through algorithmic mechanisms such as visibility bias, algorithmic sorting, and data asymmetry. Various studies confirm that algorithms can reinforce or reduce inequality, depending on how they prioritize information, present certain actors, or sort social opportunities within digital platforms. Therefore, understanding social structures in the digital era must always

consider the role of algorithms as both structural actors and as a medium for social change.

The main strength of this research lies in its theoretical contribution, which introduces a new analytical model based on complex systems for the study of social structure and societal dynamics. This contribution is significant because it offers a new lens that combines network theory, multilayer analysis, and adaptive modeling, thus expanding the boundaries of traditional social analysis. The developed framework can be used to map changes in social structure more precisely, understand the mechanisms of digital power, and analyze the reproduction of inequality in various platform contexts. Thus, this research provides a methodological and theoretical foundation that can enrich academic discourse and serve as a foundation for further research in digital sociology.

Despite producing a robust conceptual model, this study has several limitations that should be noted. These limitations relate to the scope of cases, population variation, and a methodological approach that does not fully capture the complexities of digital society. For example, this study did not test the model across gender, age, social class, geographic location, or specific cultural contexts; furthermore, the analysis primarily utilized a conceptual approach and has not been fully validated using large-scale computational data. Therefore, this research needs to be complemented by cross-platform, cross-demographic, and cross-country empirical studies to produce a more comprehensive and applicable model.

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