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Digital Societies: Impact of Technology on Social Structures and Interactions

Anupom Debnath
Department of Business Administration, International American University, Los Angeles, CA 90010, USA
Corresponding Author: debnathanupom05@gmail.com

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ABSTRACT

This study examines the intricate links between technological innovation systems (TIS) and the broader "context structures" that influence them. Historically, TIS research has acknowledged various contextual influences, but we propose that the TIS framework can be significantly enhanced by adopting a more detailed understanding of TIS context structures and their interactions. To achieve this objective, we delve into four particularly significant categories of contextual frameworks: technological, sectoral, geographical, and political. By analyzing these categories, we can uncover the diverse ways in which context structures interact with and shape a focal TIS. For instance, technological advancements can drive innovation within a TIS, while sectoral contexts can provide the necessary industry-specific conditions for TIS development. Geographical contexts offer unique regional advantages or limitations that affect TIS dynamics, and political contexts can either facilitate or hinder innovation through regulations and policies. By explicitly incorporating these context structures into the TIS framework, we enhance our understanding of the complex dynamics at play. This enriched perspective provides valuable insights for analysts, helping them to identify key factors that influence TIS performance and development. Furthermore, it sets a comprehensive research agenda aimed at exploring these interactions in greater depth, ultimately contributing to more effective and context-sensitive innovation strategies.

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1. Introduction

In the academic literature on innovation processes and accompanying policy-making, system concepts have become increasingly important over the past thirty years. These approaches have been crucial in addressing various urgent public policy issues, including national economic competitiveness, regional industrial revitalization, and global environmental sustainability (Carrasco et al., 2008).

The particular iteration of technical innovation systems (TIS) centers on comprehending the operational dynamics of the innovation system surrounding a given technology. The emphasis can be placed on established technological domains or on the birth and dissemination of novel and revolutionary innovations. A significant portion of the research using the TIS framework has concentrated on examining the development of clean-tech industries (Sarathy & Robertson, 2003; Shou, 2012; Stahl et al., 2014). As a result, it has become a fundamental component of sustainability transitions research. Within the realm of transition studies, TIS provides an analytical framework to comprehend the intricate characteristics of the development and expansion of novel businesses. It specifically concentrates on examining hindrances to this progression, which are referred to as blocking mechanisms, system weaknesses, or systemic difficulties (Sassen, 2012). The framework also aids in the translation of impediments into intervention and policy solutions, resulting in the development of ideas such as systemic instruments and policy mixes.

Technology-specific aspects have long been a focal point in TIS research, given its technology-centered approach (Hanandini, 2024). Nevertheless, due to its nature as a systems approach, analysts have consistently attempted to incorporate the influence of interactions with other systems, including sectoral and national systems of innovation, which are broader in scope than the TIS (Bibri & Krogstie, 2017). The 'functions approach' was created as a methodological tool to address the complexity of a TIS by combining multiple effects from many sources into a collection of essential operations. This has facilitated numerous comprehensive empirical examinations of how the dynamics of different

*Corresponding author: debnathanupom05@gmail.com (Anupom Debnath)

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Technological Innovation Systems (TISs) have been influenced by internal and external forces (Chayko, 2020).

Simultaneously, the functions framework does not explicitly address the dynamics of the surrounding settings. Recently, TIS scholars have revisited the connection between TISs and contextual systems (Goldsmith & Brewer, 2015). Researchers have expanded the geographical aspect, examined the simultaneous advancement and rivalry of many technologies, and connected TISs to broader policy contexts. Furthermore, there have been suggestions to integrate the TIS framework with the Multi-Level Perspective in order to more effectively understand the connection between technological advancement and changes within certain sectors (Helsper, 2008).

Although these studies have added to our understanding of how a TIS is connected to different contextual structures, we still do not have a comprehensive framework that clearly explains how the connections between a TIS and its surroundings may be conceived (Jarrahi & Eshraghi, 2019; Taylor & Gibson, 2017).

A structure of this nature would offer a minimum of four distinct advantages. An enhanced contextual understanding would enhance the TIS framework as a policy tool by providing guidance to analysts in identifying key interactions between a focal TIS and its context. Furthermore, it would enhance the consciousness among analysts and policy-makers regarding the significant variations in contexts and the diverse trajectories of technological development in different contexts (DiMaggio et al., 2001). By explicitly considering contexts, we may enhance our comprehension of the unique aspects of individual case studies. Additionally, this approach serves as a foundation for classifying, generalizing, and applying findings, which is crucial for policy-making based on Technological Innovation Systems (TIS) (Bimber et al., 2012). Fig. 1 depicts the chronology of the years in which the papers in the corpus were published.

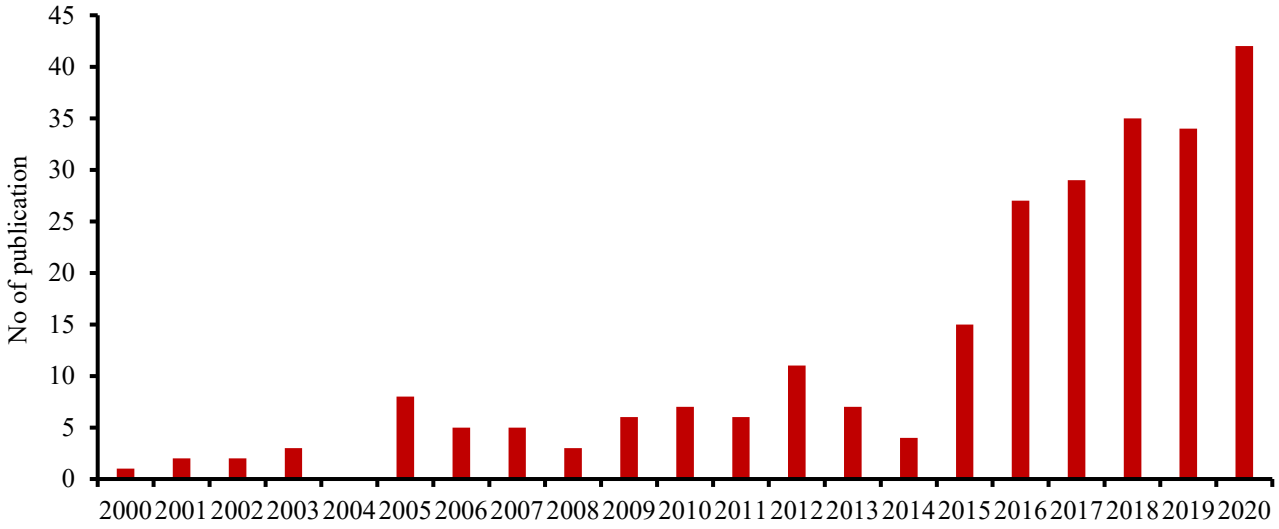

Fig. 1. Chronology of the years in which the papers in the corpus were published (Bimber et al., 2012)

Furthermore, recognizing that context structures are dynamic rather than fixed enables analysts to pinpoint highly advantageous (or disadvantageous) circumstances for the advancement of novel technologies. Furthermore, the integration of context structures into a cohesive framework will enhance analytical research by examining the specific influence of a particular TIS (or group of TISs) on various contexts. Therefore, an added advantage could be to facilitate the creation of a TIS-based framework that is useful for assessing significant transitions that involve the expansion and decline of several technologies and related sectoral transformation processes.

This research aims to develop a more explicit framework for analyzing the relationships between a TIS (Technological Innovation System) and various context structures. Specifically, it focuses on examining the relationship between a TIS and four different context structures. In addition, we develop a series of inquiries that could serve as the foundation for a research plan. The chosen scenarios encompass additional TISs, industrial sectors, geographical locations, and political regimes.

2. Technological innovation system structures

A technological innovation system refers to a collection of components, such as technologies, actors, networks, and institutions, that actively contribute to the advancement of a specific technology domain, such as a particular technical knowledge area or a product and its. The TIS perspective highlights the interconnectedness of these factors, resulting in synergistic effects such as shared resources that enable actors to collaborate effectively, which would not be possible if they worked independently.

The presence of system-level assets necessitates the careful selection of system boundaries. The boundary delineates the TIS, which refers to the domain where interconnections and interdependencies within a particular technical area occur, from its "context," encompassing all other structures and pertinent aspects outside of the TIS. Within the literature, the

establishment of system boundaries is primarily regarded as an analytical issue. This means that system boundaries can be defined in various ways, depending on the specific research focus of the analyst. Furthermore, these boundaries often need to be modified as the analysis progresses. The primary objective of boundary setting is to establish the specific technology and level of analysis that will be the main emphasis. This includes determining the knowledge field, product, or applications of the technology that will be examined. In empirical analysis, it is typical to employ a geographical delimitation, such as a region or a country.

The literature often provides well-developed conceptualizations of the structures and processes inside a focal TIS. As stated in the introduction, the understanding of what occurs outside and across the system border has been less methodically developed. In this part, our objective is to identify several sorts of significant interactions that transcend TIS bounds and potentially result in interconnected dynamics between a TIS and diverse contextual structures. There are two main types of TIS-context interactions: "external links" and "structural couplings". These terms describe distinct levels of interdependence. The divergence between these is more of a gradual process rather than a definitive separation. The primary inquiry to contemplate is whether actors within a TIS have the ability to exert control over the fundamental contextual factors or not. Fig. 2 shows process of finding paper containing potential solutions.

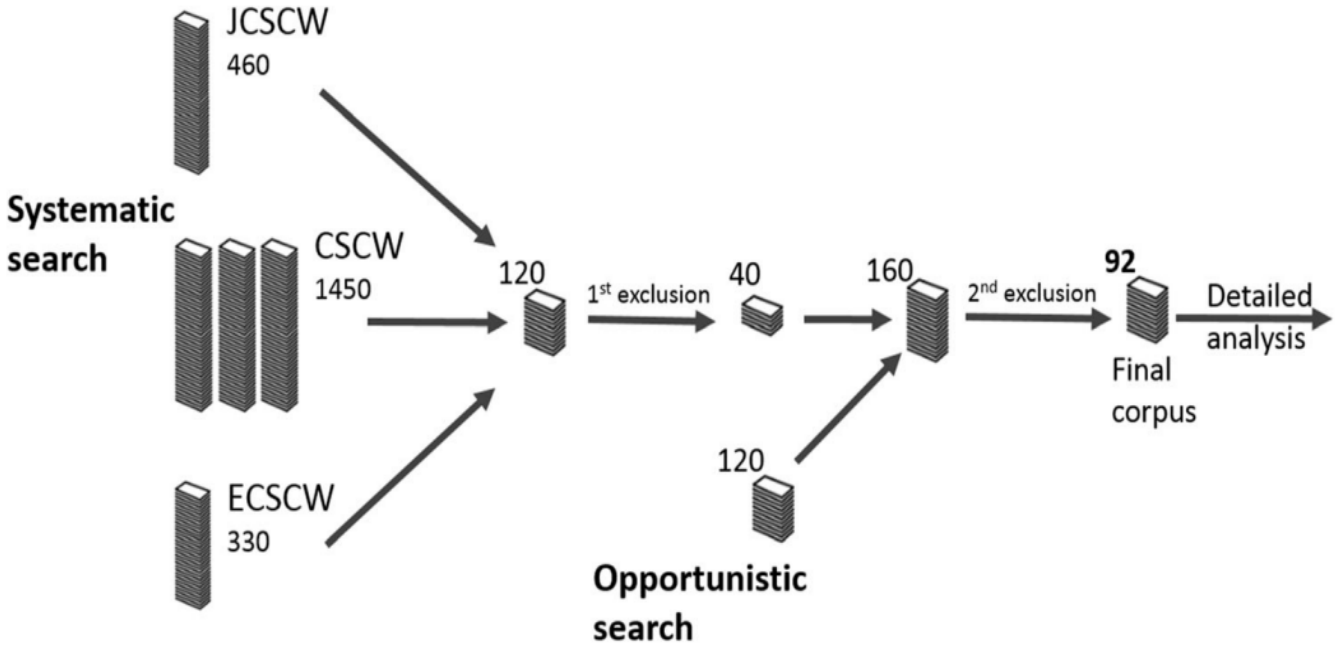

Fig. 2. Process of finding paper containing potential solutions (Bimber et al., 2012).

External linkages refer to the effects, resources, or assets that exist between a TIS and a particular context. These factors impact the growth of the TIS but are not influenced by internal processes within the TIS. Examples include abrupt fluctuations in crucial industrial inputs, significant technological catastrophes, and profound shifts in political agendas within a society. In addition to these remote forces, external links can also be in closer proximity to the impact of the focal TIS. This includes national policies that affect the generation of knowledge or market conditions, as well as the availability of physical infrastructure, a highly skilled workforce, or supportive public discussions (such as Climate Change in the context of renewable energies). Generally, we can assume that context structures that are closer to the effect of TIS-internal processes will gradually transform into structural couplings.

While external links mostly function from the context to the TIS, it is also worth considering the potential influences in the opposite direction. Nevertheless, this occurrence is somewhat less common, particularly during the initial stages of development. An example could arise when the presence of a Technological Innovation System (TIS) is used by established industry players to justify their continued investment in traditional technologies. They may utilize the TIS to demonstrate that they are taking action or to argue that the new technology is not functioning effectively. Both examples are prevalent in the recent history of alternative drive trains in the vehicle sector.

The second type of interaction, which is more significant, is influenced by "structural couplings". These couplings refer to shared features such as individuals, networks, institutions, and technology between a TIS and certain context structures. Structural connections occur because the majority of TIS parts are not solely designed to promote the technology being considered.

3. Analysis results

Rather, they are commonly integrated concurrently into multiple diverse situations. Consider a company that offers a wide range of products, such as food and clothing, and

oversees multiple diverse methods of innovation. This company may be affiliated with a certain TIS (such as organic food), yet simultaneously and more significantly, it must adapt to changes in a specific industry (in this case, retail), operate in many policy areas, and oversee global value chains. This implies that the decisions and strategies of actors who share a common interest cannot be solely attributed to their membership in the focal TIS. Fig. 3 shows technology involvement by age.

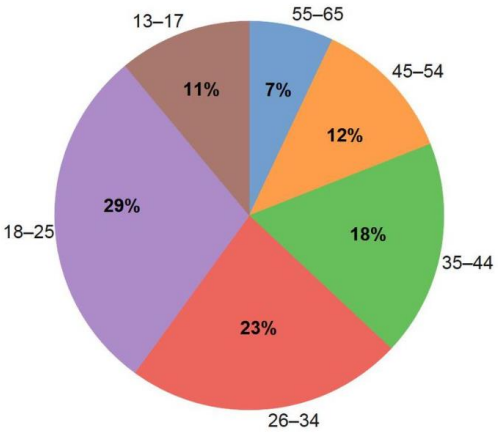

Fig. 3. Technology involvement by age (Hill et al., 2015).

Instead, these decisions and strategies are influenced by an intricate interplay of internal decision-making processes within the firm. These processes involve weighing the tensions and trade-offs between various goals that the firm aims to achieve in different domains. The company can be regarded as a connecting framework between the TIS and many contexts, requiring it to adapt to changes in these distinct domains. Networks and institutions can also serve as parts of structural coupling. One instance is the feed-in tariff in Germany, which is an intricate agreement that balances the needs of many supporters of renewable energy and the broader concerns of political parties, established energy companies, and other parties involved.

Couplings can encompass individual elements or an entire spectrum of elements. This allows for a wide range of system overlaps, varying from completely autonomous to highly resonant systems. A TIS (Technological Innovation System) that has couplings to context structures, whether it's numerous elements or just a few crucial ones, can be significantly influenced by these structures and can also exert influence on them in return. This suggests that the interaction between a focal TIS and different context structures might lead to interdependent dynamics, where the dynamics observed in a particular context can influence the development of a TIS and vice versa. The study of Gamliel and Gabay (2014) investigates the impact of digital education on the empowerment of different generations and their social interaction. The findings of this study are presented in Table 1.

Table 1. An analysis of the empowerment of children and seniors before and after the MCP program (Hill et al., 2015).

Comparing Pre-/Post-MCP Empowerment of Children and Seniors

	Pre-MPC			*Post-MPC*		
Empowerment subscale	*Seniors mean/SD (n=25)*	*Children mean/SD (n=29)*	*t test*	*Seniors mean/SD (n=24)*	*Children mean/SD (n=27)*	*t test*
Self-confidence	3.47/0.42	3.15/0.83	**2.317***	4.08/0.69	3.96/0.58	0.661
Self-efficacy	3.76/0.49	3.27/0.78	**2.663***	4.21/0.43	3.89/0.74	1.821

Note. Two-tailed significance: *$p<.05$; **$p<.01$.

4. Conclusions and recommendations

This work contends that the dynamics of technological innovation systems are impacted by many contextual structures. Furthermore, we make progress in developing a detailed characterization of these contexts. Context structures are defined as organizational domains that demonstrate a certain level of institutional coherence. We categorize interactions into two main types: external linkages and structural couplings. These types differ in the level of interdependence between a focal TIS and certain surrounding structures. We will provide a more comprehensive analysis of four distinct sorts of situations. Firstly, advancements in a central Technological Innovation System (TIS) are influenced by advancements in other TIS. This connection has the potential to be both encouraging and competitive. Furthermore, there exists a reciprocal relationship between TISs and sectors.

A sector consists of various Technology and Innovation Suppliers (TISs) that provide the necessary technologies and products to fulfill a specific role for potential users. Interaction occurs as a result of legislation, conventions, cognitive frames, and physical infrastructures that are distinctive to each sector. Furthermore, we identified a spatial aspect of TIS context structures.

Technological advancements are not uniformly spread across different locations, and regional frameworks have varying

effects on the creation and spread of technology. Ultimately, we identified a political aspect characterized by a "conflict over institutions."

Initially, it is important to recognize that there exist additional context structures that are pertinent, apart from the four that we specifically address in this study.11 Although we did not include a comprehensive list of all pertinent context structures, we anticipate that the explanations presented in this study will serve as a model for assessing future context structures. Furthermore, the four context structures may not be well delineated in a practical scenario. The main idea expressed here is that, depending on the objective of the study, we might concentrate on a certain contextual framework to examine its dynamics and connections to the central Technological Innovation System (TIS). Therefore, we might see the contexts as distinct conceptual lenses that exclude each other, with each lens highlighting unique aspects and collectively offering a more comprehensive understanding of an empirical situation.

The consequences of a clear and more comprehensive understanding of TIS settings for analysts are substantial. One advantage is that it helps identify the root causes of systemic issues, which may subsequently be addressed through various treatments.

It emphasizes that in order to fully comprehend the TIS in question, one must also have a deep awareness of the dynamics of many contexts and how they interact with the TIS. An important lesson for analysts is the wide range of topics that can be covered in TIS studies. These topics include the politics of institutional change, which can be examined by analyzing the discourses of different political networks, as well as the technological connections between TIS, both within and outside of sector boundaries.

The second lesson is that the analyst must obtain a comprehensive comprehension of industrial dynamics, which encompasses a more than superficial awareness of the technologies involved and relies on insights from several scientific fields. It is essential to comprehend the importance of interactions with supplementary Technological Innovation Systems (TISs), such as infrastructure, and the connections of a technological nature where the main TIS can get advantages from the knowledge base and products created in other TISs.

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References

Bibri, S. E., & Krogstie, J. (2017). On the social shaping dimensions of smart sustainable cities: A study in science, technology, and society. *Sustainable Cities and Society*, *29*, 219-246.

Bimber, B., Flanagin, A., & Stohl, C. (2012). *Collective action in organizations: Interaction and engagement in an era of technological change*. Cambridge University Press.

Carrasco, J. A., Hogan, B., Wellman, B., & Miller, E. J. (2008). Agency in social activity interactions: The role of social networks in time and space. *Tijdschrift voor economische en sociale geografie*, *99*(5), 562-583.

Chayko, M. (2020). *Superconnected: The internet, digital media, and techno-social life*. SAGE Publications, Incorporated.

DiMaggio, P., Hargittai, E., Neuman, W. R., & Robinson, J. P. (2001). Social implications of the Internet. *Annual review of sociology*, *27*(1), 307-336.

Gamliel, T., & Gabay, N. (2014). Knowledge exchange, social interactions, and empowerment in an intergenerational technology program at school. *Educational Gerontology*, *40*(8), 597-617.

Goldsmith, A., & Brewer, R. (2015). Digital drift and the criminal interaction order. *Theoretical Criminology*, *19*(1), 112-130.

Hanandini, D. (2024). Social Transformation in Modern Society: A Literature Review on the Role of Technology in Social Interaction. *Jurnal Ilmiah Ekotrans & Erudisi*, *4*(1), 82-95.

Helsper, E. (2008). *Digital inclusion: an analysis of social disadvantage and the information society*. Department for Communities and Local Government.

Hill, R., Betts, L. R., & Gardner, S. E. (2015). Older adults' experiences and perceptions of digital technology:(Dis) empowerment, wellbeing, and inclusion. *Computers in Human Behavior*, *48*, 415-423.

Jarrahi, M. H., & Eshraghi, A. (2019). Digital natives vs digital immigrants: A multidimensional view on interaction with social technologies in organizations. *Journal of Enterprise Information Management*, *32*(6), 1051-1070.

Sarathy, R., & Robertson, C. J. (2003). Strategic and ethical considerations in managing digital privacy. *Journal of Business ethics*, *46*, 111-126.

Sassen, S. (2012). Interactions of the Technical and the Social: Digital formations of the powerful and the powerless. *Information, Communication & Society*, *15*(4), 455-478.

Shou, D. (2012). Ethical considerations of sharing data for cybersecurity research. Financial Cryptography and Data Security: FC 2011 Workshops, RLCPS and WECSR 2011, Rodney Bay, St. Lucia, February 28-March 4, 2011, Revised Selected Papers 15,

Stahl, B. C., Doherty, N. F., Shaw, M., & Janicke, H. (2014). Critical theory as an approach to the ethics of information security. *Science and Engineering Ethics*, *20*, 675-699.

Taylor, J., & Gibson, L. K. (2017). Digitisation, digital interaction and social media: embedded barriers to democratic heritage. *International Journal of Heritage Studies*, *23*(5), 408-420.