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ORIGINAL RESEARCH ARTICLE

An Analysis of the Driving Forces Influencing Productivity-Oriented Design Management in Urban Planning and Architecture Offices in Tehran

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ABSTRACT

BACKGROUND AND OBJECTIVES: The driving forces of productivity-oriented design management in architecture and urban planning offices, as a novel approach to improving project performance, focus on identifying and analyzing the key factors influencing the design process. Accordingly, the present study aims to examine the driving forces affecting the status of productivity-based design management in selected architecture and urban planning offices in Tehran.

METHODS: The study is applied in nature and uses a descriptive–analytical method. Theoretical data were collected through documentary research, and empirical data were obtained via a Delphi-based survey. Twenty experts were selected through purposive sampling, and 40 factors in six main dimensions were analyzed using structural cross-impact analysis in MICMAC software.

FINDINGS: The cross-impact analysis indicated that the driving forces occupy a complex, intermediate state, mostly in the independent cluster. Among 31 identified drivers, the most influential include precise project planning, advanced design software use, effective stakeholder communication, quality control, human resource management, and project risk management. These factors have the greatest direct impact on productivity-oriented design management in the studied offices.

CONCLUSION: The analysis identified key drivers such as precise project planning, advanced design software, stakeholder communication, quality control, and risk management as having the greatest direct impact.

RUNNING TITLE: Key Drivers of Productivity-Oriented Design Management in Design Offices

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INTRODUCTION

In today's competitive and innovation-driven environment, design management has emerged as a core element in fostering creativity and productivity within professional systems. Over time, this concept has evolved from a purely technical process into a strategic, interdisciplinary approach that establishes an organic link between design, management, and innovation. Contemporary design management not only organizes design workflows and decision-making in projects but also serves as a driving force for organizational transformation particularly in architecture and urban planning offices where design constitutes the core of their activities. By coordinating multidisciplinary teams, optimizing resources, and enhancing the quality of design processes, this type of management creates a foundation for value creation and sustainable competitiveness (Buchanan *et al.,* 2011). In essence, design management integrates creative thinking, strategic planning, and the management of human and technical resources, facilitating innovation, organizational agility, and project success (Gasparin, 2018). From this perspective, it can be viewed not only as a managerial tool but also as a philosophical approach to structuring the design process and creating meaningful, efficient urban environments (Borja de Mozota, 2003), which plays a decisive role in project quality and the productivity of architecture and urban planning offices (Horne, 2022).

Productivity in design management refers to the optimal use of human, financial, and technological resources to achieve higher-quality outcomes. This concept focuses not only on reducing time and costs but also on enhancing creativity, innovation, and team coordination. By optimizing design processes, architecture and urban planning offices can deliver more effective projects with greater added value. Consequently, productivity is considered a key tool for improving the quality, speed, and impact of projects in competitive and urban contexts (Ševčíková & Knošková, 2022). In these offices, productivity is a critical challenge due to resource constraints and the need to rapidly adapt to market changes, and its effective management can play a decisive role in project success (Alawad *et al.*, 2020). Productivity is not merely cost reduction; it is a means to improve design quality, foster innovation, and create added value in projects. Architecture and urban planning offices—especially in complex urban and socio-economic environments must utilize resources effectively to deliver high-quality, efficient, and impactful urban projects (Borja de Mozota, 2003). Achieving this requires identifying process weaknesses, addressing negative feedback loops, and fostering effective stakeholder interactions. Recent studies indicate that adopting modern design management approaches, particularly productivity-based models, significantly enhances the efficiency of architecture and urban planning offices and facilitates innovation in design processes. Innovations emerging from these processes not only respond to market needs but can also have positive and lasting impacts on urban quality of life (Scaletsky & Costa, 2019). Today, architecture and urban planning offices in Tehran—as key actors in the construction and project execution industry—face serious challenges in productivity-oriented design management. Issues such as inefficient allocation of human resources, lack of operational and quality standards in design processes, insufficient use of advanced tools and software, and poor coordination among stakeholders reduce efficiency, increase costs, and negatively affect project quality and client satisfaction.

From a theoretical standpoint, prior research has been limited, mostly examining technical or managerial aspects in isolation, without providing an integrated framework for identifying and analyzing key productivity drivers. Gaps remain in integrating modern technologies, the role of innovation and creativity in enhancing efficiency, and fostering effective interactions between design teams and project management. This situation highlights the necessity of productivity-based design management models in Tehran's architecture and urban planning offices, enabling the identification, prioritization, and application of factors that improve quality, reduce costs, and promote innovation. Addressing these issues is essential because these offices serve as engines of urban development, playing a vital role in enhancing project quality.

Design management (DM) is an emerging branch of management science that integrates project management tools, strategy, supply chain management, and design knowledge to create a coherent structure for guiding organizational creativity (Ratna *et al.,* 2024). In this field, design managers aim to establish an organized yet flexible environment to achieve the company's strategic objectives through effective and efficient design. The concept gained formal recognition in the 1960s, notably with the establishment of the Presidential Design Management Awards in the UK, marking a turning point in defining DM as a systematic and integrated approach for directing organizational design activities (Stalz *et al.,* 2022). This initiative laid the foundation for viewing design not merely as a creative process but as a strategic tool to enhance organizational performance and align design activities with business objectives (Chung, 2010).

Design management is a comprehensive process encompassing all levels, from strategic to operational, covering steps from need exploration to design implementation. Decisions made within DM accelerate innovation and result in products, services, communications, spaces, and brand identities that improve user quality of life and ensure sustainable organizational success. In other words, design management is responsible for developing, planning, organizing, and monitoring resources to create products that are not only aesthetically appealing and functional but also optimally designed from the user's perspective. It rests on two main objectives: first, educating managers and designers to foster mutual understanding between design and management, facilitating collaboration between these two key roles; and second, developing and implementing methods to effectively integrate design into organizational structures, processes, and decision-making. DM operates on three levels:

- Operational: brand differentiation and production;
- Tactical: managing communications, marketing, and innovation;
- Strategic: defining business direction based on design (Scaletsky & Costa, 2019).

The multifaceted nature of DM makes providing a single comprehensive definition challenging (Gancho, 2023). Design managers hold diverse roles, and their performance and impact are influenced by factors such as industry type, organization size and structure, market conditions, and the importance of design in organizational goals. Therefore, DM is not limited to specific design activities and is context-dependent. Its multidimensional nature must align with overall business objectives and market needs to maximize strategic value (Oakley, 2015).

Consequently, design management is a relatively new concept compared to traditional design practice or management science. Various perspectives have conceptualized DM, often viewing it from an organizational lens, separate from the professional context in which design occurs (Sun, 2011). Its interdisciplinary nature bridges design and management, encompassing creativity, managerial practices, innovation, and organizational culture. In this study, DM is defined at the intersection of design and management sciences, highlighting collaboration between design-driven creativity and managerial processes in small- and medium-sized enterprises (Nielsen & Christensen, 2014). DM bridges the gap between design and management, connecting knowledge domains to enable design to be more business-oriented and management to adopt more human-centered approaches (Sun, 2011). Best (2006) defines DM as managing complex design strategies, processes, and projects (Best, 2010). Scaletsky and Costa (2019) emphasize DM's focus on managing internal organizational design resources, while Gancho (2023) views it as the strategic integration of design into business, emphasizing creative aspects, user understanding, and idea visualization to achieve business goals.

This approach positions DM as a critical capability for organizations, leveraging designers' creativity and ability to provide innovative, design-driven solutions. DM adopts forward-looking and participatory methods in the design process, using skills such as observation, dialogue, and empathy to improve products, services, and processes. Ultimately, it serves as an ongoing dialogue between the company and its environment, reinforcing design credibility, customer orientation, and creative

organizational culture (Gancho, 2023). Design managers play a pivotal role in aligning design processes with managerial perspectives, ensuring design activities effectively support organizational objectives (Borja de Mozota, 2003). Their responsibilities include overseeing product quality to meet established standards and consumer needs (Brown, 2010).

Focusing on the user experience is another key element of DM, as prioritizing consumer needs can foster market differentiation and drive product innovation. DM's interdisciplinary principles connect design with fields such as art, business, marketing, and media, emphasizing that design does not operate in isolation (Best, 2010). Borja de Mozota (2003) stresses that DM should be considered a strategic asset, integrating design into core business strategy to enhance brand value and drive innovation, encouraging investment in design as a means of market differentiation and competitiveness (Borja de Mozota, 2003). Productivity enables the optimal use of potential and actual resources with minimal cost and time, especially in small- and medium-sized firms. Researchers highlight two complementary dimensions of productivity: efficiency (doing things right) and effectiveness (doing the right things) (Kargar Sourki *et al.,* 2023).

Given the limited comprehensive studies on DM's role in enhancing productivity in architecture and urban planning offices, it is evident that DM plays a central role in these offices. By coordinating design processes, human resources, and business objectives, DM improves output quality and design process efficiency. Empirical evidence shows that DM, as a bridge between creativity and management, strengthens stakeholder communication, enhances innovation processes, and fosters team collaboration, significantly contributing to the performance of architecture and urban planning offices (Borja de Mozota, 2003). Additionally, DM enables the development of coherent design strategies aligned with organizational goals, facilitating better outcomes and sustainable value creation (Scaletsky & Moreira, 2019). Various productivity models closely relate to productivity-based DM and can improve quality and efficiency in architecture and urban planning offices (Alawad *et al.,* 2022). Table 1 illustrates how these models support coordination of design processes, resource optimization, team collaboration, and project quality, ultimately enhancing overall productivity in these offices.

Table 1: Models with Productivity-Based Design Management in Architecture and Urban Planning Offices

Productivity Model	Key Features	Relation to Productivity-Based Design Management	Application in Architecture and Urban Planning Offices
MEPI Productivity Cycle	Measurement, Evaluation, Planning, Improvement	Provides a continuous framework to review and enhance processes, enabling optimal resource management and project scheduling.	In medium-sized offices, this model can support continuous assessment of project quality and efficiency, optimize resource use, and improve overall design processes.
Hersey & Goldsmith (ACHIEVE)	Performance, Clarity, Motivation, Evaluation, Environment	Identifies employee needs and creates motivation, helping managers optimize design teams and increase productivity.	In architecture and urban planning offices, it can improve team interactions, coordination, and employee motivation, enhancing overall productivity of design processes.
Peoples Model	Efficiency and effectiveness indicators, scoring system	Provides specific indicators to evaluate performance, allowing identification of strengths and weaknesses in design teams.	Managers can assess team performance across design areas and precisely analyze and improve them.
Quantan & Weton	Productivity improvement strategies based on organizational growth stages	Emphasizes sustainable growth processes, enabling design managers to develop productivity improvement	In architecture and urban planning offices, it supports creating strategic design processes and decision-

	strategies aligned with organizational growth stages.	making to enhance productivity continuously.

Source: Talwar, 2009

Each of these models addresses different aspects of productivity within design management. The MEPI Productivity Cycle, due to its phased structure, allows managers to continuously monitor and improve processes, playing an effective role in optimal resource and time management. In contrast, the Hersey & Goldsmith (ACHIEVE) model, by focusing on employee motivation and role clarity, enhances team interactions and coordination, particularly suitable for team-based environments. In medium-sized architecture offices, effective design management is a vital tool for aligning creative activities with organizational objectives. This systematic approach, combining effective leadership, collaboration among architects, engineers, and interior designers, and clear processes and structures across planning, strategy, and R&D, not only improves design team efficiency but also strengthens project innovation. The outcome is the creation of coherent, user-centered spaces aligned with the office's brand vision, improving the quality of design outputs**.**

Sourki *et al.* (2023) developed a model for evaluating the maturity of productivity management systems in Iranian organizations, addressing both research and practical gaps in implementing such systems. Their comprehensive i-MAPS model integrates conceptual elements derived from literature and expert interviews to create a structured map for productivity management. Through a two-stage assessment process involving stakeholder participation, organizational maturity and development in utilizing the productivity management system were evaluated. The findings indicate that the i-MAPS model effectively identifies potential challenges and barriers, facilitating organizations' progress toward achieving operational and strategic success. Similarly, Souza *et al.* (2017) examined project management practices in architecture and urban planning offices, highlighting common practices such as kickoff meetings, budgeting documents, and progress documentation, while identifying key challenges in communication, requirements gathering, scheduling, and portfolio management. They proposed practical project management practices such as progress planning, change requests, and client acceptance documentation to enhance efficiency and reduce management issues in design offices.

Research in design management emphasizes its critical role in bridging creativity and organizational performance. Gasparin (2018) identified five key approaches in design decision-making, underlining designers' contributions to innovation and meaning creation, while Scaletsky & Costa (2019) clarified distinctions between design management and strategic design for improved business outcomes. Borja de Mozota *et al.* (2019) analyzed four decades of research, highlighting the interdisciplinary nature of design management and its impact on skills, tools, integration, and leadership. Alawad *et al.* (2022) demonstrated that integrating strategic, tactical, and operational levels of design management enhances performance in architecture firms. Ratna *et al.* (2024) emphasized the role of innovation and creativity in strengthening SMEs within creative industries, particularly for product development, operational efficiency, and competitive differentiation. Unlike previous studies that generally focused on broad productivity factors, the present study adopts an innovative approach by specifically analyzing key drivers of productivity in architecture and urban planning offices in Tehran. Using structural or cross-impact analysis, it models the complex interrelations among design management drivers, providing a systematic understanding of interactions and synergies in real office settings. This analytical framework offers practical insights for improving management structures and enhancing productivity in architectural projects, serving as a basis for strategic decision-making.

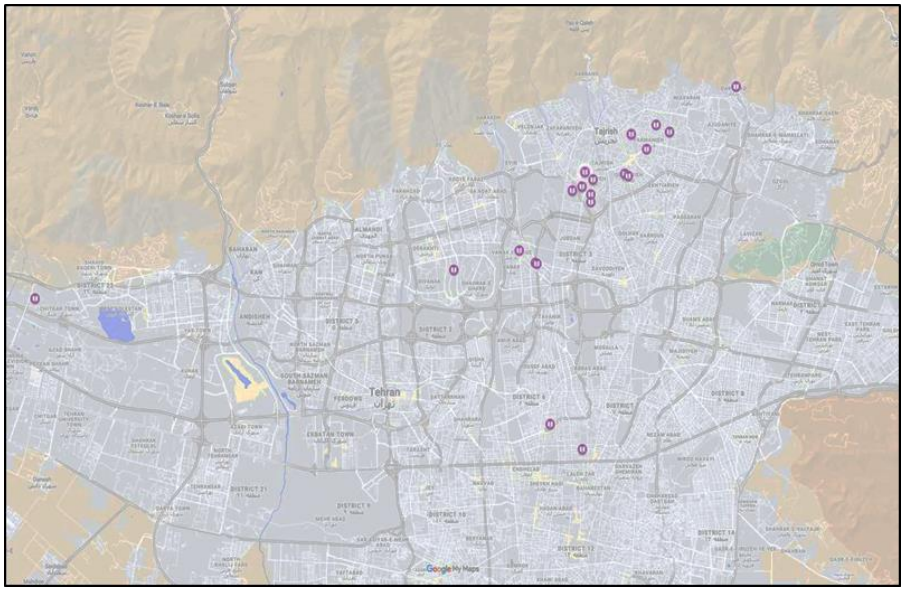

Fig. 1: The Location of the Area under Study in the Map of

management in selected architecture and urban planning offices in Tehran. The chosen offices, recognized as prominent models in the fields of design, architecture, and urban planning, were examined in this study. These offices, leveraging extensive experience and successful activities across various aspects of architecture, urban planning, and spatial design, play a critical role in fostering innovation and development in Iranian architecture. Their adoption of modern approaches, use of advanced technologies, optimization of design processes, project quality control, and provision of creative solutions make them influential actors in enhancing urban design and architectural performance (Fig. 1)**.**

The selection of these offices was based on criteria such as professional experience, number and scale of completed projects, involvement in urban development plans, and quality of design outputs. The target population of experts in this study includes managers, senior designers, engineers, and urban planners with extensive experience in managing and executing architectural projects. This group of specialists, with their comprehensive understanding of managerial and operational challenges, plays a decisive role in analyzing and evaluating the factors influencing productivity in design management within architecture and urban planning offices**.**

Identifying key drivers influencing the future state of productivity-oriented design management in Tehran's architecture and urban planning offices can improve strategic decision-making, enhance team coordination, boost project efficiency and quality, and optimize the use of human and financial resources. This understanding also allows for predicting the impact of managerial actions, setting development priorities, and establishing effective, innovative, and sustainable design processes in urban environments. Therefore, the present study aims to identify the driving forces affecting productivity-oriented design management in selected architecture and urban planning offices in Tehran. In line with this objective, the article employs cross-impact analysis to examine the key drivers influencing the current state of productivity-based design management in these offices, guided by the following research question:

- What are the key driving forces of productivity-oriented design management in selected architecture and urban planning offices in Tehran?

MATERIALS AND METHODS

productivity-based design management in selected architecture and urban planning offices in Tehran. This research is applied in purpose, mixed-methods in approach, combining documentary review and

survey techniques, and analytical-exploratory in nature, employing both quantitative and qualitative models. To identify the barriers and drivers, documentary analysis and survey data collected using the Delphi method were utilized. Since the study does not aim for statistical generalization, purposive sampling was applied for selecting the Delphi panel. The criteria for selecting experts included theoretical expertise, practical experience, willingness and ability to participate, and accessibility. The key consideration in determining the number of experts was to ensure a comprehensive representation of diverse perspectives. Typically, 14–20 experts participate in structural analyses of similar studies; accordingly, 20 experts in architecture and urban planning were ultimately selected for participation. MICMAC software was used to process the data through structural cross-impact analysis, identifying 31 initial drivers across six dimensions: individual, organizational, project, environmental, technological, and managerial (Table 2).

Table 2: Initial drivers identified in the present study

Dimension	Drivers
Individual	Var01. Technical skills, Var02. Creativity and innovation, Var03. Architectural knowledge, Var04. Communication skills, Var05. Accurate planning and time management, Var06. Motivation and commitment, Var07. Continuous learning orientation
Organizational	Var08 Organizational culture, Var09. Agile organizational structure, Var10. Implementation of management systems, Var11 Use of advanced technologies, Var12 Sufficient resources and budget, Var13 Transformational leadership
Project	Var14. Clear project definition, Var15. Precise project planning, Var16. Effective communication with clients, consultants, and contractors, Var17. Quality standards definition and control, Var18. Change management processes, Var19 Cost management
Environmental	Var20. Flexible and suitable workspace, Var21. Positive and motivating environment, Var22. Compliance with safety and health principles
Technological	Var23. Use of advanced design software, Var24. Use of online collaboration tools, Var25. Machine learning, Var26. Use of virtual and augmented reality, Var27. Accurate prototyping and modeling
Managerial	Var28. Human resource management, Var29. Creation of organizational knowledge base, Var30. Project risk management, Var31. Client relationship management

RESULTS AND DISCUSSION

Analysis of Initial Drivers Matrix and Mutual Impacts

Thirty-one drivers, identified as primary factors affecting the status of productivity-based design management in selected mid-sized architecture offices in Tehran, were analyzed using MICMAC software. The results indicate that the matrix fill rate is 96.50%, showing that the selected factors had extensive and dispersed influences on each other, and the system was in an unstable state. Out of 928 possible driver relationships in this matrix, 33 relationships were zero, meaning the factors had no influence on each other or were not influenced by each other. 162 relationships had a value of 1, indicating weak influence, 592 relationships had a value of 2, indicating relatively strong influence, and 174 relationships had a value of 3, meaning the relationships among key drivers were very high and had significant influence and susceptibility. The matrix, based on statistical indicators, after two data rotations, achieved 99% optimality, which indicates high validity of the questionnaire and its responses (Table 3).

Table 3: Initial Data Analysis of the Matrix and Mutual Impacts of Drivers

Index	Matrix Size	Number of Repetitions	Number of Zeros	Number of Ones	Number of Twos	Number of Threes	Total	Fill Rate
Value	31	2	33	162	592	174	928	96.50%

The matrix, based on statistical drivers and after two rotations, achieved 100% optimality, which confirms the high validity of the questionnaire and the responses (Table 4).

Table 4: Degree of Optimality and Efficiency of the Matrix

Influence Received	Influence Exerted	Rotation
98%	98%	1
99%	100%	2

Evaluation of the Influence and Dependence Plan of Key Drivers

The distribution pattern of productivity-based design management drivers in selected architecture and urban planning offices in Tehran on the scatterplot indicates the stability or instability of the system. In the structural cross-impact analysis method using MICMAC software, two general scatter models exist, known as stable and unstable systems. In the stable system model, the dispersion of variables forms an "L" shape; in this model, some drivers have high influence and others high dependence. In unstable systems, the situation is more complex; the development forces are dispersed around the diagonal axis of the plot, and most drivers exhibit intermediate levels of influence and dependence, making the identification of key drivers difficult (Fig. 2 and 3).

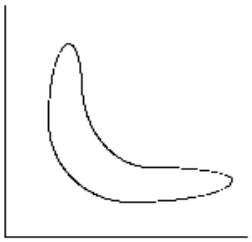

Fig. 2. Unstable System

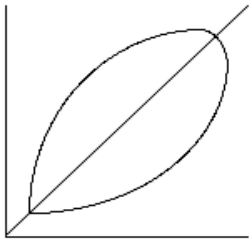

Fig. 3. Stable System

Figure 4 illustrates the distribution pattern of productivity-based design management drivers in selected architecture and urban planning offices in Tehran. This scatter pattern generally reflects an unstable system. Except for a few drivers with high influence, most drivers are positioned similarly in the influential driver section.

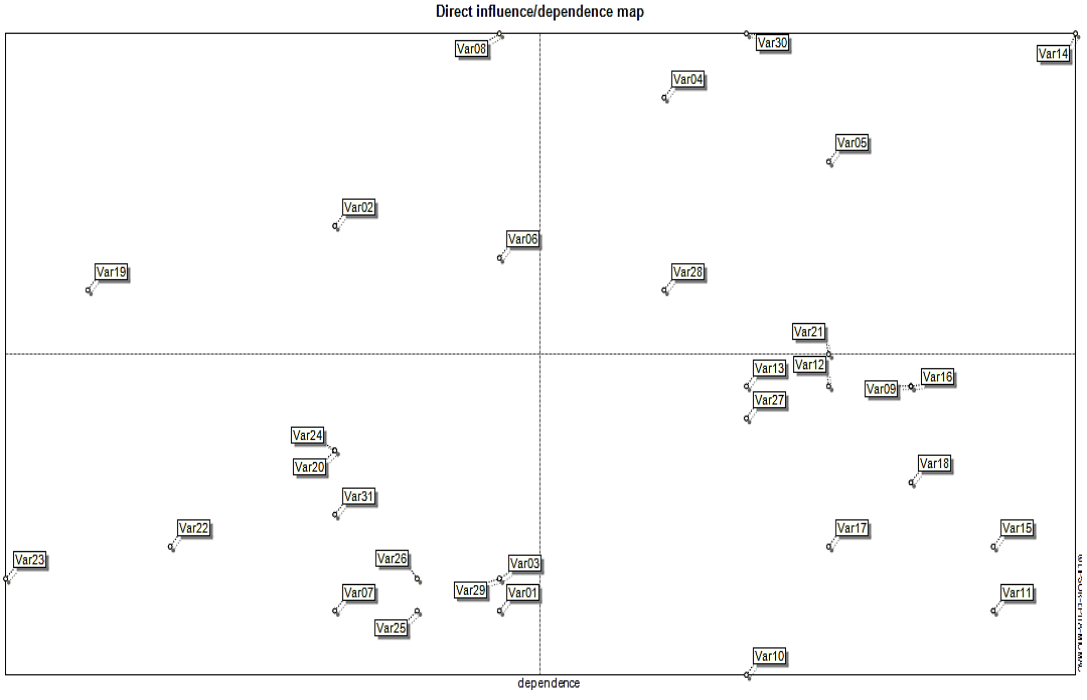

Fig. 4: Scatterplot of Productivity-Based Design Management Drivers in Selected Architecture and Urban Planning Offices in Tehran

Table 5: Direct and Indirect Impacts of Drivers on Each Other

Rank	Driver	Direct Influence	Driver	Direct Dependence	Driver	Indirect Influence	Driver	Indirect Dependence
1	Var15	385	Var14	353	Var08	383	Var14	351
2	Var23	385	Var11	347	Var30	382	Var11	346
3	Var16	385	Var15	347	Var14	381	Var15	345
4	Var17	374	Var09	342	Var04	371	Var16	342
5	Var28	364	Var16	342	Var05	362	Var09	341
6	Var08	353	Var18	342	Var06	348	Var18	341
7	Var10	347	Var05	337	Var02	348	Var05	337
8	Var12	342	Var12	337	Var19	341	Var17	337
9	Var14	342	Var17	337	Var28	341	Var21	335
10	Var30	331	Var21	337	Var21	333	Var12	335
11	Var09	326	Var10	331	Var16	329	Var27	332
12	Var19	326	Var30	331	Var09	326	Var10	330
13	Var13	326	Var27	331	Var13	326	Var30	330
14	Var21	326	Var23	331	Var12	326	Var13	330
15	Var27	321	Var04	326	Var27	320	Var04	329
16	Var01	315	Var28	326	Var24	317	Var28	324
17	Var24	315	Var01	315	Var20	315	Var06	317
18	Var18	310	Var03	315	Var18	312	Var08	317
19	Var31	305	Var06	315	Var31	304	Var03	316
20	Var02	299	Var08	315	Var17	302	Var01	315
21	Var04	299	Var29	315	Var22	301	Var29	315
22	Var06	299	Var25	310	Var15	300	Var25	311
23	Var03	294	Var26	310	Var23	296	Var26	311
24	Var05	294	Var02	305	Var26	296	Var07	307
25	Var26	294	Var07	305	Var03	294	Var02	306
26	Var29	294	Var20	305	Var29	294	Var24	306
27	Var20	289	Var24	305	Var11	292	Var20	305
28	Var07	289	Var31	305	Var25	291	Var31	304
29	Var11	289	Var22	294	Var07	289	Var22	295
30	Var25	289	Var19	289	Var01	289	Var19	289
31	Var22	278	Var13	283	Var10	279	Var23	286

Clustering of Productivity-Based Design Management Drivers in Selected Architecture and Urban Planning Offices in Tehran

Influential Drivers: This category represents the most strategically important drivers in the context of productivity-based design management in selected architecture and urban planning offices in Tehran. These drivers include organizational culture, creativity and innovation, and cost management (Table 6). These drivers have the highest influence and lowest dependence, acting as the most critical drivers; the macro status and system changes depend on their performance. Influential drivers are considered input drivers of the system and cannot be controlled by the system, as they exist outside the system and act as stable drivers.

Dual Drivers: These drivers function as both influential and dependent simultaneously. In total, six drivers influencing the productivity-based design management in selected architecture and urban planning offices in Tehran fall into the dual category. As shown in Table 6, these include clear project definition, project risk management, communication skills, precise planning and time management, human resources management, and creating a positive and motivational environment. Any changes in these drivers can affect system stability. These forces can further be divided into risk and goal drivers as follows:

Risk Drivers: Risk drivers have a high potential to become key system players, as due to their unstable nature, they can become system points of inaction. In this study, the driver “precise planning and time management” is not classified under this category.

Goal Drivers: No drivers are placed in this area. Goal drivers are more dependent than influential and can be identified as the result of system evolution with an acceptable certainty. By manipulating these drivers, the system can evolve in the desired direction. Therefore, they represent potential objectives rather than predetermined outcomes.

Dependent Drivers: Drivers in this area have low influence and high dependence in the system, affecting the evolution of influential drivers. Dependent drivers are highly sensitive and represent system outputs. Examples include urban and residential garden development, social and cultural cohesion enhancement, and waste collection and separation at the source.

Independent Drivers: Independent drivers include having a flexible and appropriate workspace, using online collaboration tools, customer relationship management, machine learning, architectural knowledge, creating organizational knowledge bases, following safety and health principles, using virtual and augmented reality, using advanced design software, continuous learning interest, and technical skills. These drivers are independent and isolated from the system. They are minimally affected by other drivers and exert little or no influence on them. They have limited interaction with the system, as they neither stop core drivers nor contribute significantly to system evolution.

Secondary Lever Drivers: Although fully independent, these drivers are more influential than dependent. They are located in the southwest of the diagram above the diagonal and can be used as benchmark points. No driver was classified in this area in the study.

Regulating Drivers: These drivers are located near the center of gravity of the diagram. They can sequentially act as secondary levers, weak goals, or secondary risk drivers. No driver was placed in this area in the study.

Table 6: Clustering of Productivity-Based Design Management Drivers in Selected Architecture and Urban Planning Offices in Tehran

Driver Type	Drivers
Influential	Organizational culture, creativity and innovation, cost management
Dual	Clear project definition, project risk management, communication skills, precise planning and time management, human resources management, creating a positive and motivational environment
Regulating	–
Dependent	Sufficient resources and budget, transformational leadership, agile organizational structure, effective communication with client/consultants/contractors, prototype and model creation, change management processes, quality standard control, project planning, using advanced technology, implementing management systems
Independent	Flexible workspace, online collaboration tools, customer relationship management, machine learning, architectural knowledge, organizational knowledge base, safety and health principles, virtual and augmented reality, advanced design software, continuous learning interest, technical skills
Goal	–
Risk	Precise planning and time management

Figures 5 and 6 illustrate the graphical representation of productivity-based design management drivers in selected architecture and urban planning offices in Tehran. These figures show direct and indirect impacts of drivers on other system components, ranging from very weak to very strong influence.

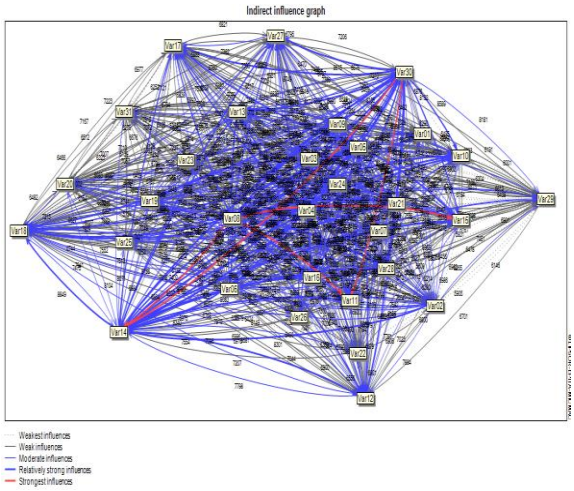

Fig. 5. Indirect relationships between drivers (from very weak to very strong)

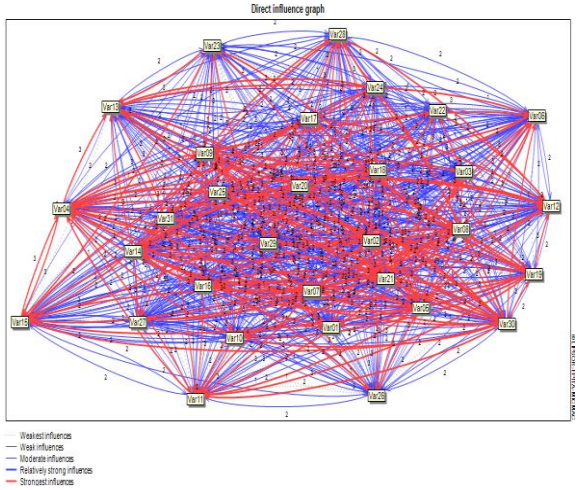

Fig. 6. Direct relationships between drivers (from very weak to very strong)

Identification of Key Productivity-Based Design Management Drivers

Among the 31 driving forces, 10 drivers have a greater key influence on the productivity-based design management in selected architecture and urban planning offices in Tehran. These drivers include precise project planning, use of advanced design software, effective communication with clients, consultants, and contractors, quality standard definition and control, human resources management, organizational culture, implementation of management systems, sufficient resources and budget, clear project definition, and project risk management .From a systemic performance perspective, these drivers exhibit high influence and low dependence within the system, playing a critical role in enhancing productivity-based design management in these offices. Consequently, they are considered the most effective and key drivers of the system (Table 7).

Table 7: Identified Key Influential Drivers

Rank	Key Driver	Direct Influence	Indirect Influence	Explanation
1	Precise project planning	385	347	Having a realistic and detailed schedule for each project prevents waste of time and resources, enhancing productivity.
2	Use of advanced design software	385	331	Using software like Revit, ArchiCAD, etc., increases design speed and accuracy, reducing human errors.
3	Effective communication with clients, consultants, and contractors	385	342	Clear and continuous communication with all stakeholders reduces ambiguity and accelerates decision-making.
4	Quality standard definition and control	374	337	Defining specific quality standards for design and execution improves final project quality and client satisfaction.
5	Human resources management	364	326	Recruiting and retaining skilled personnel, motivating them, and providing continuous training enhances team productivity.
6	Organizational culture	353	315	Establishing a culture of innovation, collaboration, and continuous learning creates a dynamic and creative work environment.
7	Implementation of management systems	347	331	Applying management systems in architecture offices organizes processes, increases productivity, and improves project quality.

Rank	Key Driver	Direct Influence	Indirect Influence	Explanation
8	Sufficient resources and budget	342	337	Providing necessary financial and equipment resources improves work speed and quality.
9	Clear project definition	342	353	Defining clear and comprehensive project objectives, scope, and expectations reduces ambiguity and improves team focus.
10	Project risk management	331	331	Identifying and managing project risks promptly prevents unexpected issues and increases project success.

CONCLUSION

Productivity-based design management in architecture and urban planning offices is one of the important and innovative approaches that has a particular impact on improving the performance and efficiency of these offices. Architecture and urban planning offices, which typically play a vital role in various architectural projects, act as a bridge between design and execution. These offices not only need to manage projects effectively but must also seek ways to optimize processes and increase their productivity .This research was conducted with the aim of identifying productivity-based design management in selected architecture and urban planning offices in the city of Tehran. The findings of this research showed that the overall dispersion pattern of the effective drivers indicates the condition of an unstable environmental system, in which the studied drivers have a complex and intermediate state in terms of influence and dependence. The clustering situation indicates a cluster concentration in the area of independent drivers.

Among the 31 driving forces, 10 key drivers influence the productivity-based design management in the selected architecture and urban planning offices in Tehran. The understanding of the findings from this research can be summarized in the following points:

- The findings from the overall analysis of the system environment showed that 174 relationships have a value of 3, which means that the relationships among key obstacles are very numerous and have high influence and dependence.
- Other results from the cross-impact analysis indicate the dispersion of the driving forces in a complex and intermediate state of influence and dependence. The clustering system indicates a concentration in the area of influenced drivers.
- The reading of the drivers affecting productivity-based design management in intermediate architecture offices in Tehran showed that among the 31 initial influential drivers, 10 factors were selected as the key drivers affecting the future status of the system, and all these key drivers were repeated in both methods of direct and indirect influence. The results indicate the importance of key drivers in productivity-based design management.

The first driver is precise project planning, which acts as a fundamental element in ensuring optimal allocation of resources and appropriate scheduling of design phases. In intermediate offices, which usually face more limited resources, effective planning can help reduce rework and waste of time and cost, and consequently increase efficiency and productivity. This has particular importance in today's competitive world, where time and cost are key success factors .The second driver is the use of advanced design software, such as BIM and CAD, which allows architecture offices to accelerate the design process and improve output quality. These powerful tools facilitate improved modeling accuracy and design optimization, thereby increasing overall office productivity. This shows that investing in modern technologies can be considered an effective strategy for improving performance in intermediate offices.

The third driver is effective communication with clients, consultants, and contractors. Establishing clear and continuous communication helps synchronize expectations and reduce conflicts. This is especially critical in intermediate offices that interact with multiple stakeholders simultaneously, preventing delays caused by misunderstandings. In fact, strong communication can act as an effective infrastructure for project management and facilitate decision-making processes.
The fourth driver is defining and controlling quality standards, which helps reduce errors and increase trust in project outcomes. Implementing quality management systems ensures that projects are executed correctly and prevents costly rework.
To improve performance and productivity in selected architecture and urban planning offices in Tehran, various measures can be considered that help optimize processes and increase efficiency:

- Developing a comprehensive project planning system focused on precise scheduling, cost control, and stage-by-stage supervision to increase efficiency and prevent resource waste.
- Investing in training and utilizing modern design software such as BIM, Revit, and ArchiCAD to improve accuracy, reduce errors, and increase design process productivity.
- Establishing effective communication mechanisms among clients, consultants, and contractors through regular meetings, digital collaboration platforms, and transparent reporting.
- Implementing a project quality assessment and control system with well-defined design standards, continuous plan review, and monitoring compliance with technical criteria.
- Designing a comprehensive human resources management system including selecting specialized personnel, enhancing skills, job motivation, and continuous performance evaluation.
- Strengthening a creative and learning-oriented organizational culture with a focus on team values, innovation, accountability, and enhancing employees' sense of belonging to the organization.
- Implementing integrated management systems (IMS) to organize design processes, document activities, and facilitate project control.
- Ensuring financial sustainability and providing sufficient resources through accurate budget planning, attracting investment, and optimal allocation of resources in projects.
- Clearly defining the scope, objectives, and expectations of projects before starting the design phase to reduce sudden changes and improve team focus.
- Creating a systematic mechanism for risk identification and management, including forecasting potential threats, assessing impacts, and designing effective mitigation strategies.

AUTHOR CONTRIBUTIONS

N. Hemmatiyan, the corresponding author, has contributed in supervising the research, leading the data analysis, interpreting the results, and preparing the manuscript. G. Safdarian contributed to the literature review, conceptual framework development, and assisted in writing and editing the manuscript. K. Bazrafkan participated in data collection, methodological design, and validation of the analytical model.

CONFLICT OF INTEREST

The author declares that there is no conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancy have been completely observed by the authors.

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The author(s) declare that no AI tools or services were not used or not highly applied during the preparation of this work.

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