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Tehran Municipality,
Tehran, Iran
Email: publisher@ijhcum.net
ijhcum@gmail.com

Editor in Chief

Professor A. Gholipour
University of Tehran,
Tehran, Iran
Email: agholipour@ut.ac.ir

Managing & Handling Editor

Dr. S.M. Tehrani
Tehran Municipality
Email: ijhcum@gmail.com

Page Designer

A. Rezaei Soltanabadi
Imajgaran Danesh
ardavanre@gmail.com

Editorial Contact Information

IJHCUM Journal, # 32, Agha Bozorgchi
Street, Akbari Street, Pol-E-Romi,
Tehran, 1964635611 Iran

Phone: +9821-96015406

Fax: + 9821- 22392096

Emails:

editor@ijhcum.com

ijhcum@gmail.com

Website: <https://www.ijhcum.net>

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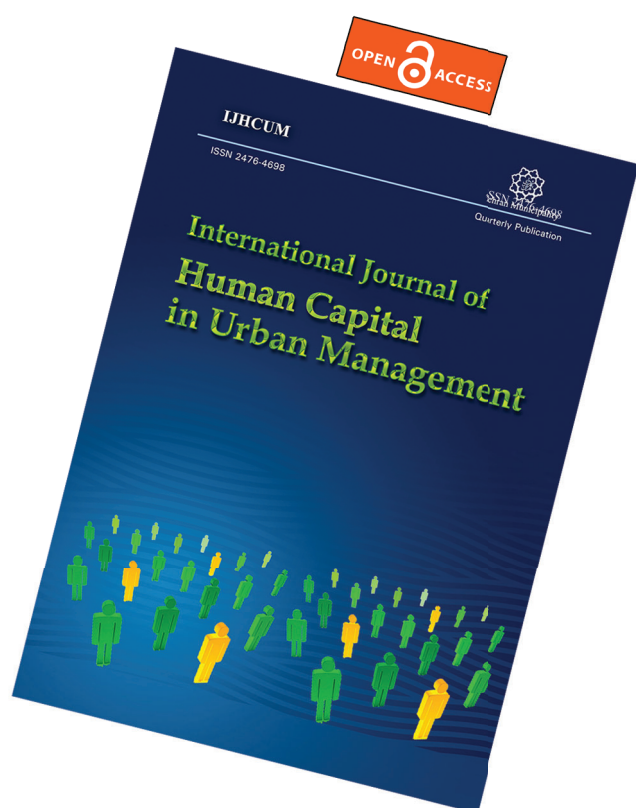
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www.ijhcum.net

ijhcum@gmail.com

editor@ijhcum.net

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Tel.: +9821- 9601 5406

Fax: +9821- 2224 6104

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ORIGINAL RESEARCH PAPER

The social responsibility of dual education in an unstable environment

O. Kolodiziev^{1,*}, V. Shcherbak², M. Krupka³, V. Kovalenko³, T. Kolodizieva⁴, V. Yatsenko⁵

¹ Department of Customs and Financial Services, Simon Kuznets Kharkiv National University of Economics, Kharkiv, Ukraine

² Department of Entrepreneurship and Business, Kyiv National University of Technologies and Design, Kyiv, Ukraine

³ Department of Finance, Money Circulation and Credit, Ivan Franko National University of Lviv, Lviv, Ukraine

⁴ Department of Finance, Money Circulation and Credit, Ivan Franko National University of Lviv, Lviv, Ukraine

⁵ Municipal establishment "Kharkiv Humanitarian-Pedagogical Academy" of the Kharkiv regional council, Kharkiv, Ukraine

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ABSTRACT

BACKGROUND AND OBJECTIVES: In a context of instability caused by various crises, including military crises, the higher education system is at great risk. Practice-oriented (dual) education is one of the most effective ways to address this problem. The innovation of this study is that for the first time a theoretical and practical model for involving all stakeholders in this process has been created and tested. The aim of the article is to substantiate a socially responsible dual education system in an unstable environment.

METHODS: In terms of objective, this is an applied and quantitative study. The study population is estimated at 13 universities, 10 companies, 50 students between November 2021 and November 2022. The sample size is estimated using the Cochran formula. A standard 5-point Likert scale questionnaire was used to collect data, where groups of questions corresponded to 4 hypotheses. All data were investigated by factor and cluster analysis using STATISTICA software (version 10.0).

FINDINGS: All four hypotheses were confirmed. Before the war, the first and second hypotheses were prioritized. According to them, the process approach of social responsibility of dual education allows designing and launching a system of social responsibility of dual education and creating a talent pool at the employing enterprise. After the outbreak of hostilities, the priorities changed. The third and fourth hypotheses allow, through the organization of supportive (enabling) processes, to ensure the effective functioning of the system. As a result, the majority of stakeholders (31%) consider it necessary to modernize the mentoring system and provide graduates with relevant professional skills, while methodological and career guidance came in second and third (16% and 13% respectively).

CONCLUSION: Using the theoretical and practical model of formation and implementation of dual education in the unstable conditions of Ukraine will help to solve the problems of the country out of crisis, post-war recovery of higher education system, to bring the requirements of production with the possibilities of training specialists in universities and can be applied in

DOI: [10.22034/IJHCUM.2023.03.01](https://doi.org/10.22034/IJHCUM.2023.03.01) other countries in a similar situation.



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*Corresponding Author:

Email: kolodizev107@ukr.net

Phone: +380503232890

ORCID: [0000-0002-6715-2901](https://orcid.org/0000-0002-6715-2901)

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INTRODUCTION

Social responsibility of dual education of any country is one of the main factors to ensure stability of the country's economy, its competitiveness in the global dimension. Some researchers (Ante and Ken, 2014) suggest that it is the interactive interaction and collaboration between business and the education system that allows all available opportunities for technological, economic, social well-being in any country to be exploited. The same thesis is supported by (Hąbek and Wolniak, 2016) that any crisis processes (military actions, natural disasters, economic downturns) have a negative impact and reduce the options for cooperation between business and education. Most developing countries, including Ukraine, have great potential and historical experience of such cooperation. Most researchers in these countries believe that (Shcherbak et al., 2019) the education system has a high level of development, creativity, motivation for self-development and actualization of skills, including digital skills. All of these skills are particularly in high demand in today's environment. On 24 February 2022, Russia unleashed a war, which was the starting point for changing the main characteristics of social responsibility in Ukraine, including education. The unstable situation in Ukraine reduces opportunities for education, including dual education. This is confirmed by an analytical report by the International Organization for Migration (IMO, 2022), which systematized Ukraine's losses as a result of Russian aggression from 2014 to May 2022. These include: forced internal and external migration, forced deportation of the Ukrainian population to Russia, doom of civilians and military casualties. According to this report, the total number of displaced persons was 13.7 million, of whom 5.7 million left Ukraine (IMO, 2022). The Minister of Education and Science estimates that 2.5 million school age children and students and 22,000 teachers have left the country (OHCHR, 2022), representing about 40% of students and pupils. This supports research (Beaudoin, 2016; Beerkens et al., 2011) that indirect losses include lost profits for businesses, unpaid salaries for employees, destroyed infrastructure, including educational facilities, and the inability to obtain full educational services. Consequently, such losses together directly reduce the possibility of using dual education to develop not only the practical skills of students, but also the business itself. Accordingly,

this study investigates the impact of dual education on the level of development of social responsibility of higher education in an unstable environment caused by martial law. It can be said that so far no research has been conducted in this field in Ukraine, so this study is innovative. Previous research has shown that the social responsibility of dual education as an effective factor has been linked to innovative changes in higher education under martial law. The following research hypotheses were developed by examining the effective interaction of both main structures, i.e. higher vocational education and enterprises:

Main hypothesis:

The use of dual education increases the social responsibility of educational institutions and enterprises under martial law-induced instability.

Hypothesis 1: The process approach of social responsibility of dual education is a sequential implementation of 4 main interrelated components.

Hypothesis 2: The first component (Design and development of dual education programmes) and the second component (Implementation of the basic dual education programme) allow to design and launch a system of social responsibility of dual education.

Hypothesis 3: The third component (Organization of supporting (enabling) processes) ensures the process of functioning of the dual education social responsibility system.

Hypothesis 4: The fourth component (Measuring and controlling the effectiveness of dual education) allows evaluating and monitoring the achieved level of social responsibility of dual education.

Theoretical Foundation

It should be noted that dual education is widely used in almost all countries (Cedefop, 2015). Dual training is a type of training in which the theoretical part of the training takes place in an educational organization, while the practical part takes place in the workplace (Baumann-Pauly et al., 2013). Enterprises place an order with educational institutions for a specific number of specialists, employers take part in drawing up the curriculum (Juanatey et al., 2021). Students undertake on-the-job training in the enterprise (Urbanek, 2020). In the dual system of education the role of the employer intensifies and qualitatively changes (Selcuk, 2019). Beaudoin, 2016; Beerkens et al., 2011 consider that the most important component of dual training is having

trained staff who act as mentors. Most researchers (Beaudoin, 2016; Beerkens *et al.*, 2011; Boer *et al.*, 2011; Campbell, 2018) believe that Germany is a pioneer of dual education. Its experience serves as a model for the entire European Union (Baethge and Wolter, 2015). Göhringer, 2002 believes that the German vocational education system is characterized by a well-developed mentoring institution, practice-oriented training and the active involvement of business in training. This researcher defines dual education in Germany as a strict legislative framework and is implemented with the help of the chambers of industry, commerce and crafts. In all progressive countries where dual education is used, great attention is paid to social responsibility not only of business processes, but also of trainee training (Beaudoin, 2016; Beerkens *et al.*, 2011). Considering social responsibility (SR) as a theoretical concept, it is only possible to define the boundaries of a company's responsibility for its impact on society and the environment (Islam *et al.*, 2021). But to implement a socially responsible business strategy in practice, it is necessary to build processes for managing social responsibility and integrating it into core business processes: production, sales management, logistics, HR management, etc. (Kuratko, 2005).

Rationale for the main hypothesis

The researchers' point of view (Geel and Backes-Gellner, 2012) is supported by the main hypothesis proposed. This will ensure systematic engagement with key stakeholders, planning, implementation and monitoring of social programmes, as well as evaluating the effectiveness of social investments by business. This requires approaching social responsibility as a special business process integrated into the business practices at all its levels and ensuring its functioning (Javernick-Will, 2012). First of all, this work should be carried out in relation to those activities where key business stakeholders are involved (Kabir and Thai, 2017). Research into social responsibility practices confirms that one of the most relevant areas of business social policy implementation is the management of human resources - both internal (personnel) and external (local community), which have a significant impact on the achievement of business goal (Khosro and Gaye, 2009). Along with medical care, social security and the formation of a comfortable social infrastructure, companies are

actively involved in the development of education as one of the areas of social investment as part of their social responsibility strategy (Kocsis and Pusztai, 2021). The integration of the different perspectives of scholars confirms that the basic hypothesis of using dual education increases the social responsibility of educational institutions and enterprises under conditions of instability.

Theoretical justification for the first hypothesis

Before the start of hostilities in 2022, the most demanded area for large Ukrainian industrial companies was the support of vocational education sector in close cooperation with public authorities and state educational organizations. The research interest of the authors of the article is conditioned by the prospects of practical application of management approach to the process of formation of production personnel training programmes on the basis of socially responsible dual education model in order to reduce personnel risks in post-war period (Boer *et al.*, 2011). Due to the acute shortage of young qualified personnel in enterprises and the labour market, which emerged against the background of the consequences of the demographic crisis in the 1990s, there is now a serious competition for labour resources (Stevens and Shibanova, 2021). This workforce has to meet the requirements of modern industry (Strike *et al.*, 2006). That is, we are talking about training young professional workers who are physically and intellectually capable enough to operate modern high-tech equipment, who are career-oriented and involved in the employer's corporate culture (Chennamaneni *et al.*, 2012). The existing state system of secondary vocational education is unable to train such professionals without the support of business. With the support of the Ministry of Education and Science of Ukraine (MES), already in 2014, 13 pilot projects were organized to introduce elements of dual education in higher education institutions and a roadmap for the introduction of dual education in Ukraine was developed. The higher education institutions involved in the experiment are: Lugansk National Agrarian University, Lviv Polytechnic National University, Kharkiv National Beketov University of Municipal Economy, Kyiv National University of Construction and Architecture, National Technical University of Ukraine Kyiv Igor Sikorsky Polytechnic Institute, Odessa State

Academy of Construction and Architecture, Odessa National Polytechnic University, National Forestry University National University Of Economics And Finance, Faculty Of Mechanics And Optics, M.E. Zhukovskiy Kharkiv Aviation Institute, Kharkiv State University of Food and Trade, National University of Water Economy and Environmental Management, National Transport University. The project was to last until 2023. However, with the outbreak of hostilities in Ukraine, the social responsibility of professional practice-oriented education has significantly decreased, which reduces the opportunities for businesses to train high-quality personnel for their business processes. Studies of the specifics of the Ukrainian model of social responsibility point to the predominance of personnel support, social protection and development programmed in the total number of socially responsible practices of domestic companies. Under wartime conditions, the focus of internal social responsibility has the dynamics of reducing the social expenditures of enterprises and training and development programmes. Integration of different views of scholars confirms that the first hypothesis of the need for a process-based approach to social responsibility of dual education takes place. Such a process approach can represent a consistent implementation of the main interrelated components.

Theoretical justification for the second hypothesis

Before the war, the main trend of Ukrainian enterprises was to increase labour productivity through the introduction of new technologies, automation of production processes, and optimization of the number of personnel. These factors determined a significant increase in requirements to the level of competences and qualifications of workers and specialists (Huerta *et al.*, 2012). Therefore, the HR policy of large industrial companies was reoriented from internal charity in favour of personnel (provision of gratuitous services and compensation packages) to social investments in training and development of working and potential employees, primarily young people studying and re-employed at the enterprise (Powell *et al.*, 2016). The prevailing socio-economic context of state-business interaction requires industrial companies in wartime conditions to build new long-term engagement strategies (Chin *et al.*, 2015). These strategies should

be focused on reproduction of human resources for their production facilities, social investments in the system of professional dual education through implementation of joint partnership programmes with educational organizations (Donald *et al.*, 2018). The use of dual education as a form of vocational education allows the practical part of the training to be carried out on the workplace and the theoretical part on the basis of the educational organization (Donia *et al.*, 2016). The system of dual education implies joint financing of workplace-specific training programmes by commercial enterprises interested in qualified personnel and regional authorities interested in economic development and improvement of living standards in the region (Gangiet *et al.*, 2018). Integration of different points of view of scholars confirms that the second hypothesis of the need to design, develop and implement dual education programmes will allow organizing a system of social responsibility of dual education. Such programmes will allow organizing effective interaction between educational institution and business in unstable military conditions.

A theoretical justification for the third hypothesis

The management of the area of training young qualified personnel for modern high-tech production falls within the area of social responsibility and social investments of business and requires a professional managerial approach (Groza *et al.*, 2011). Based on the goals of social responsibility management, i.e. system management of the social responsibility policy integrated into the company's activities, business is faced with the tasks of planning, organizing, motivating, coordinating and controlling the activities of personnel directly interacting with stakeholders on behalf of the company (Chuang, 2004). This interaction takes place at different levels, with different frequency and effectiveness. In order to manage effectively, management must systematically capture, analyze and respond appropriately to signals from the external and internal environment of the organization (Šajeva, 2014). Integration of studies by different scholars leads to the conclusion that it is the organization of supportive (enabling) processes that ensures the functioning of the social responsibility system of dual education.

Theoretical justification for the fourth hypothesis

The organization manages its social responsibility

and is able to draw conclusions about its achievements and mistakes, plan its activities for the future and build a strategy for sustainable development. All modern management models are to some extent based on the process approach to company management. This approach is expressed in the representation of company activities in the form of a cycle of management actions for planning, plan implementation, control and correction of deviations - the so-called "Schuchart-Deming cycle" or the management process algorithm "PDCA". The process approach is recognized as the fundamental basis for modern management approaches, on the basis of which such management systems as Total Quality Management system (TQM), Process Integrated Quality System (PIQS) integrated with business processes; ISO series standards for management systems; Business Process Management System (BPMS); Enterprise Resource Planning (ERP) - Comprehensive Resource Planning and Management System. International standards in the field of social responsibility such as "AA1000SES Standard for Quality Management of Stakeholder Engagement" and "IQNet SR10 - Social Responsibility Management Systems. Requirements", based on the principles of ISO 26000 and the methodology of ISO 9000 series of standards, also contain a PDCA algorithm that ensures continuous improvement of a company's social responsibility activities through planning, implementation and execution of social responsibility tasks, performance review and evaluation, and results analysis by the management (Hong *et al.*, 2011). The above-mentioned process approach to social responsibility management can be decomposed into separate markets, processes of production of various products and services, processes of management of separate spheres, including staff training on the basis of dual education (Hansen *et al.*, 2011). Thus, in the process of forming a social responsibility management system, the company's activities are 'assembled' and institutionalized in accordance with legislation and international requirements for social responsibility of the company, taking into account stakeholder expectations. The international standard ISO 26000 (clause 3.3.4) indicates the necessity to integrate social responsibility into all aspects of the organization's activity: "Since social responsibility concerns the potential and existing impact of the organization's decisions and activities, the main

focus should be placed on the behaviour within the regular, day-to-day activities of the organization. Social responsibility should be included as an integral part of the company's core strategy, with some accountability at all relevant levels of the organization (Di Paolo and Matano, 2016). It should be reflected in decision-making and taken into account in the implementation of activities". This shows how these requirements can be met and the principles and methods of social responsibility can be incorporated into the field of activity of companies that have joined the dual education system. This framework serves as a basis for building a modern and effective management model that contributes to achieving the business objectives of HR management and increasing stakeholder satisfaction (Campbell, 2018). The analysis of existing theoretical approaches to existing methods for measuring and monitoring the effectiveness of dual education confirms the fourth hypothesis and allows the assessment and monitoring of the achieved level of social responsibility of dual education. The present study and the conceptual model were developed on the basis of academic sources and previous studies with a new framework; consequently, according to the research, there has been no research on the social responsibility of dual education in an unstable environment in Ukraine so far. Therefore, the conceptual model of the study was chosen (Fig. 1) according to the research literature. The aim of the article is to justify a socially responsible dual education system in an unstable environment. The study was conducted during the year: November 2021 - November 2022 on the basis of 10 industrial enterprises and 13 higher educational institutions of Ukraine.

MATERIALS AND METHODS

Survey design and data collection

The present study is applied research in terms of its purpose and is a quantitative study in terms of its method. Data for the model was collected from three sources: 10 employers, 50 students in cooperative education and 13 institutions of higher education. Information was collected by Computer Assisted Telephone Interviewing (CATI) using a questionnaire developed on the Lemur survey platform of New Image Marketing Group. Telephone numbers of enterprises were selected from an open database YouControl - service of checking counterparties. The

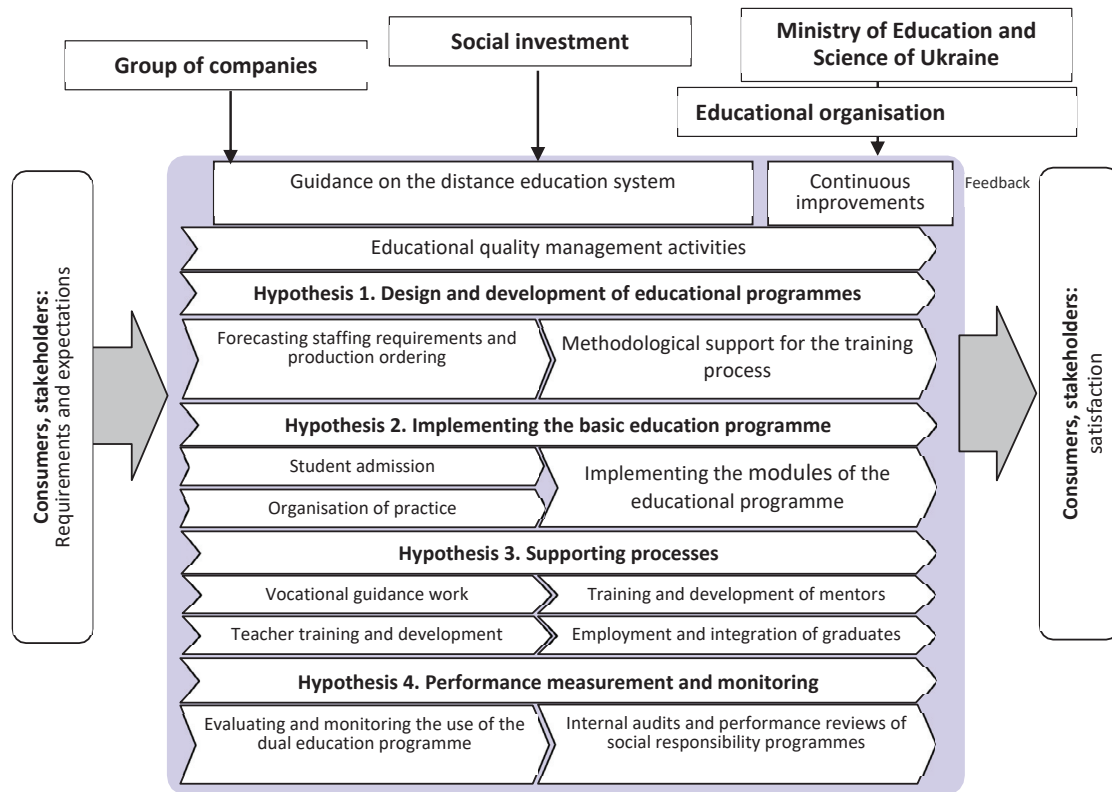


Fig. 1: Conceptual model for a socially responsible dual education system in an unstable environment in Ukraine

Table 1: Sample for the study amongst stakeholder groups – employers

The general population	Number of non-responses	Number of invalid answers	Number of valid responses
10	1	1	8

selection is random. The rotation order of the database was generated randomly. The questionnaire contained four groups of questions to measure the variables of the conceptual model and consequently to confirm the proposed hypotheses. The first set of questions concerned the experience of enterprises in designing and developing dual education programmes to train their staff (for employers-companies) (Kocsis and Pusztai, 2021); the second set of questions concerned the awareness of the effectiveness of enterprise-based dual education received (for students) (Cohen, 1998); the third set of questions concerned the organisation of supportive (enabling) processes (for educational institutions) (Selcuk, 2019); the fourth group of questions - to assess the effectiveness of the dual form of learning (for the stakeholders: state, society) (Cohen, 1998; Stevens and Shibanova, 2021). The

responses received were processed using a 5-point Likert scale, where a score of 1 was given when the respondent absolutely disagreed, 2 points disagreed, 3 points no opinion, 4 points agreed, 5 points absolutely agreed. Sample design: a total of 500 sets of numbers were made (Hair et al., 2014). Of these, 250 people were interviewed (rejection rate 77.5%). Responses to all questionnaire questions from 10 companies were obtained. Thus, the coefficient of valid responses is 0.11; the theoretical error without regard to the effect of the sample design is no more than 4.9% (Table 1).

Building a conceptual model for a socially responsible dual education system in an unstable environment in Ukraine

A socially responsible dual education system in an unstable environment in Ukraine consists of

four components, each corresponding to one of the proposed hypotheses: 1) design and development of educational programmes; 2) implementation of the basic educational programme; 3) supporting (enabling) processes; 4) measurement and control of effectiveness (Fig. 1).

The methodology of calculating each of the components of socially responsible dual education system in Ukraine is presented in the form of theoretical and practical model of dual education formation and implementation in unstable conditions of Ukraine (Fig. 2). As it can be seen from Fig. 2, each of the system components manifests one of the hypotheses of social responsibility of one or several participants of dual education process.

RESULTS AND DISCUSSION

Results of the implementation of the developed model

The research was carried out in three stages. At

the first stage, in order to build a theoretical model of socially responsible system of dual training of qualified personnel in the conditions of crisis changes in Ukraine, a toolkit (questionnaires) was developed to conduct a survey among the main stakeholder groups: companies-employers, educational institutions, students. Further, the data was collected, analyzed, and the results were processed. In order to study the experience of employing companies using the form of dual training, the method of in-depth interview by telephone and case study was chosen. The sampling is solid. The average length of the interview was 20 minutes. The guide contained a list of mandatory topics for discussion, which made it possible to study the experience of the surveyed enterprises' cooperation with educational institutions in the organization of dual form of training, to identify and analyze the problems faced by employers, to collect suggestions for overcoming problems outlined by respondents to improve the effectiveness

Hypothesis 1. Design and development of educational programmes	Securing staffing needs: $L_S = N_{ij} / N_i$, where N_{SFij} – the need for the i -th category of personnel trained by the j -th dual education programme; N_i – the need for the i -th category of staff. Methodological support for the training process: $L_{MM} = N_{mm} / N_{usr}$, where N_{mtr} – the number of distance learning tutorials; N_{us} – the number of users of the j -th educational programme (students, teachers, tutors).
Hypothesis 2. Implementing the basic education programme	Student enrolment: $L_R = N_{Rij} / N_i$, where N_{Rij} – the number of applications submitted for the j -th dual education programme. Organization of internships: $L_{IS} = N_{ISij} / N_{STij}$, where N_{ISij} – the number of submitted applications for practice in the j -th dual education programme; N_{STij} – the number of students who study in the j -th dual education programme. Implementation of modules of educational programme: $L_{ME} = N_{MEij} / N_{STij}$, where N_{MEij} – the number of students who successfully completed the modules of the educational programme and passed the examination.
Hypothesis 3. Supporting processes	Vocational guidance work: $L_{WG} = N_{Rij} / N_{AP}$, where N_{Rij} – the number of applications submitted for training in the j -th dual education programme; N_{AP} – the number of professionally oriented applicants. Teacher training and development: $L_{TCH} = N_{STij} / N_{GRj}$, where N_{GRj} – the number of study groups for the j -th dual education programme. Training and development of mentors: $L_{GR} = N_{STij} / N_{GRj}$, where N_{STUTij} – the number of students per mentor. Employment and adaptation of graduates: $L_{EMPL} = N_{STEMPLij} / N_{STij}$, where $N_{STEMPLij}$ – the number of students successfully employed after completing the programme.
Hypothesis 4. Performance measurement and monitoring	Evaluating and monitoring the use of the dual education programme: $L_{EVA} = N_{STEMPLij} \times P_{ij}$, where P_{ij} – the company's profit per employee. Internal audits and performance analysis of social responsibility programmes: $L_{SRP} = N_{STEMPLij} \times SB_{ij}$, where SB_{ij} – social payments per employee.

Fig. 2: A theoretical and practical model of dual education formation and implementation in unstable conditions of Ukraine

Table 2: System of indicators of social responsibility of dual education in Ukraine

Indicators	Designation
Level of provision in staffing requirements, L_s	X_1
Level of teaching provision, L_{MM}	X_2
Level of provision in student admissions, L_R	X_3
Level of provision in work experience, L_{IS}	X_4
Level of provision for curriculum modules, L_{ME}	X_5
Level of vocational guidance, L_{WG}	X_6
Level of training and development of teachers, L_{TCH}	X_7
Level of training and development of tutors, L_{GR}	X_8
Level of employment and adaptation of graduates, L_{EMPL}	X_9
Level of utilisation of the dual education programme, L_{EVA}	X_{10}
Level of performance of social responsibility programmes, L_{SRP}	X_{11}

of cooperation with educational institutions. The general population- 10 enterprises indicated by vocational higher and higher education institutions as partners in training applicants in the dual form of education. The processing of questionnaires made it possible to calculate 11 indicators of social responsibility of all stakeholders before and after the outbreak of hostilities in Ukraine. The deciphering of the symbols is shown in Fig. 2 and Table 2.

The proposed model was tested on the basis of 13 universities, 10 enterprises that responded positively to the questionnaire provided, 50 students who underwent dual training. The developed model of socially responsible system of dual training of qualified personnel is a business process of personnel training for an industrial enterprise structured as a set of basic and supporting processes, in which the requirements and expectations of consumers and stakeholders - business, government and citizens are identified at the input, and their satisfaction is assessed at the output (Fig. 2). The model also contains the scheme of joint managing influence of the state and business with the help of social investment tool, the implementation of which is the responsibility of dual education programme implementers - educational organization of vocational education. The functions of development, implementation, evaluation and monitoring of the dual education programme, organization of internal audits and formation of proposals for improvement of the system are performed by the group of specialists of the dual education system. This model has undergone a cycle of implementation at industrial enterprises in Ukraine, during which a package of local regulations and methodological tools was developed and applied, which allowed to distribute responsibility

between the company management and regional authorities, to form collegial management bodies, to describe, agree and regulate the functionality of the structural units of the enterprise and the educational organization. The main indicator of the effectiveness of the dual training programme is the employment of graduates in accordance with the need and requirements of production, expressed in quantitative and qualitative characteristics (the number of employed graduates and their qualification level). An analysis of the dynamics of companies' demand indicators for skilled workers and specialists in the pre-war period shows that it has not yet been possible to fully satisfy production demands. In order to analyses the impact of individual indicators on the social responsibility of dual education, a factor analysis was conducted (Table 3).

The results of data processing by factor analysis can be interpreted as follows: those indicators that do not affect the process under study are highlighted in black, those that do affect it are highlighted in red. In other words, the data in Table 3 shows that during the first research period 24.11.21 - 24.02.22 out of eleven indicators five ($x_1, x_2, x_5, x_6, x_{10}$) influence the process; during the second research period 24.02.22 - 24.11.22 out of eleven indicators six ($x_3, x_4, x_7, x_8, x_9, x_{11}$) influence the process. They are highlighted in red, respectively. That is, the data in Table 3 show that before the outbreak of hostilities, 5 out of 11 initial indicators influence the social responsibility of dual education, and after the outbreak of hostilities, 6 out of 11. In other words, before the outbreak of hostilities, employers were influenced to a greater extent by the possibility of meeting production needs for personnel trained through the dual programme and the economic effect obtained

Table 3: Results of factor analysis of the impact of individual indicators on the social responsibility of dual education (STATISTICA 10 listing)

Variable	Factor Loadings (Unrotated) (data) Extraction: Principal components (Marked loadings are >0,700000)	
	24.11.21 – 24.02.22	24.02.22 – 24.11.22
X ₁	0,937628	0,136939
X ₂	0,963231	0,213981
X ₃	0,179234	0,967737
X ₄	0,297035	0,923993
X ₅	0,938388	0,242523
X ₆	0,826765	-0,234214
X ₇	0,296315	0,741028
X ₈	0,278221	0,357436
X ₉	0,543605	0,782692
X ₁₀	0,885595	0,257035
X ₁₁	0,257035	0,897513
Explanatory Variable (Expl.Var)	5,348632	2,804293
Percentage of the total variance explained (Prp.Totl)	0,514863	0,380429

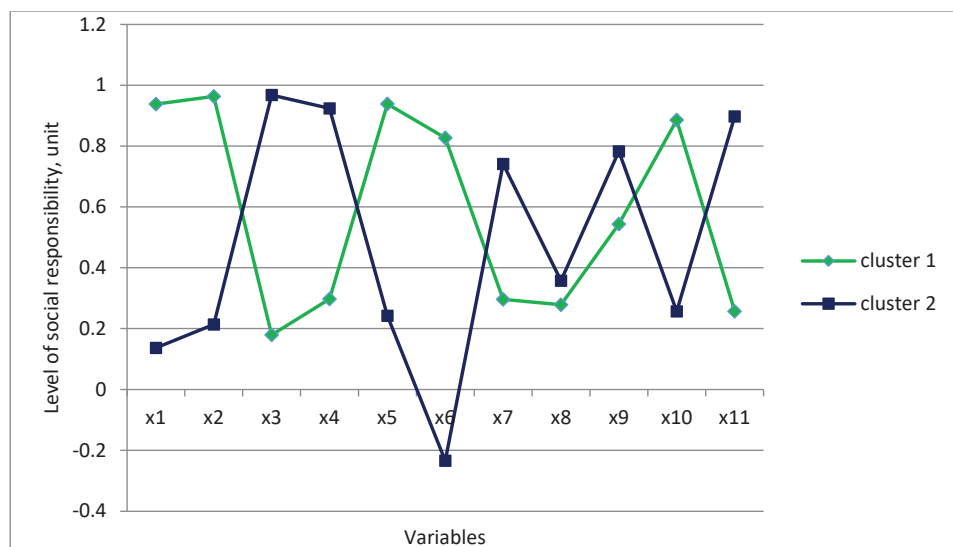


Fig. 3: Cluster analysis of the achieved level of social responsibility where cluster 1 - level of social responsibility for individual components of the dual education system before the outbreak of hostilities in Ukraine; cluster 2 - after the outbreak of hostilities

through the use of student labour in production. That is, the first and second hypotheses were confirmed: the complementation and integration of the 4 main interrelated components, the design and development of dual education programmes and the implementation of the basic dual education programme. This makes it possible to design and launch a socially responsible dual education system.

After the outbreak of hostilities, the priorities changed. Employers were now more interested in the availability of work placements to provide students with the necessary qualification skills. In other words, the third and fourth hypotheses are confirmed and come to the fore: organizing the supporting (enabling) processes), measuring and monitoring the effectiveness of dual education. This approach makes

it possible to ensure the functioning of the system, to evaluate and monitor the achieved level of social responsibility of dual education.

The equations of the dependencies of social responsibility performance for these 2 periods are as follows.

For the period 24.11.21 - 24.02.22 (Eq. 1):

$$Y_{SR24.11.21-24.02.22} = \frac{1}{5,348632} \times (0,0,937628x_1 + 0,0,963231x_2 + 0,938388x_5 + 0,826765x_6 + 0,885595x_{10}) \quad (1)$$

For the period 24.02.22 – 24.11.22 (Eq. 2):

$$Y_{SR24.02.22-24.11.22} = \frac{1}{2,804293} \times (0,967737x_3 + 0,923993x_4 + 0,741028x_7 + 0,357436x_8 + 0,782692x_9 + 0,897513x_{11}) \quad (2)$$

The results of the cluster analysis of educational services according to the achieved level of social responsibility of logistical educational processes under martial law are shown in Fig. 3.

The dual training system implies organizational and resource participation of industrial companies in the vocational education of students and is associated with such expenses as remuneration and additional bonuses for teachers of educational organizations, hiring their own vocational trainers, providing, renting and maintaining premises, purchasing and servicing equipment, purchasing materials, providing students with special clothing and personal protective equipment, organising transportation to places. Part of the costs are borne directly in the company's budget, while part of the funding is transferred to the educational organisation in kind or in the form of targeted charitable donations. All of these social costs were inherent to companies for the beginning of military operations in Ukraine. After the outbreak of hostilities, the main indicator of the effectiveness of social investment for businesses is the training and employment of the required number of graduates from dual education programmes who meet the competence and qualification requirements of the employer, and the retention of trained personnel in the company and its location through the creation of attractive working conditions and social infrastructure. The trends identified in the research process in the preparation and implementation of dual education

confirm the views of many researchers (Šajeva, 2014; Selcuk, 2019):

- Thus, some researchers (Beaudoin, 2016; Beerkens et al., 2011) have found that poor vocational orientation of school and university entrants, students and graduates, lack of understanding of part of the target audience of the dual education programme what the future profession is and what the career prospects at the company are. Thus, the significance of Hypothesis 3: The third component (Organization of supporting (stimulating) processes) ensures the process of the dual education social responsibility system functioning. Therefore, in order to counterbalance this tendency, indicator x_6 "Level of Career Guidance, L_{WG} " was included as one of the evaluation indicators in the model, which has a great impact on the level of social responsibility in the support processes phase of the dual programme.

- Also, some researchers (Ante and Ken, 2014; Baumann-Pauly et al., 2013; Chin et al., 2015) point out that the learning outcomes of the dual education programme do not meet the requirements of production. This approach violates the main points of Hypothesis 2: The first component (Design and development of dual education programmes) and the second component (Implementation of the basic dual education programme) allow to design and launch a system of social responsibility of dual education. In order to compensate for this trend, the indicator x_2 "Level of methodological support of the educational process, L_{MM} " was included in the model at the design and development stage of the dual programme, and the indicator x_7 "Level of teacher training and development, L_{TCH} " at the support process stage.

- Researchers (Campbell, 2018; Di Paolo and Matano, 2016; Donald et al., 2018) have also identified a mismatch between dual education programme outcomes and employer requirements (professional standards, corporate culture) identified in qualifying exams and employment testing. This violates the main points of Hypothesis 4: The fourth pillar (Measuring and monitoring the effectiveness of dual education) allows evaluating and monitoring the achieved level of social responsibility of dual education. In order to level out this tendency at the stage of supporting processes of the dual programme, the indicator x_9 "Level of employment and adaptation of graduates, L_{EMPL} " was included in the model as one of the evaluation indicators.

- Also, according to the researchers (Geel and Backes-Gellner, 2012; Kocsis and Pusztai, 2021; Kuratko, 2005) low motivation of graduates to choose the target enterprise as a permanent and prospective place of work and career building due to weak attractiveness of the enterprise location and employees' place of residence contradicts the main statements of Hypothesis 3. This hypothesis argues that the organization of supportive (stimulating) processes ensures the process of dual education social responsibility system functioning. In order to compensate for this tendency, the indicator x_{10} "Level of use of dual education programme, L_{EVA} " was included in the model as one of the evaluation indicators during the measurement and control phase of the dual education programme. This indicator most closely reflects the potential for socio-economic incentives for personnel, including graduates from the dual education programme.

- Also, the decreasing trend in the number of graduates leaving for military service in the Ukrainian Armed Forces and the insufficient proportion of graduates returning after demobilisation identified by researchers (Cedefop, 2015; Hansen et al., 2011) suggests that the impact on this indicator, employers will increase the effectiveness of dual programmes. To counterbalance this trend, at the stage of measuring and monitoring the performance of the dual programme, indicator x_{11} "Level of performance of social responsibility programmes, L_{SRP} " was included in the model as one of the evaluation indicators. This indicator most closely reflects the social responsibility towards graduates of the programme who took part in military operations.

The field of challenges and opportunities for the social responsibility of dual education in a period of instability caused by military action in Ukraine has thus revealed a number of problems. One of the most important is the low level of mentoring, the involvement of industry representatives in the interaction with the target groups of young people.

CONCLUSION

The theoretical contribution of the study is that the proposed set of hypotheses is an innovative system of dual education in the unstable conditions of martial law in Ukraine. The use of the proposed system allows, on the one hand, business to comply

with professional standards, develop employer branding, on the other hand, educational institutions and the state to perform the functions of social protection of graduates. The different perspectives of business and state on the training process of the dual education model is a valid reason for a stakeholder dialogue between partners and consensus building. Therefore, the approach to dual education system as one of the company's activities from the perspective of social responsibility is the most adequate strategy for building constructive interaction between business, authorities and students and their families interested in receiving quality professional education. The practical contribution of the conducted research is that the theoretical and practical model of social responsibility of dual education developed on the basis of the conceptual model allows: practically confirming or refuting the proposed hypotheses, identifying the prevailing trends in unstable conditions, designing methods of hedging the risks of reducing the quality level of dual education. The proposed theoretical and practical model for social responsibility of dual education is based on 11 calculated indicators. The proposed model of social responsibility of dual education is based on 11 calculated indicators. Factor analysis revealed that 5 out of 11 indicators influence the level of social responsibility of dual education before the war in Ukraine. The remaining indicators influence the level of social responsibility after the outbreak of hostilities. And it is more influenced by the provision of admission of students and in industrial practice. The low level of mentoring during this period has a negative impact on the level of social responsibility. The process integration scheme shows that a step-by-step implementation of the employer model of a practice-oriented (dual) learning process using stakeholder engagement and satisfaction methods within a social responsibility paradigm allows for a sustainable effect in the form of social investment by business and government, ensuring transparency and accountability to stakeholders and the community at large. In addition, the integration of production processes and dual education reveals the need to improve the institutional environment - additional regulation or, on the contrary, the elimination of certain requirements to reduce administrative barriers.

Suggestions

According to the results obtained, the following suggestions are offered to higher education institutions and companies:

1. To use the developed theoretical and practical model of social responsibility of dual education by employers to create a talent pool, motivating graduates to continue their working career in the enterprise.
2. To create a socially responsible system of dual training of qualified personnel under conditions of instability in Ukraine in enterprises, using the experience and knowledge of trainers, using the elements of exit from the crisis and aspects of social responsibility management to improve the efficiency of personnel.
3. Increase the interest of graduate students to take part in dual education programmes both to improve their own qualifications, acquire unique skills, and get their first job.
4. To conduct this study in other educational institutions and companies, comparing the results with the results of this study.

Limitations and future research

The present study is limited by the fact that it was conducted on the basis of higher education institutions and production enterprises. As a suggestion, more educational institutions (colleges, lyceums, vocational technical schools) could be involved to determine what other factors might influence the level of social responsibility of practice-oriented learning. More research is proposed to show the impact of different motivators on social responsibility job satisfaction, the results of the training received.

AUTHOR CONTRIBUTIONS

O. Kolodiziev substantiated the research methodology, conceptualization, V. Shcherbak supervised the project administration, M. Krupka collected and analyzed literature, wrote the initial draft; V. Kovalenko did the research, observation; T. Kolodizieva did the visualization; V. Yatsenko did the software, the validation, the formal analysis.

CONFLICT OF INTEREST

The authors declare no potential conflict of interest regarding the publication of this work. 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 witnessed by the authors.

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ABBREVIATIONS (NOMENCLATURE)

%	Percentage
AA1000SES	Stakeholder Engagement Standard - Accountability
BPMS	Business Process Management System
CATI	Computer Assisted Telephone Interview
Eq	Equation
ERP	Enterprise Resource Planning
Expl.Var	Explanatory Variable
Fig	Figure
IMO	World Migration Report 2022
IQNet SR10	Social Responsibility Management System
ISO	International Organization for Standardization

MES	The Ministry of Education and Science of Ukraine
PDCA	Plan-do-check-act
PIQS	Process Integrated Quality System
Prp.Totl	Percentage of the total variance explained
SR	Social responsibility
STATSTICA	Statistical analysis software package
TQM	Total Quality Management
Var	Variable

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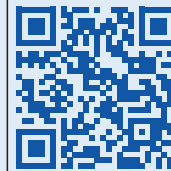


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ORIGINAL RESEARCH PAPER

Investigation of the relationship between urban stress and urban resilience

Kh. Moghani Rahimi, M. Behzadfar, S. Jalilisadrabad*

School of Architecture and Environmental Design, Iran University of Science and Technology, Tehran, Iran

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ABSTRACT

BACKGROUND AND OBJECTIVES: Making society resilient is considered a critical and challenging issue in mental health planning or stress-relieving urban planning. However; although in recent years, many studies have separately addressed stress and urban resilience, no study has explained the relationship between the two. Therefore, the present study aims to explain the relationship between urban stress and urban resilience in the Region 8 of the District 1 of Tehran Municipality.

METHODS: This study is applied descriptive-analytical research. The required data are collected using both quantitative and qualitative methods and analyzed by regression analysis. First, using the library method, the indicators of urban stress and urban resilience were identified, then the study sample was selected using these indicators and the Delphi method. After; that, the information related to the indicators was collected using questionnaire and library methods, and finally, the relationship between urban stress and urban resilience was investigated through multivariate regression.

FINDINGS: The research findings indicate a high correlation between the two abovementioned concepts (correlation coefficient= 0.925). Moreover; the adjusted R² shows that resilience indicators explain 83% of the total variations in urban stress. Also; the most critical indicators affecting the citizens' stress include the status of open space, gender structure of the population, permeability, average building density, education level, resident participation, spatial diversity, citizen's sense of belonging, social diversity, violence, crime, the safeness of the environment, social capital, social solidarity, the strength of buildings, vulnerability to natural hazards, income status, employment status, environmental pollution, access to services, the age structure of the population, and safety, respectively.

CONCLUSION: it is possible to significantly reduce urban stress by enhancing urban resilience and paying attention to its effective indicators.

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*Corresponding Author:

Email: jalili@iust.ac.ir

Phone: +982173228297

ORCID: [0000-0003-1816-7610](https://orcid.org/0000-0003-1816-7610)

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INTRODUCTION

Cities are expanding rapidly (Evans *et al.*, 2020). In; 2007, the global urban population exceeded 50% for the first time (Chinomso, 2014). Also; by 2025, about 70% of the global population is expected to reside in cities (Adli and Schondorf, 2020), and about 90% of this growth will happen in Africa and Asia (Kirkbride *et al.*, 2018). Urban areas, where half of the global population lives, experience many problems and issues due to their advantages (Mahmodzadeh and Herischian, 2018). For example, urban life affects mental health (Kyriakou and Resch, 2019), and urban stress and its adverse effects are the most important factors in increasing mental disorders in cities (Streit *et al.*, 2014). The stress of city life can be a basis for developing psychosis and mental disorders (Kennedy and Adolphs, 2011), (Wandersman and Nation, 1998). Urban stress is one of the important factors for physical and mental diseases, moral anomalies, reduced security of citizens, and waste of human capital in cities. For this reason, urban planners and designers must pay attention to this issue especially. The environment, especially the built environment of the city, greatly influences humans (Rishi and Khuntia, 2012; Neisiani *et al.*, 2020). Urban stress is one of the mental health challenges faced by urban communities (Pykett *et al.*, 2020). Despite the frequent use of this term in scientific articles and the media, its exact nature remains poorly defined. This concept is neither clearly defined nor well studied, and a better understanding of its nature seems to be a critical element for progress in this research area (Abrahamyan Empson *et al.*, 2019). For this reason, according to the definitions provided by (Rishi and Khuntia, 2012; Mehdipour *et al.*, 2017; Kyriakou and Resch, 2019; Elsamahy and Abd EL-Fattah, 2018; Miller and Phillips, 2005; Ventriglio, 2020; Abrahamyan Empson *et al.*, 2019; Kumar *et al.*, 2020), urban stress seems to be cumulative stress induced by the experience of living in the urban environment with undesirable conditions. It is a general term referring to the relationship between urban context and its impact on citizens' psychological state and a response to some perceived threats induced by adverse urban events such as pollution, high population, extreme temperature, crowding, noise, destroyed landscape, excessive accumulation of solid waste, waste of time during commuting, etc. It is created when the mentioned undesirable conditions

are beyond the tolerance of the city dweller. Also; nowadays, the global perspective has changed from reducing damage to increasing resistance to risks, so it is essential to consider the issue of resilience in urban decisions (Mahmodzadeh and Herischian, 2018). Enhancing urban resilience will result in minimized damage caused by hazards. This issue is so important that it is considered a new model for urban development by some researchers (Rezaie *et al.*, 2021). The term resilience stems from the Latin Resilio, meaning to rebound (Rezaie *et al.*, 2021), and it refers to the extent to which a system is capable of absorbing risks and reorganizing itself (Alberti *et al.*, 2003). Although many definitions have been presented for this concept, all these definitions are in the same direction. Enhancing resilience in cities is an important issue, and cities must react more quickly and more effectively to minimize risks. Urban resilience refers to the ability of a city to absorb disturbances while maintaining its functions and structures (Mahmodzadeh and herischian, 2018). Urban resilience refers to the ability of a city or an urban system to withstand stress and shocks (Karimi Razkani *et al.*, 2019), and it aims to reduce the vulnerability of cities and strengthen the abilities of citizens to deal with risks (Mohammadi Kazemabadi *et al.*, 2020). The research background includes two parts: urban stress and urban resilience. The study of urban stress began with Simmel's thesis in 1903 (Simmel, 1903). Next; in the 1950s and 1960s, Prindle (Prindle, 1968), and Milgram (Milgram, 1970) addressed this issue.)Table 1(presents the background of urban stress.

Reviewing previous studies on urban stress identifies 12 approaches: Studies on the relationship between urbanization and stress, Studies on the difference between urban and rural environments in stress, Studies on urban stress, Studies on urban stressors, Studies on only a stressful factor or stress induced by a part of the city, Studies on the relationship between stress and mental health or diseases such as asthma, Studies on stressful places, Studies on the effects of urban stress on specific groups, Studies on effective solutions or approaches to urban stress, Studies on the ranking of cities in the stress rate, Studies on the design of non-stressed spaces, and Studies on new urban stress assessment techniques. The study of resilience was started in 1973 by Holling. And his opinion resilience is defined as a "measure

Table 1: Background investigation of urban stress

Authors	Year	Research title	Results
Simmel	1903	The Metropolis and Mental Life	Proof of the relationship between urbanization and stress.
Proshansky	1972	Urban Stress	Stress factors such as noise have many effects.
Christmas	1973	Psychological stresses of urban living: a new direction for mental health services in the inner city	Emphasizing the necessity of developing health services against urban stress.
Lazarus and Cohen	1977	Environmental Stress	Must examine urban stress continuously and in the natural environment.
Baum <i>et al.</i>	1981	Stress and the Environment	Stress affects the relationship between people and their surroundings.
Cohen <i>et al.</i>	1986	Environmental stress and cognitive performance	Stress affects human behavior and health.
Burton	1990	Factors in urban stress	Introduction of urban stressors.
Haines <i>et al.</i>	2001	Chronic aircraft noise exposure, stress responses, mental health and cognitive performance in school children	Airport noise causes stress.
Jaffee <i>et al.</i>	2005	Race, urban community stressors, and behavioral and emotional problems of children with special health care needs	Urban stress assessment is the most crucial way to identify urban stressors.
Quinn <i>et al.</i>	2010	Stress and the city: housing stressors are associated with respiratory health among low socioeconomic status Chicago children	Urban stress as a social pollutant has a significant effect on the exacerbation of asthma symptoms.
Lederbogen <i>et al.</i>	2011	City living and urban upbringing affect neural social stress processing in humans	Cities negatively affect mental health and mood, and anxiety disorders are more common in cities.
Adli	2011	Urban stress and mental health	Urban stress should be investigated thoroughly interdisciplinary manner.
Seth <i>et al.</i>	2012	The Concrete Jungle: City Stress and Substance Abuse among Young Adult African American Men	Public health interventions to control drug use should address psychological factors such as stress and neighborhood violence.
Rishi and Khuntia	2012	Urban Environmental Stress and Behavioural Adaptation in Bhopal City of India	Provide guidelines for other cities to develop environmental competence and raise awareness about urban stress.
Lederbogen <i>et al.</i>	2013	Urban social stress Risk factor for mental disorders	To understand urban stress, factors such as social conditions, environmental pollutants, infrastructure, and economic issues should be considered.
Steinheuser <i>et al.</i>	2014	Stress and the City	Urban upbringing is associated with increased cortisol response to acute stress.
Freeman <i>et al.</i>	2015	The Stress of the Street for Patients with Persecutory Delusions: A Test of the Symptomatic and Psychological Effects of Going Outside into a Busy Urban Area	Compared to staying at home, street exposure resulted in significant increases in paranoia, voices, anxiety, negative beliefs about self, and negative beliefs about others.
Willie <i>et al.</i>	2016	Stress in the City: Influence of Urban Social Stress and Violence on Pregnancy and Postpartum Quality of Life among Adolescent and Young Mothers	A stress reduction program is needed to help young mothers in urban areas.
Adli <i>et al.</i>	2016	Neurourbanistik-ein methodischer Schulterschluss zwischen Stadtplanung und Neurowissenschaften	Introducing an interdisciplinary approach between architecture, urban planning, neuroscience, and medicine, for which the term neuro-urbanism is proposed.
Söderström <i>et al.</i>	2017	Unpacking 'the city: An experience-based approach to the role of urban living in psychosis	Identifying stress coping tactics through systematic analysis of interviews and observations.
Mubi Brighenti and Pavoni	2017	City of unpleasant feelings	Adaptation strategies to stressful environments are not only personal or individual but also group and social.
Knöll <i>et al.</i>	2017	A tool to predict perceived urban stress in open public spaces	Types of public open space, street network characteristics, and building density are, the most important predictors of perceived urban stress.
Maureen	2017	Revealed: The world's least stressful cities	According to the findings of the Zipjet Institute, the least stressful cities in the world are including Stuttgart, Luxembourg, Hanover, Bern, Munich, Bordeaux, Edinburgh, Sydney, (Kravat) Graz, and Hamburg. Moreover; the tensest cities in the world are Baghdad, Kabul, Lagos, Dakar, Cairo, Tehran, Dhaka, Karachi, New Delhi, and Manila. According to these results, Tehran is the sixth most stressful city in the world.
Li and Liu	2018	Housing stress and mental health of migrant populations in urban China	Poor housing conditions are significantly associated with perceived stress.

The relationship between urban stress and urban resilience

Table 1: Background investigation of urban stress

Authors	Year	Research title	Results
Chrisinger and King	2018	Stress Experiences in Neighborhood and Social Environments (SENSE): a pilot study to integrate the quantified self with citizen science to improve the built environment and health	The results of this research are identifying several stress factors through biosensing.
Elsamahy and Abd EL-Fattah	2018	Designing non-stressed psychological public spaces	Development of a methodology for designing stress-free public spaces.
Fett <i>et al.</i>	2019	Psychosis and urbanicity	Library research in the field of mental health and urban stress and identification of challenges.
Meloni <i>et al.</i>	2019	Predicting pro-environmental behaviors in the urban context: The direct or moderated effect of urban stress, city identity, and worldviews	City identity moderates the relationship between urban stress and willingness to pay for green energy and non-waste generation, respectively.
Baumann <i>et al.</i>	2020	Urban remediation: a new recovery-oriented strategy to manage urban stress after first-episode psychosis	Examining possible strategies to help promote mental health and reduce urban stress.
Evans <i>et al.</i>	2020	Urbanicity, biological stress system functioning and mental health in adolescents	The findings of this research provide evidence of the relationship between urbanization, stress, and mental health problems.
Pykett <i>et al.</i>	2020	From Urban Stress to Neurourbanism: How Should We Research City Well-Being?	Citizen-centered approaches can create more effective ways to address urban stress and promote wellness in urban communities.
Shannon <i>et al.</i>	2020	Neighborhood Violent Crime and Perceived Stress in Pregnancy	Regardless of race, violent neighborhood crimes are associated with high levels of perceived stress in an urban cohort and pregnant women.
Hernandez <i>et al.</i>	2020	Urban Stress Indirectly Influences Psychological Symptoms through Its Association with Distress Tolerance and Perceived Social Support among Adults Experiencing Homelessness	Increasing social support reduces urban stress.
Adli and Schondorf	2020	Macht uns die Stadt krank. Wirkung von Stadtstress auf Emotionen, Verhalten und psychische Gesundheit; Does the city make us ill? The effect of urban stress on emotions, behavior, and mental health	The final finding of this research is to introduce a method to study stress in cities.
Vargas <i>et al.</i>	2020	Chronic stress, structural exposures, and neurobiological mechanisms: A stimulation, discrepancy and deprivation model of psychosis	Determining the cause of stress at the systems level is a necessary step in reducing barriers to effective interventions and health policy.
Dykas <i>et al.</i>	2021	Early Adolescents' Risk-Taking Propensity, Urban Stress, and Affiliation with Risky Peers	Dependence on risky peers is in high levels of urban stress.
Buttazzoni <i>et al.</i>	2021	How Do Urban Environments Affect Young People's Mental Health? A Novel Conceptual Framework to Bridge Public Health, Planning, and Neurourbanism	Proposing two new conceptual frameworks (research-oriented and practice-oriented), which focus on the relationship between urban environments and the mental health of young people. And can help guide practice and future research in this field.
Moghani Rahimi <i>et al.</i>	2022	Investigating the Factors Affecting Urban Stress in World Literature	Urban stress is mostly due to social stressors such as population density, social isolation, social deprivation, and poor social interactions, as well as environmental stressors such as noise pollution and air pollution. urban stress and physical health can mediate the effects of urbanization on mental health and the effects of mental health on the city. A better understanding of this relationship and the effect of mediators and trying to reduce the negative effects of cities on mental health will help a lot to develop coping strategies, better planning of future cities and maximum exploitation of the benefits of urban life.
Moghani Rahimi <i>et al.</i>	2023a	Explaining the Relationship between City and Mental Health Using Content Analysis Technique and Maxqda Software	

(2016), have reviewed the theoretical literature on this issue. However; there are a few studies on the relationship between resilience and another issue. Zhang and Li (2018), investigated the relationship between resilience and urban sustainability, Leitner *et al.* (2018), examined the relationship between resilience and globalization; and Jones *et al.* (2011), studied the relationship between resilience and tourist attraction. As mentioned; many studies have separately addressed urban stress and resilience using different approaches. However; no study has explained the relationship between these two topics

[illegible]

so far, although identifying this relationship can be very effective in stress-relieving urban design and urban planning. The degree of correlation between these two issues is not known. Also, it is not clear what effect each of the indicators or dimensions of urban resilience has on urban stress. Making society resilient, or enhancing the ability of a society to resist past and future difficulties and promoting belief in this ability, is a critical and challenging issue in mental health planning or stress-relieving urban planning (Lloyd *et al.*, 2005). Therefore; the present study aimed to explain the relationship between urban stress and urban resilience in the Region 8 of the District 1 of Tehran Municipality, which is identified as the most stressful Region in the district according to the expert's opinion. The current study was carried out in Tehran, in 2022.

MATERIALS AND METHODS

Survey design and data collection

The present study is applied descriptive-analytical research. The required data were collected using quantitative and qualitative methods such as the questionnaire, interview, observation, and library studies and then, analyzed using regression analysis. In the present study, 23 resilience indicators (Table 2) were examined, and the data on seven indicators were collected using a questionnaire and the rest through quantitative methods such as spatial analysis, field sampling, etc. To assess urban stress, 34 indicators (Table 3) were examined, and the data on 15 indicators were collected using a questionnaire and the rest through quantitative methods. According to the residents of the case study in 2020 (59429 people), and Cochran's formula, with a confidence level of 95%, an error of 0.05%, and a normal variable rate of 1.96, the minimum number of questionnaires was 381 people. Considering that proportional stratified sampling was used in this research and the number of questionnaires related to each block is proportional to its population. However, since the population percentage of some blocks is less than the others and the number of questionnaires related to them is less than 0.5, one questionnaire was distributed in that block, and finally, 413 people in the case study were selected as samples using the simple random sampling technique, and the questionnaires were distributed among them. The data on objective indicators were also collected using

field surveys, library studies, and spatial analyses. The reliability of the questionnaire was examined with Cronbach's alpha coefficient, which was calculated as 0.73. Finally, the correlation between mixed-use and urban stress reported by citizens was evaluated with regression analysis. It should be noted that the Likert scale was used to measure qualitative indicators. Also, how to collect information related to indicators and metrics related to them is described in the tables.

Introduction of case study

The Delphi technique was used to identify the case study considering that the relative certainty of the stressfulness of the studied area was critical. For this purpose; in several steps, using the Delphi technique, first, a region of Tehran city and then a district of that region have been selected. In the first step, the indicators presented in (Table 3) were checked by 15 experts familiar with the city of Tehran in 22 districts of this city. In fact, at this stage, the experts were given a table with the indicators in the rows and the regions in the columns, and they were asked to rate each region from 1 to 5 based on their knowledge. Then the scores were analyzed and District 1 of Tehran city was selected. This area is one of the upper-class districts of Tehran city, which has experienced high-rise building construction and a sharp increase in population and building densities in recent years. Moreover; Municipal Districts 1 and 2 in Tehran are known as the districts where one can see the neighborhood of upper and lower-class residents (Young Journalists Club, 2018). In addition, this district is one of the hazard-prone areas of Tehran, which is in poor conditions in terms of safety and vulnerability to natural hazards (Hashemi *et al.*, 2014). In the next step, it was attempted to identify the experts in the field of urban planning who were familiar with the Municipal District 1 of Tehran and the issues of mental health and urban stress. To this end, Authors who had a history of research in this area and those urban planning experts who have a history of non-research activity in this area (municipal employees or consulting companies) were identified. Next, using a semi-structured questionnaire, the individual characteristics of 21 experts and their interest in participating in the next stage were measured. Then, a structured questionnaire was developed, and 15 experts interested in participating in the next step were asked to rank the regions in this district in urban

stress (Based on the indicators presented in Table 3). The reliability of the questionnaire was examined with Cronbach's alpha coefficient, which was calculated as 0.79. The validity of the questionnaire was also evaluated by experts. Experts, experts were asked to give each of the 9 areas a score from 1 to 5. f the experts, 53.33% were female, and 46.66% were male. Also; four experts had a doctoral degree, 6 had a master's degree, and 5 had a bachelor's degree. It should be noted that before this step, objective indicators such as temperature, environmental pollution, building density, *etc.*, were examined in region 1, and related information was provided to the experts along with a questionnaire. This action was very useful in ranking objective indicators by experts. Finally; the total score of each Region was analyzed,

and the Region 8 of the District 1 was selected as the case study (More information on how to choose a case study is mentioned in this reference (Moghani Rahimi *et al.*, 2023b)). As shown in Fig. 1, this region, with an area of 3.13 km², is located in the northern part of Tehran and has two neighborhoods, Hekmat and Chizar.

RESULTS AND DISCUSSION

In this section, according to the purpose of the research and the reviewed literature, urban resilience, which was evaluated with 23 indicators presented in Table 2, was considered an independent variable, and urban stress of citizens was considered a dependent variable. The relationship between them was investigated through a multivariate regression model. To measure the urban stress in the blocks, several experts familiar with the study area were asked to make a pairwise comparison between the 34 indicators presented in Table 3. Then, using Expert Choice software and AHP method, the importance coefficient of each index was determined. Finally, considering the importance coefficient of each index and the direction of its impact on urban stress, and using the weighted average, The stress value of each

block is calculated and considered as a dependent variable. This model examines the correlation coefficient between independent and dependent variables, the amount of explanation of changes in the dependent variable by the independent variable, and the regression coefficient of each of the independent variables (Saidi *et al.*, 2021; Jehan *et al.*, 2020). In fact; at this stage, the data on each urban stress indicator were collected and analyzed, and the stressfulness of each block was calculated. Then; the final data on this question were analyzed as the dependent variable and the data on resilience indicators as the independent variable in SPSS software. Table 4 shows the summary of this model. The correlation coefficient between the variables was estimated as 0.925, indicating a very high correlation between the identified indicators of resilience and urban stress. Moreover; the adjusted R² shows that 23 resilience indicators explain 83% of the total variations in the stressfulness of the living environment. In other words, the identified factors predict 83% of the variance of the dependent variable. This result shows that urban resilience has a great impact on urban stress. In fact, by making the urban environment resilient, urban stress can be greatly reduced and the

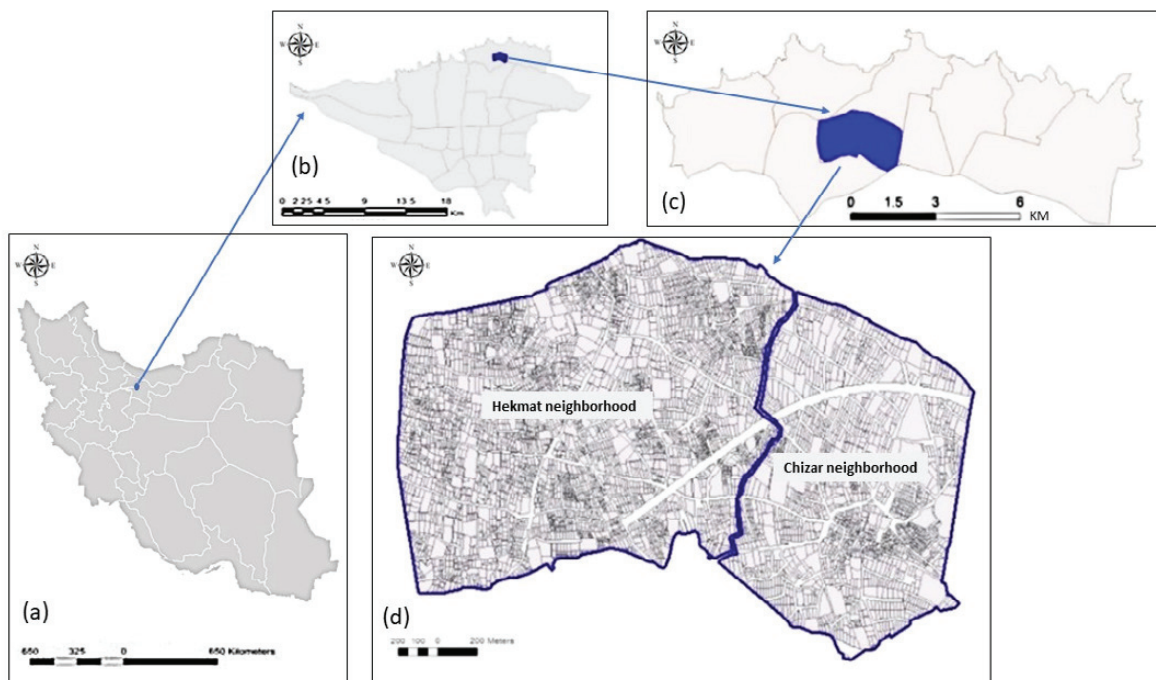


Fig 1: Geographic location of the study area; (a) Iran, (b)Tehran, (c) District 1 of Tehran, (d) Region 8 of the District 1 of Tehran Municipality

Table 4: Summary of the regression model

Correlation coefficient	R ²	Adjusted R ²	Std. Err
0.925	0.855	0.834	0.7698

Table 5: F test of the regression model

Model	The sum of squares of dispersion	df.	The mean of squares (MS)	F-statistic	Sig.
Variations in or dispersion of the contribution of the model	5.536	23	0.241	40.417	0.000
Variations according to residuals	0.936	158	0.006		
Total variation of dispersion	6.472	181			

mental health of citizens can be improved. Of course, this result was somewhat predictable. But the most important measure to make the urban environment resilient to reduce stress is to identify the importance of urban resilience indicators.

(Table 5) shows the second significant output of regression analysis and answers whether the independent variables can explain the variations in the dependent variable. According to; this table, the Sig. of the F-value is explained at the error level < 0.05. According to; this table and the Sig. of the F-test (< 0.05), it can be said that the set of identified factors can predict variations in citizens' stress.

The third significant output of the regression analysis includes the coefficients of the independent variables, as shown in (Table 6). Since independent variables, i.e., resilience indicators, differently influence citizens' stress, beta coefficients can be used in regression analysis to determine the relative significance of each independent variable (Tabaeian *et al.*, 2021).

In this section, beta coefficients have been used to measure the impact of each urban resilience index (independent variable) on urban stress (dependent variable). The values of these coefficients show the sensitivity of the dependent variable to each of the indicators of the independent variable. According to (Table 6) and the beta coefficients presented in it, the most critical indicators affecting citizens' stress include the status of open space (-0.345), the gender structure of the population (0.285), permeability (0.28), the average building density (0.264), the education level (0.24), the resident participation (-0.191), spatial diversity (-0.174), citizens' sense

of belonging (-0.171), social diversity (-0.163), violence (0.154), crime (0.136), safeness of the environment (-0.135), social capital (-0.132), social solidarity (-0.129), the strength of buildings (-0.126), vulnerability to natural hazards (0.115), income status (-0.113), employment status (-0.112), environmental pollution (0.097), access to services (-0.077), the age structure of the population (0.077), safety (-0.069), and population density (0.058), respectively. At the 95% confidence level, one can say that the population density indicator has no significant effect on the citizens' stress. This indicator does not affect the dependent variable because its error value or Sig. is more significant than 0.05. This conclusion is quite logical considering that different individuals may have different perceptions of population density because they have various preferences regarding the crowd around them. Some people experience more stress in solitude, while others experience urban stress when they are in a crowd. Low population density and high population density are both considered stressful. Also; the indicators of crime, violence, the age structure of the population, the gender structure of the population, education level, permeability, average building density, and environmental pollution directly influence urban stress. In other words; urban stress will also increase as these indicators are enhanced. The higher the amount of crime and violence, the percentage of the population under 6 years old and over 65 years old, the percentage of the female population, the literacy rate, the percentage of passages with a width of less than 6 m, the building density, and environmental pollution in the city, the more urban stress citizens

Table 6: Coefficients of factors identified in the model

Independent variable		Non-normalized coefficient		Normalized coefficient	T	Sig.
		B	Std. Err	Beta		
		3.947	0.112		35.289	0.000
1	Social diversity	-0.032	0.007	-0.163	-4.761	0.000
2	Crime	0.032	0.009	0.136	3.521	0.001
3	Violence	0.034	0.008	0.154	4.065	0.000
4	Safeness of environment	-0.025	0.007	-0.135	-3.644	0.000
5	The age structure of the population	0.025	0.011	0.077	2.259	0.025
6	Social The gender structure of the population	0.051	0.007	0.285	7.476	0.000
7	Education level	0.053	0.007	0.24	7.178	0.000
8	Resident participation	-0.047	0.008	-0.191	-5.558	0.000
9	Citizens' sense of belonging	-0.038	0.008	-0.171	-4.926	0.000
10	Population density	0.014	0.011	0.058	1.302	0.195
11	Social solidarity	-0.039	0.01	-0.129	-3.994	0.000
12	Social capital	-0.044	0.011	-0.132	-3.928	0.000
13	Economic Employment status	-0.023	0.007	-0.112	-3.33	0.001
14	Income status	-0.045	0.017	-0.113	-2.614	0.010
15	Spatial diversity	-0.035	0.007	-0.174	-5.036	0.000
16	Strength of buildings	-0.049	0.013	-0.126	-3.698	0.000
17	Spatial Permeability	0.043	0.005	0.28	8.528	0.000
18	Status of urban open space	-0.087	0.008	-0.345	-10.372	0.000
19	Access to services	-0.034	0.014	-0.077	-2.315	0.022
20	Average building density	0.066	0.012	0.264	5.629	0.000
21	Safety	-0.021	0.011	-0.069	-2.023	0.045
22	Environmental Environmental population	0.03	0.012	0.097	2.547	0.012
23	Vulnerability to natural hazards	0.029	0.011	0.115	2.723	0.007

experience. However; since an individual's education level can lead to the knowledge of coping skills and, thereby, the perception of less urban stress, its positive effect on urban stress was observed in the present study. Also; the indicators of social diversity, safeness of the environment, resident participation, citizens' sense of belonging, social solidarity, social capital, employment status, income status, spatial diversity, the strength of buildings, the status of open space, access to services, and safety indirectly influence urban stress. In other words; increasing these indicators will result in reduced urban stress. As shown in Fig. 2, in the spatial dimension, the "status of open space" indicator is the main indicator affecting citizens' stress, followed by the gender structure of the population in the social dimension, the vulnerability to natural hazards in the environmental dimension, and the income status in the economic dimension. According to the research findings, "the status of open space" is known as the indicator with

the greatest impact on urban stress. In fact, the lack of open space and large constructions in the urban environment have the greatest impact on the stress of citizens. The more urban open space there is in the city, the less urban stress a person experiences. According to Table 6, social resilience has the greatest impact on urban stress. After this dimension, spatial resilience, environmental resilience, and economic resilience are important, respectively.

urban stress by Knöll *et al.* (2017) was measured using indicators such as Population density, Environmental pollution, Temperature, Quality of roads, Urban texture, and Average building density. Then, Vojnovic *et al.* (2019) introduced indicators such as Security in the environment, Population density, Employment and income, Safety, Mixed land use, Traffic, Quality of roads, walking facilities, Average building density, and Urban furniture as the most critical indicators affecting urban stress. Then, the Interdisciplinary Forum Neurourbanism

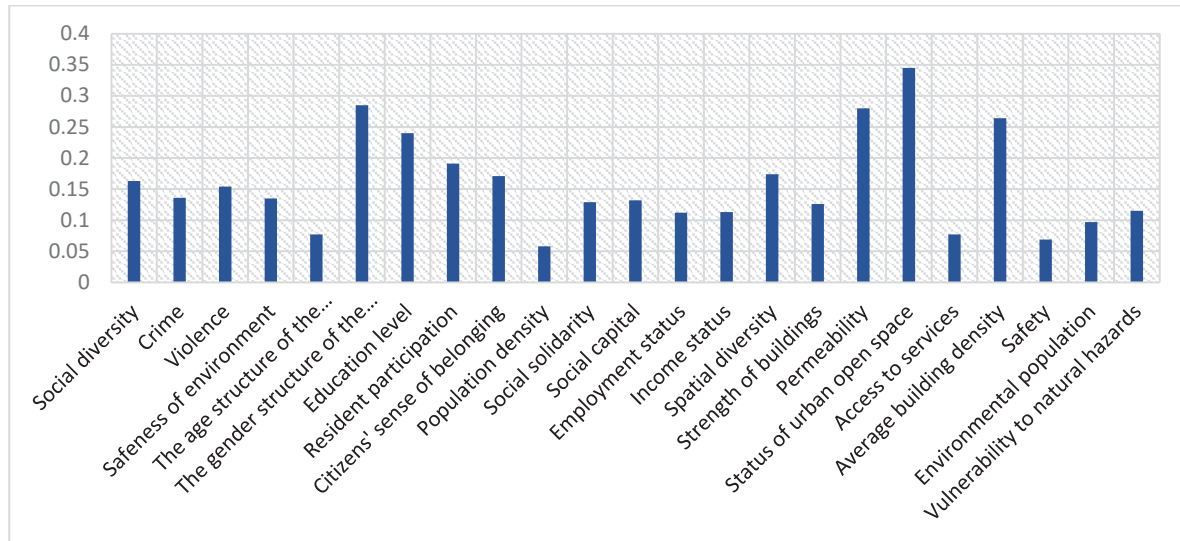


Fig 2: Investigating the influence of resilience indicators on urban stress

(2019), introduced proposed indicators such as social interactions, population density, participation rate, cultural and psychological deprivation, public transportation, and the beauty of the environment. The current study also identified urban resilience as a critical factor in reducing citizens' stress and indicators such as the status of open space, the gender structure of the population, permeability, the average building density, the education level, resident participation, spatial diversity, citizens' sense of belonging, social diversity, violence, crime, the safety of the environment, social capital, social solidarity, the strength of buildings, vulnerability to natural hazards, income status, employment status, environmental pollution, access to services, the age structure of the population, safety, and population density, as the most critical effective indicators. This research develops the results of previous studies and promotes urban resilience as an effective solution to reduce urban stress.

CONCLUSION

Urban stress is a critical cause of physical and mental disorders in cities. Also, enhancing urban resilience results in minimized damages caused by hazards. Making the community resilient is a critical and challenging issue in mental health planning or stress-relieving urban planning. However, although many studies have separately addressed urban stress

and resilience in recent years, no study has explained the relationship between the two. Therefore; the present study aimed to explain the relationship between urban stress and urban resilience in the Region 8 of the District 1 of Tehran Municipality, which was selected based on the status quo of Tehran and District 1 of this city. The research findings indicated that the correlation coefficient between the variables was estimated as 0.925, indicating a very high correlation between the identified resilience indicators and urban stress. Moreover; the adjusted R^2 shows that 23 resilience indicators explain 83% of the total variations in the stressfulness of the living environment. In other words; the identified factors predict 83% of the variance of the dependent variable. Also; the most critical indicators affecting the citizens' stress include, respectively, the status of open space, gender structure of the population, permeability, average building density, education level, resident participation, spatial diversity, citizens' sense of belonging, social diversity, violence, crime, the safety of the environment, social capital, social solidarity, the strength of buildings, vulnerability to natural hazards, income status, employment status, environmental pollution, access to services, the age structure of the population, and safety. Also; the indicators of crime, violence, the age structure of the population, the gender structure of the population, education level, permeability, average building density,

and environmental pollution directly influence urban stress. In other words, urban stress will also increase as these indicators are enhanced. The higher the amount of crime and violence, the percentage of the population under 6 years old and over 65 years old, the percentage of the female population, the literacy rate, the percentage of passages with a width of less than 6 m, the building density, and environmental pollution in the city, the more urban stress citizens experience. However; since an individual's education level can lead to the knowledge of coping skills and, thereby, the perception of less urban stress, its positive effect on urban stress was observed in the present study. Moreover; the indicators of social diversity, safeness of the environment, resident participation, citizens' sense of belonging, social solidarity, social capital, employment status, income status, spatial diversity, the strength of buildings, the status of open space, access to services, and safety indirectly influence urban stress. In other words, increasing these indicators will result in reduced urban stress. Also; at the 95% confidence level, one can say that the population density indicator has no significant effect on the citizens' stress. This indicator does not affect the dependent variable because its error value or Sig. is more significant than 0.05. This conclusion is logical, considering that different individuals may have different perceptions of population density. Because different individuals have various preferences regarding the crowd around them, some people experience more stress in solitude, while others experience urban stress when they are in a crowd. Low population density and high population density are both considered stressful. As a result; it is possible to significantly reduce urban stress in the studied Region and Tehran city by enhancing urban resilience and paying attention to its effective indicators.

AUTHOR CONTRIBUTIONS

Kh. Moghani Rahimi performed the literature review, experimental design, compiled the data, analyzed and interpreted the data, prepared the manuscript text, and manuscript edition. M. Behzadfar performed the literature review, compiled the data and manuscript preparation. S. Jalilisadrabad performed the literature review, compiled the data, analyzed and interpreted the data, and manuscript preparation.

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CONFLICT OF INTEREST

The authors declare no potential conflict of interest regarding the publication of this work. 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 witnessed by the authors.

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ABBREVIATION

<i>B</i>	Uncorrected regression coefficient
<i>Beta</i>	Beta coefficient
<i>df.</i>	Degrees of Freedom
<i>MS</i>	The mean squares
<i>R²</i>	R-squared correlation
<i>Sig.</i>	significance

Std. Err standard error of the mean

T T-test

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ORIGINAL RESEARCH PAPER

Spatio-temporal variability of urban particulate matter using GIS: a lesson from COVID-19 restrictions

M.T. Islam¹, M. Islam², A.A. Nayeem^{2,3,*}, A.K. Majumder²

¹ Department of Geography and Environment, Shahjalal University of Science and Technology, Sylhet, Bangladesh

² Center for Atmospheric Pollution Studies (CAPS), Department of Environment Science, Stamford University Bangladesh, Dhaka, Bangladesh

³ Department of Environmental Science, Environmental System Analysis Group, Wageningen University and Research, Wageningen, The Netherlands

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ABSTRACT

BACKGROUND AND OBJECTIVES: Air pollution and its associated health impacts have become a major concern worldwide, particularly in developing countries. Anthropogenic activities were significantly reduced during the COVID-19 pandemic, allowing for the opportunity for source reduction of air pollutants. A number of studies have been conducted in Dhaka, but most of them are concentrated on a single ground-monitoring station, making it impossible to draw a comprehensive pollution scenario for the entire city. In contrast, this study evaluated the spatio-temporal changes of urban Particulate Matters (PM) in 70 locations from five different land use categories. Hence, this study investigated the influence of the COVID-19 pandemic on PM1 (aerodynamic diameter $\leq 1 \mu\text{m}$), PM2.5 (aerodynamic diameter $\leq 2.5 \mu\text{m}$) and PM10 (aerodynamic diameter $\leq 10 \mu\text{m}$) concentration during three specific time frames: November 2019 (Pre-lockdown), April 2020 (During lockdown), and November 2020 (Post-lockdown).

METHODS: The data were collected through portable air quality meter (AEROQUAL 500) during lockdown (April 2020) and post-lockdown (November 2020) period. Data set of pre-lockdowns (November 2019) was collected from Center for Atmospheric Pollution Studies (CAPS). The Tukey's Post Hoc Multiple Comparison Test was conducted using Statistical Package for the Social Sciences (SPSSv26) to address the significant changes in air quality between the periods. Additionally, the GIS (Geographical Information System) platform was used to see the spatial and temporal variations of PMs over the city.

FINDINGS: The study found that average ground level PM1, PM2.5 and PM10 concentration reduced by 75.1, 75.4, 69.6% and 41.1, 32.6, 29.2% respectively during lockdown compared to pre-lockdown and post-lockdown periods. Moreover, the reduction during lockdown was significant at $\alpha=0.05$ level. The highest reduction was seen in residential areas from the pre-lockdown to lockdown period, whereas in the lockdown to post-lockdown phase that was found in the industrial areas. Interestingly, the northern part of Dhaka city was less polluted than the southern part in all three studied periods. Besides, the Dhaka city dwellers enjoyed comparatively good quality air in lockdown.

CONCLUSION: This study suggested that land use-based source apportionment is required to eliminate the particulate concentration from Dhaka city. Besides, 24 hours continuous data is also important to understand the interaction between particulate concentration and climatic forces. Promoting cleaner transportation options, such as electric vehicles and public transportation is recommended as a means of reducing vehicle emissions. Furthermore, governments could consider implementing emissions regulations, setting limits on emissions, or mandating the use of cleaner fuels and technologies to reduce industrial pollution.

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*Corresponding Author:

Email: nayeem@stamforduniversity.edu.bd

Phone: +8801815622852

ORCID: [0000-0001-6203-4298](https://orcid.org/0000-0001-6203-4298)

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INTRODUCTION

Air pollution has become a major threat worldwide in terms of human health risks and economic loss. Since the industrial revolution, the demand for fossil fuels has increased significantly which is the major contributor to the increase in air pollutants in the global atmosphere (Goyal *et al.*, 2023). Most of the south Asian countries (18 out of 20) are suffering from severe particulate pollution while vehicle exhaust and industrial emissions are the dominant sources (Pushpawela *et al.*, 2023; Gunasekara and Waraketiya, 2022). The different sized particulate matter (particularly PM_{10} , $PM_{2.5}$ and PM_{10}) concentration is more dangerous since it creates severe public health issues (Shang *et al.*, 2018). A number of epidemiological studies have found strong relationships between $PM_{2.5}$ and premature death (Zhao *et al.*, 2017; Shang *et al.*, 2018). Study revealed that each $10 \mu g/m^3$ increase in $PM_{2.5}$ concentration leads to a 0.23% increase in mortality from respiratory diseases (Chen *et al.*, 2019). In 2019, Dhaka was listed as the second most polluted city in the world just after New Delhi in terms of $PM_{2.5}$ exposure (Majumder *et al.*, 2021). A number of sources contribute to airborne particulate matter in Dhaka city where brick kilns are one of them. Most of the kilns are located in the north and west of the city, influencing as a substantial contributor to triggering the $PM_{2.5}$ concentration, particularly during the winter season (Nayeem *et al.*, 2019; Rana *et al.*, 2020). Besides, uncontrolled industrial emission is another major source of $PM_{2.5}$ in several areas of the city (Adhikari *et al.*, 2023). Vehicle exhaust, particularly that emitted by diesel-powered buses and heavy trucks, has also been identified as a significant source (Razib *et al.*, 2020). More recently, another newly added significant source of particulate matter in Dhaka city is the construction of Bus Rapid Transit (BRT) and Mass Rapid Transit (MRT) (Nayeem *et al.*, 2020). Despite the multiple detrimental health and economic consequences of the COVID-19 epidemic, it had encouraging results in lowering air pollution due to restrictions on social and economic activities (Dutheil *et al.*, 2020; Masum and Pal, 2020). COVID-19 lockdown could be inferred as an effective control measure for air pollution in the urban areas from several researches of various parts of the world (both developed and developing countries) (Majumder *et al.*, 2021; Abdullah *et al.*, 2020; Bera

et al., 2021). These studies were focused on different air pollutant emissions including $PM_{2.5}$ in lockdown. Most of the studies were conducted through satellite observations (Dutheil *et al.*, 2020; Nakada *et al.*, 2020; Tobías *et al.*, 2020; Nadzir *et al.*, 2020) though very few researchers also utilized ground level data (Kayes *et al.*, 2019). The scopes of these studies were pollution monitoring, source identification, policy recommendation in terms of $PM_{2.5}$, PM_{10} , SO_2 , NO_2 , and O_3 . Xu *et al.*, (2020) recorded 30.1% less air pollution in China during the pandemic lockdown compared to the normal situation. He also mentioned that the Air Quality Index (AQI) in Wuhan, Jingmen, and Enshi decreased drastically in 2020 compared to 2017-2019. Abdullah *et al.*, (2020) showed that $PM_{2.5}$ concentration was reduced by 58.4% in the capital of Malaysia. A sharp reduction of $PM_{2.5}$ had also been observed in Delhi, Kolkata and Kathmandu by 45.44%, 34.08% and 37.42% respectively in 2020 compared to 2019 (Majumder *et al.*, 2021).

Purpose, Objectives and Hypothesis

Several studies worldwide have shown that anthropogenic activities significantly contribute to air pollution, but the COVID-19 pandemic led to a temporary shutdown of these activities resulting in a reduction of air pollutants in the atmosphere. However, most of the ground-based studies (Islam and Chowdhury, 2021; Pal and Masum, 2021; Masum and Pal, 2020) are concentrated on a small number of sampling locations for each city which was unable to draw the holistic pollution scenario of an urban area (Majumder *et al.*, 2021; Hossain *et al.*, 2019). Hence, it is important to consider a large number of sampling locations in a particular city to get a comprehensive pollution status. So, this study focused on 70 locations of Dhaka city and examined the impact of lockdown measures on air pollution levels during three specific time frames: November 2019 (Pre-lockdown), April 2020 (During lockdown), and November 2020 (Post-lockdown). Therefore, the main purpose of this study was to investigate the influence of the COVID-19 pandemic on urban Particulate Matters (PMs) in the context of different land use categories in Dhaka city. The specific objectives to achieve the purpose were; a) To evaluate the status of PM_{10} , $PM_{2.5}$ and PM_{10} concentration during lockdown compared to pre-lockdown and post-lockdown period, b) To compare the fluctuations in pollution levels among different

land use categories during selected time frames, c) To explore the spatio-temporal variability of particulate matter based on 70 locations over the Dhaka city, and d) To examine the AQI and compare it among three different phases of lockdown. The study assumed that the concentration of PM would be significantly lower during the lockdown period compared to pre-lockdown and post-lockdown periods. Additionally, the study predicted that industrial areas might have higher pollution levels compared to other land categories in all time frames. Moreover, the north and south part of Dhaka city might have different pollution scenarios in the studied period. Ultimately, the implementation of lockdown might help to improve the AQI of the city. This study had been carried out in the Dhaka city in 2020.

MATERIALS AND METHODS

Area Selection

The Department of Environment (DoE), had classified Dhaka city into five types of land use including 70 places based on exposure duration to monitor noise levels (in Environment Conservation Rules 1997, Schedule 4), namely: 1. Sensitive area, 2. Residential area, 3. Commercial area, 4. Industrial

area, and 5. Mixed area in 2017 under a noise pollution survey in 8 divisional cities of Bangladesh (DoE, 2006). However, DoE identified 10 places for sensitive areas (educational institutions, mosque and hospital) since people stay for a short period of time in these locations. On the other hand, 20 places were chosen for residential areas because individuals spend the majority of their time at home, while 15 places were for commercial areas. Furthermore, 20 locations were selected from mixed areas because those areas were the combination of other two or more land uses. Finally, DoE identified only 5 locations at industrial areas in Dhaka city since all major industrial hubs were outside of the town. This study followed these 70 stations based on land use for the particulate matter sampling (Fig.1).

Data Collection

The Aeroqual 500 series, a laser-based sensor that utilizes the light scattering method to detect particle size and measure concentration, was used to measure particle concentration in the ambient environment. Data was collected for the month of April 2020 (during lockdown) and November 2020 (post-lockdown) for each parameter at each location,

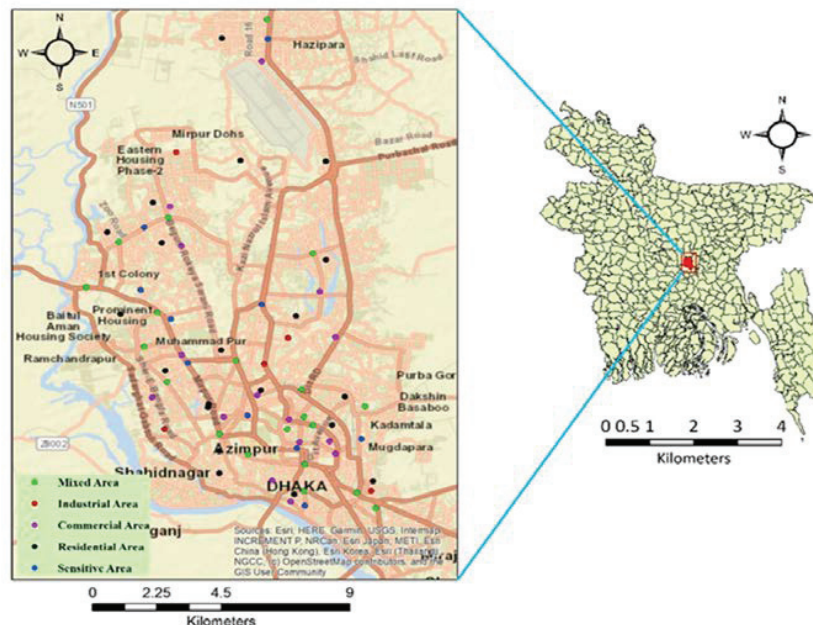


Fig. 1: The map in left side showing the sampling locations in different land use categories of Dhaka city and the index map at the right side showing the location of Dhaka city within a Sub-district map of Bangladesh

and data for November 2019 (pre-lockdown) was obtained from the Center for Atmospheric Pollution Studies (CAPS), Department of Environmental Science, Stamford University Bangladesh. The data collection process was the same for all three-time frames, with the Aeroqual monitor placed on a tripod about 5 feet above the ground, recorded concentration automatically every hour on an SD card, and later exported the data in Comma-Separated Value (CSV) format. The monitor displayed the mean value of each particle size in ppm, which was later converted to micrograms. All three particles were recorded in one sensor, which required a 3-minutes warm-up period before recording data, and the sensor was factory calibrated prior to sampling.

Data Analysis

For the specified time frames, the mean and standard deviation were calculated for each particle size, and a whisker box plot was utilized to visualize the range of the data, outliers, and the symmetry or skewness of the distribution. Tukey's Post Hoc Multiple Comparison test was employed to determine the significance of the differences in PM_{10} , $PM_{2.5}$, and PM_{10} concentrations between the months in a specific land category, with a p-value of 0.05. All the statistical analysis was conducted using SPSSv26 software. Besides, all attribute data of 70 sampling locations were synchronized in ArcGIS 10.8 which is a professional software popular in the GIS (Geographical Information System) platform. Then, to estimate values at unsampled locations the Inverse Distance Weighting (IDW), a spatial interpolation method, was used. Finally, geo-spatial mapping was done to visualize all spatio-temporal analysis.

AQI Calculation

The Air Quality Index (AQI) typically reflects

the degree of air cleanliness and focuses on the assessment of the effects of air pollution on human health and provides recommendations for the portion of the population that might be sensitive to pollution (Xu *et al.*, 2020). This study followed the U.S. Environmental Protection Agency's (EPA) AQI system to categorize air quality (Table 1). To determine the daily (24hr) PM_{10} and $PM_{2.5}$ based AQI for assigning categories the following equation (Eq. 1) (USEPA, 2012) was used.

$$I_p = \frac{(I_{HI} - I_{LO})}{(BP_{HI} - BP_{LO})} (C_p - BP_{LO}) + I_{LO}$$

Where, I_p = Index value for pollutant

C_p = Rounded concentration of pollutant

BP_{HI} = Higher breakpoint value of C_p

BP_{LO} = Lower breakpoint value of C_p

I_{HI} = Index breakpoint value of BP_{HI}

I_{LO} = Index breakpoint value of BP_{LO}

The breakpoints for PM_{10} and $PM_{2.5}$ concentrations along with the ranges of AQI category used in this study have been stated in Table 1.

RESULT AND DISCUSSIONS

Descriptive Analysis

The ground level PM (PM_{10} , $PM_{2.5}$ and PM_{10}) data were collected in three periods to observe the influence of COVID-19 lockdown on quality of air in Dhaka city. Generally, these pollutants originate from fossil fuel combustion, biomass burning, fires, vehicle emission, construction activities etc. But many of these pollution sources were inactive during lockdown, since Bangladesh imposed strict mobility restrictions to prevent the spread of the COVID-19 outbreak. From this study, it was evident that PM concentration had been reduced drastically during the lockdown period compared to pre-lockdown and

Table 1: Break points of PM_{10} and $PM_{2.5}$ in $\mu g/m^3$ with AQI category (USEPA, 2012)

Break Points of PM_{10}	Break Points of $PM_{2.5}$	AQI	Category
0-54	0-12	0-50	Good
55-154	12.1-35.4	51-100	Moderate
155-254	35.5-55.4	101-150	Unhealthy for sensitive group
255-354	55.5-150.4	151-200	Unhealthy
355-424	150.5-250.4	201-300	Very unhealthy
425-504	250.5-500.4	301+	Hazardous

post-lockdown (Fig. 2) span. In terms of PM_{10} , the average concentration was 155.9, 38.2 and 64.80 $\mu\text{g}/\text{m}^3$ in November 2019, April 2020 and November 2020 respectively. On the other hand, the $PM_{2.5}$

concentration was 298.2, 73.1 and 108.8 $\mu\text{g}/\text{m}^3$ and PM_{10} concentration was 333.4, 98.2, and 141.2 $\mu\text{g}/\text{m}^3$ in November 2019, April 2020 and November 2020 accordingly (Table 2).

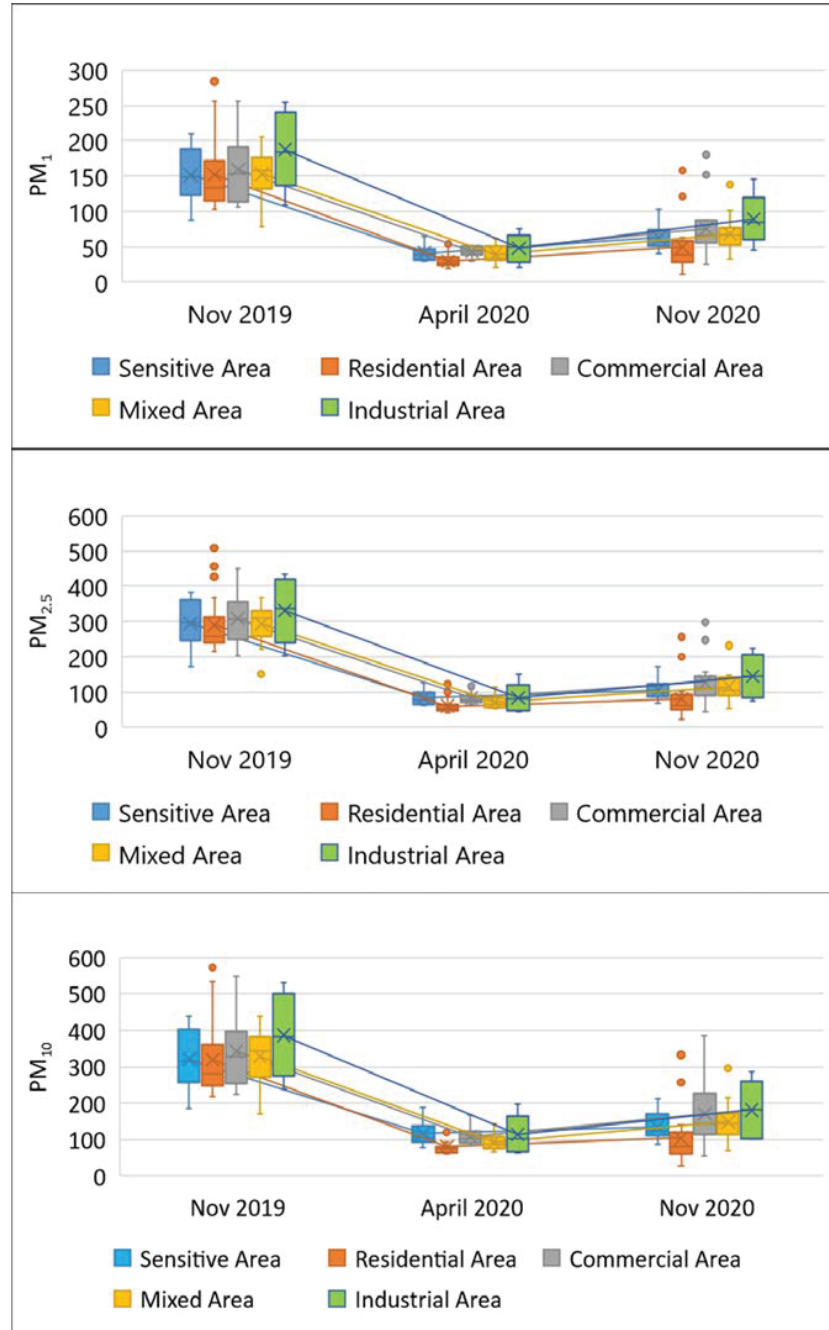


Fig. 2: The deviation of PM_{10} , $PM_{2.5}$ and PM_1 concentration ($\mu\text{g}/\text{m}^3$) during the three phases of lockdown

Table 2: Descriptive statistics of PM concentration ($\mu\text{g}/\text{m}^3$) in different study period

Year	Statistics	PM ₁	PM _{2.5}	PM ₁₀
November 2019	Mean	155.9	298.20	333.4
	Std. Deviation	44	72.3	90.6
	Minimum	79	151	172
	Maximum	284	507	572
	Range	205	356	400
April 2020	Mean	38.2	73.1	98.2
	Std. Deviation	12.7	22.8	30.9
	Minimum	18	40	61
	Maximum	76	150	198
	Range	58	110	137
November 2020	Mean	64.8	108.8	141.2
	Std. Deviation	32.9	54.3	71.3
	Minimum	12	22	28
	Maximum	180	298	384
	Range	168	276	356

This data reflect considerable changes among the three months of two consecutive years. It could be depicted from [table 3](#) that in April 2020 (during lockdown) the ground level average PM₁, PM_{2.5} and PM₁₀ concentration decreased by 75.1, 75.4, and 69.6% compared to pre-lockdown and was 41.1, 32.6, and 29.2% less than post-lockdown. [Table 3](#) shows that during those all three periods the concentrations of PMs were lower in the residential areas than all other land uses and these were even within the permissible limit (PM_{2.5} - 65 $\mu\text{g}/\text{m}^3$ and PM₁₀ - 150 $\mu\text{g}/\text{m}^3$ for 24 hours observation), according to the Bangladesh National Ambient Air Quality Standard (BNAAQS) mentioned in the Air Pollution (Control) Rules'22 during the lockdown. In contrast, the industrial areas had polluted air in most of the time. Even in the lockdown, the concentration had exceeded the BNAAQS. However, based on the land use, the average PM₁ concentration reduced by 72.8-80.4%, PM_{2.5} concentration reduced by 71.6-79.2% and PM₁₀ concentration reduced by 63.4-74.8% during the lockdown in comparison to the pre-lockdown (November 2019) ([Table 3](#)). Meanwhile, the PM's concentrations (34.8-46.4% for PM₁; 21.3-42.2% for PM_{2.5}; and 13.1-37.2% for PM_{2.5}) were also

less during lockdown than the post-lockdown period (November 2020) ([Table 3](#)). The main reasons for the decline in the lockdown could have been linked to lower industrial emissions, less mobility, and lower traffic contributions ([Nayeem et al., 2021](#)). After the withdrawal of this shutdown in Bangladesh; though the concentration increased, it was still lower than November 2019 probably because of less public movement till that time. Moreover, among three PMs, PM₁ had the highest reduction (72.8-80.4%) in the context of land use-based reduction calculation although PM_{2.5} reduced the most in average concentration (75.4%). Therefore, the concentration range of PM₁ was higher than the other two. In the lockdown period, among all the land uses, the residential areas had seen the highest reduction (74.8% - 80.4%) of all PMs comparing to the pre-lockdown period. This could be attributed to the choice of people to stay at home, depending on online services for daily necessities and use of environmentally friendly transport like bicycle and rickshaw ([Sarkar and Khan, 2021](#)). On the other hand, the higher changes (37.2% - 46.4%) were found in the industrial areas from the lockdown to the post-lockdown period due to the activities to return to

Table 3: Mean Concentration of PM₁, PM_{2.5} and PM₁₀ (µg/m³) with Relative Changes (%)

Variables	November 2019	April 2020	November 2020	A	B
Sensitive Area					
PM ₁	151	40.8	62.6	-73.0	-34.8
PM _{2.5}	293.8	83.3	105.8	-71.6	-21.3
PM ₁₀	320.8	117.3	134.9	-63.4	-13.1
Residential Area					
PM ₁	151.7	29.7	49.5	-80.4	-39.9
PM _{2.5}	290	60.3	81	-79.2	-25.6
PM ₁₀	319.7	80.7	104.2	-74.8	-22.6
Commercial Area					
PM ₁	159.0	43.2	74.9	-72.8	-42.4
PM _{2.5}	307.8	81.9	128.0	-73.4	-36.0
PM ₁₀	341.7	108.5	171.3	-68.2	-36.6
Mixed Area					
PM ₁	152.5	39.2	67.6	-74.3	-42.0
PM _{2.5}	293.2	71.5	114.9	-75.6	-37.8
PM ₁₀	328	94.6	148.8	-71.2	-36.4
Industrial Area					
PM ₁	187.2	47.6	88.7	-74.6	-46.4
PM _{2.5}	336	83.4	144.3	-75.2	-42.2
PM ₁₀	386.2	113.8	181.2	-70.5	-37.2

Note: A= April 2020 vs Nov 2019; B= April 2020 vs Nov 2020

the pre-lockdown production level including the day long operation of the production units along with the movement of heavy transportations in these areas. Furthermore, among all the periods the least reduction has been observed in the sensitive areas (63.4% - 73.0% in the pre-lockdown to lockdown and 13.1% - 34.8% in the lockdown to post-lockdown phases). Though the educational institutions were closed till 12th September 2021, the medical centers and hospitals remained crowded in all those times which might be the reason for less reduction (Nayeem *et al.*, 2020).

Box plots are produced to identify the dispersion nature of the measured concentration of PMs. The first plot shows that the concentration of PM₁ was highly dispersed in industrial areas, commercial areas and mixed areas in the month of November 2019. Mixed areas and residential areas had relatively lower spreading with one outlier in the

later one. The overall concentration and dispersion greatly decreased in April 2020 still having a higher dispersion in industrial areas along with mixed areas compared to other land uses like before. The other three land uses showed comparatively compacted concentration with one outlier in residential and industrial areas each. This dispersion pattern of April 2020 is suggesting less movement of regular but sudden traffic. In November 2020 the concentration of PM₁ has increased in all of the studied land uses than that of April 2020 but it was still remarkably less than the concentration of November 2019. However, box plots showed a few outliers in all the studied areas which might happen due to irregular traffic movements. In the context of post-lockdown, the most dispersion has been seen in industrial areas. As it is said earlier, the industries were trying to run fully fledged in this time. However, people were still maintaining social distancing; their movements

were basically limited around their residence and working place. For that reason, the other land uses have a compacted concentration of PM_{10} . A similar scenario was also found in the box plots for $PM_{2.5}$ and PM_{10} ; in both cases the higher dispersion was noted in industrial areas and commercial areas in all the studied period. From the location of the median line for the concentration of all PMs in all of the land uses, it is obvious that the changes in the concentration were highly significant between the periods. A few relevant studies have been done in Dhaka city on the COVID-19 outbreak. 28.5-33.5% reduction was also observed in the Moderate Resolution Imaging Spectroradiometer (MODIS) using the Aerosol Optical Depth (AOD) in Dhaka mega city compared to 2016-2019 (Nayeem *et al.*, 2021). Besides, air pollution was also found to be reduced during lockdown in other top polluted megacities. Majumder *et al.*, (2021) found, $PM_{2.5}$ concentration was 36.56% and 45.44% less in Delhi; in Kathmandu 28.32% and 37.42% less; in Kolkata 41.02% and 34.08% less in 2020 than

2018 and 2019 accordingly. In Lahore, it was 44.26% less in 2020 than 2019. Table 4 depicts Tukey's Post Hoc analysis to investigate the significant changes in the average of PMs concentration data based on April 2020 with an equal sample size. The mean differences of PM_1 , $PM_{2.5}$ and PM_{10} concentration were significantly lower (at $\alpha=0.05$) in April 2020 compared to November 2019 pre-lockdown and November 2020 post-lockdown period.

Spatial and Temporal Distribution

The spatial distributions of PMs concentration in different time periods are shown in Figs. 3, 4 and 5. From these figures it is clearly specific that the pollution level was considerably less in all selected locations of Dhaka city during the COVID-19 lockdown period. It could be mentioned that, the southern part of Dhaka city (known as Old Dhaka) was comparatively highly polluted in terms of PM_1 , $PM_{2.5}$ and PM_{10} in November 2019. Since November is a dry month, the wind blows from north to south, which

Table 4: Summary of Tukey's Post Hoc Multiple Comparisons between PM concentration and different month

Variables	Month-Year (a)	Month-Year (b)	Difference (a-b)	Significant
PM_1	November 2019	April 2020	117.743*	.00
		November 2020	91.133*	.00
		November 2019	-117.743*	.00
		November 2020	-26.610*	.00
	November 2020	November 2019	-91.133*	.00
		April 2020	26.610*	.00
		April 2020	214.871*	.00
		November 2020	179.104*	.00
$PM_{2.5}$	November 2019	November 2019	-214.871*	.00
		November 2020	-35.767*	.00
		November 2019	-179.104*	.00
		April 2020	35.767*	.00
	November 2020	April 2020	233.471*	.00
		November 2020	190.479*	.00
		November 2019	-233.471*	.00
		November 2020	-42.993*	.01
PM_{10}	November 2020	November 2019	-190.479*	.00
		April 2020	42.993*	.01

* The mean difference is significant at .05 level

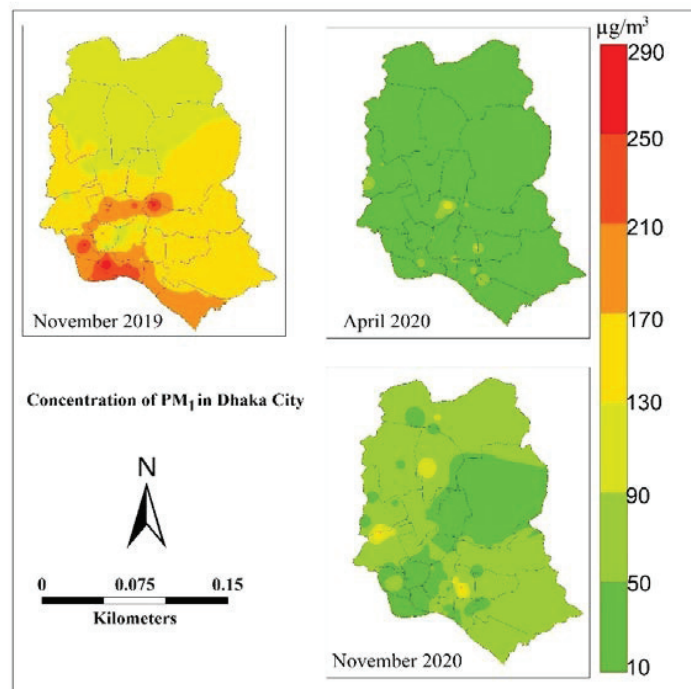


Fig. 3: Spatial and temporal distribution of PM_{10} in Dhaka city

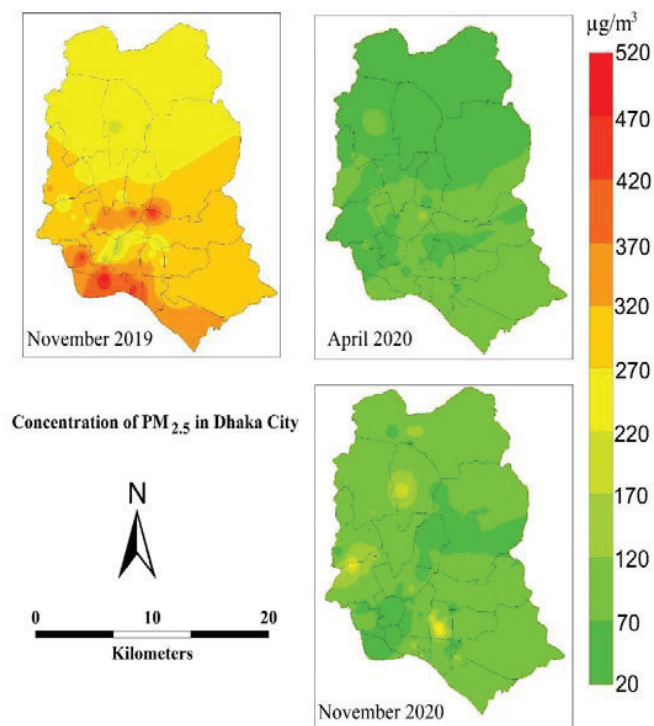


Fig. 4: Spatial and temporal distribution of $PM_{2.5}$ in Dhaka city

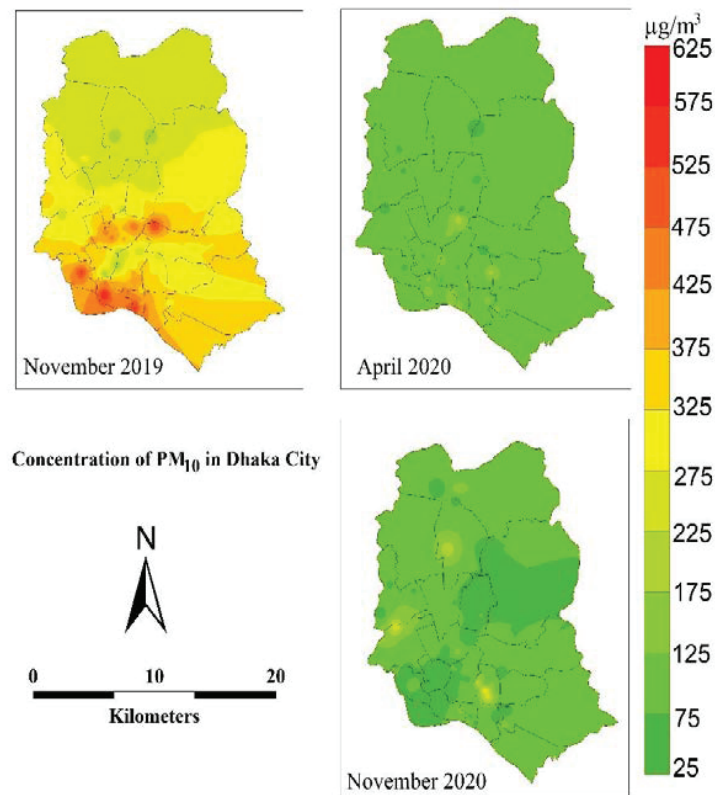


Fig. 5: Spatial and temporal distribution of PM₁₀ in Dhaka city

may contribute to the high pollution level in this area (Nayeem *et al.*, 2019). Furthermore, wind speed is too low in Old Dhaka (located in the southern part of Dhaka) due to unplanned building structures, which may also contribute to high PM pollution (Nayeem *et al.*, 2020; Tusher *et al.*, 2018). Moreover, a number of illegal brick kilns (situated in the close proximity to Old Dhaka) had started their operation in late October of 2019 which might also be a reason for high pollution in November in that part of Dhaka (Saha *et al.*, 2021; Guttikunda *et al.*, 2012). Eventually, the pollution was a bit lower in the northern part of Dhaka city (e.g., Mirpur Cantonment area) compared to the southern part.

Air Quality Index (AQI) Analysis

Fig. 6 was constructed to visualize AQI categories found for all 70 locations during the months of November 2019, April 2020 and November 2020 in Dhaka city. It is interesting to see that the quality

of air was worst in November 2019 (pre-lockdown) in terms of both PM_{2.5} and PM₁₀. In the case of PM_{2.5}, 47 (68%) locations' air quality was 'Hazardous' in November 2019 while 32% were in the 'Very Unhealthy' category. April 2020 exhibits slight improvement of AQI since no sign of 'Hazardous' and 'Very Unhealthy' though the majority of the locations (75%) were in 'Unhealthy' category and 25% locations experienced 'Unhealthy for Sensitive' quality air. In November 2020, with increased PM_{2.5} concentration categories of 'Hazardous' (3%) and 'Very Unhealthy' (11%) had returned though 52 (74%) locations experienced 'Unhealthy' air. Hence, the quality of post-lockdown air was better than pre-lockdown in Dhaka city. However, an almost similar AQI scenario is observed in terms of PM₁₀ concentration. A significant improvement with 'Moderate' and 'Unhealthy for Sensitive Groups' categories rather than 'Hazardous' and 'Very Unhealthy' was observed in Dhaka city during the lockdown period. Even, the considerable

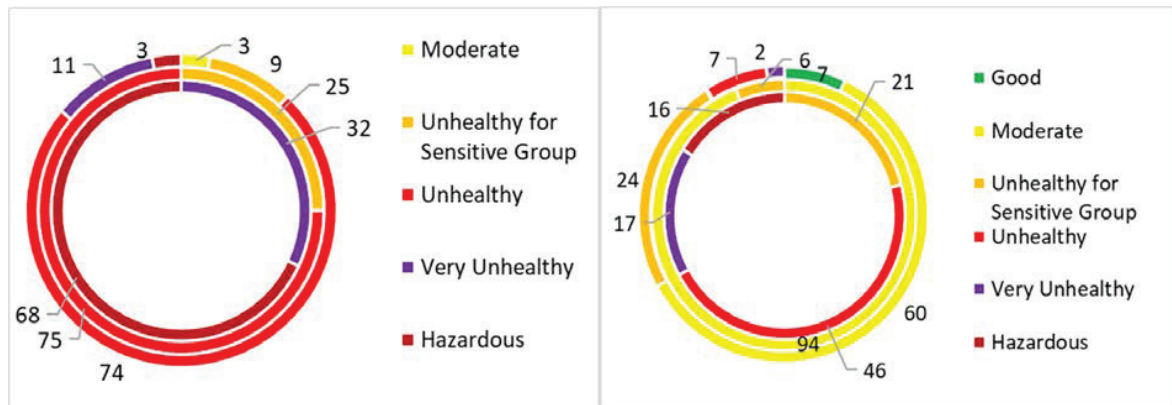


Fig. 6: Category of AQI in November 2019 (Inner), April 2020 (Middle) and November 2020 (Outer) based on $PM_{2.5}$ (left side) and PM_{10} (right side) in selected locations of Dhaka city

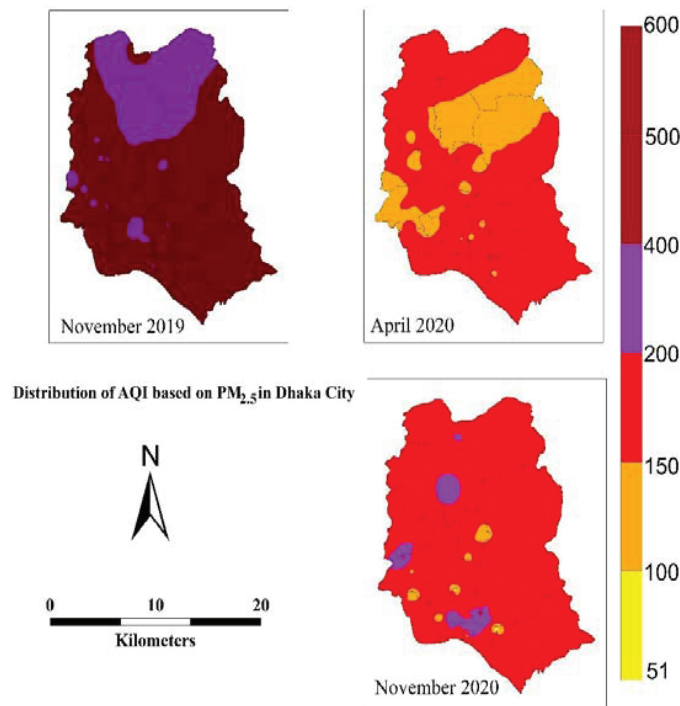


Fig. 7: Spatial and temporal distribution of AQI based on $PM_{2.5}$ concentration in Dhaka city

good air was also found during the post-lockdown period where 5 locations show the 'Good' category of air quality in Dhaka city. This improvement in the AQI was justified by some other studies conducted not only in Dhaka but also in other cities in Bangladesh (Islam and Chowdhury, 2021; Pal and Masum, 2021; Masum and Pal, 2020). The spatial distributions

of different AQI categories in different periods are shown in Figs. 7 and 8. Fig. 7 is showing a clear improvement in air quality from pre-lockdown to the lockdown period in all over Dhaka city and again a deterioration from lockdown to post-lockdown. Even the industrial areas returned to old pollution status to some extent. Similarly, Fig. 8 is also illustrating that

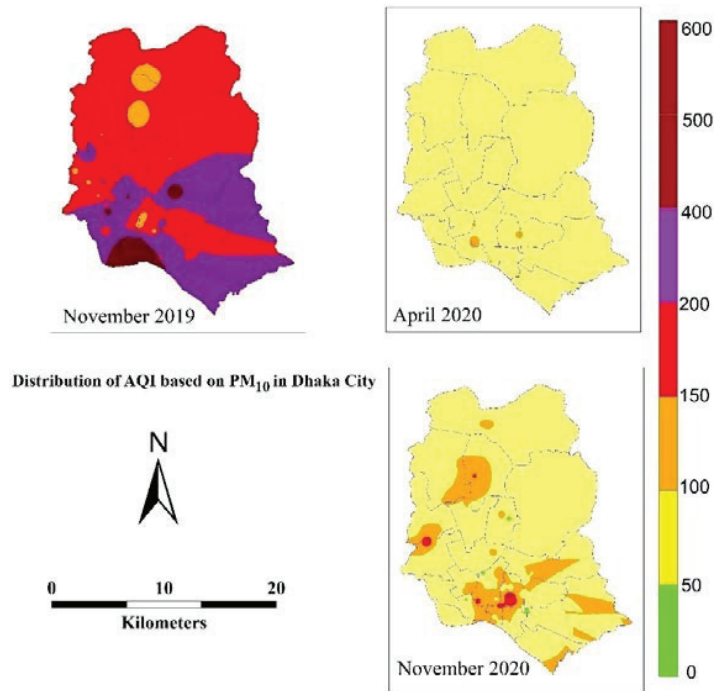


Fig. 8: Spatial distribution of AQI based on PM₁₀ concentration in Dhaka city

the AQI of the whole city was improved during the lockdown period. In both figures the southern part had a worse pollution scenario than the northern part. Hence, people living in the southern part of Dhaka are more susceptible to PMs related health risks (Hossain et al., 2019).

Since the COVID-19 lockdown provided a unique opportunity to study the changes in air pollution scenario, a good number of studies (Table 5) have also been done in Bangladesh like any other places of the world.

However, all of these studies were based on very few numbers of sampling locations, in most of the cases only one location. To get a clear picture of the pollution status a larger number of scattered sampling locations are needed. Therefore, this study selected 70 locations divided among 5 land use categories scattered over the Dhaka city to understand the comprehensive air pollution status change in pre-lockdown to lockdown and lockdown to post-lockdown periods. This study also considered PM₁ concentration and post-lockdown phase which were absent in previous studies.

Implications

It is apparent that air pollution has significantly decreased on a global scale, including in Bangladesh, although the degree of reduction varied depending on the meteorological factors and pollution sources. Therefore, Bangladesh should take advantage of the lessons learned during the COVID-19 pandemic and implement effective control measures. Despite numerous air pollution regulations implemented in Bangladesh since 1989, pollution levels have not decreased significantly due to a lack of awareness, financial resources, and an increase in population, vehicles, and industries (Islam and Chowdhury, 2021). Consequently, the urgent implementation of a Clean Air Act in Bangladesh is necessary to combat this issue. Many developed and developing countries have already implemented a Clean Air Act, which has ultimately helped to reduce air pollution problems (EPA, 2022). This Act could also be applied in Bangladesh to control emissions from the transportation, industrial, and domestic sectors by enforcing stricter regulations and promoting the use of cleaner technologies in factories. The government

Table 5: The changes of PMs concentration in Bangladesh during COVID-19 lockdown compared to pre-lockdown found in other studies

City	Changes (%)			Total sampling point	Source
	PM ₁	PM _{2.5}	PM ₁₀		
Dhaka	-	28-57	-	6 locations	Pavel et al., 2020
	-	26	-		Rahman et al., 2021
	-	17	-	1 location (US Embassy)	Islam et al., 2021
	-	11	-		Sarkar and Khan, 2021
	-	26	-		Islam and Chowdhury, 2021
	-	33	65		
Gazipur	-	33	45		Pal and Masum, 2021
Narayanganj	-	33	64	1 location (CAMS)	
Rajshahi	-	80	88		
Chattogram	-	32	40		Masum and Pal, 2020

and other organizations could provide incentives for industries and individuals to adopt cleaner air technologies, such as more efficient engines, electric and low-emission vehicles. Furthermore, government and industrialists could invest in research and development to create new technologies and processes that can help reduce pollution, such as developing cleaner fuels, more efficient engines, and improved waste management practices. Educating the public about the negative effects of vehicle and industry-derived pollution can increase awareness and encourage people in promoting sustainable practices like reducing energy consumption, recycling, and utilizing public transportation. Ultimately, creating sustainable cities and communities by reducing air pollution and improving the urban environment can make cities more livable and resilient.

CONCLUSIONS

The current study revealed a significant reduction of PMs concentrations in Dhaka city during lockdown (April 2020) compared to pre-lockdown (November 2019) and post-lockdown (November 2020) period. The ground level average PM₁, PM_{2.5} and PM₁₀ concentration reduced by 75.1, 75.4, 69.6% during lockdown compared to the pre-lockdown and were also 41.1, 32.6, 29.2% lower than the post-lockdown. The mean differences between the concentration of November 2019 and April 2020 and again April 2020 and November 2020 were significantly lower

(at $\alpha=0.05$) too. Furthermore, the highest reduction from pre-lockdown to the lockdown (74.8% - 80.4%) was found in the residential areas and from post-lockdown to the lockdown (37.2% -46.4%) was seen in the industrial areas. Less vehicular and public movement and shutting down of industrial activities might be attributed to these reductions. However, the least reduction (63.4%-73.0%, 13.1% - 34.8%) had been observed in sensitive areas for the both periods may be due to higher concentration of people and transportation around medical centers and hospitals. The spatial distribution map of PMs concentration suggested that the northern part of Dhaka city was less polluted than the southern part throughout those three studied time frames. Moreover, air of Dhaka city experienced a good state in the lockdown period since the PM_{2.5} based AQI improved to “Moderate” and “Unhealthy for Sensitive Groups” in April 2020 from “Very Unhealthy” and “Hazardous” categories which again deteriorated in November 2020 as “Very Unhealthy” and “Hazardous” had returned with other categories. Hence, the abatement of PMs concentration occurred due to the restraining measures imposed to reduce population mobility and the closure of numerous commercial establishments and industries. The geo-spatial maps of AQI say that the people of the southern Dhaka city were at more risk of PMs related health implications than the north. Though this study could not represent the 24 hours data for each location (which is important

to understand the interaction between air pollution and climatic forces), this is the first ever land use-based study on the influence of COVID-19 on air quality of Dhaka city. Moreover, to explore the overall pollution status of Dhaka city, this study concentrated on 70 locations with an underlying fact that more sampling locations could make the scenario better representative. Besides, scientific study on land use-based source apportionment is also required to eliminate the specific pollutants.

AUTHOR CONTRIBUTIONS

M.T. Islam initiated and contributed to the preliminary concept of the study. Methodology was designed by M.T. Islam and A.K. Majumder. Data was collected by M.T. Islam and A.A. Nayeem under the supervision of A.K. Majumder. M. Islam and A.A. Nayeem did the formal analysis. In manuscript writing, M.T. Islam and A.A. Nayeem prepared the original draft while A.K. Majumder and M. Islam completed all critical revisions and necessary editing of the manuscript. M.T. Islam was involved in the acquisition of research funding.

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CONFLICTS OF INTEREST

The authors declare that there is not any 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 has been completely observed by the authors.

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ABBREVIATIONS

<i>AQI</i>	Air quality Index
<i>BRT</i>	Bus rapid transit
<i>BNAAS</i>	Bangladesh National Ambient Air Quality Standard
<i>CAMS</i>	Continuous Air Monitoring Station
<i>CNG</i>	Compressed natural gas
<i>CSV</i>	Comma Separated Value
<i>DoE</i>	Department of Environment
<i>GDP</i>	Gross domestic product
<i>GIS</i>	Geographic Information System
<i>IDW</i>	Inverse Distance Weighting
<i>MRT</i>	Mass rapid transit
<i>PM₁</i>	Aerodynamic diameter of particles ≤1 μm
<i>PM_{2.5}</i>	Aerodynamic diameter of particles ≤2.5 μm
<i>PM₁₀</i>	Aerodynamic diameter of particles ≤10 μm
<i>SPSS</i>	Statistical package for the social sciences
<i>USEPA</i>	United States Environmental Protection Agencies
<i>WHO</i>	World Health Organization
<i>α</i>	Level of significance
<i>μg/m³</i>	Microgram per cubic meter

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ORIGINAL RESEARCH PAPER

The effect of corporate social responsibility on sustainable development with the mediating role of employee participation in knowledge-based companies

Z. Delrobay¹, A. Vedadi^{2,*}, N. Pilevari Salmasi³

¹ Department of management, Islamic Azad university, Science and Research Branch, Tehran, Iran

² Department of Management, Islamic Azad university, Central Branch, Tehran, Iran

³ Department of Management, Islamic Azad University, West Branch, Tehran, Iran

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ABSTRACT

BACKGROUND AND OBJECTIVES: Sustainable development is a process that envisions a desirable future for human societies in which living conditions and resource use meet human needs without compromising the integrity, beauty, and stability of vital systems. Knowledge-based companies today are among those companies that act as factories for converting knowledge into goods and services. In this regard, organizational social responsibility can be the basis for the sustainable development of companies and organizations. Therefore, this research aims to examine the role of the organization's social responsibility for sustainable development in terms of mediating the participation of employees of knowledge-based companies.

METHODS: This research is applied in terms of purpose, descriptive survey and correlation in terms of method. Field and library methods, literature reviews, and standard questionnaires were used to collect information. The statistical population consisted of 578 senior and middle managers of knowledge-based companies in the Science and Technology Park of Sharif University of Technology, Tehran- Iran, and 231 people were sampled using Cochran's formula method and stratified random sampling. A standard questionnaire was also used to collect information. The validity of the questionnaire was checked and confirmed using convergent and divergent validity and confirmatory factor analysis and its reliability using Cronbach's alpha coefficient, joint and combined reliability. Finally, the collected data was analyzed using SPSS and smartPLS software's.

FINDINGS: Based on the results of the Kolmogorov-Smirnov test, the significance of this test was calculated for all indicators less than 0.05 and 0.000, and due to the lack of normal distribution of the data, the smart PLS software was used. The overall fitting criterion was calculated to be 0.551, which means that the model fits well. When testing the main hypothesis, a coefficient of 0.408 was calculated, showing that employee participation explains 40% of the impact of social responsibility on sustainable development. The path coefficient of the sub-hypotheses for these relationships is above 0.5 and the significance is above 1.96. It can be said that the sub-hypotheses of the research are confirmed.

CONCLUSION: According to the indicators obtained, the organization's social responsibility positively and significantly impacts sustainable development and employee participation. The positive role of employee participation in sustainable development was also confirmed. Finally, the results showed that employee participation can mediate the impact of social responsibility on sustainable development.

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*Corresponding Author:

Email: ahvedadi@gmail.com

Phone: +989121326188

ORCID: 0000 0003 1110 5281

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INTRODUCTION

Sustainable development is one of the most comprehensive concepts in recent decades and is a process that envisions a favorable future for human societies in which living conditions and resource use meet human needs without harming the integrity, beauty and stability of vital systems (Ruggerio, 2021). Today, companies can achieve sustainable competitive advantage by moving in the path of sustainable development and paying attention to the needs of society and preserving natural resources (Zafar et al., 2021). In the meantime, knowledge-based companies are among the companies that operate as a factory for converting knowledge into goods and services. Although knowledge-based companies are responsible for the creation of a sustainable knowledge-based economy and the development of indigenous knowledge in many countries, but these companies in Iran are not in a favorable condition in terms of quantity and quality according to the 20- year vision of the country, and are facing challenges in their development path (Gholipour et al., 2014). Successful companies, are those which continuously create new knowledge, distribute it broadly throughout the organization and quickly use it in new technologies and products (Tajpour and Razavi, 2023). In addition, the economic sanctions of recent years have had significant positive and negative effects on the sustainable development of knowledge-based companies active in the country (Ghavidel et al., 2019). It should be noted that the main indicators of sustainable development are classified into four general categories: social indicators, environmental indicators, economic indicators and finally institutional indicators (Swati, et al., 2020). In addition, research has shown that integrated management systems and corporate social responsibility can be the basis for the sustainable development of companies and organizations (Abdelhalim and Eldin, 2019; Ikram et al., 2019). Conducting preliminary investigations at the Presidential Office of Science and Technology and Science and Technology Parks in Tehran, as well as conducting preliminary talks with some managers and trustees of knowledge-based companies have shown that, despite the low growth of such companies in recent years, there are no proper statistics on their sustainable development. On the other hand, the lack of

attention and compliance of organizations and sub-managers to their duty and social responsibility is one of the societal problems and problems that can hinder sustainable development. One of the most important results of adhering to the principles of social responsibility is the sustainable development and well-being of society. Therefore, knowledge-based companies must be leaders when it comes to social responsibility beyond their legally defined duties. In this context, in this research we are looking for an answer to the question, which effects does the social responsibility of organizations have on the sustainable development of knowledge-based companies with regard to the mediation of employee participation?

Literature Review

Corporate social responsibility has received increasing attention from academics in recent years (Hur et al., 2018). In recent years, this concept has become a global and growing concern of governments and corporate executives. The movement towards global social responsibility arises from the global growth of companies (Barakat et al., 2016). This term is widely accepted and its meaning encompasses areas such as safety, product, and honesty in advertising, labor rights, environmental sustainability, ethical behavior and global responsibility and has a wide range of stakeholders including employees, customers, communities and environment, competitors, business partners, investors, shareholders and governments (Madueno et al., 2016). The social responsibility of organizations and companies is not only considered a moral obligation or social marketing, but it is a big element in the missing link of the relationship between government policies and corporate policies (Islam et al., 2021). The social responsibility literature shows that employees who acknowledge their existence in an organization and accept responsibility work beyond their duties. Indeed, social responsibility plays an important role in the issue of introducing employees as an important element of the organization. As a result, the employees fulfill their responsibilities in the organization (Rupp et al., 2018). More than ever, managers of global trading companies are looking for foundations for sustainable development, therefore, the role of active organizations in

sustainable development is receiving more and more attention from experts and practitioners of human societies. From these people's point of view, the lack of attention and compliance with their duty and social responsibility by organizations and subordinate managers is one of the societal problems and problems that can hinder sustainable development (Bombiak, Marciniuk-Kluska, 2018). Today, the company's intangible resources are considered to be one of the most important drivers of competitive advantages and sustainable growth (Meysami *et al.*, 2022). Human capital is viewed as a vital intangible resource that plays a significant role in achieving corporate goals. Because a committed employee knows his responsibility and does extra work for the company's success (Abbas and Dogan, 2022). Organizations that fail to answer employees' questions about the importance of the tasks they perform will struggle to retain an energetic and competent workforce (Farrukh *et al.*, 2020). Meanwhile, employee ownership is now considered one of the most exciting human resources approaches towards organizational development and growth (Agarwal, and Kapoor, 2022). The implementation of the participation system can be one of the most efficient and powerful mechanisms and managerial tools to motivate employees and create the basis for a micro-collective presence in the organization (Nazari 2022). Employee participation is defined as the commitment of the organization's members to their job responsibilities. When participating, people use and express themselves physically, cognitively, and emotionally during role performance (Dongrey and Rokade, 2022). Previous studies have ignored the potential impact of corporate social responsibility practices on individual employee performance (Latif *et al.*, 2022). Additionally, most organizations are still unfamiliar with the role of social responsibility in increasing employee engagement and individual performance (Story and Castanheira, 2019). Therefore, it requires researchers' attention to examine the relationship between social responsibility and individual employee performance, which plays a key role in all types of companies and is essential for company success (Dal Mas *et al.*, 2022). Also, most of the research in this field has been conducted in developed countries, and its investigation in developing countries and

knowledge-based enterprises of these countries has been neglected. In a research, Hojjati Niko (2018) discussed the sociological investigation of the factors influencing the societal participation of citizens in the realization of sustainable development using the social development approach. Examining the research results shows that the result of this research on the relationship of social trust as one of the sociological factors affecting social participation has been confirmed. Social cohesion and sense of social belonging also have a significant association with social participation, and when examining the impact of background variables on social participation, it was observed that variables other than age (gender, marital status, and education) had no impact on the participation rate. Khosravi (2017) discussed sustainable development in terms of choosing the best social responsibility criterion from an expert perspective and it showed that, according to expert opinion, social sustainability as the best criterion for sustainable development and managerial responsibility was chosen as the preferred option. In a study, Babajnejad (2017) discussed the impact of corporate social responsibility engagement on employee satisfaction behavior related to employee participation. The hypotheses of this research include the impact of social responsibility on employee involvement, job satisfaction and employee behavior, and the impact of employee involvement on job satisfaction and employee behavior, and structural equation modeling was used to test the research hypotheses. The results of the study showed that the hypotheses of the study were confirmed. Swati, *et al.*, (2020) conducted a study in India, entitled "Important survey regarding the structure and calculation of sustainable development indicators". The study showed that the main indicators of sustainable development can be divided into four categories: social indicators (equality, health, education, housing, security, and population), environmental indicators (climate, land, seas, lakes and oceans, freshwater and biodiversity), economic indicators (economic structure, production and consumption patterns) and finally institutional indicators (institutional structure and institutional capacity). Abdelhalim and Eldin (2019) conducted a research in Egypt entitled "Can corporate social responsibility lead to sustainable development?" The results of

this research showed that compliance with different types of social responsibility, including social, moral, legal and discretionary responsibility, can influence sustainable development. Ikram *et al.* (2019), accomplished a research entitled “Can environmental management systems affect sustainable development?” This research, conducted on the manufacturing companies of Pakistan, showed that integrated management systems (quality, health, safety, environmental management) as well as adhering to the organization’s social responsibility can lead to sustainable development. Faizullah *et al.* (2022), worked on a study entitled “Explanation of the relationship between exercising the role of social responsibility and sustainable development”. This research aims to analyze the relationship between fulfilling the social responsibility role of the National Refinery and Broadcasting Company of Iran’s petroleum products with the sustainable development. The results showed that social responsibility helps to realize sustainable development, and they choose social responsibility as a defensive measure. Social responsibility, as a tool for job security and protection of private interests, is the result of regular activities that help to build relationships with the company’s stakeholders and environmental activists, leading to these groups receiving support and activities such as introducing the social aspect in the product and the production process and the introduction of human resources development programs and the achievement of a higher level of friendly relations with the environment through recycling and pollution reduction or progress in the social goals of the organization. The subject of current research is sustainable development in knowledge-based companies. Saz-Gil *et al.* (2020) conducted a study entitled “Corporate social responsibility review in the area of sustainable development Goals” which showed that the sustainable development goals are an opportunity and a frame of reference for corporate social responsibility strategies. Companies can enhance their corporate and social image within the framework of strategic social responsibility measures, and undoubtedly improve people’s health and well-being and take steps towards sustainable development. The area of knowledge-based enterprises are in Sharif University Science and Technology Park. Science and Technology Park

of Sharif University of Technology was established in 2015. With the establishment of the park, the activities related to entrepreneurship and the establishment of knowledge-based businesses at Sharif University of Technology, which have been gradually developed since 2000, were integrated into the oversight of the park. As a university park, this complex aims to become a national model in the field of sustainable development and community-level value creation by creating a win-win interaction between the university’s academic body and other institutions. 167 accepted start-ups and 381 accepted new companies have operated in this park since inception, and the current research has been conducted in 90 new companies and 52 grown companies accepted in the park. The current study was conducted in 2022 in Tehran.

MATERIALS AND METHODS

Considering that the main objective of this study is the role of social responsibility of organizations for sustainable development in terms of mediating the participation of employees of knowledge-based companies, the aim of this research is in the field of applied research. This type of research is conducted to improve the behaviors, methods, tools, devices, products, structures and patterns used by human societies. Also, considering that library study methods and field methods such as questionnaires have been used in this research, it can be stated that the current research is descriptive surveillance research by its nature and method. The statistical population of the present study consisted of all senior and middle managers of knowledge-based companies in the Science and Technology Park of Sharif University of Technology. Given that the number of these individuals was estimated at 578 individuals based on Cochran’s formula, 231 individuals were sampled and selected by the stratified random sampling method. Field and library methods, literature reviews, and standard questionnaires were used to collect the data. Corporate social responsibility, using 4 items, was measured using the standard research questionnaire by Aljarah and Alrawashdeh (2020). A standard questionnaire of Kulachai *et al.* (2018) with 4 items was used to check employee participation. Also, sustainable development was measured using Vijtilak’s standard questionnaire, in three economic (4 items), social (5 items) and

environmental (4 items) dimensions. With regard to validity, in addition to construct validity using confirmatory factor analysis, convergent and diagnostic validity were also used. Confirmatory factor analyzes showed that the factor loading for all items is over 0.4 and the significance is over 1.96, which confirmed the construct validity. The average variance extracted (AVE) was used to check the convergent validity. To establish convergent validity, the average value of the extracted variance calculated for each index should be greater than 0.5. Since the value of AVE for all indicators is calculated higher than 0.5, the result confirms the convergent validity. Cronbach's alpha coefficient and composite reliability were also used to check reliability. Values above 0.7 for Cronbach's alpha and composite reliability indicate the reliability of the index. Considering that the combined reliability and Cronbach's alpha coefficient for the research indicators is above 0.7, the confidence in the reliability of the research instrument is confirmed. Information on the reliability and validity of the research tool is presented in Table 1.

To check diagnostic validity: If the average variance extracted for a variable is greater than the square of the variable's correlation with other variables, then there is diagnostic validity for that

variable. Table 2, shows the numbers for the mean diameter are the extracted average variance.

According to Table 2, the average variance extracted for each variable is more than the correlation of that variable with other variables. Therefore, the diagnostic validity of research variables is confirmed. In the data analysis section, SPSS software was used to check descriptive statistics and the partial least squares method, and smartPLS software was used to check hypotheses. The conceptual model of the research can be drawn based on the theoretical foundations in Fig. 1:

In this context, the research hypotheses are presented as follows:

The main hypothesis

- The social responsibility of the organization has a significant impact on sustainable development through the mediation of employee participation.

Sub-hypotheses

- Organizational social responsibility has a significant impact on sustainable development;
- Organizational social responsibility has a significant impact on employee participation;
- Employee participation has a significant impact on sustainable development.

Table 1: Factor loading values, significance statistics, Cronbach's alpha, composite reliability and AVE

Construct	Item	The correlation coefficient	Significant statistics	Average variance (AVE)	Composite reliability	Cronbach's alpha	Predictive correlation index (Q ²)	Determination coefficient index (R ²)
Corporate social responsibility	Q1	0.792	7.496	0.543	0.751	0.777	0.284	0.445
	Q2	0.504	4.729					
	Q3	0.728	8.466					
	Q4	0.673	6.055					
Sustainable Development	T1	0.652	3.594	0.512	0.807	0.785	0.269	0.651
	T2	0.794	9.861					
	T3	0.889	16.696					
	Q5	0.684	5.498					
Employee participation	Q6	0.730	4.961	0.614	0.824	0.780	0.23	0.651
	Q7	0.786	17.493					
	Q8	0.658	10.837					

Table 2: Average extracted variance and correlation between research variables

Indicator	Corporate social responsibility	Employee participation	Sustainable development
Corporate social responsibility	0.543		
Employee participation	0.498	0.614	
Sustainable development	0.478	0.598	0.512

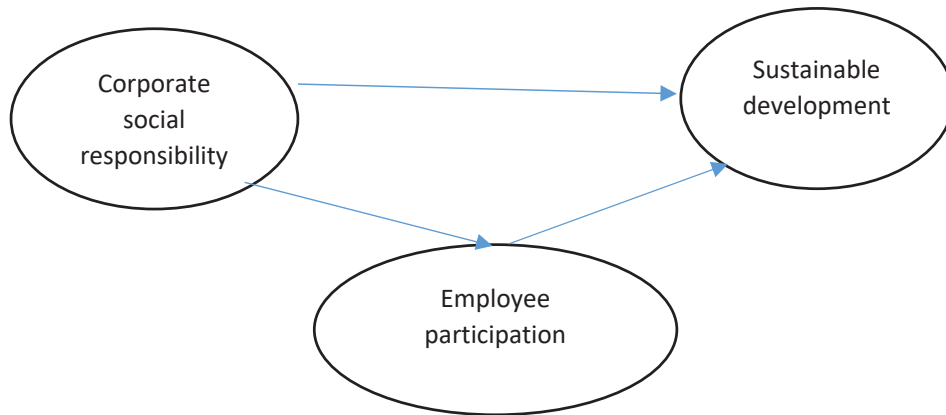


Fig.1: Research conceptual model

Table 3: Respondent demographics

Gender		Age			Education			Work experience		
Man	Woman	Under 40 years	40 to 50 years	Over 50 years	Bachelor's degree	Masters	Doctorate	Under 10 years	10 to 20 years	Over 20 years
189	42	14	137	80	7	52	172	23	58	81

RESULTS AND DISCUSSIONS

As already mentioned, the research results are presented in two sections of descriptive and inferential statistics. In the descriptive part, the demographic characteristics of the respondents were first examined. The results are as described in Table 3:

Next, the normality of the data was checked. Based on the results of the Kolmogorov-Smirnov test, the significance of this test was less than 0.05 for all indicators and was calculated at 0.000, which means that the data do not follow a normal distribution. For this reason, smart-PLS software, which is capable of analyzing abnormal data, was used for data analysis. Research hypotheses were examined below. The output of the PLS software for testing research hypotheses is as described in Fig 2 and 3.

Index of the coefficient of determination (R^2) of the dependent variable

The value of R^2 for the research endogenous constructs is calculated as 0.651 and 0.445.

Predictive correlation Index Q^2

The reading of Q^2 for research indicators is 0.284,

0.269, 0.23, which is positive and at a favorable level. Based on this, it can be said that the predictive power of the model with respect to the variables is favorable.

Goodness of Fit (GOF) Index

This index is the Goodness of Fit (GOF) which is calculated by the subscription's geometric mean and R^2 , according to Eq. 1:

$$GOF = \sqrt{\text{communality} \times R^2} = \sqrt{0.556 \times 0.548} = .551 \quad (1)$$

Considering that this index was calculated as 0.551 for the current research model, it can be said that the model has a good fit.

Based on the output of the model, the results of the hypotheses are shown in Table 4:

As it can be noticed, the examination of the sub-hypotheses showed that the path coefficient for these relationships is above 0.5 and the significance is above 1.96. As a result, it can be said that the sub-hypotheses of the research are confirmed. On this account, the social responsibility of the organization has a positive and significant impact on sustainable development. The social responsibility of the organization has a positive and significant impact

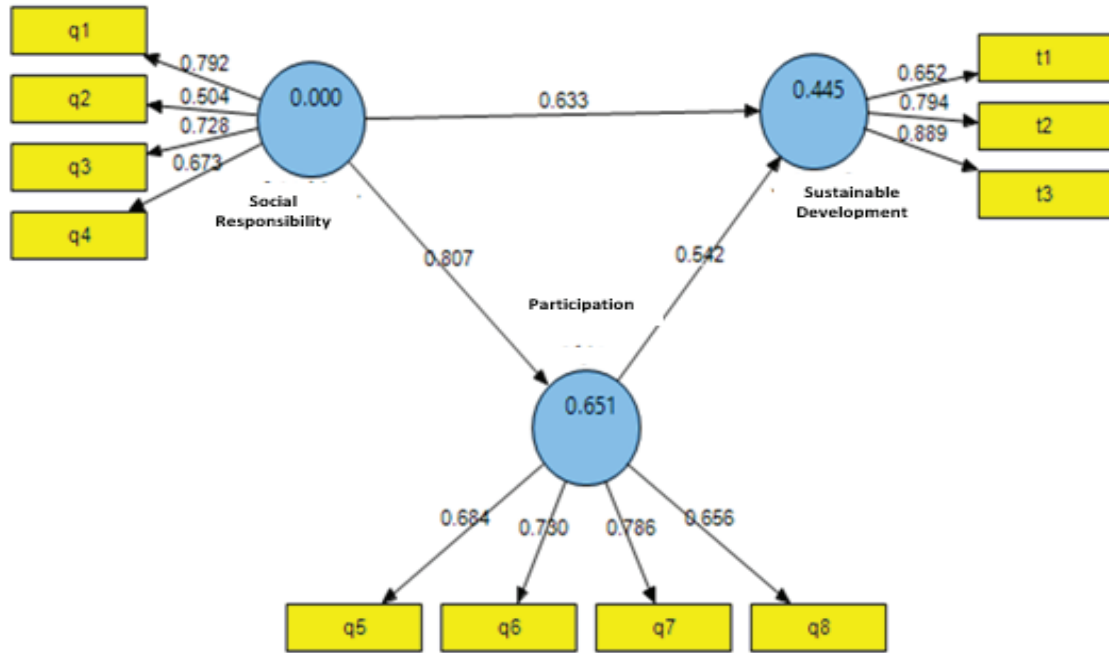


Fig. 2: Factor loading values and path coefficients of the research model

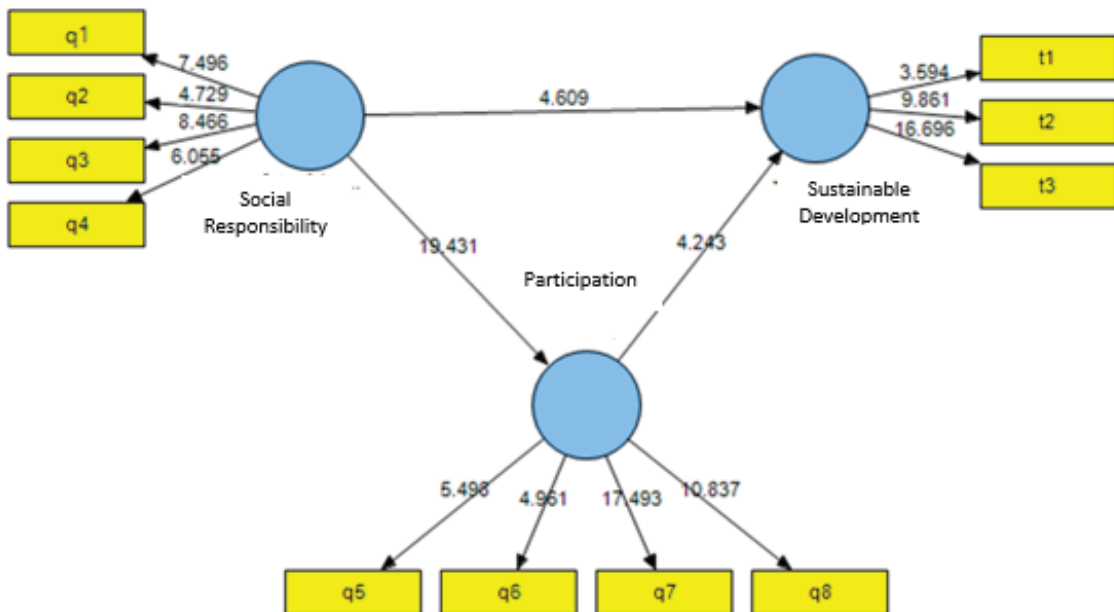


Fig. 3: Significance of the research model

Table 4: The results of the structural model assessment to check research hypotheses

Direction		Path Coefficient	Significant Number		Test Result
The social responsibility of the organization has a significant impact on sustainable development		0.633	4.609		Confirmed
The social responsibility of the organization has a significant impact on employee participation		0.807	19.431		Confirmed
Employee participation has a significant impact on sustainable development		0.542	4.243		Confirmed
Mediation hypothesis	Direct	Indirect	Total	Variance Accounted For (VAF)	
The social responsibility of the organization has a significant impact on sustainable development through the mediation of employee participation	0.633	0.437, 0.542, 0.807	1.07	0.408	Confirmed

on employee participation. Employee ownership has a positive and significant impact on sustainable development. In addition, when examining the main hypothesis, a VAF coefficient of 0.408 was calculated, showing that employee participation explains 40% of the impact of social responsibility on sustainable development. Consequently, the organization's social responsibility through the mediation of employee ownership has a significant impact on sustainable development. The current research has found that corporate social responsibility has been an area of interest for academics and professionals around the world for several decades, and researchers pay special attention to the ethical, social, moral, environmental and sustainable concerns of companies with the research of [Hur et al. \(2018\)](#) and [Faizullah et al. \(2022\)](#). The results also showed that the organization's social responsibilities have a significant effect on employee participation. This is also in line with [Babainejad \(2017\)](#) research. In addition, the results showed that employee participation has a significant impact on sustainable development. The simplest means of human resource development is the implementation of the partnership system, which is recognized by managers for its simplicity and ability to learn, while [Faizullah et al. \(2022\)](#) consider social responsibility as a tool for securing jobs and protecting private interests, which helps to build relationships with the company's stakeholders and environmental activists and it leads to support for these groups, and includes activities such as introducing a social aspect into the product and production process and

introducing human resource development programs and achieving a higher level of friendly relations with the environment through recycling and reduction of environmental pollution or advances in Information Technology are the social goals of the organization that are effective for sustainable development. On the other hand, trust in the results of social responsibility has a significant impact on sustainable development. Today, the growth and development of various industries and business entities, the consequences and impact of their activities on society, and the lack of social reporting have created a gap between business entity expectations and society expectations. The concept of corporate social responsibility has been broadened as the corporate mindset has changed from a narrow and flexible view of increasing profitability to a broader view, i.e. quality of life, protection of resources and meeting the general needs of society. In other words, this kind of perspective includes the principles of sustainable development. Participation means the connection and engagement of workers with their organization. Engaged and committed employees are the most useful asset for any business to gain competitive advantage in the marketplace. In fact, the strength of a company is measured by the participation of its employees. Social responsibility is related to employee engagement because employees enjoy working for organizations that use their resources for the benefit of society and employees. Employee participation, opportunities for intellectual development and advancement and involvement as much as possible in the activities

and processes of the organization are very efficient. Employee engagement is becoming increasingly fragile without becoming a dominant culture and enduring process. Given that organizational change and transformation are necessary for organizations in today's world, the lack of public participation minimizes organizations' chances of success. When employee engagement is measured by their collaborative work style and is perceived and measured by showing more commitment, it can create an unstable situation where highly engaged employees are expected to work even harder to maintain their engagement demonstrate what will seriously harm the continuation of their participation and the stability of the participation system.

CONCLUSION

Sustainable development refers to comprehensive political, economic, social and environmental development; It is defined as meeting the needs of the present generation without compromising the ability of future generations to meet their needs. The purpose of education for sustainable development is to empower people and society to understand responsibility and take responsibility for creating a sustainable future. Knowledge-based organizations absorb information and transform it into knowledge through interaction with their environment. With knowledge, the organization can organize itself and keep itself alive and dynamic. Considering the importance of sustainable development of knowledge-based enterprises, the present research has delved into the issue of sustainable development of knowledge-based enterprises in more depth and detail. In this regard, organizational social responsibility is the basis for the sustainable development of companies and organizations. As human capital is considered a vital intangible resource to create competitive advantage and sustainable growth, it plays a significant role in achieving business goals. Employee participation is now considered one of the most prominent approaches in HR work towards organizational development. The implementation of the participation system is also one of the most effective management tools for employee motivation. According to the results of current study, the social responsibility

of the organization has a positive and significant impact on sustainable development. The social responsibility of the organization also has a positive and significant impact on employee participation. Employee involvement also has a positive and significant impact on sustainable development. But according to the model presented and the mediating role of employee ownership, employee ownership explains 40% of the impact of social responsibility on sustainable development. Due to the sensitive role of knowledge-based companies in the economic system and the importance of sustainable development in today's dynamic environment, it is therefore important and worth considering to pay attention to the essential and vital factor of employee participation, which makes the impact of the organization's social responsibility on sustainable development smoother, and this should be reflected in the organization's policies and plans during sustainable development.

Suggestion

In accordance with the results obtained, it is proposed:

- Knowledge-based enterprise managers should institutionalize a culture of collaboration in the organization to create sustainable development and gain a competitive advantage, and contribute to the creation of sustainable development by fostering this spirit in their employees;
- The atmosphere of the organization should be such that employees see themselves as part of the organization and take voluntary action to achieve the organization's results;
- Managers of knowledge-based companies should formulate and implement the necessary policies to achieve sustainability goals through employee behavior;
- The organization's policies and goals should be designed and formulated to achieve the well-being of employees and society.

Limitations

The limitations of the research include the small number of global scientific research and studies related to the research purpose, the lack of internal scientific research related to the research topic, and the small number of experts related to the topic.

AUTHOR CONTRIBUTIONS

Z. Delrabai performed the literature search, data collection, data analysis and interpretation. A. Vedadi, the corresponding author, was responsible for reviewing the results and editing the text. N. Pilehvari was of great help in literature research and data interpretation.

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CONFLICT OF INTEREST

The authors declare no potential conflict of interest regarding the publication of this work. 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 witnessed by the authors.

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ABBREVIATIONS

<i>AVE</i>	Average variance extracted
<i>EP</i>	Employee participation
<i>GOF</i>	Goodness of fit
<i>Q²</i>	Predictive correlation index
<i>R²</i>	coefficient of determination index
<i>VAF</i>	Variance accounted for

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ORIGINAL RESEARCH PAPER

The impact of green human resources practices on organizational sustainability:
The mediating role of job embeddedness

B.Kh. Almagharbeh*, N.A. Alalean

Department of Business administration, Amman Arab University, Amman, Jordan

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ABSTRACT

BACKGROUND AND OBJECTIVES: Green human resource management has become one of the most critical components of a forward-thinking for eco-friendly companies. The majority of academics hold the opinion that in order to implement green human resource management techniques, personnel must be encouraged and motivated to be ecofriendly. This study aims at investigating the impact of Green human resources practices on organizational sustainability: The mediating role of job embeddedness in the pharmaceutical manufacturing companies in Jordan.

METHODS: The current study looks at the effects of several green human resource management strategies on organizational sustainability either directly or indirectly through job embeddedness. a quantitative approach was used. The data is collected through questionnaire from the Study sample included (404) employee in (16) Jordanian Pharmaceutical manufacturing companies. A Structural Equation Modelling is conducted to achieve study objectives.

FINDINGS: Findings confirmed, that (green work life balance, green reward) showed a significant positive effect on the organizational sustainability, while (green training, green career opportunities) didn't have direct significant effects on organizational sustainability, as well, the outcomes indicated that all green human resources practices (green work life balance, green reward, green training, green career opportunities) had direct significant effect on job embeddedness. The findings indicated that the mediator (Job embeddedness) improved the organizational sustainability. The results illustrate that green work life balance exerted positive and significant effects on organizational sustainability ($\beta = 0.41$) and Job embeddedness ($\beta = 0.27$). While No abbreviation in the abstract didn't has direct significant effects on organizational sustainability ($\beta = 0.03$; $t = 0.64$; $p > 0.01$), and significant effects on Job embeddedness ($\beta = 0.40$). Also the result indicated that green rewards has direct significant effects on organizational sustainability ($\beta = 0.24$), and Job embeddedness ($\beta = 0.26$). While GCO green career opportunities didn't has direct significant effects on organizational sustainability ($\beta = 0.04$ $t = 0.87$; $p > 0.01$) and significant effects on Job embeddedness ($\beta = 0.39$). As well as JE exerted positive and significant effects on organizational sustainability ($\beta = 0.38$). The findings imply that the mediator does increase organizational sustainability.

CONCLUSION: The study suggests that the pharmaceutical manufacturing businesses should provide their workers with green benefits and promote a green work-life balance and search for other green practices in order to prevent organizational deterioration.

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*Corresponding Author:

Email: b.almagharbeh@aau.edu.jo, abadi.bashar@yahoo.com

Phone: +962778500667

ORCID: [0000-0003-4674-2432](https://orcid.org/0000-0003-4674-2432)

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INTRODUCTION

The significance of environmental challenges and their consequences on society, make green human resources management one of the most important themes in the business world and sustainability especially in the pharmaceutical manufacturing companies (Jehan *et al.*, 2020). Many business companies focus on increasing their profits while using and consuming large amounts of natural resources, omitting to consider how their operations align with environmental sustainability (Shaban, 2019; Neisiani *et al.*, 2020). The concept of green Human Resource Management (HRM) focusing on transforming employees to be green-oriented, by applying the concept of green policies, practices, and systems in all activities including selection and recruitment, acquisition, training and development and rewards systems (Chuah *et al.*, 2021). Green HRM practices translate noble ideas, aspirations, and daily HR activities into individual behavior inside the firm (Peerzadah *et al.*, 2018), and encourage the use of green practices in HR procedures to ensure that employees' attitudes, traits, norms, and personalities are in line with the goals of reducing waste and pollution, performing in an innovative manner to achieve, and implementing the idea of environmental sustainability in their organizations (Ashraful *et al.*, 2021). Green HR is the procedure that environment-friendly concept applying the HR policies which leads to more participation from the employees, cost-effective leadership developing the organizational sustainability pathway (Tang *et al.*, 2018), since the leadership works to improve the employees' knowledge, experiences, skills and behaviors toward the concept environmental management and green human resource management (GHRM) (Das and Singh, 2016). When a firm sets targets for all members, it emphasizes on converting environmental objectives into action plans for all employees including environmental incidents, environmental responsibilities, reduction of carbon emissions, and introducing and communicating the environmental interests and policies (Ari *et al.*, 2020; Kumar *et al.*, 2020). On the other hand, employees can be given opportunities to engage in environmental management to encourage them to support pollution prevention and recognize new environmental opportunities. This can be done by giving them a clear green vision, a green learning environment,

new communication channels, green practices, and encouraging green involvement (Renwick *et al.*, 2013). By implementing GHRM, service companies, particularly those in the pharmaceutical manufacturing industry, can experience positive results that improve their competitive advantage, efficiency and financial benefits, as well as the creativity and innovation of their employees. These benefits extend beyond just protecting the environment (Abbasi *et al.*, 2016). Job embeddedness is crucial and related to sustainability, which is the set of factors that affect an employee's decision to stay on the job (Zhao *et al.*, 2016). These factors include work-related issues like relationships with coworkers, individual skills, and job requirements, as well as outside-of-work issues like personal, family, and community responsibilities (Holtom *et al.*, 2006). GHRM practices are adopted and used in order to enhance and develop the green behavior of the employees, and to achieve successful environmental management inside the organization (Mousa and Othman, 2020), to attain this goal, it will be necessary to integrate green practices into human resource management roles. This will help firms' environmental management systems provide successful environmental performance (Ren *et al.*, 2018; Mehdipour *et al.*, 2017), therefore, this study is aimed to investigate the impact of green human resources management's practices on organizational sustainability: The mediating role of job embeddedness in the pharmaceutical manufacturing firms in Jordan 2022. Fig. 1, theoretical framework shows the relationship between green HR practices and organizational sustainability with the mediating role of Job embeddedness.

GHR practices occur when a company employs various organizational sustainability approaches, procedures, policies, and plans (Dutta, 2012). HR has the duty and obligation to educate and inform the workforce about organizational sustainability. Combining HR policies and practices offers a number of benefits, including increased employee engagement, cost savings, and performance effectiveness (Swarnalatha, 2020). Nowadays, almost everyone agrees that green HRM practices in any firm may increase organizational sustainability by adopted Job embeddedness (Lülfes and Hahn, 2013). Although there is a body of literature on green HR, (Peerzadah *et al.*, 2018) co-evaluated this existing and emerging literature on GHR with the overarching

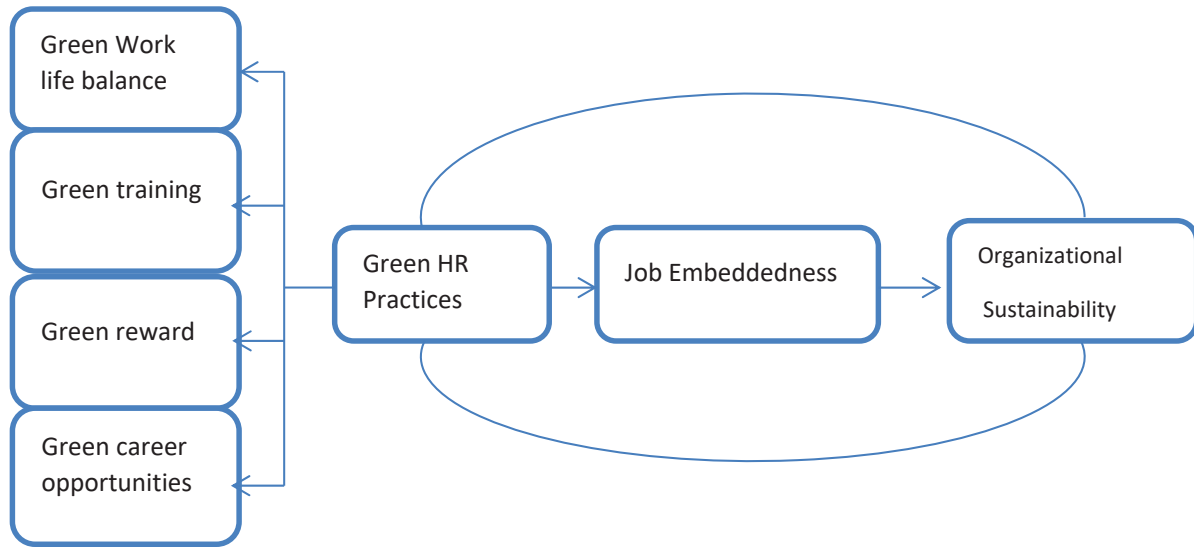


Fig. 1. Research model

conclusion that the impact of green HR practices on an organization has not yet been fully dissected. No doubt this particular submission has left the empirical research door open for further research opportunities on green HR practices. Another notable research void noted by [Rahimnia et al. \(2019\)](#) that mediator relationships between green HR practices and their outcomes are being studied with the suggestion that some organizational practices should be considered. [Malik et al., \(2020\)](#) also confirmed that several empirical studies have examined the relevance of green human resources practices to organizational results like, financial and organizational performance. Yet, there is still a gap in the practice and literature of green human resources practices and the effects of Job embeddedness styles. This research plans to bridge the gaps in literature and practice by including the concept of Job embeddedness as a potential mediating factor. Green Work Life Balance (GWLb) is a crucial part in the work to build social sustainability by creating changes in organizations in terms of enhancing employee's commitment to their surrounding environment and community in which they carry their activities and work procedures to ensure workers' future well-being, and lessen social and economic inequalities ([Gálvez et al., 2020](#)). Researchers believe that achieving a proper work-life balance is a difficult task experienced by the employees depending on work flexibility measures ([Gregory and](#)

[Milner, 2009](#)). Firms that intend to support work-life balance must understand the essential elements of social sustainability, including making improvements in worker's working conditions, to ensure the future of the community and the organization, considering work-life balance as an issue relates to personal dignity in the work environment, and should be viewed as more than just way to coordinate work and family time, ([Gálvez et al., 2020](#)). Teleworking has a significant impact on work-life balance by decreasing a number of issues related to the working environment, enhancing job satisfaction, and increasing employee involvement with the objectives of their businesses. Teleworking is defined as an employee practices that is decentralized, undertaking outside of the company, which depends on the use of ICT ([Akpa, 2022](#)). A novel paradigm called "green work-life balance" has been developed to strengthen interactions between work and personal life and promote environmentally sustainable behavior in both contexts, providing advantages for the environment, businesses, and people. Also, it is anticipated that teleworking and its adoption, will address many issues with work-life balance, boosting employee engagement with their firms and job retention ([Vasa and Thatta, 2018](#)). Green work-life balance depends on initiatives made by HR with the objective to create sound occupational environment by combining both sustainability and operational efficiency to create comfortable

workforce to be more efficient and productive at their work to improve the organizational environment (Akpa, 2022).

H1: GWLB directly influence on organizational sustainability.

H1a: GWLB influence on employees Job embeddednes.

H1b: GWLB influence on organizational sustainability through Job embeddedness.

Green Training (GT), the objectives of introducing green training are to make the employees able to use their skills and competencies according to green standards and criteria (Bansal and Roth, 2000), and to make them experts and acknowledge about the importance of the environmental protection practices, to give them the managerial skills to appropriately deal with their routine daily activities and practices, since training and development programs and workshops play the role in developing the required skills and knowledge of the employee leading to achieve the organizational sustainability goals (Jabbour, 2016). ecological training of the employees create a culture in the organization in which the employees feel that they are accountable for environmental results and consequences, since training improves the employee's attitudes and awareness about the organization's environmental management initiatives (Jackson *et al.*, 2011). Also, the green training process is an ongoing process and is not limited to new employees, but includes all employees' at all administrative levels. This is to keep them constantly updated with the latest methods that contribute to the green performance process (Jabbour, 2016).

H2: GT directly influence on organizational sustainability.

H2a: GT influence on employees Job embeddednes.

H2b: GT influence on organizational sustainability through Job embeddednes.

Green reward (GR) is a system that offers both monetary and non-monetary incentives to employees in order to retain them and motivate them to work toward accomplishing environmental objectives. One of the key purposes of "green HRM" is to compensate workers in a way that encourages and motivates them to work toward environmental objectives. (Zibarras and coan, 2015). Employees may

feel motivated by nonfinancial rewards through green pay and rewards, such as recognition and praise from their managers (Jackson *et al.*, 2011). Rewards can be powerful means for achieving harmony between the employee's performance and the firm's goals through combining both monetary and nonmonetary rewards as an effective way in motivating employees (Renwick *et al.*, 2013). Organizations that implement green incentive policies typically tie employee remuneration to the environmental behavior they engage in and the results of that conduct, which encourages workers to work environmentally friendly and engage in pro-environment actions. (Arulrajah *et al.*, 2015).

H3: GR directly influence on organizational sustainability.

H3a: GR influence on employees Job embeddednes.

H3b: GR influence on organizational sustainability through Job embeddednes.

Green Career Opportunities (GCO) It indicates the extent to which job opportunities and appointments are compatible with the desires and goals of employees within their organizations, as employees who participate in environmental performance within organizations are often interested in opportunities that support them and lead them to career development within the organizations in which they work (Karadas and Karatepe, 2019). Company leadership must offer the right chances that are appealing and inspiring to employees who have knowledge of environmental management, ecological commitment, and ecofriendly behaviors in order to recruit and retain highly qualified and talented workers (Ren *et al.*, 2018). One of the key components of green human resource management practices is offering workers green opportunities, since this opportunity will affect the human resource system's overall and on employees' behavior and performance at the business level (Al-Ghazali and Afsar, 2021). Ability- motivation – opportunity theory focuses on the employees' abilities, motivation and opportunities contribution to better performance, so providing the right opportunities cannot be underestimated (Boselie and Boon, 2005). In this regard, leaders should give employees the support they need through a variety of opportunities to be active participants in this process to help the organizations achieve their ecologic goals and increase

their green competitiveness; since employees are the main implementers of GHRM measures; they are able to spot opportunities for new ideas (Tang *et al.*, 2018).

H4: GCO directly influence on organizational sustainability.

H4a: GCO influence on employees Job embeddedness.

H4b: GWLB influence on organizational sustainability through Job embeddedness.

Job Embeddedness (JE) was developed using turnover models with the fundamental goal of improving understanding and research of voluntary turnover via examination of the numerous reasons why workers choose to remain with their companies (Yang *et al.*, 2011). The view of employees toward the attractiveness of quitting their jobs is thought to influence whether or not they ultimately decide to remain with the company. According to Ghosh and Gurunathan, (2015) job embeddedness is the communal factors and motivations keeping the employee from quitting their work. Since the concept of job embeddedness encompasses a wide range of factors that can affect an employee's decision to remain or leave, depending on his or her experiences while carrying out his or her tasks and duties, experiences, responsibilities, and relationships with coworkers, managers, and supervisors. Making the employee embedded within the organization encourage him to remain with the company, the employee gets more integrated there and has a lower potential to depart. According to Yang *et al.*, (2011), Employees decide whether to quit or stay based on their actions and the decision-making process. It is a truth that when workers are dissatisfied with their positions for a variety of reasons, they will begin to consider looking for alternative positions elsewhere. They will compare these positions with their current positions to determine which is the most advantageous and appealing to them. (Mitchell *et al.*, 2001). When an individual discovers that his future objectives, professional aspirations, and personal plans match well with the work and with the company's culture and rules, he will remain in his position and his organization and exhibit low levels of turnover intention and behavior. Ng and Feldman (2007), have shown the necessity and value of a thorough understanding of employee embeddedness due to its influence on work outcomes like desire to

leave the company, since workers' performance may be anticipated by job embeddedness Halbesleben and Wheeler (2008) proven that individuals who are more deeply ingrained in their jobs have a significant influence on the self-esteem of the business and task performance. Job embeddedness is regarded as an essential and significant technique for employee retention in the field of human resource management. It has been noticed by Rahimnia *et al.* (2019) that a high perceived job security by organizational and community embeddedness practices has been found to reduce the pursue to search for alternative jobs.

H5: Job embeddedness has significant direct impact on organizational Sustainability.

To achieve the objectives of the study and verify these hypotheses, The current study has been carried out on pharmaceutical companies in Jordan in 2023.

MATERIALS AND METHODS

Research design and data collection

The study used a descriptive analytical approach, which is a technique the researcher uses to study a specific phenomenon as it actually happens. Using this approach, the researcher accurately describes the phenomenon without exaggerating or understating it, while also defining and outlining its causes and the extent to which it is associated with other phenomena (Bryman and Bell, 2011). Describes the degree to which of pharmaceutical industrial companies' use of green human resources practices. It is analytical as well, looking at how green human resources practices affect organizational sustainability among employees of pharmaceutical manufacturing firms in Jordan, the study sample was collected using a probabilistic method, so each worker in the population of study was identified and had an equal opportunity of being participating in the sample. This sampling approach is known as the simple random sampling technique, the data was collected via questionnaire, which prepared for this purpose. The adapted research instruments were originally in English, and since most Jordanian employees use the Arabic language to perform their duties, the researchers translated the tools from English into Arabic with the help of professional translators, who used a back-translation technique. To confirm the correctness of the translation with respect to linguistic and cultural cues, a pre-test with 20 workers showed that the tools were clear and free of ambiguity. To lessen the impact of Common

Method Bias (CMB), as was noted by Podsakoff, MacKenzie, and Podsakoff (2012), respondents were instructed not to reveal their identities. In order to improve the employees' impression of anonymity, an online survey was employed. HR representatives sent the questionnaire link via email and other channels, including WhatsApp groups. To achieve the goals of this study, the research model is made up of three different components that have been operationalized and modified from earlier studies. The next paragraphs include descriptions of the constructs, sources, and scales.

- Green human resources practices was measured using (Ren *et al.*, 2018; Ari *et al.*, 2020; Muster and Schrader, 2011; Renwick *et al.*, 2013; Ogbu Edeh and Okwurume, 2019; Kim *et al.*, 2019; Tang *et al.*, 2018; Malik *et al.*, 2020). Twelve-item scale with sub-dimensions (Green work life balance, Green training, Green reward, Green career opportunities). Employees were asked to assess how much green HR practices were used. Responses were graded on a 5-point scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

- Organizational sustainability was measured using the (Ogbu Edeh and Okwurume, 2019; Jehan *et al.*, 2020; Roca-Puig, 2019; Malik *et al.*, 2020). Seven-item scale, the workers were asked to evaluate how sustainable their organization is. Responses were scored on a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree).

- Job embeddedness was measured using the (Shah *et al.*, 2020; Yu *et al.*, 2020; Liu, 2018). Six-item scale Employees were asked to evaluate the extent of their Job Embeddedness in work. Responses were graded on a 5-point scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

Population of the study and Sample size

Based on the suggestion of Churchill and Iacobucci (2010) in defining the unit of analysis for the research study. So the population targeted in this study was all the 23 Pharmaceutical manufacturing companies in Jordan. However, only 16 companies took part in the study. The sample of this study will be consisting of 404 employees, working in pharmaceutical companies. The population of study consisted of all workers in Pharmaceutical manufacturing companies in Jordan, which there number (10,855) employees, who work in (23) Pharmaceutical manufacturing companies, based on The Jordanian Association

of Pharmaceutical Manufacturers 2021/2022. As the appropriate sample size is (375) individual according to (Sekaran and Bougie, 2016) and to ensure obtaining the appropriate sample size (455) questionnaires were sent to the study sample. (404) of them retrieved and used for data analysis.

Analytical methods

Structural equation modeling is a quantitative research technique used to look for and understand structural relationships between variables (Devault, 2018). This technique and the following statistical tools were employed for analyzing data (Cronbach alpha, composite reliability for reliability test, factor analysis, average variance extracted for convergent validity. Heterotrait- Monotrait ratio for discriminant Validity).

RESULTS AND DISCUSSION

Demographics data

Table 1 shows the demographic characteristics of study sample. Frequency analysis was utilized to diagnose the demographic distribution of the study sample. Our analysis denote that 49.26% of the participants are female, while 50.74 % of the participants are male workers. The age ranges of the participants are as follows: 20 - 29 years old made up 18.1% of the participating, 30 - 39 years old made up 47 % of the participating workers, the largest group. Furthermore, 40 - 49 years old made up 26.2% of the participating workers, the second largest group; and finally the remaining participants belong to those 50 and above years old. The educational level of the participants is overwhelmingly high worker with bachelor's degrees made up 50.7 % of the sample. Consequently, workers with postgraduate and higher degrees made up 24% of the sample; and 12.9% of the sample are workers with associate degrees and diplomas. Organizational tenure reflects the duration by which a worker has spent in the Pharmaceutical manufacturing firms. Around 47.8% of the participating workers have worked in this sector for more than 10 years; 39.3% of the participating workers have worked for a duration that spans between 5 and 9 years; and the remaining have worked for less than 5 years.

Reliability and validity

The internal consistency reliability assesses how consistently a test's findings are obtained across

Table 1: Demographic statistics

Variables		Frequency	Percentage
Gender	Male	205	50.74%
	Female	199	49.26%
Age	20 – 29 years	73	18.1%
	30 - 39 years	190	47.%
	40 – 49 years	106	26.2%
	50 years and more	35	8.7%
Educational level	High School	50	12.4%
	Associate degree	52	12.9%
	Bachelor's degree	205	50.7%
	Post graduate degree	97	24.%
Numbers of years in service	Less than 5 year	52	12.9%
	5 – 9 years	159	39.3%
	10 years and more	193	47.8%

Table 2: Internal Reliability and convergent validity indicators

Variables	Ca	Rho	CR	AVE
Organizational Sustainability	0.901	0.923	0.930	0.890
Green Work life balance	0.851	0.863	0.872	0.782
Green Training	0.833	0.842	0.832	0.734
Green Reward	0.805	0.812	0.805	0.681
Green Career Opportunities	0.821	0.835	0.814	0.711
Job Embeddedness	0.839	0.868	0.890	0.670

Note: Ca = Cronbach's alpha; CR= composite reliability; AVE= average variance extracted

various conditions. Internal Consistency Reliability tests identify how all factors on the test relate to all other factors (Hajjar, 2018). It was examined using the widely used metrics: Cronbach's alpha (α) and composite reliability (CR) indicators. Approved and desirable values according to these indicators is 0.70 for every construct or variable. Findings in Table 2 indicate that all the values for Cronbach's alpha and CR are higher than the cutoff points, demonstrating that the constructs accurately capture the concepts and also show harmony and reliability (Hair et al., 2012). The average variance extracted (AVE), is commonly used to validate constructs. In statistics, AVE is a measure of the amount of variance that is captured by a construct in relation to the amount of variance due to measurement error. These conventional indices are formed by factor loadings resulting from estimated least squares or maximum likelihood regressions. The average variance extracted (AVE) exhibited by each construct is should ideally be greater than 0.50, the results shown in Table 2 indicate that all the constructs in this study have (AVE) greater than 0.50. Therefore, the current study has established and confirms the criteria for internal consistency and convergent validity (Hair et al., 2016; Henseler et al., 2009).

Discriminant validity

After the created of convergent validity, the test for discriminant was undertaken using two methods namely: the traditional (Fornell and Larcker, 1981) and the recently developed Heterotrait-Monotrait Ratio of Correlations (HTMT) criterion (Henseler et al., 2015). In the earlier method, we followed the decision criteria that stated that discriminant validity is true if the square root of the AVE value for each construct is greater than the inter-correlation with other constructs (Fornell and Larcker, 1981). According to the findings in Table 3. the square root of the AVE for each construct is higher than any other inter-construct correlation coefficient. Additionally, we applied the decision criterion that discriminant validity is valid in the latter technique if the HTMT correlation ratios are less than the benchmarks of 0.85 or 0.90. (Henseler et al., 2015). According to Table 4 findings, the HTMT correlation ratios fell short of the desired cutoff points of 0.85 and 0.90. Which are ranged from 0.092- 0.594. As a result, the current study satisfies the requirements for discriminant validity.

Evaluation of the structural model

After analyzing the data by structural equation

Table 3: Fornell-Larcker discriminant validity

Variables	OS	GWL	GT	GR	GCO	JE
OS	0.645					
GWL	0.691	0.740				
GT	0.525	0.717	0.781			
GR	0.805	0.812	0.805	0.887		
GCO	0.693	0.813	0.732	0.847	0.881	
JE	0.494	0.231	0.441	0.55	0.434	0.855

Table 4: Contemporary HTMT discriminant validity diagnoses

Variables	OS	GWL	GT	GR	GCO	JE
OS	-					
GWL	0.177	-				
GT	0.135	0.405	-			
GR	0.321	0.092	0.226	-		
GCO	0.494	0.257	0.459	0.594	-	
JE	0.277	0.212	0.161	0.178	0.169	-

Table 5: Direct effects

Hypothesis	Predictor(s)	β	SE	t-value	p-value
H1	GWL > OS	0.41	0.04	5.97	0.00
H1a	GWL > JE	0.27	0.08	3.42	0.00
H2	GT > OS	0.03	0.04	0.64	0.53
H2a	GT > JE	0.40	0.06	6.30	0.00
H3	GR > OS	0.24	0.04	5.73	0.00
H3a	GR > JE	0.26	0.06	4.31	0.00
H4	GCO > OS	0.04	0.04	0.87	0.38
H4a	GCO > JE	0.39	0.08	4.83	0.00
H5	JE > OS	0.38	0.08	4.81	0.00

Information: F statistics = 39.77; R squared = 0.57; Significance = 0.01; SE= standard error

modeling (SEM) the results are shown in [Tables 5](#). that GWLB exerted positive and significant effects on organizational sustainability ($\beta = 0.41$; $t = 5.97$; $p < 0.01$) and Job embeddedness ($\beta = 0.27$; $t = 3.42$; $p < 0.01$). These findings support hypotheses H1 and H1a. While GT didn't has direct significant effects on organizational sustainability ($\beta = 0.03$; $t = 0.64$; $p > 0.01$), and significant effects on Job embeddedness ($\beta = 0.40$; $t = 6.30$; $p < 0.01$) these findings conflict hypotheses H2 and support H2a. Also the result indicated that GR has direct significant effects on organizational sustainability ($\beta = 0.24$; $t = 5.73$; $p < 0.01$), and Job embeddedness ($\beta = 0.26$; $t = 4.31$; $p < 0.01$). These findings support hypotheses H3 and H3a. While GCO didn't has direct significant effects on organizational sustainability ($\beta = 0.04$; $t = 0.87$; $p > 0.01$) these findings conflict hypotheses H4, and significant effects on Job embeddedness ($\beta = 0.39$; $t = 4.83$; $p < 0.01$) these findings support hypotheses H4a. As well as JE exerted positive and significant effects

on organizational sustainability ($\beta = 0.38$; $t = 4.81$; $p < 0.01$), these findings support hypotheses H5.

Indirect effect

In [Table 6](#) the indirect impact was examine by using Job embeddedness as a mediating variable. The author determined the indirect effect through the method of bootstrapping by SmartPLS by using a single mediator. The finding in [Table 6](#) demonstrated that all the relationship mediated significantly. GWLB>JE>OS has path co-efficient ($\beta=0.42$; $P=0.00$). As well GT>JE>OS, ($\beta=0.38$; $P=0.00$) has significant relationship. Also, GR>JE>OS ($\beta=-0.40$; $P=0.00$) has indirect effect significant. GCO>JE>OS has ($\beta=0.22$; $p=0.00$) mediations and significant indirect effect. These findings support hypotheses H1b, H2b, H3b, H4b.

- This result is in line with a research ([Acpa, 2022](#)). Who stressed that "green work-life balance" improves work-life relations and encourages

Table 6: In direct effects

Hypothesis	Predictor (s)	B	SE	t-value	p-value
H1b	GWLB > JE>OS	0.42	0.08	9.77	0.00
H2b	GT > JE >OS	0.38	0.06	6.30	0.00
H3b	GR > JE>OS	0.40	0.06	4.31	0.00
H4b	GCO > JE >OS	0.22	0.08	4.81	0.00

ecologically sustainable behavior in both settings, benefiting the environment, companies, and people. Additionally, it supports the findings of the (Rahimnia *et al.*, 2019) research that practices that increase corporate and community embeddedness have been shown to decrease the desire to look for alternative employment opportunities. While green training (GT), the result of this study is not consistent with (Jehan *et al.*, 2020) who stated that green training has a positive impact on sustainability. In terms of green rewards, the findings of this research are in line with those of (Malik *et al.*, 2020; Jehan *et al.*, 2020; Arulrajah *et al.*, 2015), which affirmed that green incentives have a beneficial impact on sustainability and functional embeddedness. While the results related to green job opportunities, which were not statistically significant, do not agree with (Al-Ghazali and Afsar, 2021). Those who indicated that this opportunity affects employees' behavior and performance at the business level. This study is also consistent with (Darpan *et al.*, 2020; Choudhury, 2020) they asserted that organizational embeddedness and organizational attractiveness sequentially mediated the association between GHRM and intentions to stay in work.

CONCLUSION

This study was aimed to investigate the impact of green human resources management's practices on organizational sustainability: The mediating role of job embeddedness in the pharmaceutical manufacturing firms in Jordan 2022. The study examined the connection between GHR practices (Green work life balance, Green training, Green Reward, and Green career opportunities) and organizational sustainability. Primary data collected from study sample, has been used to obtain the outcomes. The study used SEM to assess the relationship across green Human resource practices and organizational sustainability. The mediator variable "job Embeddedness" between green HR practices and organizational sustainability is analyzed. In light of the findings GWLB, GR shows a significant

positive effect on the organizational sustainability, as well GWLB has the highest significant effect on organizational sustainability. This findings show that implementing and expanding these practices has positively impact on the organizational sustainability. It means that increase of these practices lead to more organizational sustainability. While GT, GCO didn't have direct significant effects on organizational sustainability. As well, the outcomes indicated that all practices GWLB, GR, GT, GCO have direct significant effect on job embeddedness, as well GT has the highest significant impact on Job embeddedness. The current study analyzed the indirect relationship between GHR practices and OS by using JE as mediator variable. The findings suggest that the mediator does improve the organizational sustainability. This empirical investigation draws numerous noteworthy theoretical implications. This empirical study also contributes to the body of literature by offering researchers the chance to adopt effective and efficient managerial resources for reducing the negative effects of environmental issues with workable solutions that will help them make better decisions about the most appropriate managerial resources. The importance of green practices grows yearly. Due to the market's intense competition. One of the most important ways to stay one step ahead of the competition is to ensure that organizations are built with flexibility and intelligence, greening, identifying problems early and responding quickly with new innovations. This indicates that the notion of green practices continues to be a hot topic that calls for additional scholarly research that will encompass a variety of different organizational resources for its progress and sustainability. Managers are advised to create an enabling organizational structure that will increase employee job embeddedness because it will not only promote the competitive advantage of the organization but will also have positive impacts on employees' growth and their tendency to survive and remain with the organization. Managers are to direct organizational policies towards

the sustenance of GHR practices (GWLb, GR) in situations where there are low level of organizational sustainability. This study revalidates the significance of job embeddedness in boosting the effectiveness of organizational sustainability, by ensuring that employees irrespective of their qualifications and practices have access to the competitive advantage and sustenance of organizational sustainability via job embeddedness. One of the key limitations of this study was the use of a self-reported instrument for data collection. Self-reported data are typically prejudiced when recounting their own experiences, since individuals often avoid mentioning their unwanted practices or some people usually try to embellish some of their practices, which would affect the results of data analysis. Also the study sample was selected from a single industry (pharmaceutical industry) and from one nation, so it is important to take care when applying study findings to different industries and other nations. As the practices of individuals differ from one sector to another and from one society to another, especially since the current study focused on the pharmaceutical industry sector, which is often concerned with the environment and green practices more than some other sectors, due to the specificity of this sector and the practices that affect the environment. Future research should take into account strategies for collecting longitudinal data, which is a series of repeated observations made over an extended period of time on the same people to help assess change or field experiment. Also the future direction of this study should adopt the comparative analysis of data from different sectors or countries in order to ascertain what a particular country is doing better or peculiar to a specific sector compared to others. Use other constructs in green human resources practices literature such as green participation in the decision making, green empowerment, green teamwork and green staff selection.

AUTHOR CONTRIBUTIONS

B. Kh. Almagharbeh carried out the idea development, methodology, software, review of literature, and manuscript preparation. N.A. Alalean corrected data, prepared the first draft, wrote, reviewed, and edited it, as well as checked software, and validated it.

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CONFLICTS OF INTEREST

The authors declare that there is not any 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 has been completely observed by the authors.

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ABBREVIATIONS

<i>GCO</i>	Green career opportunities
<i>GHR</i>	Green human resource
<i>GHRM</i>	Green human resource management
<i>GR</i>	Green reward
<i>GT</i>	Green training
<i>GWLb</i>	Green work life balance
<i>HTMT</i>	Heterotrait-Monotrait Ratio

JE Job embeddedness
OS Organizational sustainability

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ORIGINAL RESEARCH PAPER

Investigating the effective factors on place attachment in residential environments: Post-Occupancy Evaluation of the 600-unit residential complex

Gh. Motalebi^{1,*}, A. Khajuei², F. Fanaei Sheykholeslami²

¹ School of Architecture, University College of Fine Arts, University of Tehran, Tehran, Iran

² Department of Architecture and Urbanism, Ferdowsi University of Mashhad, Mashhad, Iran

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Place attachment

Post-Occupancy Evaluation

Residential environment

Residential facility programming

ABSTRACT

BACKGROUND AND OBJECTIVES: Place attachment is among the most important aspects of the interaction between people and their places, to keep residential environments safe, sustained, and resilient. This study aims to identify the factors that influence the creation and enhancement of place attachment in residential settings, with a focus on physical elements. Given the significance of these factors in architecture and facility programming, the study aims to provide architects and designers with effective strategies for designing and redesigning residential environments. The results of this study on place attachment can be utilized in the architectural facility programming process and design decision-making.

METHODS: This study proposed a theoretical framework in which the relationship between subjective and objective physical and individual characteristics and time were the main components of making sense of place attachment. Using a survey method, the study investigated the significance of place attachment among residents of the 600-unit residential complex in Mashhad, Iran, through a questionnaire divided into three sections. The first section focused on individual characteristics and time spent in the complex, while the second and third sections measured the objective and subjective physical characteristics and the extent of people's attachment to the complex, respectively. The data from 158 participants were analyzed using SPSS and SmartPLS software.

FINDINGS: Results of SPSS analysis showed objective physical characteristics ($p < .01$, $r = .241$), as well as the subjective physical characteristics ($p < .01$, $r = .223$) and time ($p < .01$, $r = .237$), were the most important components affecting place attachment, highlighting the role of physical strategies used in the residential complex for creating and developing this feeling. Considering these physical factors affecting the establishment and enhancement of place attachment emphasizes the role of architects and planners in satisfying this crucial human need which directly affects people's personal and social health.

CONCLUSION: The results revealed time, subjective, and objective physical characteristics are three factors that have a direct impact on place attachment. Objective physical characteristics have a direct impact on place attachment and also indirectly impact it through their effect on subjective physical characteristics. On the other hand, the relationship between individual characteristics and place attachment is indirect, as individual characteristics affect the time spent in a place, and an increase in time spent leads to a stronger place attachment. The findings can be employed extensively in architectural programming in residential environments to improve the quality of life.

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*Corresponding Author:

Email: Motalebi@ut.ac.ir

Phone: +9821-66409696

ORCID: [0000-0001-6548-7911](https://orcid.org/0000-0001-6548-7911)

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INTRODUCTION

Place attachment, a key theory in the exploration of human–land relationships, is a positive emotional relationship between an individual and a place (Feng *et al.*, 2022; Lebrusán and Gómez, 2022). According to a study by Beyer *et al.* (2020), emotions and affective experiences play a significant role in shaping our mental image of a place and our attachment to it. The process of attachment is a psychological phenomenon that connects individuals to their environment across various levels, including home, neighborhood, city, and country, and in diverse settings, such as workplaces, educational institutions, public spaces, and recreational areas. (Lewicka, 2010; Heidari *et al.*, 2019;). Residential environments represent a crucial aspect of individuals' life and well-being as they provide a primary context for daily living and social interaction (Maller *et al.*, 2006). Thus, they are the most important place people may attach to in their lifetime (Bonaiuto *et al.*, 2003). People's needs for belonging are fundamental to creating place attachments (Pirbabaei *et al.*, 2015; Javan Forouzande and Motalebi, 2011) that can support the revitalization of declining neighborhoods at both social and physical levels (Brown *et al.*, 2003). Place attachment is one of the essential factors in assessing the human-environment relationship and creating high-quality human environments. It plays a crucial role in increasing human responsibility, cooperation, and quality of life. Conversely, a lack of attachment to a place can result in insufficient investment in maintenance, leading to increased life cycle costs and reduced usefulness of residential buildings. By analyzing the existing literature on place attachments, this study proposes a theoretical framework using an analytical method. The present study investigates the physical, individual, and time factors affecting the creation and reinforcement of place attachment in residential complexes. The first part of the study, using a deductive approach, examines existing theories and models of place attachment and proposes a theoretical framework for how people perceive and examine the factors affecting place attachments. The second part of the research analytically examines the proposed hypotheses using survey research. Data were collected using a questionnaire. SPSS (Statistical Package for the Social Sciences) and PLS software (Partial Least Squares) were used for data analysis, measuring the relationship between

variables. The main question of this study is: "What are the main effective factors that contribute to creating and reinforcing place attachment among the residents of residential complexes?" The findings of this research on the effects of the objective and subjective physical factors on place attachment is a Post-Occupancy Evaluation (POE) to be used in the facility and architectural programming process. Facility programming is a phase of the building planning process (Preiser and Vischer, 2004; Sanoff, 1989; Popov, 2004). Facility programming is a critical phase in designing new or renovated facilities such as residential complexes, defining the problem to be solved, and providing architectural designers with information about building user needs and patterns of activities that occur in space (Sanoff, 1977). The primary phase of facility programming is evaluation, which is used for learning from existing facilities to improve functional and physical characteristics in residential environments for smart growth (Federal Facilities Council, 2002; Preiser, 2001; Preiser *et al.*, 2018).

Literature review

Attachment, as one of the most prominent concepts of contemporary psychology, refers to the process of forming emotional bonds between humans. John Bowlby formulated this theory's basic principles, drawing on concepts from ethology, cybernetics, information processing, developmental psychology, and psychoanalysts (Mikulincer and Shaver, 2012; Bretherton, 1992). The theoretical foundations and main themes of Attachment Theory were presented by John Bowlby in the three-volume series "Attachment and Loss" in 1979, 1980, and 1982. Based on This theory, long-term emotional bonds to particular individuals are a fundamental part of human nature. An attachment bond to someone provides feelings of security and well-being in the presence of that person (Bowlby, 1974). According to developmental psychology, an individual's social, emotional, cognitive, and behavioural structures are configured by previous experiences in life. These structures increase conscious and unconscious decisions and preferences. In reference to their experiences, people endeavour to create predictability, stability, and order in their lives (Weiner *et al.*, 2012). In Hashas's (2004) attachment model, an individual's social, emotional, cognitive, and behavioural configurations constitute

an individual's self. According to this model (Fig. 1), all new experiences are perceived, organized, classified, and remembered under the configuration of the self. Besides, the "self" design also stimulates one's behavioural motivations. Each individual's expectations and needs are established as the self is constructed. When those needs and expectations are satisfied by an object or subject, the person feels safe and comfortable and continues to expect his or her needs to be satisfied by the object or subject. In this way, the individual becomes attached to the object or subject. The individual starts having hopes and making plans based on the attachment figure. As an expression of their affection, they care for, pay attention to, and support the attachment figure based on the satisfaction of the individual and people's needs. Despite their complexity and different meanings and definitions, this thinking and its indicators are widely used in environmental studies and are of particular importance. Based on Hashas's model, it can be said that if a place could satisfy an individual's expectations and needs, the person feels safe and comfortable and continues to expect his or her needs to be satisfied by that place.

Dimensions of place attachment

Attachment to place is a complex and multifaceted concept that goes beyond the narrow definition of attachment in psychology, which focuses primarily on the formation of emotional bonds between individuals. Instead, place attachment encompasses a broader range of psychological, social, and cultural factors that contribute to a sense of belonging and connection to particular places. (Devine-Wright, 2013; Giuliani, 2003). The use of place attachment in many studies has led to many definitions (Table 1). Despite these numerous definitions, it can be said

that place attachment generally refers to links people make between themselves and places (Lewicka, 2008). The definitions presented in the early years of the concept of place attachment examined it as a product, meaning "feel attached" in individuals or groups to a place. As the studies expanded and the importance of How and Why of attachment to places became relevant, the process and reasons for attachment to places were also studied as integral dimensions of the concept of place attachment.

Numerous studies have attempted to measure place attachment, which is a subjective and sentimental relationship people have with a place. Scholars have identified various dimensions and forms of place attachment, (Scannell and Gifford, 2010a; Daneshpour et al., 2009) with most conceptualizations attempting to describe the range of emotions people associate with specific environments. (Kyle et al., 2005). There are two dominant traditional and recent views on explaining place attachment dimensions. The traditional view of place attachment considers it to have two dimensions, place identity and place dependence, (Williams and Vaske, 2003) which respectively refer to the self-defining aspects of a person's identity in relation to the physical environment and the functional aspects of a place in fulfilling an individual's needs and goals (Larson et al., 2018; Daryanto and Song, 2021). The two-dimensional model of place attachment has been criticized for neglecting the collective dimension and the role of society, as well as trivializing natural environments. Scholars have emphasized the need to understand the social context of spatial links, leading to the development of models that account for the social and cultural dimensions of making place attachments, as well as the functional and physical dimensions. This study focuses on these

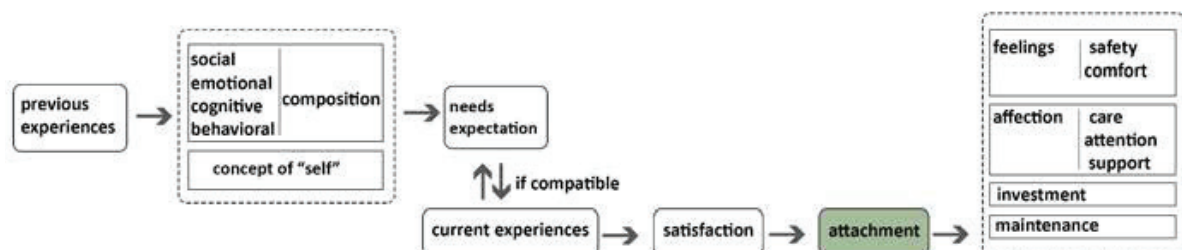


Fig. 1: Attachment theory based on human needs (Hashas, 2004)

Table 1: Definitions of place attachment

Theorist	Definitions of place attachment
Relph (1976)	A need for a long and deep experience of a place, and preferably involvement in the place
Shumaker and Taylor (1983)	The positive affective bond between individuals and their residential environment
Proshansky <i>et al.</i> (1983)	A potpourri of memories, conceptions, interpretations, ideas, and related feelings about specific physical settings
Shamai (1991)	A personal and collective experience in combination with the meaning of place and its symbols to create a 'Personality' of the place
Altman and Low (1992)	The interplay of effects and emotions, knowledge and beliefs, and behaviors and actions refers to a place
Hummon (1992)	Emotional involvement with places
Brown and Perkins (1992)	Positively experienced bonds, sometimes without awareness
Ahrentzen (1992)	Relationships among place, individual, social knowledge, and his/her beliefs
Jacobs (1995)	Deep human character, the concept of giving a place a home
Bonaiuto <i>et al.</i> (1999)	Emotional attachment to a particular place, transforming the individual as part of the identity of the place
Hidalgo and Hernández (2001)	A positive affective bond between an individual and a specific place
Stedman (2003)	A positive emotional bond that develops between people and their environment
Giuliani (2003)	The bonding that occurs between individuals and their meaningful environments
Kyle <i>et al.</i> (2004)	The cognitive connection between the self and the physical environment
Manzo (2005)	An 'experience-in-place' that creates meaning
Scannell and Gifford (2010a)	A multidimensional construct that includes affective, cognitive, and behavioral components reflecting an individual's psychological connection to a specific place
Lewicka (2011)	The emotional and psychological ties that individuals develop towards specific places, and contribute to the formation of their identity and sense of belonging
Devine-Wright (2013)	The cognitive and emotional connection that individuals have to a particular place, reflecting the meanings and values they ascribe to it, the experiences they have had there, and the sense of identity that they derive from their connection to it
Ramkissoon <i>et al.</i> (2013)	A multidimensional construct that reflects the bonds between individuals and their physical environments, characterized by cognitive, affective, and behavioral dimensions
Masso <i>et al.</i> (2019)	The bonding of people to all kinds of places at various scales that various mobilities affect and re-configure it
Manzo and Devine-Wright (2020)	The enduring emotional bond that individuals develop with specific places or environments, characterized by a sense of connection, meaning, and belonging
Hernández <i>et al.</i> (2020)	A positive and affective bond between individuals and places that arises from the meaningful and memorable experiences, social interactions, and identity-related processes that take place within those place

aspects of place attachment. Scannell and Gifford (2010a) proposed a three-dimensional "person-place-process" framework of place attachment, which includes person, psychological process, and place dimensions. Raymond *et al.* (2010) also proposed a three-pole concept of place attachment, which includes personal, community, and natural environment dimensions. Place identity and place dependence are included in the one pole (personal context) because those dimensions are related to highly personalized connections to place, either symbolic (identity) or functional (dependence) in nature. Both models proposed that connections to a place can be based on social or physical attributes.

However, there is a difference between the two presented models. Whereas in Raymond *et al.*'s model, affect, cognition and behavior are not manifested in place attachment, Scannell and Gifford's tripartite place attachment framework considers the psychological process as a separate dimension of place attachment. This difference may come out from the scale of the two studies. Whereas the former model was tested at the regional scale, the latter model was tested at the community scale (Raymond *et al.*, 2010; Scannell and Gifford, 2010a). Kyle *et al.* (2005) also proposed a three-dimensional model of place attachment, which includes place identity, place dependence, and social bonding dimensions. When a

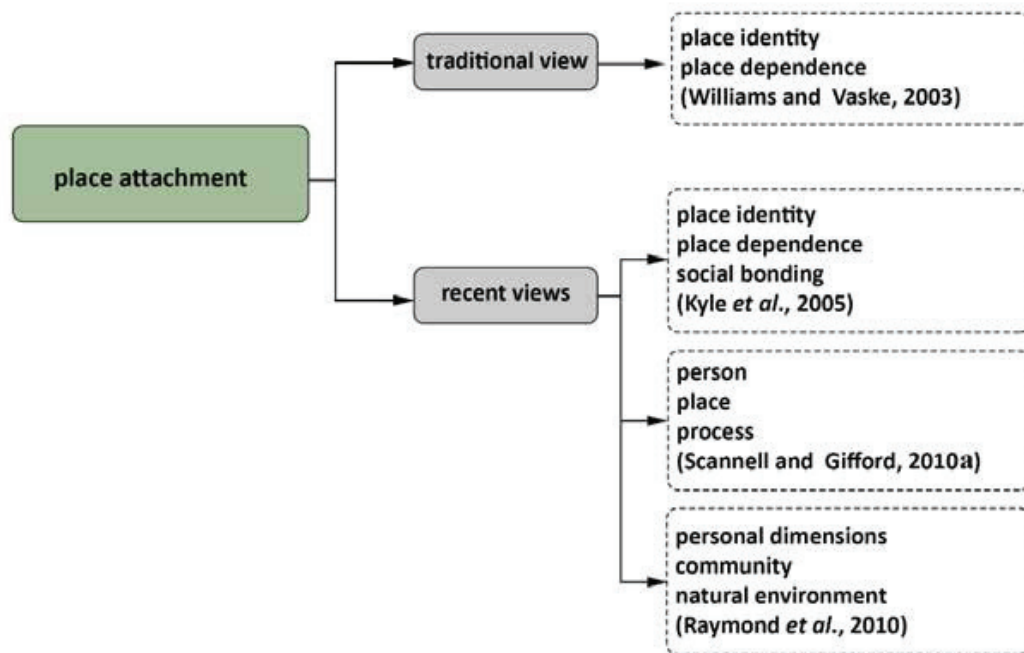


Fig. 2: Different theories on place attachment, Based on: (Williams and Vaske, 2003; Kyle et al., 1989; Scannell and Gifford, 2010a; Raymond et al., 2010)

place for a person has the role of social connection, the person sees the environment as a place for his/her social meetings, the place becomes important to the person, and the person develops emotional and sentimental connections with that place (Fathebaghali et al., 2016). Different studies have focused on the social aspect of place attachment (Low and Altman, 1992; Gieling et al., 2018). However, due to the importance of physical characteristics in architecture and facility programming, this research mainly focuses on physical aspects of place attachment. Although the model presented by Raymond et al. has had a significant contribution to the place attachment literature and its implication in environmental management at a macro scale, Kyle et al.'s model of place attachment inclusively refers to the functional and physical characteristics which can be employed directly into the facility programming of community or residential environments and increasing quality of life of the residents. Fig.2 illustrates the traditional and recent models of place attachment studied in this section.

Conceptual model of research

The conceptual model of this research is based

on Kyle et al.'s (2005) three-dimensional model and Scannell and Gifford's 'person', 'place', and 'process' dimensions in their tripartite place attachment framework. There are similarities between 'place identity' and 'place dependence' in Kyle et al.'s model and 'person' and 'place' in Scannell and Gifford's model, respectively (Fig. 3). In addition, based on recent studies, the component of "time" can also be considered as an influential factor in forming and strengthening place attachment (through social bonding and other possible processes), along with the two factors of person and place (Scannell and Gifford, 2010b; Hernández et al., 2007; Lewicka, 2005, 2010; Raymond et al., 2010; Stedman, 2006; Anton and Lawrence, 2014; Shamai and Ilatov, 2005) (Fig. 3). Thus, this study investigates the relationship between the three components of individual characteristics (person), physical characteristics (place), and time with place attachment. The main focus here is on the physical characteristics, divided into objective and subjective groups. Some factors, for instance, accessibility, facilities, and quality of materials are objectively physical, and some factors, such as Peace and safety (Ayati et al., 2016; Waxman, 2006) are the subjective output of the physical

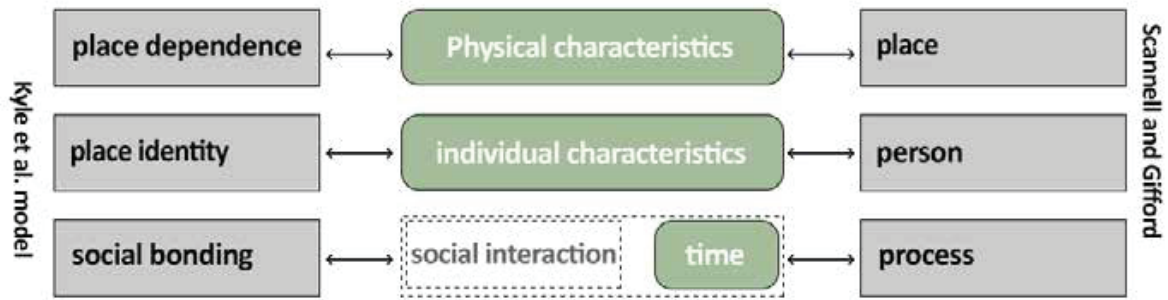


Fig.3: Base of designing the conceptual model of the research

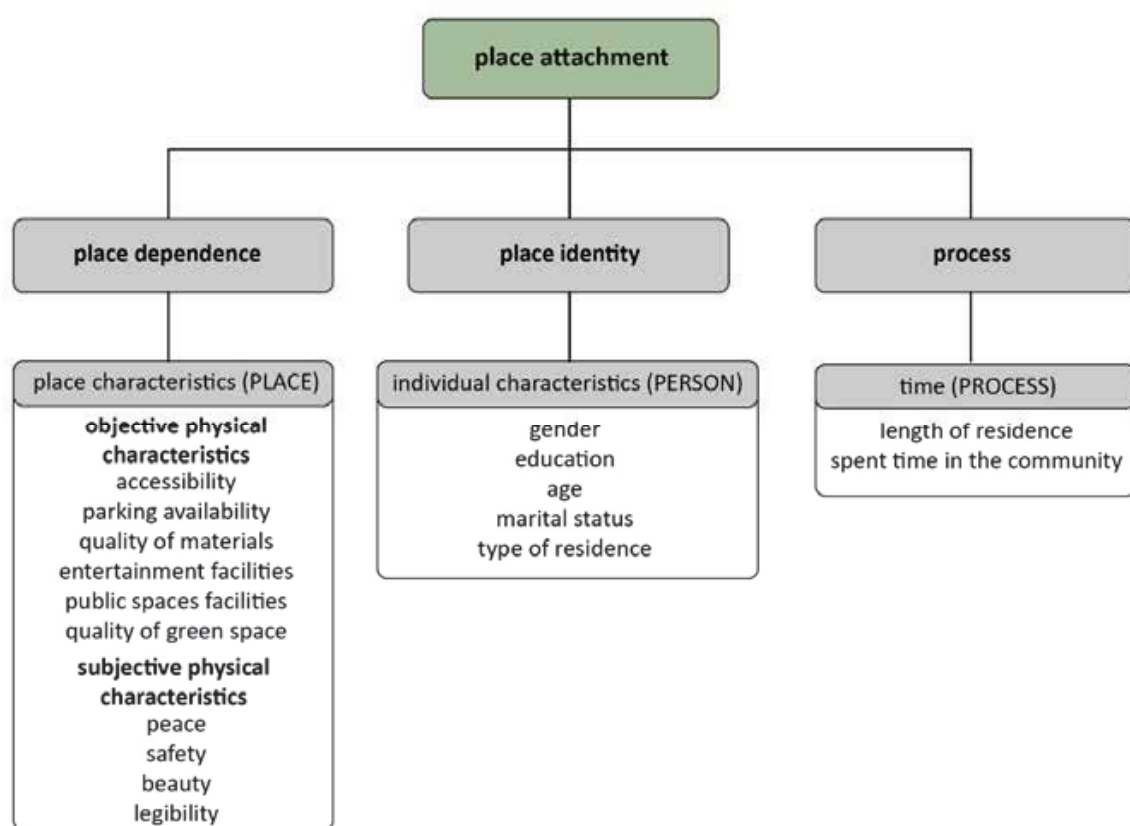


Fig. 4: The Conceptual model of the research

environment. As mentioned before, Social interaction (social bonding), is not the focus of this research, and further studies are needed to consider its effect on creating place attachment in residential complexes. Fig. 4 illustrates the conceptual model of the research and the effective factors on the place attachment in this model are also defined in Table 2.

In this study, people's perception of physical characteristics was measured in objective and subjective groups. The findings can be utilized in the architectural facility programming process and design decision-making to help designers, architects, and architectural programmers design or redesign the existing residential environments in a way that

Table 2: The category of effective factors on the place attachment

	Factor	Theorist	Description
Individual Characteristics	Type of residence (owning one's home)	(Brown <i>et al.</i> , 2003; Lewicka, 2010; Hay, 1998; Mesch and Manor, 1998, Lin <i>et al.</i> , 2020a)	- People who own their own homes have invested in their local areas, making it likely that they will live there in the long term, which is also a predictor of place attachment.
	Age	(Bonaiuto <i>et al.</i> , 1999; Hidalgo and Hernández, 2001; Lewicka, 2010; Lewicka, 2011; Dallago <i>et al.</i> , 2009; Shamai and Ilatov, 2005)	- Older people are often found to be more attached than younger people.
	Education	(Taylor <i>et al.</i> , 1985; Lin <i>et al.</i> , 2020a)	- Higher educated people were more attached than people with less education.
	Gender	(Williams <i>et al.</i> , 1992; Anton and Lawrence, 2014)	- Attachment was correlated with low income and low education.
	Marital status	(Hidalgo and Hernández, 2001; Rollero and De Piccoli, 2010)	- Women report being more attached to their homes than men.
		(Anton and Lawrence, 2014)	- Sex cannot predict home place attachment.
Time		(Brown <i>et al.</i> , 2004)	- Marriage status was positively related to home attachment.
	length of residence	(Hernández <i>et al.</i> , 2007; Lewicka, 2005, 2010; Jorgensen and Stedman, 2006; Raymond <i>et al.</i> , 2010; Stedman, 2006; Scannell and Gifford, 2010b; Anton and Lawrence, 2014; Shamai and Ilatov, 2005; Brown <i>et al.</i> , 2004)	There is a correlation between place attachment and length of residence.
	Spent time in the community	(Stedman, 2006; Scannell and Gifford, 2010b; Daryanto and Song, 2021)	- The more people are attached to a place, the more they spend time participating in property-related recreational and local association activities.
Physical Characteristics		(Aliakbarzade Arani <i>et al.</i> , 2021; Sun <i>et al.</i> , 2020; Hay, 1998)	- As people grow older and have more time to spend in their community, they become more aware of the importance of their sense of place and increase their involvement in the community.
	Objective Physical Characteristics	(Reese, 2019; Gieryn, 2000; Lewicka, 2010; Lin <i>et al.</i> , 2020b)	- Place attachment is positively related to objective physical characteristics of building and neighborhood
	Subjective Physical Characteristics	(Waxman, 2006; Bonaiuto <i>et al.</i> , 1999)	- Place attachment is related to subjective physical characteristics

improves the sense of place attachment among its residents and the quality of life. The research survey was conducted in the “600-unit residential complex” in Mashhad, Iran in 2020.

MATERIALS AND METHODS

Survey design and data collection

Based on the objectives of the study, the following question was raised:

What are the main effective factors that contribute to creating and reinforcing place attachment among the residents of residential complexes?

Drawing on the literature review, the following sub-questions were defined to answer the primary research question:

- Is there a significant relationship between the objective physical characteristics of the place and

place attachment in the residential complexes?

- Is there a significant relationship between the subjective physical characteristics of the place and place attachment in the residential complexes?

- Is there a significant relationship between the individual characteristics of the residents and place attachment in the residential complexes?

- Is there a significant relationship between the component of time and place attachment in the residential complexes?

In order to investigate the research questions, one main hypothesis and four sub-hypotheses were presented.

Objective and subjective physical characteristics of the place, individual characteristics, and the component of time contribute to creating and reinforcing place attachment among the residents of

residential complexes.

- There is a significant relationship between the objective physical characteristics of the place and place attachment in the residential complexes.
- There is a significant relationship between the subjective physical characteristics of the place and place attachment in the residential complexes.
- There is a significant relationship between the individual characteristics of the residents and place attachment in the residential complexes.
- There is a significant relationship between the component of time and place attachment in the residential complexes.

A multi-step approach was used for evaluating the aforementioned hypotheses. To this end, this study examined the theoretical framework of the concept of place attachment. Then, analyzing different theories, the conceptual model of this research is made for developing a questionnaire to study the effects of individual, physical, and time factors on place attachment in a residential complex. Then, the survey method was used to evaluate the variables. Questionnaire studies are commonly used in environmental psychology (for instance, in Kyle *et al.*, 2004; Raymond *et al.*, 2010) because they are a direct way to gather information about attitudes, feelings, perceptions, anticipations, and values, and they have high external validity and are relatively easy to administer and analyze. However, they may suffer from response bias and social desirability effects (Podsakoff *et al.*, 2003). These flaws cannot be avoided, but more than one approach and method may be used to bear on each aspect of a problem. Other approaches for collecting data in the context of this study were to observe visible behavior and interview, which have their own flaws and additionally were difficult or even impossible, because this research was conducted during the Covid-19 pandemic, when the presence of people in public places was limited and controlled, and it was not possible to observe the behaviors in the context of social life. Therefore, a paper survey was used. One advantage of the paper survey is the participation rate. Generally, response rates are greater in comparison to the online survey method. This questionnaire was designed and revised based on both the exemplars (Hidalgo and Hernández, 2001; Ujang, 2012; Jorgensen and Stedman, 2001; Lewicka, 2010), and comments received by a group of experts in social sciences. After

fixing the defects, questionnaires were distributed to the 52 residents of the residential complex (as a pilot study) for validation and re-examination, and then the ultimate corrections were made to the final draft of the questionnaires. The final sample size was 158 (excluding the pilot test samples). The questionnaire items were categorized into three main sections according to the findings from the literature review (Table 2) (Fig. 4) and were rated on a 5-point Likert Scale. The first section was developed to study the individual characteristics of the residents and the time spent in the complex; the second section measured the perceived objective and subjective physical characteristics of the complex, and in the third section, using attachment items, the extent of people's attachment to the residential complex was investigated. As this residential complex, as a neighborhood-garden has unique physical features that should be taken into consideration in studying the impact of objective and subjective physical characteristics on place attachment, some of the characteristics evaluated are quantity and quality of green spaces, accessibility (pedestrian and vehicular), public space facilities, entertainment facilities, legibility, safety, etc. Additionally, according to the conceptual model of the research, in the third section, place attachment is measured through three different categories of items (related to place identity, social bonding and place dependence). SPSS and SmartPLS 3 software were used to analyze the data and measure the variables' relationship.

Study area

This research surveyed a residential complex named "600-unit", which is located in Mashhad, Razavi Khorasan Province, Iran (Fig. 5). This complex is housed within a 12-hectare plot of land. The four-story apartment buildings are built between 1971 and 1975.

The complex is located in the center of Mashhad, surrounded by Ershad Boulevard in the south, Ferdowsi Boulevard in the north, Dehkhoda Boulevard in the west, and Shahid Sadeghi Boulevard in the east (Fig. 6). The overall structure of this complex is demonstrated in Fig. 7 and Fig. 8.

Statistical population and sampling method

The statistical population of this study consisted of all families living in the 600-unit complex, and with

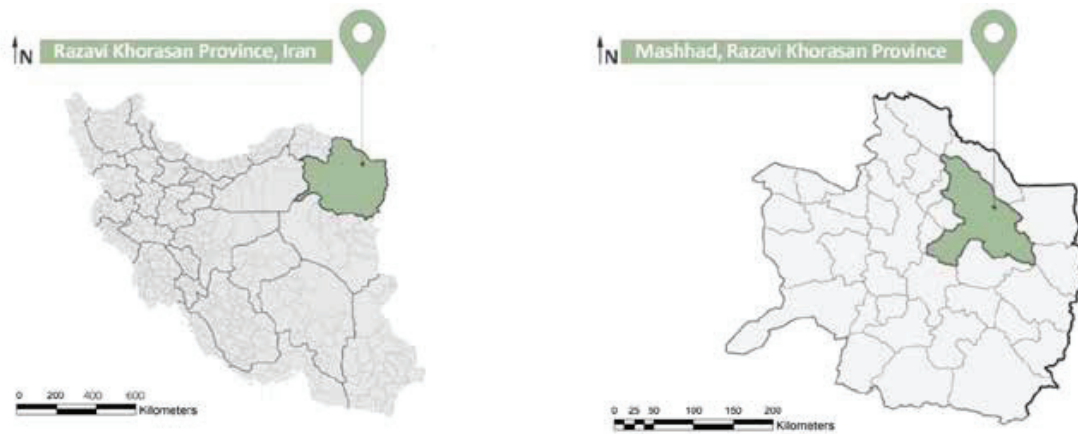


Fig. 5: The location of the case study in Mashhad, Razavi Khorasan, Iran

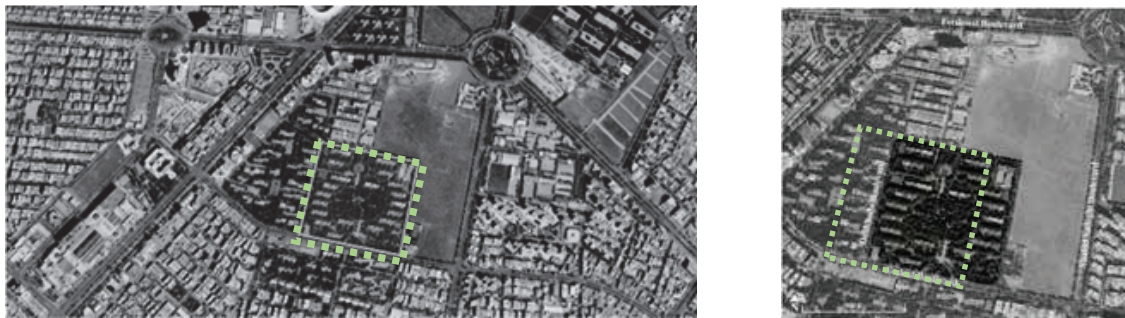


Fig. 6: The location of the 600-unit residential complex (Google Earth)

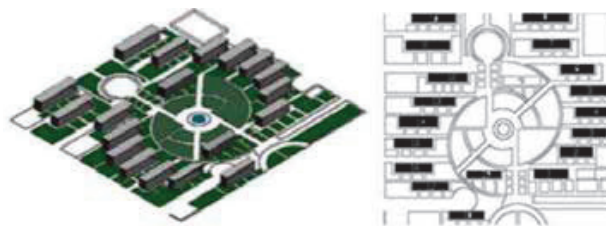


Fig. 7: The overall structure of the 600-unit complex.



Fig. 8: The 600-unit complex.

Table 3: Reliability of the variables

Concept	Component	Number of questions	Cronbach's alpha coefficients
Physical characteristics	Objective Factors	6	0.719
	Subjective factors	4	0.721
Place attachment	Place identity	7	0.202
	Place dependence	4	0.721
	Process	4	0.764

Table 4: Demographic information of the participants

Variable	Gender	Education	Age	Marital status	Type of residence	Length of residence
	Male Female	Less than a diploma Diploma Associate Degree Bachelor's Degree Master's Degree Ph.D.	Less than 20 years 21-30 years 31-40 years 41-50 years 51-60 years More than 60 years	Single Married (without children) Married (with children)	Owned Rented	Less than 5 years 6-10 years 11-15 years 16-20 years 21-30 years Over 30 years
Frequency (%)	50.3 49.7	4.8 26.9 14.5 33.8 16.6 3.4	0.7 21.4 35.2 26.2 8.3 8.3	24.8 9.7 65.5	73.8 26.2 26.9	11.0 18.6 12.4 11.7 19.3 26.9

a household size of 3.39 (Parsoumash Consultant Engineering, 2010) is 2034 (=600*3.39). According to the Cochran formula (with an error coefficient of .07 and response distribution rate of .5), the minimum reliable sample size is 154. As mentioned in Section 3, the sample size is 158 (excluding the pilot test samples) in this study. The Cochran formula computation is as Eq. 1:

$$n = \frac{\frac{z^2 pq}{d^2}}{1 + \frac{1}{N} \times \left(\frac{z^2 pq}{d^2} - 1 \right)} \quad (1)$$

$$n = \frac{\frac{1.812^2 * 0.5 * 0.5}{0.07^2}}{1 + \frac{1}{2034} \times \left(\frac{1.812^2 * 0.5 * 0.5}{0.07^2} - 1 \right)} = 154.84$$

Eq. 1: Cochran formula computation, Based on: (Cochran, 1977)

RESULTS AND DISCUSSION

Reliability

Various approaches are used to calculate reliability, including test-retest, parallel or peer-to-peer, and Cronbach's alpha. Cronbach's alpha is the most common measure of internal consistency ("reliability"). It is most commonly used when multiple Likert questions in a survey/questionnaire exist that form a scale and to determine if the scale is reliable. So, in this study, Cronbach's alpha test was used to measure data reliability. This coefficient for the components of physical factors (subjective and objective factors) and place attachment (place identity, social bonding, and place attachment) is shown in Table 3.

Demographic information

As shown, Cronbach's alpha coefficient is higher than 0.7 for all components, which indicates the reliability of the measurement tool for evaluating the variables.

The sample's demographic characteristics, such as type of residence, gender, education, age, marital status, and length of residence, are shown in Table 4.

Table 5: Tests of normality

		kolmogorov-smirnov ^a			shapiro-wilk		
		statistic	df	sig.	statistic	df	sig.
Place attachment		.062	158	.200 [*]	.987	158	.216
Subjective characteristics	physical	.107	158	.000	.962	158	.000
Objective characteristics	physical	.111	158	.000	.983	158	.068
Age		.221	158	.000	.893	158	.000
Gender		.342	158	.000	.636	158	.000
Education		.217	158	.000	.911	158	.000
Marital status		.409	158	.000	.636	158	.000
Type of residence		.461	158	.000	.550	158	.000
Length of residence		.191	158	.000	.874	158	.000
Spent time		.229	158	.000	.877	158	.000

df: Degree of Freedom

sig: Significance Level

Data analysis

The data were analyzed by SPSS and SmartPLS software. The first case was used to provide descriptive and inferential statistics. The second case was used for assessing the strength of the relationships between the variables and examining other possible (hidden) relationships.

Inferential statistics

To test the mentioned hypotheses in section 3, first, the normality of data is examined using the Kolmogorov-Smirnov as well as the Shapiro-Wilk test. Since the sample size is bigger than 50, Kolmogorov-Smirnov is more appropriate to rely on when the results of those two do not match (Table 5).

The Kolmogorov-Smirnov test is used to test the null hypothesis that a set of data comes from a normal distribution. However, $SIG.<0.05$ suggests strong evidence of non-normality. According to this, non-parametric tests are used to test the relations between place attachment with different variables. The test to be used depends upon the type of research question being asked. The other determining factors are the type of data being analyzed and the number of groups or data sets involved in the study (Parikh *et al.*; 2010). In this study, to measure the relationships between place attachment and objective physical characteristics, subjective physical characteristics, as well as the component of time, Spearman Correlation is used. Additionally, Spearman Correlation, Mann-Whitney U, and Kruskal-Wallis H are used to test different individual characteristics (depending on the types of variables). Table 6 shows the result of these tests.

The results show that there are significant relationships between Objective Physical Characteristics and Place Attachment (with a 99% probability), Subjective Physical Characteristics and Place Attachment (with a 99% probability), and Time and Place attachment (with a 98% probability). This means that by increasing the quality of objective and subjective physical characteristics and increasing the amount of time connecting with the place in non-gated residential complexes, residents' attachment to the environment will be strengthened. To determine the effects of mentioned variables and their strength on the formation of place attachment in non-gated residential complexes, and to find other hidden indirect relationships, structural equations were prepared using PLS software.

Structural equations

Path analysis and causal modeling were introduced by Wright in the 1920s. It can model latent constructs uncontaminated by measurement error (Hair, 1998; Wang *et al.*, 2004) under conditions of non-normality and small to medium sample sizes. PLS path modeling can be used for analyzing the multiple-block structure of variables when the data has these features: causal relationship, small sample, missing values, or display of co-linearity (Wixom and Watson, 2001). In order to discover the relationships of hidden variables, besides the four mentioned hypotheses, four other hypotheses were defined to form the structural model for place attachment. These hypotheses are mentioned below:

H1.1: Objective physical characteristics are related

Table 6: The result of the analysis tests

	Hypothesis	Test	Sig. (p)	Correlation coefficient (r)	Z	Mann- Whitney U	Kruskal- Wallis H	df	Result
H-1.1	There is a significant relationship between the objective physical characteristics of the place and place attachment in the residential complexes.	Spearman	.004	.241**	-	-	-	-	Valid
H-1.2	There is a significant relationship between the subjective physical characteristics of the place and place attachment in the residential complexes.	Spearman	.007	.223**	-	-	-	-	Valid
H-1.3	There is a significant difference between place attachment in men and women.	Mann-Whitney U	.704	-	-.380	2532.000	-	-	Invalid
H-1.3	There is a significant difference between place attachment in owners and tenants.	Mann-Whitney U	.024	-	-2.264	1560.000	-	-	Valid
H-1.3	There is a significant difference between place attachment among people with different education levels.	Kruskal-Wallis H	.180	-	-	-	7.592	5	Invalid
H-1.3	There is a significant difference between place attachment among people with different marital statuses.	Kruskal-Wallis H	.327	-	-	-	2.223	2	Invalid
H-1.3	There is a significant relationship between age of residents and place attachment in the residential complexes.	Spearman	.131	.126	-	-	-	-	Invalid
H-1.4	There is a significant relationship between the length of residence and place attachment in the residential complexes.	Spearman	.004	.237**	-	-	-	-	Valid
H-1.4	There is a significant relationship between the amount of time spent in the complexes' public spaces and place attachment in the residential complexes.	Spearman	.021	.192*	-	-	-	-	Valid

df: Degree of Freedom

sig: Significance Level

z: z-score

to Place attachment.

H1.2: Subjective physical characteristics are related to Place attachment.

H1.3: Individual characteristics are related to Place attachment.

H1.4: Time is related to Place attachment.

H1.5: Objective physical characteristics are related to time.

H1.6: Subjective physical characteristics are related to time.

H1.7: Individual characteristics are related to time.

H1.8: Individual characteristics are related to subjective physical characteristics.

H1.9: Objective physical characteristics are related

to subjective physical characteristics.

The conceptual framework of place attachment modeling is defined based on these hypotheses and is shown in Fig. 9. In fact, this model demonstrates the possible hidden relationships between different variables of this study. Further analysis and calculation with Smart PLS software will examine whether these hypotheses are correct or not.

The path coefficients for the structural model and the weights for the measurement model are obtained by SmartPLS 3.0 software. The result of the bootstrap resampling technique, which was used to determine the statistical significance of the paths, shows that five of these paths are significant. Table 7 shows the path coefficients and significance

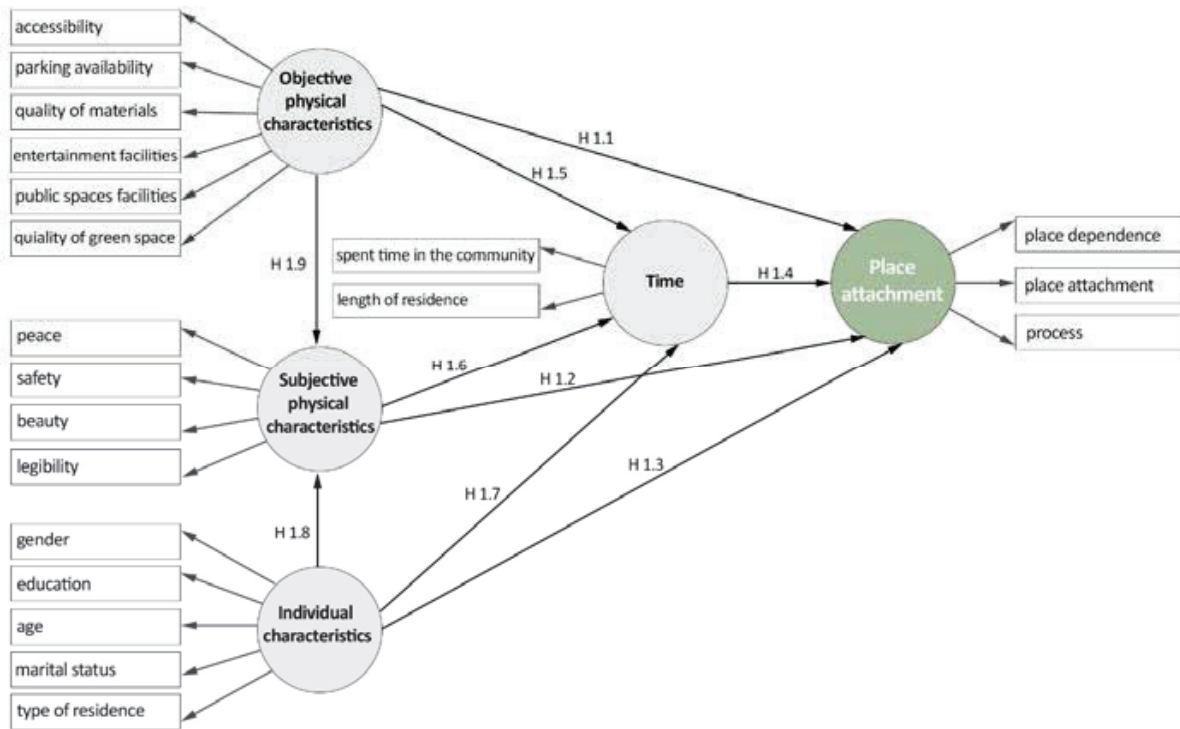


Fig. 9: The conceptual framework of PLS path model based on the hypotheses

Table 7: Path coefficients (mean, Standard deviation, T Statistics and P values)

	Hypotheses	Sample mean	Standard deviation	T statistics	P value	parameter	Conclusion
H1.1	Objective physical characteristics → Place attachment	0.403	0.102	3.896	0.000	3.896	Supported
H1.2	Subjective physical characteristics → Place attachment	0.187	0.105	1.876	0.030	1.876	Supported
H1.3	Individual characteristics → Place attachment	0.000	0.154	0.244	0.404	0.244	Not supported
H1.4	Time → Place attachment	0.234	0.129	1.926	0.027	1.926	Supported
H1.5	Objective physical characteristics → Time	0.065	0.111	0.570	0.284	0.570	Not supported
H1.6	Subjective physical characteristics → Time	0.000	0.108	0.181	0.428	0.181	Not supported
H1.7	Individual characteristics → Time	-0.476	0.351	1.700	0.045	1.700	Supported
H1.8	Individual characteristics → Subjective physical characteristics	-0.036	0.112	0.426	0.335	0.426	Not supported
H1.9	Objective physical characteristics → Subjective physical characteristics	0.501	0.090	5.365	0.000	5.365	Supported

levels. The path coefficients are ranked as follows (from highest to lowest): “Objective physical characteristics ® Subjective physical characteristics” (5.365), “Objective physical characteristics ® Place

attachment” (3.896), “Time ® Place attachment” (1.926), “Subjective physical characteristics ® Place attachment” (1.876), “Individual characteristics ® Time” (1.700).

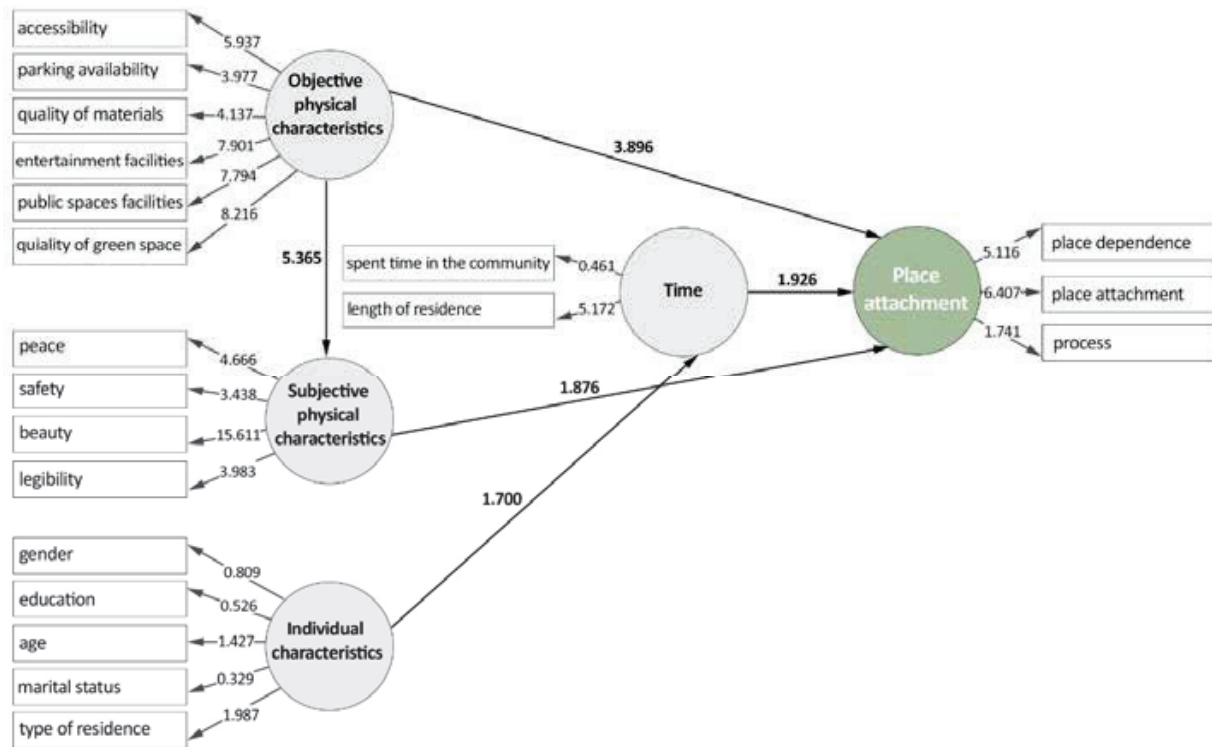


Fig. 10: The result of the PLS path model

The results demonstrate that “Objective physical characteristics” not only directly affect “Place attachment”, but also indirectly impact it by affecting “Subjective physical characteristics” in residential complexes. “Time” and “Subjective physical characteristics” have a direct influence on “Place attachment”, while the impact of “Individual characteristics” on “Place attachment” is indirect. In fact, “Individual characteristics” affect the “time” people spend in a place, and an increase in this “time” factor leads to an increase in “Place attachment”. Based on these findings, the initial conceptual model has been modified, and the final path flow with the parameters of each path is illustrated in Fig. 10.

CONCLUSION

Place attachment is important in assessing how people connect with their environment, and it contributes to creating better residential areas that encourage responsibility, cooperation, and an overall improvement in quality of life. This study focuses on identifying the factors that promote and strengthen

place attachment in residential complexes, using the 600-unit residential complex in Mashhad as a case study due to its unique environmental features. This complex is unique in its environmental features and design, which is based on the neighborhood-garden concept and shares common facilities with the urban environment, such as green spaces and entertainment facilities. Although the complex was constructed around 50 years ago, its residents still have a strong attachment to the environment, which has resulted in efforts to maintain and improve the surroundings, leading to a longer useful life for the residential buildings. This research investigates the impact of three general components, namely the physical characteristics of the residential environment (objective and subjective), the individual characteristics of the residents, and time, on place attachment in the 600-unit residential complex, utilizing SPSS and PLS software. The first case (SPSS) was used to provide descriptive and inferential statistics. The second case (PLS) was used to assess the strength of the variables’ relationships and examine

other possible (hidden) relationships. Both methods yielded completely compatible results, indicating that three factors, namely time, subjective, and objective physical characteristics, have a direct impact on place attachment. Objective physical characteristics not only directly influence place attachment but also indirectly affect it by influencing subjective physical characteristics in residential complexes. The relationship between individual characteristics and place attachment is indirect. It means that individual characteristics impact the time people relate to a place, and an increase in this time factor leads to an increase in place attachment. As represented in Table 6, among the individual characteristics, type of residence is the only effective factor with a significant relationship with place attachment. Landlords have more place attachment than tenants. This also directly relates to the time people live in the complex. The average landlord's length of residency in the complex is significantly longer than tenants. The findings of the study reveal that the residents of the 600-unit residential complex are mainly attached to the place due to its distinct physical features. The loadings of the physical characteristic's components demonstrated that the quality of green spaces, entertainment facilities, public space facilities, and accessibility were the most important components determining objective physical characteristics, and beauty, peace, legibility, and safety were the most influential factors determining subjective physical characteristics, respectively. These findings highlight the crucial role of architects and planners in designing high-quality residential environments that satisfy people's needs, improve their quality of life, and enhance their sense of place attachment. To this end, architects and planners in designing or redesigning residential complexes should consider factors such as recreational and sports facilities, facilities needed for public spaces, security, legibility, beauty, and pleasantness of spaces. Providing these facilities, not only fulfills functional needs but also strengthens place dependency and increases people's presence in the environment. Increased presence enhances the likelihood of social interactions and strengthens social links within the place, leading to greater place attachment. These results can be used in architectural programming within the design process of similar residential complexes or in redesigning residential complexes with similar characteristics to the 600-unit

complex. However, place attachment is a complex and multidimensional concept that involves various aspects. Therefore, understanding and measuring place attachment requires a comprehensive and multidimensional approach and further research could investigate the effectiveness of social features in residential complexes for addressing concerns such as raising the level of human responsibility and cooperation in residential environments. Overall, this research provides significant insights into the development and strengthening of place attachment in residential settings, highlighting the significance of designing high-quality residential environments that cater to people's needs and promote their overall well-being.

AUTHOR CONTRIBUTIONS

Gh. Motalebi; A. Khajuei and F. Fanaei Sheykholeslami designed the model and the computational framework and analyzed the data. All the authors conceived the study and were in charge of the overall direction and planning.

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CONFLICT OF INTEREST

The authors declare no potential conflict of interest regarding the publication of this work. 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 witnessed by the authors.

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ABBREVIATIONS (NOMENCLATURE)

PLS	Partial Least Squares
POE	Post-Occupancy Evaluation
SPSS	Statistical Package for the Social Sciences

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ORIGINAL RESEARCH PAPER

Transformational leadership, knowledge-based work passion and organizational citizenship behavior: A survey dataset from public university

U. Udin*

Department of Management, University of Muhammadiyah Yogyakarta, Yogyakarta, Indonesia

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ABSTRACT

BACKGROUND AND OBJECTIVES: The leadership styles in higher education, especially public universities, face enormous challenges in handling global situations, i.e., the Covid-19 pandemic. The current dataset of this study aims to verify how transformational leadership is more effective in influencing organizational citizenship behavior through knowledge-based work passion. Individuals with a high level of knowledge-based work passion are able to feel happiness, pride, and pleasure, and are totally involved and make sense of their work. In addition, they also show highly positive emotions toward the people around them and are happy to assist them.

METHODS: Structural equation modeling (SEM) with AMOS 21.0 software is used to analyze the data collected from 221 professional lecturers utilizing a purposive sampling technique from a total of 1,242 lecturers in Southeast Sulawesi, Indonesia public universities. The loading values of the survey instrument, composite reliability, and average variance extracted are tested to justify reliability and convergent validity for the measurement model in this study.

FINDINGS: The results show that transformational leadership positively and significantly affects knowledge-based work passion ($\beta = 0.568$, C.R. = 6.536; $p < 0.001$) but not organizational citizenship behavior ($\beta = 0.061$, C.R. = 0.608; $p > 0.001$). In addition, knowledge-based work passion directly has a positive and significant effect on organizational citizenship behavior ($\beta = 0.696$, C.R. = 3.571; $p > 0.001$). Further, the mechanism effect of transformational leadership on organizational citizenship behavior through knowledge-based work passion was tested. The result indicates the mediating role of knowledge-based work passion ($\beta = 0.395$, $p > 0.001$) in the relationship between transformational leadership and organizational citizenship behavior.

CONCLUSION: This study contributes significantly to organizational management practices, especially in the field of education, by identifying how transformational leadership improves organizational citizenship behavior through knowledge-based work passion. When individuals recognize their leaders as transformational, they are more likely to behave and engage in volunteering for extra tasks, having a positive work environment, feeling more connected to the organization and being flexible in their duties.

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*Corresponding Author:

Email: udin@umy.ac.id

Phone: +6285343709228

ORCID: [0000-0002-5491-9085](https://orcid.org/0000-0002-5491-9085)

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INTRODUCTION

Leadership is the ability to influence, direct and inspire individual behavior to contribute positively in the workplace. The leadership styles in higher education, especially public universities, face enormous challenges in relation to handling global situations, i.e., the Covid-19 pandemic. Leaders who focus on academics must create a comfortable work atmosphere (Tajpour and Razavi, 2023) and a fair as well as competitive academic culture during and after the global pandemic (Russell *et al.*, 2021; Wei and Vasudevan, 2022). In addition, leaders in higher education need to identify themselves as individuals who have high aspirations, are quick and precise in acting as well as implementing strategies for organizational progress, and taking the time to reflect on successful career growth (Selzer and Robles, 2019). Garad *et al.* (2022) emphasized that the transformational leadership style can improve employee performance and effectiveness as well as organizational efficiency. In addition, transformational leadership promotes transparency and accountability in higher education institutions (Handayani *et al.*, 2022). Therefore, transformational leadership, which is always called as future-oriented with strategic policies (Dharmasmita *et al.*, 2020; Udin and Shaikh, 2022), is seen as capable of increasing employee confidence and organizational innovation to overcome and resolve various situations and turbulence within the organization, especially higher education. Transformational leadership, over the last three decades, has emerged as one of the most effective leadership styles in driving and achieving organizational goals (Avolio *et al.*, 2009; Udin *et al.*, 2023). Transformational leadership is seen as a process in which a leader describes a vision of the future in detail, stimulates the behavior of individuals to appear more creative, and supports and guides them by providing inspirational motivation to achieve common goals. Previous studies on the linkage between transformational leadership and organizational citizenship behavior indicate contradictory findings. Khaola and Rambe (2021); Pattnaik and Sahoo (2021); Qalati *et al.*, (2022) revealed a significant direct relationship between transformational leadership and organizational citizenship behavior. In contrast, no significant relationship was found between transformational leadership and organizational citizenship behavior

(Yuwono *et al.*, 2023; Zhang *et al.*, 2020). More studies need to be on the linkage of transformational leadership to organizational citizenship behavior mediated by knowledge-based work passion. Thus, to address this gap, this paper aims to verify how transformational leadership influences organizational citizenship behavior through knowledge-based work passion. Individuals with a high level of knowledge-based work passion are able to feel happiness, pleasure, and pride and are totally involved and make sense of their work. In addition, they also show highly positive emotions toward the people around them and are happy to assist them.

Literature review and hypotheses development

The review of literature in this study focuses on transformational leadership and its impact on organizational citizenship behavior through knowledge-based work passion.

Organizational citizenship behavior

Organizational citizenship behavior refers to discretionary actions taken by employees to support organizational effectiveness, but these actions are not mandatory and are not formally rewarded in organizational management. Organizational citizenship behavior is individual discretionary behavior that, in the aggregate, promotes organizational function and effectiveness (Organ, 1988). Organizational citizenship behavior shows employee behavior needed by the organization to achieve common goals (Khan *et al.*, 2020), such as helping colleagues, contributing positively to various organizational events and providing useful suggestions for organizational development (Bambale, 2014; Udin and Yuniawan, 2020). In social identity theory, Ashforth and Mael (1989), Scheepers and Ellemers (2019) assert that individuals tend to categorize themselves into groups and organizations that are in line with their personal goals. When employees feel congruence with organizational values and norms and get kindness from the organization, they will have a reciprocal relationship with the organization, are more likely to behave positively according to organizational expectations, and show various other discretionary behaviors in helping others outside their job description (He *et al.*, 2019). Several previous studies have proven that organizational citizenship behavior is significantly

influenced by transformational leadership (Hapsari *et al.*, 2021; Qalati *et al.*, 2022) and passion for work (Amalia *et al.*, 2021; Gao and Zhang, 2022; Wan *et al.*, 2022).

Transformational leadership

The concept of transformational leadership was first proposed by Burns (1978) to describe 'world-class leaders'. Several years later this concept was developed by Bass (1985) and Bass and Stogdill (1990); that transformational leadership is characterized as a leader who is able to motivate followers to achieve greater common goals by putting aside self-interest. According to Bass and Avolio (2004), there are 4 main characteristics of transformational leadership: intellectual stimulation (the ability of leaders to challenge assumptions and generate innovative ideas of followers); idealized influence (the ability of leaders to behave as individuals who are respected and admired); individualized consideration (the leader's ability to pay attention to and support the needs of each follower); and inspirational motivation (the ability of leaders to inspire and encourage followers' self-confidence). Transformational leadership, as the most powerful leadership style, is able to inspire employees to develop new skills, stimulate them to achieve common goals beyond personal interests, and endlessly encourage employees to seek new opportunities to achieve the highest level of achievement (Le *et al.*, 2018). Transformational leadership significantly impacts increasing organizational knowledge capital and achieving the highest results according to organizational expectations (Son *et al.*, 2020). Transformational leadership influences the organizational citizenship behavior of followers to produce effective organizational transformation (Koo and Lee, 2022). Transformational leaders always engage in meaningful communication with followers to pursue common goals, targets, and visions. Transformational leaders also appear inspiring and focus on encouraging follower initiatives within the organization (Astuty and Udin, 2020), so they work with high enthusiasm and passion for work (Althnayan *et al.*, 2022; Suhana *et al.*, 2019; Sulistiyan *et al.*, 2018). Thus,

H1: Transformational leadership has a positive and significant effect on organizational citizenship behavior.

H2: Transformational leadership has a positive

and significant effect on knowledge-based work passion.

Knowledge-based work passion

Work passion has become a great concern for today's organizations because of the belief that employees who have passion for work are able to produce better performance (Duckworth, 2016; Ho and Astakhova, 2020). Work passion indicates a very strong feeling from the individual towards work activities because of the values and meanings contained therein (Vallerand *et al.*, 2003). Employees who have passion for work contribute to higher work engagement and engagement as well as performance gains and achieve higher success (Chummar *et al.*, 2019; Ho and Astakhova, 2018; Jachimowicz *et al.*, 2022). Work passion, from a theoretical point of view, is the self-identity of individuals who are passionate about work (Birkeland and Buch, 2015) and are embedded as well as into their core self-concept (Vallerand *et al.*, 2003). Work passion, in organizational practice, is the desire of employees to work optimally by showing a higher performance contribution. In a previous study, Vallerand *et al.* (2003) conceptualized work passion into two types: harmonious and obsessive passion. Obsessive work passion indicates individual enthusiasm in their work with total and uncontrollable work involvement to the exclusion of other activities (Lalande *et al.*, 2017). Meanwhile, harmonious work passion describes individual work enthusiasm in their work by internalizing work as a self-identity and being free to engage in work as well without any pressure. Work passion can encourage higher levels of career achievement in organizations, and harmonious work passion stimulates quality performance improvement (Amarnani *et al.*, 2020). Employees who have harmonious work passions tend to appear more proactive, dare to challenge the status quo, and are more than happy to voice constructive thoughts on their work and organization. Employees with harmonious passions also strive to succeed in their mission, overcome work problems with constructive suggestions and invest more time and energy at work (Gao and Jiang, 2019; Ho *et al.*, 2018), so they are willing to share useful ideas to improve performance and achieve the expected goals. Passion for knowledge encourages individuals to engage in voluntary practices related to knowledge, especially in terms of donating and disseminating

existing knowledge (Fraser, 2021; Kaiser *et al.*, 2007; Najmuldeen, 2021). Passion for knowledge becomes a value and self-concept that encourages employees to continue learning and increasing their capacity to provide useful things to all elements of the organization. Thus,

H3: Knowledge-based work passion has a positive and significant effect on organizational citizenship behavior.

H4: Knowledge-based work passion mediates the effect of transformational leadership on organizational citizenship behavior.

To address the previous research gap, this paper aims to verify how transformational leadership influences organizational citizenship behavior through knowledge-based work passion. Individuals with a high level of knowledge-based work passion are able to feel happiness, pride, and pleasure, and are totally involved and make sense of their work. In addition, they also show highly positive emotions toward the people around them and are happy to assist them. The current study was carried out in Southeast Sulawesi, Indonesia, in 2019.

MATERIALS AND METHODS

Sample methodology

This study greatly considers and applies a quantitative approach. Using the database of professional lecturers with status as civil servants via a purposive sampling technique from a total of 1,242 lecturers, 300 questionnaires were distributed to all public universities in Southeast Sulawesi, Indonesia. In the first stage, 10

questionnaires were sent to University of Sembilanbelas November (USN) Kolaka via e-mail and WhatsApp, and 7 were returned. In the second stage, 265 questionnaires were distributed directly by the researcher to University of Halu Oleo (UHO) Kendari, and 231 were returned. In the third stage, 25 questionnaires were administered directly by the researcher to the State Islamic Institute of Kendari, and 21 were returned. Thus, the total number of questionnaires in the formal data collection was successfully returned was 259 (with a response rate of 86.3%). After the process of selecting and verifying the questionnaires, there were 38 questionnaires not suitable for processing for several reasons; for example, the questionnaires needed to be completed and fulfilled the requirements as respondents (i.e., did not include functional structure). Therefore, the number of valid and appropriate questionnaires to be used in this study was 221, which will then be processed through descriptive statistics.

Table 1 shows the descriptive statistics of respondents that males were 62.9% and 37.1% were females. From an age point of view, 43.9% were aged between 41 and 50, 28.5% were over 51 years old, 19% were between 31 to 40 years old, and 8.6% were under 30. In terms of educational qualification, 64.7% were master's degrees, and 35.3% were doctoral degrees. In terms of work experience, 42.6% had worked for 11 to 15, and 32% had worked for more than 16 years. Furthermore, in terms of functional structure, 43.4% of the respondents were expert assistants, 33% were assistant professors, 23.1% were Associate professors, and 0.5% were full professors.

Table 1: Demographic characteristics of respondents

Demographics	Characteristics	Frequency	Percentage (%)
Gender	Male	139	62.9
	Female	82	37.1
Qualification	Master	143	64.7
	Doctor	78	35.3
Age	≤ 30 year old	19	8.6
	31-40 year old	42	19
	41-50 year old	97	43.9
	≥ 51 year old	63	28.5
Work experience	3-5 year	22	10
	6-10 year	34	15.4
	11-15 year	94	42.6
	> 16 year	71	32
Functional structure	Expert assistant	96	43.4
	Assistant professor	73	33
	Associate professor	51	23.1
	Full professor	1	0.5

Measures

Transformational leadership. Transformational leadership is adapted from Kirkman *et al.* (2009), MacKenzie *et al.* (2001) and measured with four dimensions and their interrelationships: 1. Core transformational leadership behavior (three items: CT1, CT2, CT3), 2. High-performance expectations (three items: HP1, HP2, HP3), 3. Supportive leader behavior (four items: SL1, SL2, SL3, SL4), 4. Intellectual stimulation (three items: IS1, IS2, IS3). **Knowledge-based work passion.** Knowledge-based work passion is adapted from Carmeli *et al.* (2011), Vallerand *et al.* (2003) and associated with eight items: KK1, KK2, KK3, KK4, KK5, KK6, KK7, KK8. **Organizational citizenship behavior.** Organizational citizenship behavior is adapted from Zoghbi Manrique de Lara (2008), Zoghbi Manrique de Lara and Espino Rodríguez

(2007) and associated with three dimensions: 1. OCB-Organization (four items: BO1, BO2, BO3, BO4), 2. OCB-Colleagues (four items: BC1, BC2, BC3, BC4), 3. OCB-Students (four items: BS1, BS2, BS3, BS4).

RESULTS AND DISCUSSION

All valid samples were analyzed using structural equation modeling (SEM) with AMOS 21.0 software to confirm the measurement model. The instruments used in this study were adapted from previous studies. It had been validated to confirm and justify the content, face validity, and reliability. The assessment of factor loading, composite reliability, and average variance extracted was carried out.

Assessment of normality

Table 2 shows that the univariate normality test

Table 2: Assessment of normality

Variable	Min	Max	Skew	c.r.	Kurtosis	c.r.
CT1	3.000	7.000	-0.371	-2.250	0.469	1.423
CT2	3.000	7.000	-0.338	-2.050	-0.087	-0.263
CT3	3.000	7.000	-0.344	-2.087	0.645	1.957
HP1	4.000	7.000	-0.212	-1.284	-0.589	-1.786
HP2	3.000	7.000	-0.369	-2.238	-0.050	-0.153
HP3	3.000	7.000	-0.164	-0.996	-0.566	-1.717
SL1	3.000	7.000	-0.401	-2.434	-0.003	-0.009
SL2	3.000	7.000	-0.307	-1.860	-0.523	-1.586
SL3	3.000	7.000	-0.345	-2.096	-0.236	-0.716
SL4	3.000	7.000	-0.374	-2.268	-0.344	-1.043
IS1	4.000	7.000	-0.064	-0.390	-0.208	-0.633
IS2	4.000	7.000	0.168	1.022	-0.414	-1.255
IS3	4.000	7.000	-0.137	-0.833	-0.197	-0.599
BO1	4.000	7.000	-0.304	-1.844	-0.679	-2.060
BO2	3.000	7.000	-0.342	-2.078	0.146	0.443
BO3	3.000	7.000	-0.412	-2.502	-0.281	-0.851
BO4	3.000	7.000	-0.303	-1.840	-0.463	-1.405
BC1	3.000	7.000	-0.024	-0.145	-0.042	-0.127
BC2	4.000	7.000	-0.394	-2.390	-0.718	-2.180
BC3	3.000	7.000	0.085	0.514	-0.652	-1.979
BC4	3.000	7.000	-0.195	-1.184	-0.260	-0.790
BS4	3.000	7.000	-0.417	-2.531	-0.197	-0.597
BS3	3.000	7.000	-0.374	-2.267	-0.414	-1.256
BS2	3.000	7.000	-0.174	-1.056	-0.413	-1.253
BS1	3.000	7.000	-0.412	-2.498	-0.434	-1.318
KK1	3.000	7.000	-0.224	-1.358	-0.721	-2.187
KK2	3.000	7.000	-0.139	-0.843	-0.622	-1.889
KK3	3.000	7.000	-0.334	-2.026	-0.736	-2.232
KK4	3.000	7.000	-0.108	-0.653	-0.756	-2.293
KK5	4.000	7.000	-0.202	-1.224	-0.635	-1.928
KK6	3.000	7.000	-0.195	-1.186	-0.575	-1.746
KK7	4.000	7.000	-0.150	-0.913	-0.716	-2.173
KK8	4.000	7.000	-0.334	-2.030	-0.644	-1.953
Multivariate					30.213	4.673

has been fulfilled because the CR value for skewness and kurtosis is less than 2.58. This means that each indicator has skewness and kurtosis, which form a normal curve pattern. The results of the multivariate normality test show that the CR value is 5.192, which is below 8 (Ferdinand, 2014) or below 10 (Kline, 2015), indicating the multivariate normal distribution.

Factor loading, composite reliability, and average variance extracted

Table 3 presents the constructs' factor loading, composite reliability (CR) and average variance extracted (AVE). This result indicates that all 34 indicators are acceptable and that all functions exhibit the required standard loading values, CR and AVE for measuring model functions. The values of

factor loading (ranging from 0.549 to 0.948) are more than 0.5, CR coefficient of all variables (ranging from 0.800 to 0.981) is higher than 0.7, and AVE values of all variables (ranging from 0.577 to 0.864) are higher than 0.5 indicating the perfect set of variables (Hair *et al.*, 2012; Henseler *et al.*, 2015).

Goodness of fit index

Table 4 and Confirmatory Factor Analysis (CFA) of Figs. 1, 2, 3 and 4 show the results of the goodness of fit indices. All suggested indices for the goodness of fit meet the standard criteria set by Hair *et al.* (2014). Hair *et al.* (2014) recommended that the root mean square error of approximation (RMSEA) for each model = 0.042, 0.048, 0.000, 0.023 < 0.05; the minimum discrepancy divided by its degrees of

Table 3: Standard Factor loading, composite reliability (CR), and average variance extracted (AVE)

		Constructs and Items	Estimate	CR	AVE
CT1	<---	CT	0.694	0.800	0.577
CT2	<---	CT	0.908		
CT3	<---	CT	0.652		
HP1	<---	HP	0.927	0.824	0.615
HP2	<---	HP	0.650		
HP3	<---	HP	0.750		
SL1	<---	SL	0.919	0.958	0.851
SL2	<---	SL	0.927		
SL3	<---	SL	0.920		
SL4	<---	SL	0.923	0.856	0.665
IS1	<---	IS	0.791		
IS2	<---	IS	0.824		
IS3	<---	IS	0.830	0.981	0.864
KK1	<---	Knowledge-Based Work Passion	0.948		
KK2	<---	Knowledge-Based Work Passion	0.922		
KK3	<---	Knowledge-Based Work Passion	0.936		
KK4	<---	Knowledge-Based Work Passion	0.934		
KK5	<---	Knowledge-Based Work Passion	0.917		
KK6	<---	Knowledge-Based Work Passion	0.931		
KK7	<---	Knowledge-Based Work Passion	0.935		
KK8	<---	Knowledge-Based Work Passion	0.913		
BO1	<---	OCBO	0.844	0.922	0.749
BO2	<---	OCBO	0.794		
BO3	<---	OCBO	0.932		
BO4	<---	OCBO	0.886		
BC1	<---	OCBC	0.923	0.944	0.809
BC2	<---	OCBC	0.800		
BC3	<---	OCBC	0.948		
BC4	<---	OCBC	0.918		
BS1	<---	OCBS	0.549	0.875	0.644
BS2	<---	OCBS	0.849		
BS3	<---	OCBS	0.896		
BS4	<---	OCBS	0.867		

Note: CT = Core transformational leadership behavior; HP = High-performance expectations; SL = Supportive leader behavior; IS = Intellectual stimulation; OCBO = OCB-Organization; OCBC = OCB-Colleagues; OCBS = OCB-Students

Table 4: Model fitness

SEM Model	Chi-square	DF	Sig.	RMSEA	CMIN/DF	GFI	AGFI	TLI	CFI	NFI
Model 1 – Transformational leadership	84.864	61	0.023	0.042	1.391	0.945	0.917	0.983	0.987	0.954
Model 2 – Knowledge-based work passion	30.227	20	0.066	0.048	1.511	0.968	0.942	0.995	0.996	0.989
Model 3 – Organizational citizenship behavior	42.859	51	0.784	0.000	0.840	0.968	0.952	1.005	1.000	0.980
Model 4 – Full model	542.625	485	0.036	0.023	1.119	0.876	0.856	0.991	0.991	0.925

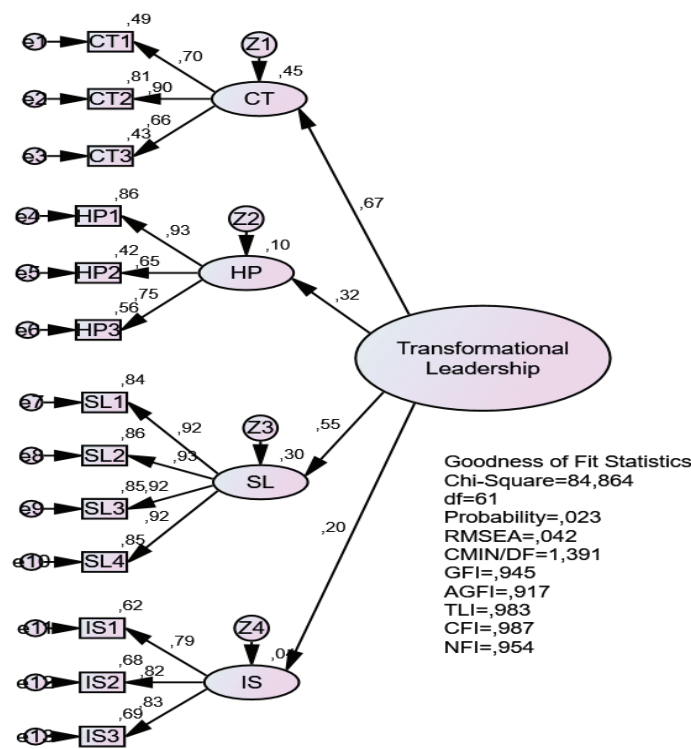


Fig. 1: CFA analysis for transformational leadership

freedom (CMIN/DF) = 1.391, 1.511, 0.840, 1.119 < 2.0; goodness fit index (GFI) = 0.945, 0.968, 0.968, 0.876 > 0.85 (Finch, 2020); adjusted goodness of fit index (AGFI) = 0.917, 0.942, 0.952, 0.856 > 0.80 (Baumgartner and Homburg, 1996); Tucker-Lewis index (TLI) = 0.983, 0.995, 1.005, 0.991 > 0.90; comparative fit index (CFI) = 0.987, 0.996, 1.000, 0.991 > 0.90; normed fit index (NFI) = 0.954, 0.989, 0.980, 0.925 > 0.90; $p < 0.05$.

Table 5 and Fig. 4 show that transformational leadership directly has a positive and significant effect

on knowledge-based work passion ($\beta = 0.568$, C.R. = 6.536; $p < 0.001$) but not on organizational citizenship behavior ($\beta = 0.061$, C.R. = 0.608; $p > 0.001$), indicating H1 is rejected and H2 is supported. In addition, knowledge-based work passion has a positive and significant effect on organizational citizenship behavior ($\beta = 0.696$, C.R. = 3.571; $p > 0.001$), indicating that H3 is supported. Further, the mechanism effect of transformational leadership on organizational citizenship behavior through knowledge-based work passion was tested. The result indicates the mediating

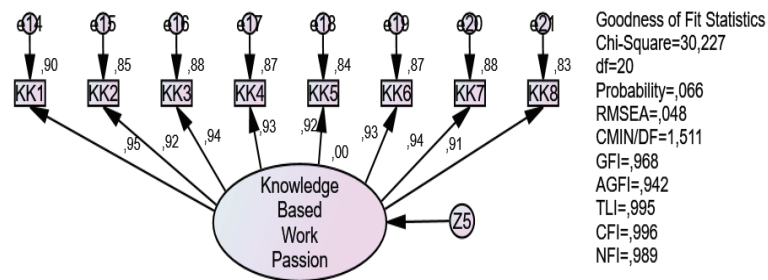


Fig. 2: CFA analysis for knowledge-based work passion

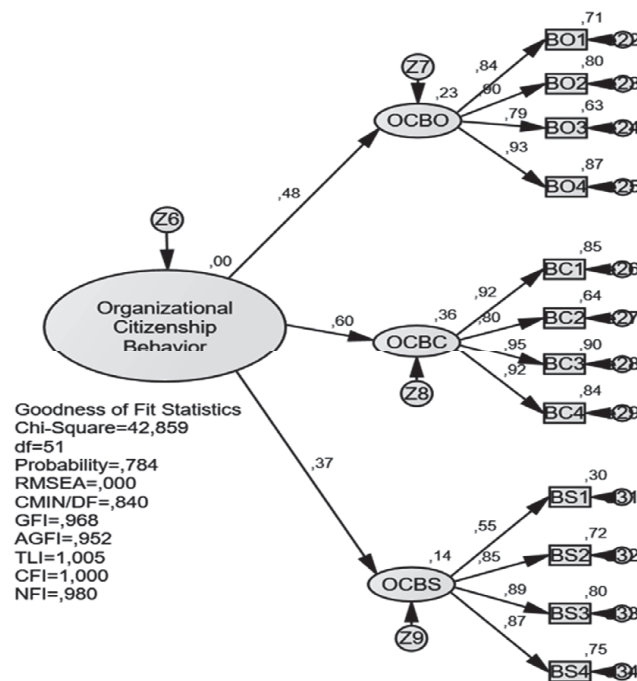


Fig. 3: CFA analysis for organizational citizenship behavior

Table 5: Hypotheses testing

Hypotheses	β	Estimate	S.E.	C.R.	p
Transformational Leadership \rightarrow Organizational Citizenship Behavior	0.061	0.013	0.021	0.608	0.543
Transformational Leadership \rightarrow Knowledge-Based Work Passion	0.568	0.527	0.081	6.536	***
Knowledge-Based Work Passion \rightarrow Organizational Citizenship Behavior	0.696	0.157	0.044	3.571	***

Note: *** Significant at the $p < 0.001$ level (two-tailed)

role of knowledge-based work passion ($\beta = 0.395$, $p > 0.001$) in the relationship between transformational leadership and organizational citizenship behavior. Thus, H4 is supported. Transformational leadership, by creating an attractive vision and paying attention to employees' needs, encourages them to appear

more proactive and innovative to achieve the good of the organization as a whole (Kim and Park, 2019; Mubarak *et al.*, 2021; Sattayaraksa and Boon-itt, 2016). Since transformational leader's challenge and inspire employees as well as appear as role models, they have the confidence and confidence to engage

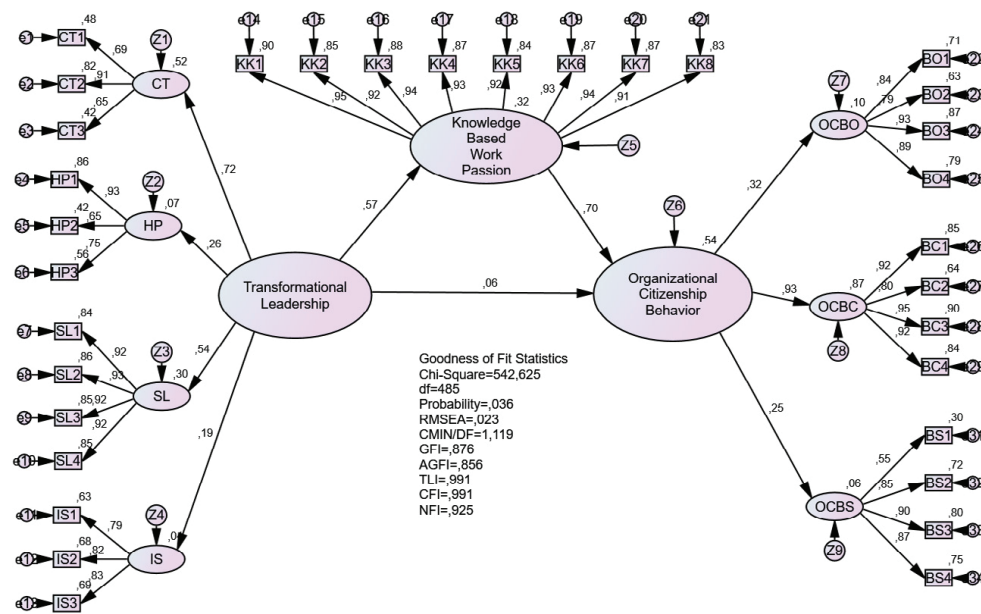


Fig. 4: Final measurement model

in learning activities to increase work knowledge and skills and demonstrate high organizational citizenship behavior to support the success of colleagues in the organization. Transformational leadership influences organizational citizenship behavior (Cho and Kao, 2022; Majeed and Jamshed, 2021; Tian et al., 2020) by increasing the level of positive emotions (Tajpour et al., 2018) and enthusiasm of employees to gather and share knowledge throughout the organization, inspiring them to be interested in moral values and ideas that support organizational goals and increasing intellectual abilities as well as encourage their work motivation to achieve common goals (Deichmann and Stam, 2015). Transformational leadership also inspires employees to develop themselves by encouraging them to produce innovative ideas, meaningful work and sense of fulfillment, which in turn can promote organizational citizenship behavior.

CONCLUSION

This study provides information about how transformational leadership affects organizational citizenship behavior through knowledge-based work passion in the higher education sector. The obtained results from the dataset analysis showed that transformational leadership directly affects knowledge-based work passion, which

positively encourages and enhances organizational citizenship behavior to contribute to organizational effectiveness. These results guide academia, researchers and practitioners to consider and analyze their studies in the social science and management field. The current dataset contributes significantly to organizational management practices, especially in the field of education, by identifying how transformational leadership improves organizational citizenship behavior through knowledge-based work passion. Transformational leadership directly impacts knowledge-based work passion, which in turn, positively encourages and enhances organizational citizenship behavior to contribute to organizational effectiveness. When individuals recognize their leaders as transformational, they are more likely to behave and engage in volunteering for extra tasks, having a positive work environment, feeling more connected to the organization and being flexible in their duties. Transformational leadership has proven to drive significant change in organizations by increasing follower commitment to the continuous search and creation of original knowledge and creating compelling visions of the future to increase inspiration and overall performance at all levels of the organization. This study was conducted in three Indonesia public universities, particularly in

Southeast Sulawesi. It is better recommended for future research to duplicate the proposed model and utilized it in another setting, for example, hospitality and tourism as well as the healthcare sector.

AUTHOR CONTRIBUTIONS

U. Udin has performed the writing the original draft, conceptualization, investigation, methodology, and supervision.

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CONFLICT OF INTEREST

The author declared no conflict of interest concerning this research work. Also, the author has checked all the ethical affairs comprising duplicates, misconduct, data making, informed consent, and plagiarism.

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ABBREVIATIONS

CT	Core transformational leadership behavior
CFA	Confirmatory factor analysis
HP	High-performance expectations
IS	Intellectual stimulation
OCBO	OCB towards organization
OCBC	OCB towards colleagues
OCBS	OCB towards students
SL	Supportive leader behavior

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ORIGINAL RESEARCH PAPER

The relationship between financial and non-financial measures, organizational justice, and employee satisfaction

M. Hakkak¹, M. Nadaf^{2,*}, H. Khalilipour¹

¹ Department of Public Administration, Faculty Economics and Administrative Sciences, University Lorestan, Khorramabad, Iran

² Department of management, Faculty economic and Social Science, Shahid Chamran University of Ahvaz, Ahvaz, Iran

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ABSTRACT

BACKGROUND AND OBJECTIVES: Today, human resources play a key role in the success of organizations and leading organizations have creative, motivated and capable employees. In addition to the characteristics of the employees, the measures and practices related to strategic human resources management planned and implemented by organizations are effective mechanisms to attract employees who believe in their abilities and create energy and motivation in the Khuzestan Regional Water Organization, like any other organization. Also, it requires the deployment of the strategic human resources management capacity and its subsystems to improve the perceived organizational fairness of employees in order to improve work behavior and employee satisfaction, which the present study has dedicated to this important topic. The aim of the study is therefore to examine the relationship between performance appraisal measures and employee satisfaction and to investigate the mediating role of procedural and distributive justice in the relationship.

METHODS: The research population were employees of the Khuzestan Regional Water Organization. The sample size was selected based on Morgan's table as 297 people. Data were collected using simple random sampling method. Data were analyzed by descriptive and inferential statistics using SPSS25 and AMOS24 software.

FINDINGS: Based on the quantitative data analysis, the results of testing the research hypotheses show that financial measures are significantly related to procedural fairness (C.R.= 6.009) and distributive fairness (C.R.= 5.748), non-financial measures are significantly related to procedural fairness (C.R.= 3.643) and Distributive Justice (C.R.= 5.196). Financial metrics have a significant correlation with employee satisfaction (C.R.= 4.080), non-financial metrics have a significant correlation with employee satisfaction (C.R.= 2.569). Procedural fairness has a significant association with employee satisfaction (C.R.= 2.786), distributive fairness has a significant association with employee satisfaction (C.R.= 2.084). Procedural and distributive justice play a partially mediating role in the relationship between financial and non-financial measures and employee satisfaction.

CONCLUSION: The results showed that the use of the comprehensive performance evaluation system is effective on organizational justice and the result will lead to the improvement of the job satisfaction of the employees and the results of this research can be used and generalized in governmental organizations and public non-governmental organizations that have almost the same organizational structure. The use of non-financial measures is suggested to evaluate employee performance, in addition to using traditional financial objective measures to evaluate performance.

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*Corresponding Author:

Email: m.nadaf@scu.ac.ir

Phone: +989124058622

ORCID: [0000-0003-2888-4904](https://orcid.org/0000-0003-2888-4904)

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INTRODUCTION

Performance measurement (PM) is an essential part of management accounting research (Nuhu et al., 2022). PM and rewards are important as they are critical elements for motivating organizations (Rafiq et al., 2020). Implementation of Performance Measurement Systems (PMS) significantly assist the organization in conducting strategic plans, evaluating the achievement of goals, and codifying the management services compensation programs (Agritansia and Sholihin, 2011). Many organizations fail to implement their strategies, mainly because of the difficulty in translating the strategy into operational conditions (Kumar et al., 2021). Therefore, it is necessary to create and improve tools and mechanisms that allow the strategy to be properly implemented and communicated (Sharaf-Addin and Fazel, 2021). In this context, models and tools such as Balanced Scorecard (BSC) have been adopted by most organizations to strategically manage their performance (Akinbowal et al., 2022). The BSC is a model that helps transform strategy into operational goals that guide behavior and performance, enabling the identification of good management practices and guiding organizational change management in a continuous improvement process. The four main perspectives of this model are: financial (mainly for the benefit of shareholders, creditors and the government; benefits are mainly financial); customer (identifies the customer segments and markets in which the organization will compete and the attributes valued to achieve the desired financial performance). Internal processes (identifies the processes you need to excel in to create value). learning and growth (creating core competencies for the organization to compete and create value in the future). Businesses, industries, government agencies, non-profit organizations, among others, use the Balanced Scorecard as a coherent strategic planning system to measure performance and align organizational actions to transform vision and mission into goals and objectives (Gomes et al., 2021). The relationship between the PMS and their behavioral consequences has been the subject of many researches behavioral in the current period (Arisman et al., 2022). Recent studies indicate that the PMS affects the employee's behavior through several variables, including role ambiguity (Burney and Widener, 2007), role clarity (Setiawati et al.,

2022), Procedural Justice (PJ) (Arisman et al., 2022), Distributive Justice (DJ) (Susiana et al., 2017), feedback (Hartmann and Slapničar, 2009), intrinsic and extrinsic motivation (Lau and Roopnarain, 2014). Selecting the appropriate measures are used to evaluate the employee's performance is very important as it can influence their attitudes, such as their perception of Organizational Justice (OJ), Employee Satisfaction (ES), and organizational commitment. Recently, due to the inadequacy of Financial Measures (FM), the use of Non-Financial Measures (NFM) has been emphasized in accounting literature (Arisman et al., 2022). The traditional PM methods have used FM, such as: 1) My ability to meet my budget; 2) My ability to avoid unfavorable budget variances; 3) My ability to meet or better budgeted costs or sales; and 4) My ability to achieve budgeted cost reduction or budgeted sales growth (Marie et al., 2014). Using FM to evaluate employee's performance might lead to higher employee performance through their perceptions of justice in the measuring stages and their ES as a consequence (Lau and Roopnarain, 2014). However, the use of FM does not necessarily lead to adverse consequences. Consequently, it is likely that superiors, who rely on budget targets to evaluate their subordinates, will also provide these subordinates high budgetary participation in order to solicit the favorable behaviors (Tan and Lau, 2012). FM are perceived more accurately as they are objective (Chia et al., 2014). The use of FM for performance evaluation may be too limited, dense, incomplete, retrospective, and examine employee's' actions with short-term thinking and fail to capture the long-term consequences of their efforts properly. Due to these shortcomings, organizations are paying more attention to the NFM, as they may be broader, focusing on long-term behaviors of the employee's and investigating the different performance aspects (Lau and Roopnarain, 2014). There are three advantages of using non-financial measurements. First, managers can obtain business progress information from the company before the financial statements are published. Second, employees can obtain information from superiors about the behaviors needed to achieve strategic goals. Third, investors can receive more accurate information about the overall performance of the company since the use of non-financial measures that reflect intangible values, for example the productivity of the

research and development department (Arisman *et al.*, 2022). The use of NFM for performance evaluation, such as ES, citizenship behavior, and attempts to educate colleagues, emphasize the long-term goals and cover a wide range of areas (He and Lau, 2012). Hence, PM based on several NFM may improve employee's job satisfaction. An employee may perform well in indicators, such as customer satisfaction, product development, and innovation. Hence, if employees are evaluated based on these parameters, they will understand the performance measurement rationally and as a result, they will have reasonable satisfaction and high satisfaction with the evaluation process (Tan and Lau, 2012). The previous studies also indicate that adopting NFM for evaluating employee's performance through PJ has a significant impact on their job satisfaction (Chia *et al.*, 2014). Therefore, it seems that using multiple performance measures (MPM) will lead to the employee's job satisfaction (Lau and Martin-Sardesai, 2012). However, many companies in the world use FM and NFM at the same time. Has led to the emergence of comprehensive performance management systems (CPMS), such as balanced scorecard, which has placed greater emphasis on NFM (He and Lau, 2012). Over the past decade, adopting a balanced scorecard as a tool for measuring performance has been one of the most controversial topics in management accounting literature. The use of FM should be considered in today's fast competitive business conditions. The NFM is used to supplement the FM counterparts. Using these measures to evaluate performance has raised concerns for employees. The employee's responses to PMS may play a critical role in determining the success of these systems (Chia *et al.*, 2014). The purpose of this study is to investigate the influence of using FM and NFM on employee's attitudes. A study by Lau and Sholihin (2005) showed that employee's job satisfaction is influenced by FM and NFM. FM and NFM are significantly related to employee's job satisfaction through PJ (Chia *et al.*, 2014) and DJ (Susiana *et al.*, 2017). The mere use of FM has short-term effects on employee's, which are more frequently addressed in the accounting literature. However, the use of NFM along with FM ones has a positive effect on the long-term motivation and behavior of employee's (Lau, 2011). Therefore, an appropriate combination of these two measures can have behavioral effects on

the motivation (Lau and Roopnarain, 2014), better understanding of PJ (Nuhu *et al.*, 2022), DJ (Susiana *et al.*, 2017) of the employee's, and finally affect their attitudes toward the organization and ES (Lau and Martin-Sardesai, 2012). Therefore, there is a need to understand how performance evaluation measures are effect on perceive justice, and employee's behaviors. There is also a need to understand whether employee's response due to using NFM is different from what is achieved through the use of FM ones. While numerous studies have been conducted on the behavioral effects of NFM (Lau and Moser, 2008), however, in the comprehensive PMS, few studies have examined the behavioral effects of NFM alongside the FM ones on the perceptions of PJ and DJ in the organization compared to the FM (Lau and Roopnarain, 2014; Lau and Martin-Sardesai, 2012).

Literature Review

Comprehensive Performance Measurement Systems (CPMS)

CPMS are not only used in organizations to ensure that employees' behavior is consistent with organizational objectives and strategies, but also to help employees in doing their job, in searching for opportunities, and in solving problems (Van Veen-Dirks *et al.*, 2021). PMS plays two main roles: (1) as an instrument for strategic implementation and ensuring the planned actions are concurrent with the organization's goal achievements, (2) as a motivation control tool to affect the individual's peak behavior, which will ease the organization's goal achievement (Zid *et al.*, 2021). In general, the CPMS is being used in the PMS where the two measures of FM and NFM ones are implemented for the PM (Tran and Järvinen, 2022). The FM is considered as the oldest, most popular, and most comprehensive performance evaluation measure (Marie *et al.*, 2014). These measures facilitate the comparison of staff performance within the different units of the organization and senior executives are primarily aware of these performance evaluation measures (Lau and Roopnarain, 2014). Since these measures are more objective and also focusing more on these measures often aligns with organizations' plans for profitability, organizations usually implement them in order to evaluate their employee's performance (Lau and Sholihin, 2005). Although these types of measures contain valuable information for the users, they are not

capable of evaluating the performance of employee's in achieving goals in all different aspects (Lau, 2011). Therefore, it is necessary to examine the NFM along with FM ones in order to fill the PM gaps (Nuhu *et al.*, 2022). One of the significant developments in management accounting during the recent periods has been the use, and acceptance of NFM, which has affected the efficiency of management accounting methods in today's competitive environment (Lau and Oger, 2011). The use of NFM to evaluate performance is a more complete and appropriate approach from the perspective of employee's, and it is for overcoming the shortcomings of traditional PMS (Lau and Berry, 2010). Although the NFM is not new, these measures have played a prominent role in evaluating the employee's performance in recent decades (Lau, 2015). Proponents of the use of NFM believe that utilizing, such measures for performance evaluation has many benefits at the individual, and organizational levels, and will lead to increasing citizenship behavior, loyalty, performance, and employee's job satisfaction (Lau and Berry, 2010; Lau, 2015). The essential feature of the NFM is that they are expressed within the framework of non-financial terms. Since most tasks in the service organizations are non-financial, it is essential to use NFM to evaluate the performance (Lau, 2011).

Procedural Justice

Procedural Justice (PJ), which is a part of organizational justice, refers to perception of members in an organization toward a degree of fairness of official organizational procedures related to rewards (e.g., wages, personnel management systems, and promotion) (Ha and Lee, 2022). From an organizational management perspective, PJ is usually defined as a fairness, and transparent process an organization uses to decide, resolve disputes or distribute resources, and responsibilities. At the same time, from another perspective, PJ is usually described as fairness, and transparency associated with the processes, methods, and mechanisms used to determine the outcomes of employee's activities (Razak and Ismail, 2018). Lin and Hsieh (2010) have defined the PJ as the perceived justice of decision-making methods. According to Tyler (1987), PJ is related to the procedure that the company adopts to distribute the results, procedures, and employee's reactions to the fairness of this particular approach. Maitland (2017) defines the PJ as the appropriateness

of the allocation process. If the organizational approaches meet the interests of everyone, and are based on accurate information, provide an opportunity for the staff survey, and comply with the general ethical norms, there is PJ in the organization (Graso *et al.*, 2020). Procedural justice perception, represents a critical outcome of a performance evaluation system (Tran and Järvinen, 2022) and is one of four indicators for assessing the system's quality (Baird *et al.*, 2021). It refers to perceived fairness regarding processes applied in making evaluation decisions such as performance ratings and bonuses. It is considered even more important than perceived fairness of individual outcomes because of the protections that fair procedures offer (Tran and Järvinen, 2022). Along this argument, it is appropriate to focus on perceptions of procedural justice in the research, as the use of financial and non-financial evaluation measures may allow for bias in the evaluation process; hence it relates to justice perceptions regarding the system. Swalhi *et al.*, (2017) expressed that although the perception of justice depends on the results, the process of achieving these results is more critical (Karkoulou *et al.*, 2016). PJ is proportional to the final results, and fits more to the methods, processes, and mechanisms for achieving them (Folger and Cropanzano, 2001). According to Leventhal (1980), PJ refers to people's perception of justice in resource allocating within a social system. As pointed out by Swalhi *et al.*, (2017), PJ is rooted in social interactions, and affects the employee's perceptions of their relationship with the organization. Leventhal (1980) states six principles for fair evaluation procedures: 1) consistency; 2) correctability; (3) accuracy; 4) bias suppression; 5) ethicality and 6) representativeness. Consistency means that the procedures should be applied consistently across personnel and time. Correctability means that there should be some grievance system for correcting poor decisions. Accuracy refers to the collection of accurate information and valid facts for making decisions. Bias suppression relates to neutral, impartial and bias-free procedures. Ethicality means that procedures should conform to standards of ethics and morality. Lastly, representativeness aims to ensure that the concerns of all groups affected by the decision are taken into account.

Distributive Justice

Distributive justice refers to people's sense of

justice about pay distribution. This sense is first affected by the absolute values of salaries. The higher the actual pay, the higher its utility value, the more attractive it is to individuals, and the relatively higher the sense of justice. Additionally, it is influenced by the relative values of salaries (Zhou and Ma, 2022). Individuals will compare the ratio of their own income and input with those of others within the same organization (Williams *et al.*, 2020). If the ratio is basically the same, they should possess a sense of organizational justice. However, if there is a big difference, two outcomes are possible: One is that if an individual's actual income is less than the income, they feel they deserve, they will feel that they have suffered a loss and feel aggrieved (Schnauffer *et al.*, 2022). The other is that if their actual income is more than the income, they feel they should receive, they will think that they have obtained an undeserved benefit and feel guilty. In addition, individuals will compare the ratio of their own income and input with those of individuals from other organizations with similar educational backgrounds and abilities (Zhou and Ma, 2022). If the ratio is basically the same, there will be a sense of interorganizational justice, but if there is a big difference, there will be a sense of interorganizational unfairness (Georgellis *et al.*, 2019). Maitland (2017) has defined the DJ as the perceived justice of the appropriateness of the allocating results. ES with job outcomes, such as satisfactory payment has a direct impact on the perceptions of the DJ (Folger and Konovsky, 1989). The staff compare the incomes, and their share of the company with their incomes, then determine the levels of the DJ based on the perceived degree of justice (Palaiologos *et al.*, 2011). Thurston and McNall (2010) stated that when employees understand that designing a PMS is to support one of the abilities, the perception of DJ is higher among them. Ambrose and Schminke (2003) expressed that the DJ is often considered economic exchanges rather than the social ones.

Employee Satisfaction

Job satisfaction is an employee's positive attitude towards his work, which arises based on an assessment of the work situation. A pleasant work state of affairs is fashioned if the character and sort of labor to be done is in accordance with the wants and values of the staff. Thus, satisfied employees prefer their work situations than dissatisfied employees,

who do not like their work situations. Job satisfaction is the first aspect that is achieved before an employee has organizational commitment (Jufrizen and Kandhita, 2021). Evaluation reactions have a crucial role in creating the desirable business, and organizational attitude, and enhancing motivation to increase performance. Satisfaction with all evaluation reactions has been further evaluated. Of all the evaluation reactions, satisfaction has been examined more. Job satisfaction is an essential goal of organizations to achieve as it has been shown that profitability, productivity, employee's retention, and customer satisfaction are related to staff satisfaction. Motivated employee's enhance customer satisfaction, and positively affect organizational performance (Palaiologos *et al.*, 2011). Job satisfaction may be a real behavior that's displayed by everybody as work performance created by workers in accordance with their role within the company. Job satisfaction is the difference between the amount of rewards an employee receives and the amount they believe they should receive, as well as a general attitude toward one's work. It is a general attitude which is the result of several special attitudes including work factors, self-adjustment and individual social relationships outside of work. The job satisfaction is felt by the employee is influenced by two factors, namely: 1) Intrinsic factors are factors that come from within the individual that are brought by each employee since starting to work in their workplace, and 2) Extrinsic factors are factors related to - things that come from outside the employee, such as the physical condition of the work environment, interactions with other employees, the payroll system, and so on (Jufrizen and Kandhita, 2021). In a related study, Yousef *et al.*, (2017) illustrated that job satisfaction refers to the attitude of employees toward their job, its rewards, and benefits, and the organizational, social, and physical characteristics of the environment in which they work. Study on organizational behavior have divided job satisfaction into two main categories, including internal, and external job satisfaction. Internal job satisfaction is defined as the positive attitude of employees toward recognition, success, available opportunities in the organization, and development of human capacities, and responsibilities. In contrast, external job satisfaction is often associated with employee's positive attitudes toward service compensation,

interpersonal relationships, supervisors' supervision, organizational policies, and procedures, safety, and health, opportunities for continuous growth, work, and overall working life environment, social interactions at work, and job security status. If employees have a positive attitude toward internal, and external job satisfaction, this may lead to increasing job satisfaction in the organization (Razak and Ismail, 2018). Dissatisfied employees often try to find alternative jobs, while satisfied ones remain in the organization for an extended period (Son and Ok, 2019).

Goal Setting Theory

The goal setting theory assumes that a person's individual goals consciously influence motivation through one of the following four mechanisms, namely goals build effort to achieve goals, goals direct attention and effort toward goals, goals increase persistence to strive, and goals influence action directly by encouraging the use of knowledge with tasks and strategies. Goal setting theory indicates that a person will be motivated to make an effort when a goal is to be achieved. Goal setting theory explains that goal setting not only affects work, but also motivates employees to seek or use the most effective work methods (Gomes et al., 2021). Without doubt, Locke and Latham's (1990) Goal Setting Theory has been the most influential work motivation theory to date. The core prediction of this theory is that setting clear, specific, but also challenging goals has a motivational effect on individuals that leads to higher performance in a task that when goals are unclear and unchallenging. Attaining goals, in turn, results in increased job satisfaction, and organizational commitment (Locke and Latham, 2002). This was also proved to be true for individual performance in economic games. For example, Corgnet et al., (2018) ran an experiment using different agency models, and reported that agents performed better in the presence of goal setting, even under weaker monetary incentives. As Locke and Latham (2013) evidenced, the predictions of goal setting theory have been supported in almost every possible context. However, goal setting theory still has a boundary condition that has been somewhat neglected in prior studies, which is the effect of how goals are set has on individuals' goal attainment. Prior studies on goal setting showed that an actor's performance will

vary if the goals are set unilaterally by an authority figure or if set in a participative manner (Monzani et al., 2022). In the "old normal," a series of joint experiments helped resolve the controversy that mixed findings regarding goal setting type created (Latham et al., 1988). In this section, the framework of Adler and Borys (1996) was developed, in which they distinguished between permissive and coercive types of formalization. Since performance measurement can be conceived as a form of formalization, this framework can be used to contrast these two types of performance measurement. While Adler and Borys (1996) propose that "employees' attitudes to the system depend on the type of formalization with which they are confronted", Tessier and Otley (2012) emphasize that the orientation of the system, as enabling or coercive, needs to be separated from the assessment of the quality of the system to increase conceptual clarity and to make it possible to empirically examine the relationship between these two concepts. Building on these insights, hypotheses were developed about the relationship between the type of performance measurement system—enabling or coercive—and the employees' attitudes to these systems as captured by procedural fairness and red tape (Van Veen-Dirks et al., 2021). These studies consider performance measurement to be a form of formalization. Several scholars have investigated the characteristics of management control systems that make people experience them as more or less fair. These studies have focused on a range of characteristics including subjective versus objective systems (Bellavance et al., 2013; Van Veen-Dirks et al., 2021), diversity of performance measures and a focus on outcome versus effort in performance measures (Hartmann and Slapničar, 2012), bonus payments (Voußem et al., 2016), and participation in goal setting (Groen 2018). Some also highlight the importance of the management control system for procedural fairness and, for example, emphasize that an important dysfunctional consequence of a management control system can be that the system is not experienced as fair by the employees (Van Veen-Dirks et al., 2021). These authors further emphasize the importance of fairness by referring to the work of Folger and Cropanzano (1998): "when individuals perceive a lack of fairness, their morale declines, they become more likely to leave their jobs, and may even retaliate against the organization. Fair treatment, by

contrast, breeds commitment intentions to remain on the job and helpful citizen behavior that go beyond the call of formal duties” (Van Veen-Dirks *et al.*, 2021). Although these studies provide relevant insights into how management controls affect procedural fairness, the focus is on features of management control systems that have not been studied before. As such, the current research complements these studies by examining the effects of financial and non-financial measure on procedural justice and distributive justice. In addition, while the literature often refers to several normative procedural justice principles that can usually be traced back to the work of Hartmann and Slapničar (2012) comment that “these are not observable or designable characteristics of the performance evaluation themselves”. As a consequence, there is still only limited understanding of what the actual design and development process of the performance measurement system should be to achieve procedural fairness, distributive justice and, more broadly, a positive attitude toward the performance measurement system (Van Veen-Dirks *et al.*, 2021). Thus, it is expected that there is a direct relationship between CPMS and organizational justice.

H1a: FM is significantly related to PJ.

H1b: NFM is significantly related to PJ.

H1c: FM is significantly related to DJ.

H1: NFM is significantly related to DJ.

Self-Determination Theory

The self-determination theory (SDT) asserts that humans have the natural tendency towards intrinsic growth and motivation, where this intrinsic motivation and well-being require the fulfillment of three basic psychological needs, namely (1) autonomy (2) competency and (3) relatedness (Deci and Ryan 2000). The basic psychological needs stimulate the principle of self-determination theory on physical activities based on intrinsic motivation. Intrinsic motivation relates to activities involvement due to enjoyment and satisfaction achievement without requiring an external reward or incentive (Ryan and Deci, 2000). CPMS, a performance measurement information, is used as a control tool in performance evaluation to motivate individual behavior towards the organization’s desires. CPMS that integrates psychology needs of autonomy, competence and relatedness in the performance evaluation and

assessment of football players can enhance players’ intrinsic motivation. By using self-determination, these needs are satisfied or in other words, more comprehensive use of performance information, resulting in positive effects such as satisfaction, enjoyment, and happiness (Zid *et al.*, 2021). In this study, when CPMS containing comprehensive information of employee’s performance characterizing needs of autonomy, competency and relatedness is used more comprehensively, the employee’s self-determination increases in line with the need’s fulfillment. It encourages the employee’s increased satisfaction. Thus, it is expected that there is a direct relationship between CPMS and employee’s satisfaction.

H2a: FM is significantly related to ES.

H2b: NFM is significantly related to ES.

Justice Theory

Justice theory is an important incentive theory. It suggests that employees will feel happy, work hard, and have a relatively low turnover intention if they have a sense of fairness regarding the distribution of benefits according to their own judgment (Piotrowski *et al.*, 2021). However, if they have a sense of unfairness, they will be resentful, work with negative attitudes, and have higher turnover intention (Özkan, 2022). Organizational justice refers to people’s feelings toward the reasonable nature of pay distribution, and it includes distributive justice, procedural justice, and interactive justice (Tekin and Akyol, 2017). The concept of organizational justice emerges from the Adams Equity theory (1965), according to which a person perceives organizational justice based on equity and harmony assessment of inputs related to the outcomes, observing their own input–outcome ratio, and comparing it with their colleagues’ ratio (Amazue *et al.*, 2016). It focuses on components of each justice dimension in an exchange relationship with the organization; fairness of reward system, the fairness of decision outcomes, and the fairness of interaction between managers and subordinates. The perception of this fairness affects employees’ positive or negative feelings about their treatment in the organization. In turn, employees will become motivated and satisfied if they perceive that their treatment is fair and just and vice versa (Bakotić and Bulog, 2021). Many research suggested that perceived organizational justice influences employees’ attitudes

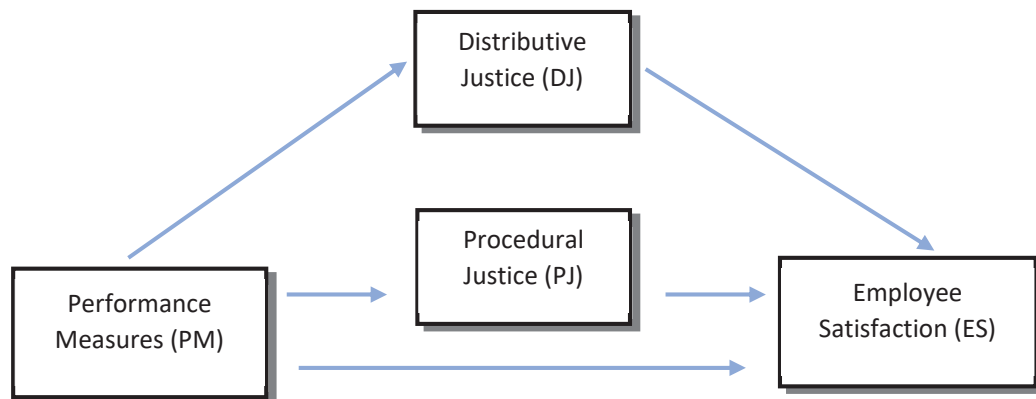


Fig. 1: Conceptual model

and behaviors that are crucial for individual and organizational success, such as organizational commitment, job performance, turnover intention, trust, organizational citizenship behavior (Mylona and Mihail, 2019; Jufrizen and Kandhita, 2021). Among many work-outcome variables that have been analyzed in relationship with organizational justice, job satisfaction has its significant place and share (e.g., Strom *et al.*, 2014). Researchers mainly empirically proved the significant positive effect of each justice dimension on job satisfaction (Sembiring *et al.*, 2020). Cohen-Charash and Spector (2001) in their meta-analysis of the role of organizational justice in the organization, highlighted findings that positive perceptions of justice and fairness are related to positive employees and organizational outcomes. Gori *et al.* (2020) pointed out that organizational justice predicts job satisfaction from a cross-cultural perspective. Further, Alamir *et al.* (2019) found that three organizational justice types impact organizational commitment through job satisfaction. Zahednezhad *et al.* (2021) found that all three organizational justice dimensions were positively linked with job satisfaction, suggesting that job satisfaction depends on perceived employees' organizational justice level. Empirical evidence also supported assumptions that different organizational justice components do not affect work outcome variables the same, among which job satisfaction stands out. This standpoint is maintained through yearly research, where empirical evidence exposed that some of the justice components accounted for more variance on work-related outcomes, like

job satisfaction, than others. In that vein, in his study, revealed that all three components of justice play a significant role in influencing employee's job satisfaction levels, emphasizing that distributive justice tends to be a stronger predictor of job satisfaction when compared to procedural justice (Bakotić and Bulog, 2021).

H3a: PJ is significantly related to ES;

H3b: DJ is significantly related to ES.

Hypotheses related to the mediating role of PJ and DJ variables are as follow:

H4a: PJ is mediated FM and ES;

H4b: PJ is mediated NFM and ES;

H4c: DJ is mediated FM and ES;

H4d: DJ is mediated NFM and ES.

The current study has been carried out in 2020 in Ahvaz- Iran.

The relationships between the research variables are presented in the conceptual model (Fig. 1):

MATERIALS AND METHODS

Participants

The statistical population of the current study is Khuzestan Regional Water Organization in Iran. For the appropriate sample size, researchers used a confidence level of 95%, an error margin of 5%. According to Saunders *et al.*, (2012), these percentages are suitable for social science researchers. Thus, 299 people were selected as the statistical sample. Data were collected using simple random sampling method. Data were analyzed using

Table 1: Estimation of the measurement model parameters

Constructs	Factor Loading	Std. Dev.	Min	Mix	Skewness	Kurtosis	AVE	Composite Reliability	Cronbach's Alphas (α)
FM							0.755	0.924	0.912
Fm1	0.931	1.290	1	5	-1.423	0.709			
Fm2	0.966	1.323	1	5	-1.237	0.266			
Fm3	0.928	1.303	1	5	-1.099	0.018			
Fm4	0.578	1.175	1	5	-0.739	-0.231			
NFM							0.544	0.857	0.856
Nfm1	0.794	1.157	1	5	-0.844	-0.117			
Nfm2	0.803	1.141	1	5	-0.769	-0.115			
Nfm3	0.791	1.120	1	5	-1.034	0.481			
Nfm4	0.628	1.143	1	5	-0.764	-0.284			
Nfm5	0.622	1.115	1	5	-0.979	0.307			
DJ							0.773	0.915	0.910
Dj1	0.931	1.175	1	5	-1.311	0.753			
Dj2	0.888	1.207	1	5	-1.264	0.657			
Dj3	0.822	1.171	1	5	0-1.298	0.883			
PJ							0.643	0.841	0.833
Pj1	0.692	1.342	1	5	-0.656	-0.789			
Pj2	0.896	1.300	1	5	-1.040	-0.060			
Pj3	0.833	1.350	1	5	-0.683	-0.802			
ES							0.742	0.933	0.933
Esat1	0.871	1.267	1	5	-1.263	0.405			
Esat2	0.907	1.308	1	5	-1.092	-0.015			
Esat3	0.922	1.255	1	5	-0.985	-0.151			
Esat4	0.860	1.266	1	5	-0.916	-0.185			
Esat5	0.734	1.140	1	5	-0.940	0.156			

descriptive and inferential statistics using SPSS25 and AMOS24 software.

Measures

PM: This scale has been derived from [Tan and Lau \(2012\)](#) for the FM, and [Lau and Roopnarain \(2014\)](#) for the NFM. Employees were asked to what extent they agree with the relevant statements (how important each factor is when evaluating one's performance by the superior). OJ: This variable has been deduced from [Lau \(2015\)](#) PJ (Respondents were required to rate the fairness of the procedures employed by their superior to determine promotions, communicate performance feedback, and determine pay increases), and [Lau and Oger \(2012\)](#) for the DJ (The instrument comprises three items which ask the respondents to rate the fairness of the reward that they received taking into consideration the amount of effort that they had put forth, the responsibilities that they had, and the amount of education and training that they had and the work that they had done), respectively. ES: To measure this variable, the investigation performed by [Lau and Tan \(2012\)](#) has been used.

Demographic questionnaire

Demographic variables include gender, age, education, and years of experience.

RESULTS AND DISCUSSION

Researchers have also used the Average Variance Extracted (AVE) in order to assess the convergent validity of each variable. According to [Fornell and Larcker \(1981\)](#), the AVE value of a variable must be more than 50% to ensure convergent validity. [Table 1](#) shows that the AVE associated with each variable is more than 50%. In the next step, the composite reliability (CR) has been evaluated. [Bagozzi and Edwards \(1998\)](#) suggested that the CR value should be higher than 0.60. As observed from [Table 1](#), CR values exceed the recommended value. Furthermore, the researchers examined the reliability of the scale using Cronbach's alpha (α). [Nunnally \(1987\)](#) noted that α values greater than 0.70 indicate the reliability, and internal consistency of the research variables. The results in [Table 1](#) show, the Cronbach's alpha of the variables more than the minimum value of 0.7, therefore, reliability is confirmed. Before examining

the research hypotheses, the normality of the data is tested by using the kurtosis, and skewness coefficients. The kurtosis, and skewness coefficients range from -7 to 7, and -3 to 3, respectively (Byrne, 2016). As shown by Table 1, the data are normal, and parametric tests are used to test the hypotheses. The factor loadings of each structure are higher than 0.50 according to the suggestion of Yong and Pearce (2013), indicating that the validity of these structures is desirable.

Correlation results

Before testing the research hypotheses, the direct relationships of the research variables were tested. The results in Table 2 show a positive, and significant relationship between these variables.

Measurement model

Direct relationship hypotheses according to Kline's (2015) suggestion, when the critical value is higher than 1.96, and the significance level is less than 0.05, this hypothesis is confirmed (Table 3).

Structural equal model (SEM)

The results of the structural model based on the research variables are presented in Fig. 2. The results in Fig. 2, and Table 3, show that FM has significantly related to PJ (0.378, $R=0.429$). Hence, H1a is supported. NFM has significantly related to PJ (0.246, $R=0.306$). Hence, H2a is supported. FM has significantly related to DJ (0.340, $R=0.414$). Hence, H1c is supported. NFM has significantly related to DJ (0.343, $R=0.326$). Hence, H1d is supported. FM has significantly related to ES (0.258, $R=0.553$). Hence, H2a is supported. NFM has significantly related to ES (0.169, $R=0.178$). Hence, H2b is supported. PJ has significantly related to ES (0.193, $R=0.680$). Hence, H3a is supported. DJ has significantly related to ES (0.143, $R=0.578$). Hence, H3b is supported.

Mediation results

As shown in Table 4, The impact of FM, and NFM through of mediating role of PJ, and DJ on ES using the bootstrap method, as suggested by Hayes and Preacher (2010) using 5,000 bootstrap simulation samples, and

Table 2: Descriptive statistics, and correlations between the study variables

Variable	Mean	FM	NFM	DJ	PJ	ES
FM	3.9933	-				
NFM	3.7157	.135*	-			
DJ	4.0067	.414**	.326**	-		
PJ	3.5429	.429**	.306**	.541**	-	
ES	3.6040	.553**	.178**	.578**	.680**	-

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 3: Path analysis for the research model (N=299)

Direct Path	Estimate	S.E.	C.R.	P-Value	Decision
DJ <--- NFM	.343	.086	5.196	***	Accepted
PJ <--- FM	.378	.060	6.009	***	Accepted
PJ <--- NFM	.246	.104	3.643	***	Accepted
DJ <--- FM	.340	.047	5.748	***	Accepted
ES <--- DJ	.143	.079	2.084	.037	Accepted
ES <--- PJ	.193	.067	2.786	.005	Accepted
ES <--- NFM	.169	.098	2.569	.010	Accepted
ES <--- FM	.258	.058	4.080	***	Accepted

95% confidence level was examined. The results of Table 4, showed that FM through PJ, and DJ have significantly related to ES (therefore, H4a, H4c is supported). Also, a significance level less than 5% ($p < 0.05$), PJ, and DJ play a partial mediating role in the relationship between FM, and ES. NFM through PJ, and perceived DJ have significantly related to ES (therefore H4b, H4d is supported). Also, with a significance level less than 5% ($p < 0.05$), PJ, and DJ play a partial mediating role in the

relationship between NFM, and ES.

The Test of Goodness of fit model

According to Hair *et al.* (2006), CMIN/DF (which is the minimum discrepancy, divided by its degrees of freedom) should be as high as 5 and according to the findings, the CMIN/DF value is less than two, and the Root Mean Square Error of Approximation (RMSEA) is less than 0.08. Furthermore, by comparing the indices

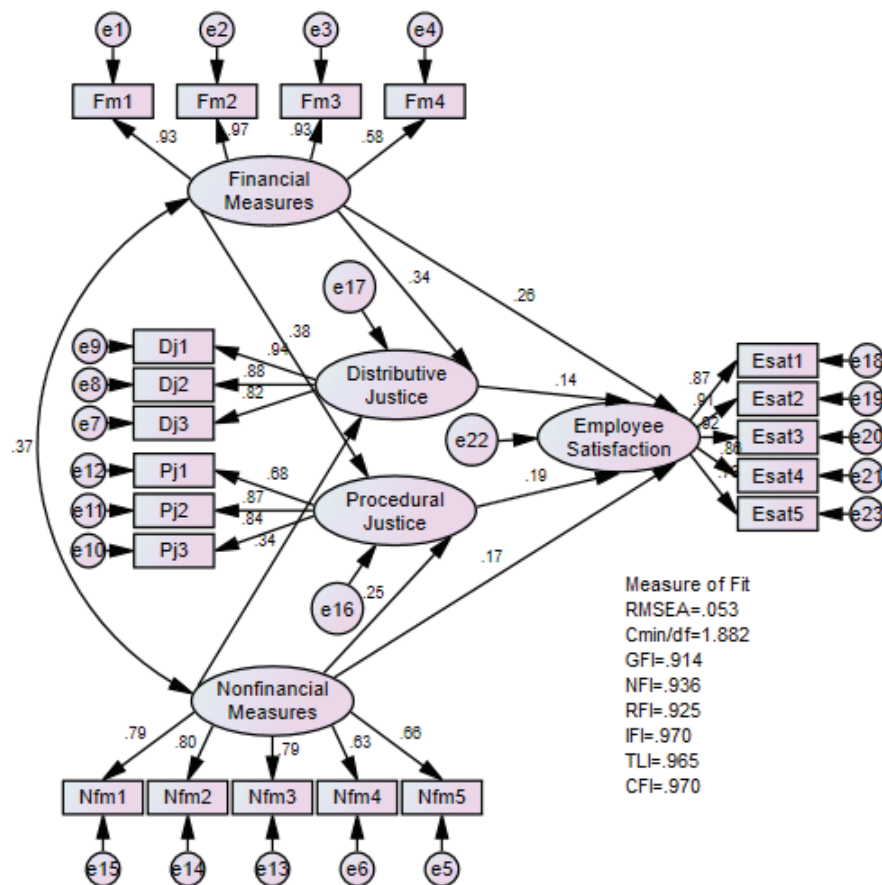


Fig 2: Structural model results: standardized (path) coefficients

Table 4: Mediation Effects in Structural Equation Models (N=299)

Indirect path	Total effect	Indirect effect	Mediation effect	P-Value	Decision
ES <--- PJ <--- FM	0.434	0.126	0.308	0.000	Accepted
ES <--- DJ <--- FM	0.434	0.120	0.316	0.000	Accepted
ES <--- PJ <--- NFM	0.610	0.198	0.413	0.000	Accepted
ES <--- DJ <--- NFM	0.610	0.228	0.383	0.000	Accepted

Table 5: The Assessment of Fitness of Final Fit Model

CFI	TLI	IFI	RFI	NFI	GFI	CMIN/DF	RMSEA	Goodness of fit index
≥ 0.95	≥ 0.95	≥ 0.95	≥ 0.90	≥ 0.90	≥ 0.90	< 2.00	≤ 0.08	Cut off value
0.970	0.965	0.970	0.925	0.936	0.914	1.882	0.053	Model Result

obtained from the model with the proposed values, the structural model gives a causal relationship between the variables, testing an excellent structural model (Table 5).

Discussion

Considering literature, this finding is consistent with the study of [Susiana et al., \(2018\)](#), and [Lau \(2015\)](#). Using FM that can be transformed into numbers (digits), can affect perceptions of PJ in the organization, and employees on the other hand, perceive PJ in the organization to be fair. Therefore, designing a performance evaluation method with FM can have good results. Other results of the study indicate that NFM have a significant relationship with PJ. The findings were confirmed by [Chia et al., \(2014\)](#). When evaluating employee performance, paying attention to NFM will motivate employees more favorably, and thereby improve the perception of PJ in the organization. The results showed that FM has a significant relationship with DJ. Looking upon literature, this finding is consistent with [Susiana et al., \(2017\)](#). If the attribution of results is based on performance evaluation measures, it leads to the desired satisfaction, and understanding of the DJ prevailing in the organization, and the organization should try to integrate its rewards, and feedback system into the performance evaluation system of the organization, and by doing so, thus distribution justice will also be tangible. The results showed that NFM had a significant relationship with DJ, and the results were in line with [Sholihin and Pike \(2009\)](#). Since employee's will be more involved in NFM, employee's perceptions of DJ will be more impactful, and employee's more satisfied if the same measures are evaluated, and promoted accordingly. The results showed that FM has a significant relationship with ES. These results are in line with [Lau and Martin-Sardesai \(2012\)](#). Using FM that can be evaluated using numbers can impact ES. It is suggested that managers should use the views of the staff in designing these measures. By participating in designing these types of measures for performance evaluation, their satisfaction will also be provided. The results showed that NFM had a significant relationship

with ES, and the very idea is in line with [Lau and Martin-Sardesai \(2012\)](#). Performance appraisal system is significant for maintaining human resources, and reward systems in organizations, and more importantly the measures used for performance evaluation should be favorable to the individual, and organization. DJ has a significant relationship with ES, supported by [Zhou and Ma \(2022\)](#). It is recommended that organizations use comprehensive performance appraisal methods in which most employee's or staff representatives are involved. The results showed that PJ had a significant relationship with ES, which was in study with [Lau and Tan \(2012\)](#), and [Zhou and Ma \(2022\)](#). It is recommended that staff be evaluated against the measures they have contributed to design. Monthly or yearly meetings to evaluate or change the status of performance evaluation are evaluated by the appropriate staff. Establish a comprehensive performance appraisal committee in which staff are actively involved. Managers allow employees to comment on their meetings, and provide opportunities for all employees to participate, and talk, leading to improved ES. DJ was the partially mediating the role of FM, and NFM, and ES, which is consistent with [Lau and Oger \(2012\)](#), and [Lau et al. \(2008\)](#). FM, and NFM in which employees are involved, and holding annual meetings, and understanding the comprehensive performance appraisal system they were involved in can be designed to provide ES. Feedback can also influence perceptions of distributed justice, and the use of flexible reward packages can improve employee's job satisfaction. PJ is partially mediating role of FM, and NFM, and ES, which is in line with [Chia et al., \(2014\)](#), and [Lau and Sholihin \(2005\)](#). Designing FM, and NFM that trigger employee engagement reflects a good understanding of PJ. Employees will have a better sense of PJ if they align their reward, and promotion systems with the desirable measures of call (combination of FM, and NFM). Also, staff representatives in monthly, and weekly meetings can influence the perception of organizational justice in the performance appraisal system, so it is essential that employees must be actively involved in the performance evaluation system.

CONCLUSION

In recent years, employee performance evaluation has continued to evolve. Many companies have abandoned traditional hierarchies and created more equal systems, even considering employee performance appraisal results. This has led to a variety of employee performance evaluation systems. Therefore, it is important to establish and improve the performance evaluation system in the direction of using comprehensive criteria for employee performance evaluation. Continuous improvement in employee performance creates a synergistic force that can support growth and development program and opportunities for organizational excellence. It is not possible to improve employee work behavior without researching and knowing the appropriate strategies for evaluating employee performance and the employee challenges in using financial metrics to evaluate performance. In this context, the purpose of this study was to examine the impact of financial and non-financial measures on employee satisfaction through the mediating role of procedural and distributive justice. The results showed that the factor loadings of all questions indicated a good validity of the questionnaire. In addition, the average variance extracted was commissioned to assess the convergent validity of each variable, giving the overall results a reasonable validity. Reliability was calculated by Cronbach's alpha and composite reliability, showing the optimal reliability for the research constructs. The relationships between the variables of interest were tested for normality of data recruitment skewness and kurtosis by Pearson's correlation coefficient, and the results showed a positive and significant relationship between the variables. Before testing the research hypotheses, the fit indices of the model were tested and the results showed that the model fit the research. The results of the research showed that financial measures are significantly related to procedural justice.

AUTHOR CONTRIBUTIONS

H. Khalilipour carried out the introduction, literature review, hypothesis development and data collection. M. Nadaf performed the methodology and data entry into the software and analyzed and interpreted the data. M. Hakkak designed the questionnaire, concluded, the research and manuscript preparation.

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CONFLICT OF INTEREST

The authors declare no potential conflict of interest regarding the publication of this work. 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 witnessed by the authors.

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ABBREVIATIONS (NOMENCLATURE)

AVE	Average Variance Extracted
CA	Cronbach's Alpha
CFI	Comparative Fit Index
CPMS	comprehensive Performance Management Systems
CR	Composite Reliability
Dj	Distributive Justice
ES	Employee Satisfaction
Fm	Financial Measures
GFI	Goodness of fit Index

IFI	Incremental Fit Index
NFI	Normal Fir Index
Nfm	Non-financial Measures
Pj	Procedural Justice
PM	Performance Measurement
PMS	Performance Measurement Systems
RFI	Relative Fit Index
SEM	Structural Equal Model
RMSEA	Root Mean Square Error of Approximation
TLI	Tucker Lewis Index

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ORIGINAL RESEARCH PAPER

Examining the impact of Yukl's leadership style on company performance: a study in the service sector

H. Xiao¹, H.L. Vasudevan^{2,*}

¹ Faculty of Business and Communication, INTI International University, Malaysia

² Tun Razak Graduate School, University Tunku Abdul Razak, Malaysia

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ABSTRACT

BACKGROUND AND OBJECTIVES: Services in China have recently emerged as the leading contributor to economic growth and job creation. It employs low-skilled workers in China's service sectors, such as tourism and retail. In terms of value-added, the service sector is the largest sector of the global economy and is crucial in more advanced economies. Businesses in this sector are concentrating on what is becoming known as the knowledge economy, or the ability to outperform competitors by understanding what target customers want and need and operating to meet those wants and needs quickly and cheaply. Almost all industries within the sector use new technology to boost production, increase speed and efficiency, and reduce the number of employees required to operate. It reduces costs while increasing revenue streams. However, when compared to Western economies, China's service sector lags. The services sector's Gross Domestic Product and employment share are small. Services trade accounts for a small portion of China's economic growth. China's new services are still in their infancy. This research aims to determine how Yukl's leadership style impacts Chinese service organizations' performance. Due to ineffective management in guiding the staff, China is currently experiencing low performance in the firm's finance or marketing, which has resulted in low performance in the operating activities and lower productivity, which has a direct impact on the company's performance in the service industry.

METHODS: The research is carried out quantitatively, using questionnaire surveys to obtain data on the determinants of the company's success. Total of 384 respondents were selected to give responses to the study. The technique used in this study is probability sampling, with systematic method.

FINDINGS: The findings showed that the hypotheses were influenced significantly and recommend to all industries because it successfully highlighted that the dimensions of Yukl's leadership style such as transactional and transformational leadership will affect firm performance especially in the Chinese service sector about the right of leadership. The dependent and independent variables, as well as the two dimensions r^2 , are all 0.553, indicating that the model has good goodness of fit. This variable is responsible for 55.3 percent of China's service industry. It indicates that the model reasonably well fits the data. As a result, the results show that the model employed in this study is both relevant and acceptable.

CONCLUSION: These findings may provide policymakers with critical information by implementing the Management by Objective policy in China's service sector due to underperformance in the firm's finance or marketing due to ineffective management in guiding the staff, which leads to underperformance in the operating activities and lower productivity, which directly influences the company performance in China's service industry. Company performance is significant because it indicates the company's ability to generate high profits, high product quality, market share, and

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*Corresponding Author:

Email: hemaloshinee@unirazak.edu.my

Phone: +0126281490

ORCID: [0000-0002-2767-8044](https://orcid.org/0000-0002-2767-8044)

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INTRODUCTION

Company performance (CP) is essential to examine how well the manager contributes to the management process and growth, which helps the firm increase its value, achievement, and core market competitiveness (Al Khajeh, 2018). Furthermore, the impact of business management direction and decisions on performance outcomes improvement should be made, which are all determined by assessing a company's performance (Narkunienė and Ulbinaitė, 2018). As a leading determinant of how well the firm's objectives can meet, company performance indicates the company's value and core market competitiveness (Bayraktar *et al.*, 2017). According to Alrowwad *et al.*, (2017), company performance can view from a variety of angles, including the process point, which refers to the transformation of inputs into outputs to achieve specific outcomes, and the economic point, which is concerned with the effective cost and realized result. Elena-Iuliana and Maria (2017) back this up by defining firm success as the sum of work impacts that produce the best link between customer happiness, economic contribution, and the company's strategic goals. Chinese enterprises performed poorly due to managerial inequity and insufficient human management, which directly influenced on operational productivity and corporate performance (Luo *et al.*, 2020). Previous researchers (Gupta *et al.*, 2020) indicated that poor company management causes long-term damage to employee relations and generates a hostile and uninviting working atmosphere, resulting in poor firm performance. Many business leaders are blind to internal unhappiness and external developments that contribute to the company's collapse (Lo *et al.*, 2016). As a result of inadequate management, many businesses are experiencing unethical practices, poor financial performance, and excessive turnover, making it impossible to fulfil the stated aim (Al Khajeh, 2018). This is further supported by Gonfa (2019), who states that poor management results in a loss of direction and purpose, making it harder to maintain high levels of performance in managerial roles, and lowering productivity. Nonetheless, poor management leads to poor decision-making, which impacts the company's success (Al Khajeh, 2018). Gonfa (2019) emphasizes that management's lack of adaptation to subordinates' perspectives, combined with a rapidly changing business environment,

has resulted in strategic planning, and forecasting decisions that are made erroneously, negatively impacting the company's financial or profit. In this case, management significantly impacts company performance, resulting in low employee productivity and task completion. Performance is a product of people's motivation and satisfaction with their jobs (Berraies and Bchini 2019; Al Khajeh, 2018; Smriti and Das, 2018). As a result, company performance remains an important variable to investigate in the management areas because various factors influence financial and marketing performance within the company, all of which contribute to the company's survival and competitive position (Gonfa, 2019).

LITERATURE REVIEW

As evidenced by several articles (Alrowwad *et al.*, 2017; Al Khajeh, 2018; Samson and Ilesanmi, 2019), company performance in China has been studied from various perspectives. However, there is still no academic research aiming to determine the relationship between the Yukl (1989) leadership style (YLS) such as transformational leadership (TFL) and transactional leadership (TSL). Perhaps, company performance has yet to encompass a wide range of circumstances, and leadership styles differ from those studied, demanding more research to understand better company performance and boost competitiveness. The service sector defines as an economic component that produces services rather than tangible assets to meet a specific demand (Panno, 2020; van der Laan *et al.*, 2020). According to Fan *et al.*, (2020), China's services have recently emerged as the dominant contributor to economic growth and job creation. However, compared with Western economies, China's service industry lags. Gross Domestic Product (GDP) and services trade make up a small fraction of China's overall commerce; employment shares in the sector are also small, and China's new services are underdeveloped (Zhou *et al.*, 2021). The company's performance is critical in figuring out how to improve a primary goal for the organization (Ali, 2020). The current goal of any firm is not just to survive but to thrive due to boosting performance and competing in a competitive market (Widodo *et al.*, 2020). According to (Narkunienė and Ulbinaitė, 2018) the theoretical importance of company performance is a critical part of company management that permits determining the impact of business and board choices on exhibition outcomes. When companies adopt

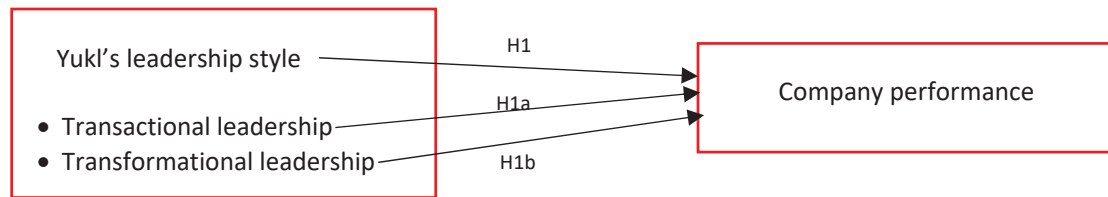
effective strategy and action plans, they can achieve high performance. It demonstrates the company's ability to achieve the goal, which results in profitability and good financial result (Ali and Islam, 2020). Parenthetically, company performance is a broad, dynamic concept that influences various factors in wide situations and life cycles (Khan *et al.*, 2019). As a result, a study of company performance in the Internet era is required; as this can not only contribute to academic research but also help us better understand company performance, resulting in appropriate measures to improve company performance (Kube and Rančák, 2018). In this study, according to Yukl (1989), there are two distinct leadership styles: transformational and transactional leadership, each of which substantially influences on the company's performance. Transformational leadership embodied their followers' moral ideals to raise awareness about ethical issues and mobilize resources to improve institutions. In contrast, transactional leadership included principles such as honesty, responsibility, and reciprocity into exchange procedures (Hoxha, 2019). Delegach *et al.*, (2017) claim that transactional and transformational leadership are two distinct of leadership that motivate individuals to work together to achieve company goals. Numerous academics have examined the topic of leadership style; however, the available knowledge is still somewhat restricted since numerous distinct leadership styles have varying effects on either employees or work satisfaction (Ohunakin *et al.*, 2019). For example, there is little transaction research on the effect of Yukl's (1989) leadership style on profitability or the leader's behaviour on achieving a goal to improve company performance (Saleh *et al.*, 2018). More precisely, Yukl's (1989) leadership style is currently under-researched in terms of its relationship to company success in China, because past research on leadership style and company performance has focused on western cultures. Thus, this current study have been carried out to close the gap by continuing the investigation into the influence of transactional and transformational leadership on company performance in China's service sector in year 2022.

MATERIALS AND METHODS

Survey design and data collection

The sampling design is probability which the respondents are selected by distributing the questionnaires to the companies in service industry

that would not be generalized to the large population. 18 million people are working for services companies in China (Zhang and Hou, 2020). All Cronbach's alpha values are greater than 0.7, including company performance (0.748), Yukl's leadership style (0.754), transactional leadership style (0.729), and transformational leadership style (0.784). A score of more than 0.7 indicates high credibility. For this study, the validity of the questionnaire was determined using face validity, content validity, and expert validity. From this population, the Kierje and Morgan (1970) table size used to determine the sample size. Based on this sample size table, maximum 384 respondents were selected to give response toward the study. The data was distributed online using a Google form. The data collection process took 6 to 8 months. This research focuses on practitioners of Chinese service industry companies as the research object. The study setting is non-contrived because this research is not carried out in an artificial environment like the lab. Researchers carry out the data collection in the natural setting. The study's time range is referred to as a one-shot or cross-sectional study. The study would be conducted in a single shot, with respondents being asked to complete a questionnaire survey just once and data being gathered only once. The study will employ a five-point Likert scale (1 strongly disagree; 5 strongly agree) to assess all latent variables. The planned study's metrics will be adapted from those of earlier studies. The independent variable (Yukl's leadership style, transactional leadership, and transformational leadership) and the dependent variable (company performance) were each broken down into four elements. This study contains a pilot test conducted on 50 respondents, including reliability testing and factor analysis to assess the validity and reliability of the data. Subsequently, descriptive analysis, factor analysis, correlation analysis and regression analysis were done on the data of 384 respondents. All these data are evaluated via the Social Science Statistical Package (SPSS). After the pilot test was completed, this study employed the same distribution technologies and channels as the pilot test to conduct comprehensive data collection. On the number of target populations stated by Krejcie and Morgan (1970), this study requires 384 sample sizes. Therefore, a total of 400 questionnaires were delivered to workers in the Chinese service industry. The following Table displays the respondents'



Figs. 1: Examining the impact of Yukl's leadership style on company performance in the service sector

summary of the response rate to the research questionnaire. Therefore, in this study, 384 accessible questionnaires were evaluated for further analysis.

Analytical framework

According to the studied literature, the component depicted in Figs. 1 below, in which the independent variable is Yukl's (1989) Leadership Style, which has two dimensions referred to as Transformational Leadership and Transactional Leadership. Additionally, there is one dependent variable, which is the company's performance.

Laitinen (2002) defines performance as the ability of an object to generate results in a priori dimension connected to the aim. Therefore, it is essential to begin a project to evaluate its success. Yukl (1989) pointed out that transformational leadership and transactional leadership have two major leadership styles that substantially impact firm performance. Hoxha (2019) also demonstrated that there is a considerable positive association between Yukl's leadership style and company performance. Furthermore, there is a significant correlation between leadership style and management behaviour (Al Khajeh, 2018). Al Khaled and Chung (2020) feel that poor company management can cause long-term damage to employee relationships and contribute to disappointing company performance. Leadership style may usually be defined as a leader or management's capacity to communicate with subordinates or specific tactics to complete their work (Hassan et al., 2019). The phrase "performance theory" refers to the perception of a link between specific performance metrics and organizational performance (Kotane, 2015). Transactional leadership is critical for businesses because it has the potential to boost employee emotional input, hence improving performance and work commitment, and so indirectly affecting company performance (Cho et

al., 2018). In addition, transformational leadership is widely acknowledged as a motivating type of leadership characterized by a distinct organizational vision (Fitzgerald and Schutte, 2010). Both are inextricably linked to performance. As a result, this research integrates the Yukl's (1989) leadership style and its two dimensions with performance theory to provide the theoretical underpinning for the impact of leadership style on firm performance.

RESULTS AND DISCUSSION

Descriptive statistics and analysis for variables entering the analysis

The mean is the arithmetic average of the scores, which is frequently used to quantify central tendency, whereas the standard deviation quantifies dispersion. The 5-point Likert scale is used in this study, and all variables are quantified using the scale's level. The lowest level of disagreement is 'strongly disagree' and the amount of agreement increases incrementally until it reaches 'strongly agree'. Table 1 provides descriptive statistics on the mean and standard deviation of all variables in this study (Company Performance, Leadership Style, Transformational Leadership, and Transactional Leadership). As the table indicates, the mean of the obtained data is consistent across all variables. However, the deviation is for transformational leadership (0.77), indicating that various respondents had varying perspectives on this variable.

Reliability Analysis

Table 2 provides the reliability coefficients test was once again performed to analyze data from 384 respondents. All the Cronbach's alpha values in the table are more than 0.7. A value greater than 0.7 indicates high credibility. Perhaps the credibility of this research is enough for further research. In this study, transformational leadership showed high reliability (0.784) compared to other variables.

Table 1: Result of the descriptive statistics

Constructs	No of items	Item	Mode	Mean	Std. Deviation
Company Performance	5	CP1	3	3.04	0.65
		CP2			
		CP3			
		CP4			
		CP5			
Yukl's Leadership Style	4	YLS1	4	3.05	0.73
		YLS2			
		YLS3			
		YLS4			
Transformational Leadership	4	TFL1	3	2.65	0.77
		TFL2			
		TFL3			
		TFL4			
Transactional Leadership	4	TSL1	3	3.17	0.66
		TSL2			
		TSL3			
		TSL4			

Table 2: Reliability coefficients

Constructs	No of items	Item	Cronbach alpha (α)
Company Performance	5	CP1	0.748
		CP2	
		CP3	
		CP4	
		CP5	
Yukl's Leadership Style	4	YLS1	0.754
		YLS2	
		YLS3	
		YLS4	
Transformational Leadership	4	TFL1	0.784
		TFL2	
		TFL3	
		TFL4	
Transactional Leadership	4	TSL1	0.729
		TSL2	
		TSL3	
		TSL4	

Correlation Analysis

This research explores the relationship between different leadership styles and company performance. Therefore, this part will analyze the correlation between each independent variable and the dependent variable. Company performance is the dependent variable in this study. The independent variables are made of Yukl's leadership style, transactional leadership, and transformational leadership. Pearson correlation analysis determines the degree of correlation between all variables.

According to [Landau and Everitt \(2004\)](#), correlation coefficients range between “- 1” and “+1,” indicating complete negative and positive correlation between variables. [Paliant \(2020\)](#) asserts that the greater the value, the more robust the association between the variables. The results in [Table 3](#) are interpreted the correlation matrix as follows in light of this guideline.

Pearson correlation analysis indicates that all variables have a significance value (2-tail) less than 0.05, indicating that their correlation value is significant. Additionally, all variables have

positive r values, indicating associated with the dependent variables. Leadership style, $r = 0.671$, demonstrating a substantial association between the type of transactional leadership and the company performance. Additionally, transactional leadership, $r = 0.689$, demonstrates a reasonably good correlation between Yukl's leadership style and company performance. However, transformational leadership, $r = 0.586$, indicates that the association between transformational leadership and company performance is weaker than the correlation between other variables.

Multiple Regression Analysis

Tables 4 and Table 5 provide multiple regression summary and multiple regression Anova analysis is used to analyze the relationship between the independent relationship (leadership style, transformational leadership, transactional leadership) and dependent relationship (company performance). Several tests are being run to guarantee that the sample data are fulfilling the requisition by applying the multiple regression analysis. According to Tables 4 and 5, the ANOVA test's p -value is less than 0.05. This indicates that the theoretical framework and all its independent variables have achieved model fit, which can be interpreted as the formation of a

significant relationship between the independent and dependent variables. The present model (Table 4) has an R-Square of 0.54 ($R^2 = 0.537$). This suggests that the present three independent variables can account for 54% of those employed in the service sector in China. Additionally, the tables summarize the major findings about the structural relationships between the dependent and independent variables. The findings indicate that all three hypotheses (H1, H2, and H3) are significant.

Table 6 illustrates the result of direct relationship between the constructs. In this Table, the researcher has also evoked hypotheses in response to the analysis.

H1: Yukl's (1989) leadership style significantly influences the company's performance in the China's service sector.

For H1, the results of this study suggest that there is a substantial association between leadership style and the performance of Chinese service sector, because the hypothesis has a p -value less than 0.05. This result demonstrates that the influence of leadership style on the performance of Chinese service sector is effective ($t = 4.582$; p -value = 0.000). This result is like other prior studies done by other researchers, which also revealed a relationship

Table 3: Correlation Matrix

Construct	CP	YLS	TFL	TSL
CP	1.000			
YLS	.671**	1.000		
TFL	.586**	.605**	1.000	
TSL	.689**	.804**	.635**	1.000

** . Correlation was significant at the 0.01 (2 - tailed) level $N = 384$

Table 4: Multiple regression model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.733 ^a	.537	.533	.44485

a. Predictors: (Constant), LAT, LFT, LS

Table 5: Multiple Regression ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	87.201	3	29.067	146.885	.000 ^b
Residual	75.198	380	.198		
Total	162.398	384			

a. Dependent Variable: CP

b. Predictors: (Constant), LS, LFT, LAT

Table 6: Discussion on the result and hypotheses

Path	Hypothesis	t-value	Sig	Decision
H ₁ : YLS → OP	Yukl's leadership style significantly influences the company performance of service sector in China.	4.582	0.000	Supported
H ₂ : TFL → OP	Transformational leadership style significantly influences the company performance of service sector in China.	4.461	0.000	Supported
H ₃ : TSL → OP	Transactional leadership style significantly influences the company performance of service sector in China.	5.445	0.000	Supported

between leadership style and the performance of Chinese service. Leadership style has a strong connection with managerial behavior which can integrate the company goal and personal interest to enhance the follower's engagement with a common goal and objective (Al Khajeh, 2019). Yukl (1989) stated there are two important leadership styles in transformational and transactional leadership that brings a significant influence on the company performance. Previous studies have confirmed the positive impact of leadership on different outcomes, including motivating employees (Hansen and Pihl-Thingvad, 2019), expanding company goals Tawas (2019), innovation and challenges (Bourne and Smith-Sherwood, 2018), employee satisfaction (Rahman and Jantan, 2019). Hoxha (2019) confirmed that leadership styles have a significant positive relationship with company performance as measured by sales growth, employment growth, market value growth, profitability, and overall performance perception.

H2: Transformational leadership style as dimensions of Yukl's (1989) leadership style significantly influence the company's performance in the China's service sector.

For H2, the results of this study suggest that there is a significant association between the transformational leadership style dimension and company performance because the p-value of this hypothesis is less than 0.05. The outcome of the t-value is positive (4.461), which suggests that the transformational leadership style dimension has a positive impact on company performance. The result showed that t-value = 4.461; p-value = 0.000 associate positive relationship between transformational

leadership style and company performance of China service sector. Transformational leadership is well acknowledged as a motivational leadership style with a clear organizational vision (Fitzgerald and Schutte, 2010). Transformational leadership theory has acquired extensive support over the years (Chauhan et al., 2019). Previous studies have confirmed the positive impact of transformational leadership on different outcomes, including employee loyalty (Delegach et al., 2017), job satisfaction (Al Khaled and Chung, 2020), organizational commitment (Ali et al., 2020), creativity and innovation (Lee et al., 2020), and employee well-being (Alrowwad et al., 2017; Alrowwad et al., 2020; Pradhan and Hati, 2022). Hansen and Pihl-Thingvad (2019) also stated, leaders can alter their companies' success through personalized consideration by paying attention to individual needs and promoting individual growth and achievement. This may significantly affect their followers' performance which in turn potentially helps to overall firm performance.

H3: Transactional leadership style as dimensions of Yukl's (1989) leadership style significantly influence the company's performance in the China's service sector.

Transactional leadership is a critical indicator of a company's performance. It is concerned with maintaining the status quo to boost the company's revenue (Yukl, 1989). Previous research has established that transactional leadership has a positive effect on a variety of outcomes, including a clear vision (Kanat-Maymon et al., 2020), a clear reward model (Chen et al., 2020), and appropriate guidance (Abdullah et al., 2018), timely error correction (Kalsoom et al., 2018), and employee commitment

(Cho *et al.*, 2018). Transactional leadership has a considerable impact on firm performance in several Asian countries, such as Indonesia (Nungky Viana *et al.*, 2020), China (Xie, 2020) and Malaysia (Ur Rehman *et al.*, 2019). Transactional leadership is critical for the business because it enhances employee emotional involvement, which results in increased performance and job dedication, which has a positive effect on the company's performance indirectly (Cho *et al.*, 2018). Additionally, transactional leadership is associated with firm performance since it assists in achieving the short-term vision and mission (Adam *et al.*, 2020).

CONCLUSION

Company leadership has become more essential than ever in many businesses in the twenty-first century. The traditional leadership style tactics are a little out of date. Many businesses now have unique leadership styles to assist them. However, in China, many companies have poor leadership styles, which has resulted in various challenges and problems. As a result, the authors examine the leadership style of China's service sector, expecting to make reasonable suggestions for enhancing China's service sector leadership style. One of the crucial management tactics for business executives is to improve their leadership style. According to the authors' study, Yukl's leadership style and both dimensions have beneficial consequences. The transformational leadership style is one of these factors. Transformational leadership is widely acknowledged as a motivating type of leadership characterized by a distinct organizational vision. Taking Chinese customs into account, the authors believe that the success of a business may be influenced by focusing on the requirements of employees, supporting personal growth and achievement, and by incorporating individualized concerns. In this case, the Management by Objective policy in China's service sector should implement and motivate employees to meet targets by any means necessary, including shortcuts that result in poor quality. The main advantages of the Management by Objective policy are that it increases employee motivation and commitment while allowing for better communication between management and employees. Management by objectives (MBO) is a policy that employs quantifiable or objective standards to assess a company's and its employee's performance. Managers can identify problem

areas and improve efficiency by comparing actual productivity to standards. Both management and employees are aware of and agree on these standards and objectives. The contribution of this research to the industry is important. It is because of successfully highlighted what kind of leadership style, especially in the context of the China service sector, will affect firm performance, highlighting the right leadership style in the service industry. An essential issue that deserves to be stressed is that the textbooks and teaching materials utilized by local universities and colleges originate from the West, and the Asian context is limited. Due to the disparities between Eastern and Western cultures, Western ideas may not be able to understand the situation in Asian countries properly. This study stresses the impact of leadership styles on business performance and gives suggestions for service sector leaders on how to adopt effective leadership styles when modifying leadership styles to improve business performance. Additionally, when people are encouraged, trained, and developed by competent leaders, the performance of the business can be considerably improved. As earlier indicated, company performance is critical to the development and success of a business. Loyal employees, influenced by a strong leadership style, tend to pay a higher price for the organization. Perhaps one of the critical organizational tactics for success will be the utilization of appropriate leadership styles for leaders. Although the study fulfils the body of knowledge, the researchers still discovered the limitations of the study during the analysis of the results. To make the study cautious, the following will list several limitations that should explore in the future study. The leadership level is the subject of this study so team leaders and middle managers were chosen, not ordinary employees, the survey results may be one-sided. In future research, researchers can try to investigate senior leaders, managers, and top management levels of ordinary leaders to enrich the diversity of survey results.

AUTHOR CONTRIBUTIONS

H. Xiao performed the literature review, experimental design, analyzed and interpreted the data, H.L. Vasudevan prepared the manuscript text, and manuscript edition. H. Xiao and H.L. Vasudevan performed the experiments and literature review, compiled the data and manuscript preparation. H.

Xiao performed in the data analysis and findings while H.L. Vasudevan compiled the data analysis and findings for the manuscript edition.

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CONFLICT OF INTEREST

The authors declare that no potential conflicts of interest in publishing this work. Furthermore, the authors have witnessed ethical issues such as plagiarism, informed consent, misconduct, data fabrication, double publication or submission, and redundancy.

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ABBREVIATIONS

\bar{Y}	Average of observed data
R^2_{adj}	Adjusted coefficient of determination

\bar{Y}	Average of observed data
R^2	Coefficient of determination
CP	Company Performance
α	Level of significance
MAD	Mean Absolute Deviation
MLR	Multiple Linear Regression
p-value	Probability value
r	Pearson correlation coefficient
r-value	Pearson correlation coefficient
n	Sample size
SSE	Sum of Squared Errors
RMSE	Root Mean Square Error
TSL	Transactional Leadership
TFL	Transformational Leadership
YLS	Yukl's Leadership Style

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ORIGINAL RESEARCH PAPER

Determination and prioritization of eco-park components for sustainable urban development

Z. Noorzadeh, M. Malekian*

Department of Natural Resources, Isfahan University of Technology, Isfahan, Iran

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ABSTRACT

BACKGROUND AND OBJECTIVES: Environmental sustainability is an important program of the United Nations to achieve sustainable urban development. It is important to understand the complicated relationship between the urban ecosystem and the natural environment to solve the environmental problems of cities. Owing to its ecological origin, the establishment of ecological parks plays an essential role in sustainable urban development as it aims to support the spiritual needs of citizens, advocate the life of other species, and minimize the manipulation of nature. This study aims to identify and prioritize important ecological, physical, economic, and social criteria in the eco-park of north-central Iran. Due to its topographic features and specific climate, it provides different habitats for wildlife and has ability to protect biodiversity in the urban ecosystem.

METHODS: There are currently intentions for biodiversity compensation in urban planning due to public opinion and species extinction problems. However, scarce studies are available to reinforce this fundamental concept in urban management. This study aimed to determine and prioritize Alborz eco-park components in north-central Iran. In this research, the indicators were selected by fuzzy Delphi, using multivariate decision-making, entropy technique, and TOPSIS.

FINDINGS: Based on the TOPSIS method, among environmental-ecological criteria, the highest rank belonged to the ex situ conservation of animals in the urban climate and biodiversity enhancement (relative closeness to ideal solution = 0.621). Eco-park establishment along the Chalus road and Hemmat superhighway was the design and physical criterion with the highest score (relative closeness to ideal solution = 0.696). From the socio-economic view, increasing the understanding of human-nature unity was the highly scored criterion (relative closeness to ideal solution = 0.767).

CONCLUSION: The eco-Park is not only about conservation but also about large-scale restoration of nature. The implementation of this new generation of parks in response to local environmental concerns regarding location, physical aspects, design, and wildlife conservation will help transition to sustainable urban development. The north-central eco-park of Iran can be used as a model for the development of sustainable urban ecosystems.

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*Corresponding Author:

Email: mmalekian@iut.ac.ir

Phone: +98313911024

ORCID: [0000-0002-6387-0850](https://orcid.org/0000-0002-6387-0850)

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INTRODUCTION

Research on urban ecology shows the effect of the increasing unplanned expansion of cities on biodiversity and essential ecosystem services (Verrelli, *et al.*, 2022) because urban ecology examines both the negative effects of urbanization and provides strategies for reduction and adaptation (Osmond, 2022). With the expansion of urbanization worldwide, wildlife research in the urban ecosystem is essential for planners and authorities of biodiversity protection in the urban environment so that the applied planning is practical for both humans and wildlife (Collins, *et al.*, 2021). Eco-city is a type of ecologically-based environmental life initiated in the light of global pollution and destruction, proclaiming the principle that human habitats can be sustainable and ecologically habitable (Chang *et al.*, 2016). Therefore, urban planners, designers, and ecologists should concentrate on urban green space strategies that explicitly protect social and ecological sustainability (Mersal, 2017). Nowadays, improper human management affects the environment and ecosystems on the globe, and ecosystems have been disregarded for decades (Vaverkova *et al.*, 2018). Nonetheless, ecological concepts can be used as the basis of the design approach to significantly contribute to reducing the environmental effects of whatever is made by humans (Masnavi and Vamenani, 2020). As defined by the World Health Organization, Urban Green Space (UGS) accounts for a part of the “green infrastructure” of the city ecosystem and an important part of public open areas of the mental health domain in each city. UGS is generally areas of natural or semi-natural ecosystems converted into urban spaces by human influence (Bilgili and Gökye, 2012). The concept of eco-cities is based on effectively harnessing the potential of urban ecosystems to create prosperous, healthy, proportionate and productive cities. The aim of this attitude is to transform cities into conventional structures with efficient function and sustainable productivity (Yang, 2013). A city is also the product of a complicated association between the environment and human activities (Sénécal, 2007), where citizen’s general sentiments toward land use and their satisfaction are an important social reference for sustainable urban management and planning, with an indirect positive effect on the urban environment available to users (Yang *et al.*, 2022; Dutoit *et al.*,

2018). At the global level, however, biodiversity compensation is used to balance negative effects on biodiversity and Ecosystem Services (ES) arising from utilization. In this reasoning, municipalities should have the capacity in terms of structures and organizational resources to devise a strategy that delivers the right outcomes for nature and people in urban planning (Hanson and Olsson 2023). This is because urban and suburban ecosystems contribute to biodiversity and ES provision and are considered to be important for Sustainable Urban Development (SUD) (European Commission, 2015). Meanwhile, rapid urbanization has become one of the most important environmental sustainability challenges in urban areas, and lack of urban planning has made ecosystem degradation more pronounced in developing countries. Accordingly, researchers should use ecological efficiency in urban development and sustainable use planning promotion (Das *et al.*, 2023). In such an insight, the landscape is considered a mosaic of connected elements that increases the connection between urban habitats (Guo *et al.*, 2007). Urban landscapes require new interventions, of which an important case is planning for their biodiversity conservation. The development of green sanctuaries, green routes, intra-urban green spaces, and natural parks are ecological approaches for biodiversity conservation inside cities (Bryant, 2004). The idea of ecological networks in Europe and green routes in the USA was raised in the early 20th century and has acted to connect green systems or cities to natural and forest areas (Johnson and Hill 2002). An eco-park criterion is the ecological-environmental index, which considers ecological principles and stabilizes the adaptation of the structure and framework of the city body on natural infrastructure to create concepts in which speculation and utilization of their potential capacity’s direct planners and city builders to create urban landscapes compatible with the city nature (Darwen and Green 1996). A major function of the ecological index is ex situ conservation, which examines species according to their natural environmental patterns in terms of the space surrounding them in nature. Because these species are excluded from their natural ecological processes, their exposure to danger necessitates management by humans in artificial and natural simulated conditions in a natural habitat. Ex situ management may be applied inside or outside the species’

geographical range, but it has to be in a controlled or modified environment (Jain and Kharkwal, 2004). It is believed that this kind of ability is an undeniable approach in the conservation and management of living systems (Van der Ryn and Cown, 2007; Bennett and Wit 2001), improving the quality of life by the correct utilization of environmental benefits, building a desirable green space for upbringing and educating children, social integration, and welfare protection (Balram, 2005; Yang et al., 2022; Power, 2006). The study area is the Alborz eco-park located in north-central Iran. This eco-park constitutes the mounds and heights of Hesar and the eastern landscape of Karaj city, which is known as the respiratory filter of the east city. The park locality in the Karaj-Chalus road, which is a major access road to the north of Iran and one of the busiest roads in the country, has created special conditions for this eco-park that affects its visitors. The virginity of the area and the free observation of wildlife in Iran for the first time, has made the ecological functions of this area of paramount importance. The establishment of this

comprehensive wildlife eco-park utilizing natural resources, green hillside, natural water resources, valuable strains of indigenous animals, and diverse plant species next to each other undoubtedly exemplifies natural resource protection in the nature destruction crisis in Iran. This study aimed to evaluate the environmental and socioeconomic aspects and design-physical dimensions of the eco-park, prioritizes its components and describe its functions as the new generation of urban parks. The current study was carried out in Karaj, Iran in 2022.

MATERIALS AND METHOD

Survey design and data collection

Field surveys were conducted in the study area from October 2021 to June 2022. The examinations included data collection from the specialized builder team, executor organizations, different geographical maps, slope and direction maps, and regional recreation maps (Fig. 1). In addition, specialized texts, library content and various national and international articles, related to eco-parks, were evaluated to

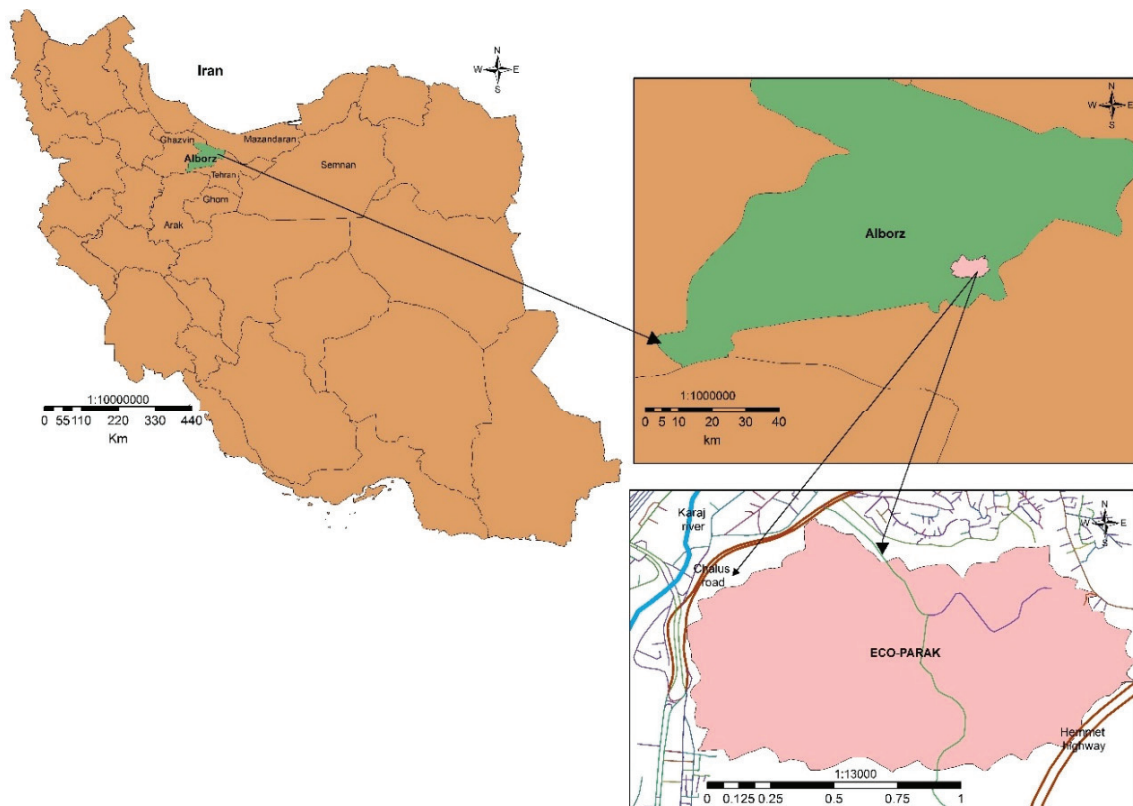


Fig. 1: Geographic location of the study area

extract the primary requirements of eco-park design, the indicators, and criteria. The final criteria were identified and selected based on the analysis of data obtained from elite experts in the field, national and international articles, and specialized texts concerning eco-parks.

Based on the indices provided by International Union for Conservation of Nature (Leverington *et al.*, 2010), the obtained criteria were classified into three socioeconomic, environmental-ecologic, and design-physical domains and used for designing structured questionnaires. To evaluate the eco-park elements from the visitor's viewpoints, personal and socioeconomic information of the eco-park visitors, and the desirability of its elements were enquired. Cochran's sampling formula for unlimited statistical population size was used in this study and the number of respondents was 384. To obtain the expert opinion about the eco-park and rank the criteria, an expert community consisting of five prominent university professors, 26 senior experts in public and private management classes with a work experience of over 10 years, was selected. Given the novelty of the research topic, a snowball sampling method was used to conduct the research about people with specific traits who might otherwise be difficult to identify (Goodman, 1961). The importance of each criterion was assessed by the above expert community, using the Fuzzy Delphi Method (FDM) (Habibi *et al.*, 2015) in the Likert scale. The final ecological, economic, social and physical design criteria were identified, and the entropy technique was used to calculate their weights. Further a high-power prioritization

method, known as TOPSIS (Technique for Order Preference by Similarity to Ideal Solution), was used for prioritization of the selected criteria. All analyses were performed and tabulate by SPSS v. 16 and EXCEL software.

RESULTS AND DISCUSSION

Analysis of visitor questionnaires

Based on the results of visitor questionnaires 51.3 and 48.7% of visitors were female and male, respectively. It shows the approximate gender equality of visitors, and represents the security of female visitors in the eco-park contrary to most urban parks in Iran. Moreover, the majority of the respondent (78%) selected family as the preferred type of travel plan (Fig. 2) and considered the environment of the eco-park to be more attractive for families. In the line with Lee and Graefe (2010), this finding indicates that the promotion of inter-generation family recreation in a nature-based tourism destination can effectively provide the ground for the healthy development of the youth. In particular, participation in nature-based recreation often provides opportunities for families to grow together and preserve their solidarity.

The results further indicated that Alborz, Tehran, and Qom were the provinces of residence for 74.5% of the respondents. After Alborz and Tehran provinces, Qom with 17% ranks third, and Semnan province with about > 7% was the visitors' place of residence. These percentages represent the acceptability of the eco-park by the residents of desert cities in north-central Iran. The statistical results for the desirability of park tourism elements of major Karaj eco-park

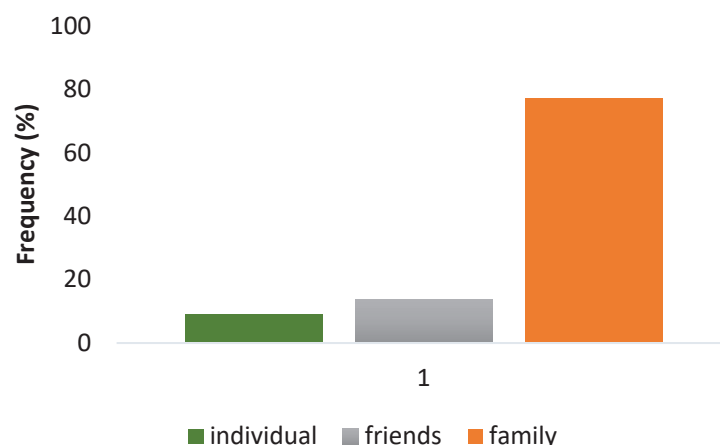


Fig. 2: Frequency percentages of the travel types preferred by the eco-park visitors

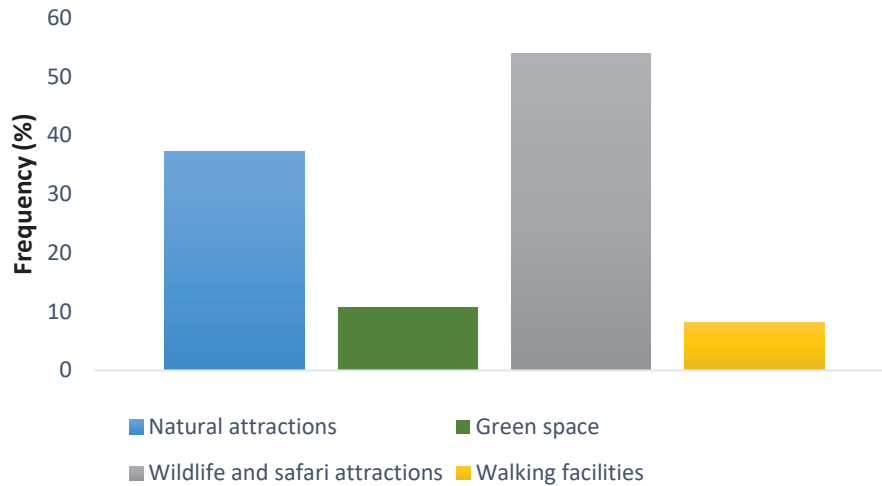


Fig. 3: Frequency percentages of major desirability elements of the eco-park from the visitors' point of views

attractions from visitors' opinions (Fig.3) indicated that wildlife and safari attractions (53.9% of opinions) and then natural attractions were the most important tourism attractions. The presence of virgin and mountainous areas and free wildlife observation are the major desirable elements from the visitors' point of view. Based on the visitors' experiences in Sheikh Mujib safari park in Bangladesh, the uniqueness and virginity of the safari was the most tourism attractions (Bhuiyan *et al.*, 2021). The safari tourism is developing in nature-based parks of many countries because tourists are satisfied with the natural attractions such as virginity, uniqueness and cleanness.

Analysis of expert questionnaires

The preliminary results of expert opinions are represented in (Table 1). These opinions were then fuzzified based on the spectrum of triangular fuzzy numbers equal to the 5-point Likert scale. The threshold was set to 0.7 in the FDM. Thus, variables were approved with a minimum consensus of 70% without the need for repetition. Three indices and 18 criteria were accepted based on the results in (Table 2). The weight (W_j) of each index, calculated by the entropy technique are given in (Table 3). The decision-making matrix was first converted to a normalized matrix, and then d_j and E_j were calculated for each index.

The final environmental-ecological criteria, prioritized by the TOPSIS technique using the weights obtained from the entropy method, are given in (Table

4). Based on the scores obtained from the TOPSIS technique, the priority belongs to ex situ conservation of animals in the urban climate and biodiversity enhancement. The first priority of biodiversity enhancement in the urban climate indicates that ecological functions are more important in the north-central eco-park of Iran due to the natural origin, ex situ conservation of wildlife, and biodiversity. The studied eco-park, which was established to enhance biodiversity in urban environments, increases peoples' understanding of the environment and its conservation. According to (Gunnarsson *et al.*, 2015), it confirms the idea that biodiversity per se affects human perception, and urban planning should provide city-based green spaces rich in species, greenness, and diversity, with natural sounds, in the form of eco-parks. It is a place where collective space is designed with an ecological approach, leading to its sustainability by paving the ground for linking natural heritage and culture because the spatial features of UGS fragments influence the ecological aspects of green space (Chen and Jim 2008; Soltanifar and Jafari, 2018).

Conservation of endemic animals and plants is the second ecological index priority, which recalls the importance of ex situ conservation of endemic animals in the eco-park, because the habitat and climate can be simulated in region-specific eco-parks. For example, the endangered Asian zebra is climatically adaptable and is currently under ex situ conservation in Alborz eco-park. The third priority is

Table 1: The prioritization results of indices based on expert opinions according to the Delphi

Row	Index	Criterion	Consensus rate				
			Totally disagree	Disagree	Neither agree nor disagree	Agree	Totally agree
1	Environmental-ecological	Ex situ conservation of animals in urban climates and biodiversity enhancement	0	0	0	8	22
2		Reduction of noise pollution and increasing visual beauty	0	0	1	19	10
3		Protection of natural topography and the original ecosystem tailored to animals	0	0	2	14	14
4		Indicative and unique location (natural stone outcrops of landscape)	1	1	6	14	8
5		Reduction of pollutants and air conditioning	0	0	5	14	11
6		Protection of endemic animals and plants	0	0	0	11	19
7		High open and wide natural view	0	0	7	15	8
8	Design-physical	Designing fencing areas for the free movement of animals	0	0	0	10	20
9		Safari feasibility to watch eco-park animals	0	0	0	9	21
10		Green landscaping in the regional natural slope	0	0	8	17	5
11		Eco-park establishment at heights, view, and perspective of the city	0	1	6	13	10
12		Eco-park establishment along the Chalus road and Hemmat superhighway	2	0	6	14	8
13		Compatible uses, construction of roads and buildings, and no destruction of the environment if possible	0	0	4	10	16
14		Socioeconomic	Increasing the understanding of man-nature unity	0	0	3	17
15	Regional development and increasing occupation		0	0	9	14	7
16	Increasing the quality of life with the proper utilization of environmental benefits		0	0	10	13	7
17	New leisure in the natural environment for all classes		0	0	7	14	9
18	Usability by intercity passengers		0	0	7	16	7

the open and wide view of natural beauty reflecting the urban landscapes from topographies. This can refer to the theory of Aldo Leopold, the ecologist and environmental protection activist, who described the ecological beauty in the light of human ethics to positively affect changes in the human perspective. His viewpoint was based on environmental ethics and believed “whatever serves to preserve the integrity, stability, and beauty of societies is right, and whatever

is against this is wrong (Bell, 2012).

Among the physical criteria, ranked by the TOPSIS (Table 5), the first priority belongs to the eco-park establishment along the Chalus road and Hemmat superhighway ($CL_j = 0.696$), which indicates the good location and accessibility of the Eco-park. Access roads influence the number of visitors. The second priority is assigned to compatible uses and no destruction of the environment ($CL_j = 0.681$).

Table 2: The results of fuzzy Delphi

Row	Index	Criterion	Triangular fuzzy values			Average defuzzified	Status
			Lower	Middle	Upper		
1	Environmental-ecological	Ex situ conservation of animals in urban climates and biodiversity enhancement	0.683	0.933	1.000	0.872	Approved
2		Reduction of noise pollution and increasing visual beauty	0.575	0.825	0.992	0.797	Approved
3		Protection of natural topography and the original ecosystem tailored to animals	0.600	0.850	0.983	0.811	Approved
4		Indicative and unique location (natural stone outcrops of landscape)	0.483	0.725	0.908	0.706	Approved
5		Reduction of pollutants and air conditioning	0.550	0.800	0.958	0.769	Approved
6		Protection of endemic animals and plants	0.658	0.908	0.000	0.856	Approved
7		High open and wide natural view	0.508	0.758	0.942	0.736	Approved
8	Design-physical	Designing fencing areas for the free movement of animals	0.667	0.917	1.000	0.861	Approved
9		Safari feasibility to watch eco-park animals	0.675	0.925	1.000	0.867	Approved
10		Green landscaping in the regional natural slope	0.475	0.725	0.933	0.711	Approved
11		Eco-park establishment at heights, view, and perspective of the city	0.517	0.767	0.933	0.739	Approved
12		Eco-park establishment along the Chalus road and Hemmat superhighway	0.483	0.717	0.900	0.700	Approved
13		Compatible uses, construction of roads and buildings, and no destruction of the environment if possible	0.600	0.850	0.967	0.806	Approved
14	Socioeconomic	Increasing the understanding of man-nature unity	0.558	0.808	0.975	0.781	Approved
15		Regional development and increasing occupation	0.483	0.733	0.925	0.714	Approved
16		Increasing the quality of life with the proper utilization of environmental benefits	0.475	0.725	0.917	0.706	Approved
17		New leisure in the natural environment for all classes	0.517	0.767	0.942	0.742	Approved
18		Usability by intercity passengers	0.500	0.750	0.942	0.731	Approved

According to (Williams *et al.*, 2015), urban living areas should be designed and managed based on nature-friendly criteria, and a sustainable human habitat should be planned based on ecological balance. In

terms of environmental problems, basic changes in urban infrastructure, such as eco-park development, should be made in metropolises suffering from heat islands caused by vegetation scarcity or settlement

The role of eco-parks in sustainable urban development

Table 3: The weight (W_j) of ecological indices with the entropy technique

Row	Index	Criterion	E_j	D_j	W_j
1	Environmental-ecological	Ex situ conservation of animals in urban climates and biodiversity enhancement	0.999	0.001	0.017
2		Reduction of noise pollution and increasing visual beauty	0.998	0.002	0.028
3		Protection of natural topography and the original ecosystem tailored to animals	0.997	0.003	0.037
4		Indicative and unique location (natural stone outcrops of landscape)	0.990	0.010	0.125
5		Reduction of pollutants and air conditioning	0.996	0.004	0.053
6		Protection of endemic animals and plants	0.998	0.002	0.020
7		High open and wide natural view	0.995	0.005	0.058
8	Design-physical	Designing fencing areas for the free movement of animals	0.998	0.002	0.019
9		Safari feasibility to watch eco-park animals	0.999	0.001	0.018
10		Green landscaping in the regional natural slope	0.996	0.004	0.052
11		Eco-park establishment at heights, view, and perspective of the city	0.994	0.006	0.078
12		Eco-park establishment along the Chalus road and Hemmat superhighway	0.988	0.012	0.157
13	Socioeconomic	Compatible uses, construction of roads and buildings, and no destruction of the environment if possible	0.996	0.004	0.051
14		Increasing the understanding of man-nature unity	0.997	0.003	0.040
15		Regional development and increasing occupation	0.995	0.005	0.064
16		Increasing the quality of life with the proper utilization of environmental benefits	0.995	0.005	0.068
17		New leisure in the natural environment for all classes	0.995	0.005	0.060
18		Usability by intercity passengers	0.996	0.004	0.055

Table 4: The ranking results of environmental-ecological indices by the TOPSIS method

Row	Index	Distance from the negative ideal d_j^-	Distance from the positive ideal d_j^+	Relative closeness to the ideal solution CL_j	Rank
1	Ex situ conservation of animals in the urban climate and biodiversity enhancement	0.003	0.002	0.621	1
2	Reduction of noise pollution and increasing visual beauty	0.004	0.006	0.398	7
3	Protection of natural topography and the original ecosystem tailored to animals	0.006	0.007	0.453	5
4	Indicative and unique location (natural stone outcrops of landscape)	0.03	0.031	0.484	4
5	Reduction of pollutants and air conditioning	0.009	0.014	0.399	6
6	Protection of endemic animals and plants	0.004	0.003	0.562	2
7	High open and wide natural view	0.018	0.018	0.501	3

Table 5: The ranking results of design-physical indices by the TOPSIS method

Row	Index	Distance from the negative ideal d_j^-	Distance from the positive ideal d_j^+	Relative closeness to the ideal solution CL_j	Rank
1	Designing fencing areas for the free movement of animals	0.003	0.002	0.618	3
2	Safari feasibility to watch eco-park animals	0.003	0.003	0.489	5
3	Green landscaping in the regional natural slope	0.009	0.007	0.569	4
4	Eco-park establishment at heights, view, and perspective of the city	0.015	0.037	0.294	6
5	Eco-park establishment along the Chalus road and Hemmat superhighway	0.053	0.023	0.696	1
6	Compatible uses and no destruction of the environment if possible	0.009	0.004	0.681	2

Table 6: The ranking results of socioeconomic indices by the TOPSIS method

Row	Index	Distance from the negative ideal d_j^-	Distance from the positive ideal d_j^+	Relative closeness to the ideal solution CL_j	Rank
1	Increasing the understanding of man-nature unity	0.013	0.004	0.767	1
2	Regional development and increasing local occupation	0.012	0.006	0.667	3
3	Increasing the quality of life with proper utilization of environmental benefits	0.02	0.009	0.695	2
4	New leisure in the natural environment for all classes	0.019	0.036	0.347	5
5	Usability by intercity passengers	0.009	0.016	0.359	4

construction far from green cities and ecological standards (Gozaloa and Gonzalez, 2018).

Increasing the understanding of man-nature unity and new leisure in the natural environment is the first socio- economic priority of the eco-park (Table 6). for all classes were assigned to the first and fifth priorities by experts. The urban environment affects citizens' audiovisual comprehension and developing eco-parks seem to be important to improve the man-nature unity (Gunnarsson *et al.*, 2015). This implies that higher scores belong to UGS aesthetics, thus, urban planners should pay special attention to understanding citizens' sense of naturalism by developing parks and green spaces rich in plant and animal species. The second priority belongs to

increasing the quality of life with the proper utilization of environmental benefits. Natural and artificial UGSs have positive effects on people's welfare (Benma *et al.*, 2018). (Dempsey *et al.*, 2018) reported a significant relationship between measurements of UGS and park distances from citizens' residence areas, suggesting that proper utilization of natural and environmental resources in the form of eco-parks increases citizens' quality of life in the social health dimension. The experience of natural environment in the urban structure underpins positive emotions and correct behaviors that satisfy specific spiritual social/human needs (Priskin, 2013). The third socio-economic priority is the regional development and increasing the local occupation (Table 6). As stated

by (Prakash, 2013), there are economic aspects that favor a better ecotourism perspective in eco-parks relative to protected areas and other urban parks, which can manifest the pattern of urban ecotourism attractions managed by the local community. Urban eco-parks are located in a specific topography as a local capital and possess the positive support of local people for biodiversity conservation and ecosystem management by combining joint possession and management. Furthermore, the economic income of tourism can create changes in local attitudes toward urban green coverage and wildlife, as eco-parks encourage local protection of resources in the form of economic ecotourism and local development.

CONCLUSION

The importance of the environment and the improvement of the urban ecological dimension have been reconsidered by urban researchers and managers, because they have realized the indispensable link between cities and natural environments. Owing to the increasing green attitude among citizens, they prefer to live in a high-quality urban environment in which the environmental dimensions are precisely planned and managed by environmental managers and experts. Eco-parks can provide a way to improve their quality of life. The results of this study demonstrate the advantages of eco-park establishment in the urban ecosystem considering the dynamic indices of the urban environment, i.e., developing the city's natural landscape with an ecological approach. The distinctive features of this eco-park seem to form a relatively diverse ecosystem providing various habitats and vegetation for the regional wildlife. For example, biodiversity enhancement in urban ecosystems and conservation of biological reserves, such as the Iranian zebra, which is protected in this eco-park. The species is classified as endangered by the IUCN, and only 600 individuals have remained in the wild. Environmental-ecologic criteria, such as endemic plant vegetation, developing artificial urban forests to increase urban green landscape and reduce urban air pollution received high scores. From the socio-economic view, increasing the understanding of human-nature unity, increasing the quality of life and increasing occupation were the highly scored indices. Thus, based on the sustainable urban development, the eco-park establishment is useful, practical,

and influential urban management for preserving and developing natural urban spaces to improve sustainable living conditions of cities. Therefore, it can be concluded that developing a new generation of urban parks tailored to regional environmental issues by considering the location, physical aspects, design, and wildlife conservation can be helpful to achieve the sustainable development of urban environments. Given the drought problems and species extinction in Iran, such eco-parks increase ecological productivity in urban ecosystems. Finally, the north-central eco-park of Iran can be used as a model for the development of sustainable urban ecosystems.

AUTHOR CONTRIBUTIONS

M. Malekian conceived the ideas. Z. Noorzadeh performed the literature review, collected the information and analysed the data. M. Malekian helped in designing structured questionnaires, manuscript preparation and editing.

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The authors declare no potential conflict of interest regarding the publication of this work. 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 witnessed by the authors.

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ABBREVIATIONS

CL_j	Relative closeness to the ideal solution
CIFOR	Center for International Forestry Research
d	The difference between the real proportion of the trait in the community and the estimated value
d_j	The decision-making matrix
d_j^-	Distance from the negative ideal
d_j^+	Distance from the positive idea
E_j	The entropy
ES	Ecosystem Services
Ex-situ conservation	The conservation of species outside their natural habitats
FDM	Fuzzy Delphi Method
IUCN	International Union for Conservation of Nature
L	Lower number
M	Middle number
n	The statistical sample size
S^2	The variance of the measured trait
SPSS	Statistical Package for the Social Sciences
SRM	Sustainable Rangeland Management
SUD	Sustainable Urban Development
TOPSIS	Technique for Order Preference by Similarity to Ideal Solution

UGS	Urban Green Space
W_j	The weight of each index
z	The confidence factor with values of 95%

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