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Responsive human resource framework for design and building of mega housing development projects in Egypt

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ABSTRACT

Design and building of Mega Housing Development Projects (MHDP) has become one of the targets of developed countries, due to their positive impact on continuous population growth, rapid urbanisation, economic situation and working force engagement. Developing countries are moving towards the establishment of MHDP, where Egypt 2030 plan aims at constructing MHDP with specific vision. Although MHDP are expected to offer HR opportunities, they will generate challenges. The purpose of this paper is to design a responsive framework to HR factors arising from the internal and external MHDP environments. The paper undergoes a review for HR challenges and opportunities in design and building of MHDP, which was followed by a qualitative analysis of case studies from countries near to Egypt. Finally, a survey questionnaire was implemented, targeting stakeholders involved in MHDP. Most external challenges facing developing countries included security for HR working in design and building, shortage in access to technology in supply from a country to organization, Governance instability systems and lack of coordination. The most challenging factors facing the developing countries include providing services for organizations during construction of new MHDP, planning more flexible funding strategies for more flexible economic construction environment, avoiding continuous change of governmental systems and biased decision making, improving educational knowledge for constructions' obstacles to improve innovation, and Engaging more employees into the construction of MHDP activities. The paper developed a responsive framework and a risk register which better suits MHDP in Egypt. Strategies for HR internal opportunities at the design stage included "exploit", "share", and "enhance". "Exploit" strategy aims to ensure that the opportunity is recognized and make the opportunity definitely happen. Regarding HR Challenges, responsive strategies include "Avoid", "Transfer", "Mitigate", or "Accept". The paper improves management practice of challenges and opportunities for HR in MHDP in Egypt.

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1. Introduction

Design and building of new cities is considered to be one of the major poles targeted by different countries. Mismanagement and swelling of the metropolitan cities have resulted in a global shift

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towards prohibiting building new housing projects in Egypt [1]. Both synergies and development opportunities can be generated for design and building of new MHDP. The intervention of New Cities in Egypt will create a positive impact by reducing the rate of unemployment in Egypt [2]. Building of new MHDP in Egypt can actually help in achieving strategic goals for better delivery of MHDP in Egypt. Since 43% of the population in Egypt live in 223 cities, of which 56% are concentrated in the Greater Cairo Region (GCR) and Alexandria, building MHDP arise to be a solution for better urbanisation in Egypt [3]. Despite gained opportunities, the construction of new MHDP in Egypt generates major challenges. MHDP complexity is characterised as high level of risk and uncertainty, large number of people conflicts, missing rise of interpretation, large number of resources managed between stakeholder's and long-life implementation [4]. MHDP require employment of personnel with high managerial technical skills in Egypt.

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In a study of unemployment in Egypt, researchers found that the probability of being unemployed increases significantly from one gender to another [2]. Policy makers in Developing countries are in a persistent need for outlining a clear multilevel, highly collaborative strategy for HRD [5]. However, the Egyptian strategy 2030 clarifies and ensures that both flexible policy and transparency with stakeholders will present Egypt's core motivator for strategic MHDP investments. Poor management of these challenges could lead to negative impact on building new MHDP [6].

Egypt was successful in managing its available resources, implementing and encouraging external investors with more flexible policy making decisions, contract types, and benefits. Human resources involved in the design and building of MHDP have a very critical role in improving the economic situation for countries. By building and developing MHDP in Egypt, more opportunity will be offered for different human resource to be engaged in the design and building and thus improving the country's GDP. Thus, Egypt can get the opportunity to have more stable economy, attract more external investments, and improve its technical skills within available human resources. HR roles in design and building of MHDP are considered one of the major elements of success, especially within the Egyptian context. The paper aims to recognize HR key Opportunities and Challenges arising from the internal and external stakeholder's environments. The construction of MHDP faces different HR challenges which can greatly affect stakeholders' goal of successful delivery of their construction [5]. The paper recognized human resource challenges and opportunities in design and building of MHDP. Analysis of case studies for national and international MHDP is followed. A risk breakdown structure was used to organize identified challenges and opportunities. Challenges and opportunities are coded and categorized into external and internal construction environment factors. The paper reviewed human resource studies to highlight challenges and opportunities. The paper performed a survey for introducing experts' opinions and to add possible mitigations for human resource factors. A responsive HR framework was developed to improve knowledge of human resource management and organizations practice of managing HR challenges and opportunities in design and building of MHDP. The HR framework involved recognition and mitigation of HR challenges and opportunities in design and construction phases. The HR framework improved organizations' practice of managing HR factors related to external and internal design and construction environment of MHDP.

2. Methodology

The paper methodology is explained in Fig. 1. First, a review for both HR Challenges and Opportunities in MHDP was done. Through the review, case studies success factors were recognised. Furthermore, an in-depth analysis for developing countries was performed. HR factors were then prioritized for each of developed and developing countries. The process of risk breakdown structure (RBS) was then used to classify HR factors into both external and internal organization related-factors. Finally, a Survey questionnaire was implemented to introduce Experts opinions to overcome the challenges, where a purposeful sample of 30 experts, was selected. For the aim of simplifying different HR challenges and opportunities, Table 1 introduces a coding to each HR factor. This coding system is suggested by the authors for the ease of analysis and understanding of the HR factors.

3. Recognition of global case studies for mega housing developments

Case studies and their detailed characteristics of MHDP are presented in Table 2. Mega housing projects are characterized by

accommodation of large population, high cost of construction, large size of projects, using large number of interrelated resources and activities [15]. MHPD have recognized economic impacts that included: Higher cost of transportation was monitored due to decentralization. Higher GDP was achieved due to the increase of construction jobs. Smarter cities allowed minimization of waste and cost regarding the use of solar panels and smart lighting to save energy, smart equipment's to reduce quantity and cost of water consumption. Case studies social impacts included increased time to reach work destination due to far accommodation of workers from site. Positive impact was monitored after construction by support of fast urbanization. Job opportunities have increased that included increase in technical office and site construction jobs during execution. The process of construction improved technical skills and computer skills for after construction.

4. Opportunities and challenges of HR in mega housing development projects

An analysis will be offered to different literature sources that dealt with HR factors affecting successful delivery of MHDP projects. The aim of this review is to recognise and classify HR challenges and opportunities based on both internal and external environment of an organization.

4.1. Challenges of human resources in design and building of MHDP

The design and building of MHDP faces different HR challenges which can greatly affect stakeholders' goal of successful delivery of their design and building. One of the most crucial factors which can practically influence and improve the economic situation of a country is the Human resource development. Human resource development has recently been a major priority, if not an obsession for leaders and policymakers in the developing new cities [5]. The development of HR is characterized by different connotations regarding its external and internal environment. The relation between external environment and the human resource development ensures the institutional setup of the country for improvement of organizations' successful engagement in design and building of new cities. Table 3 summarizes HR challenges either internal or external towards the design and building of MHDP. The number by which the challenge is repeated all over the study of developed countries is indicated. It is clear from Table 2, that most developing countries agree that the key internal challenge facing stakeholders in constructing MHDP is scarcity of resources, as MHDP require well-qualified and trained workers, who are scarce in developing countries. Most external challenges facing developing countries include security for HR working in design and building, shortage in access to technology in supply from a country to organization, Governance instability systems and lack of coordination [7,2,6,8,5,9,10,11].

4.2. Opportunities of human resources in design and building of MHDP

This paper categorized HR opportunities with respect to internal and external construction environment. Internal HR opportunities are opportunities that are beneficial to organizations' HR management. External opportunities included benefits for countries that are hosting the construction project of MHDP. It was observed that the most frequently external opportunity is providing job opportunities. That is due to the high unemployment rate all over developing countries. Table 4 summarizes HR opportunities classified into either internal opportunities or external opportunities towards the design and building of MHDP. At the end of the table, the number by which the opportunity is repeated all over



Fig. 1. The process of the research methodology, Authors.

Table 1
Human Resource Coding System, by Authors.

Human Resource Challenges and Opportunities in the Construction Industry			
Human Resource Challenges		Human Resource Opportunities	
Internal (A)	External (B)	Internal (C)	External (D)
A.1 Availability of suitable work force	B.1 Available Human Resources	C.1 Government Technology Support	D.1 Improving Countries Human Resource Skills
A.2 Employee Diversity	B.2 Flexibility of Policy Makers	C.2 Improving Organizational Level of Intelligence	D.2 Solution for high population
A.3 Globalisation and multicultural diversity	B.3 Lack of Mega Housing Projects Data Base	C.3 Increasing Competency Chances	D.3 Providing More Job Opportunities
A.4 Integrating Human Resource with Technology	B.4 Required Knowledge and Technology	C.4 Improving Human Resource Skills	D.4 Improving Political Environment and Trust
A.5 Construction Safety of Employees	B.5 Poor Governance Systems	C.5 Attracting Talent Employees	D.5 Increasing Investments
A.6 Decentralized Work Sites	B.6 Weak Economic Situation		D.6 Improving Human Resource Use of Technology

the study of developed countries is indicated. It is clear from Table 4, that the most important opportunity gained from the analysis of the case studies is providing job opportunities, due to the high unemployment rate all over developing countries. Other opportunities include solution for high population which is a common fact shared among most developing countries nowadays.

5. Analysis of case studies for developing mega housing projects

The following review qualitatively analyses four examples of working on building or developing different cities to include more

Table 2
Global mega housing projects.

Reference	Country	Case Study
[1,2,3,5,8]	EGYPT	Egyptian Mega Housing Development Projects. Project Name: New Alamein City Area: 50,000 Feddan Expected Population: 3 Million Cost: \$14.2 Billion Job Opportunities: Project Name: New Ismailia City Area: 2,078 Feddan Expected Population: 314,000 Project Name: New Capital Area: 170,000 Feddan Expected Population: 7 Million Cost: \$50 Billion Egypt New Capital City. Five million people at a cost of \$45 billion
[16]	SOUTH AFRICA	Capetown Mega Housing Projects
[17]	BOKSBURG	Leeuwpoort Mega Housing Project
[18]	JAPAN - TOKYO	Shibuya Station Development project
	CHINA	Nanhui New Mega City Housing demand increased by 50% due to Tokyo 2020 Olympics 800,000 houses with a cost of \$4.5 billion.

complex new MHDP. Case studies selection was based on specific criteria, including: scale, budget and geographical location.

5.1. Analysis of HR factors in case studies

Identified developing countries case studies include: The Mediterranean Region, African Context in Morocco and Tunisia, Pakistan, and Egypt as indicated in Table 5. The table highlighted

Table 3
Human Resources Internal and External Challenges.

Case Study	(HR) Challenges in SDP	Code	No.
Egypt, Morocco, and Tunisia, Countries within the Mediterranean, India, Sub Saharan Africa, Pakistan.	Stakeholder's Technology	C I	1
	Government Policy Flexibility	C E	2
	Governance	C E	2
	Instability Systems	C E	2
	Shortage in access to technology	C E	1
	Economy Weakness	C E	1
	Lack of Competitiveness	C E	1
	Unbalanced Geographical Development	C E	1
	Poor Transportation Facilities	C E	1
	High Rate of Pollution	C E	1
	Rapid Growth and Urban Sprawl	C E	1
	Urban Poverty and Inequality	C E	1
	Threats to Cultural Identity	C I	2
	Low Educational Level HR	C E	2
	Urban Violence and Insecurity	C I	4
	Resources Scarcity Work Force	CI	1
	Diversity Innovation and Research	CI	1
	Lack of Smart Data Base	CI	1
	Poor Technical Training	CI	1
	Suitable (HR) Strategy	CI	1

Table 4
Human Resources Internal and External Opportunities.

Case Study	(HR) Opportunities	Code	Repeated Opportunity/ Case Study
Egypt, Moroco, and Tunisia, Mediterranean Region	Increase Construction Investments	O E	1
	Solution for High Population	O E	3
	Providing More Job Opportunities	O E	4
	Chance for Improving Employee Skills	O I	1
	Improving Employee Skills	O I	1
	Flexible Financial Stability	O I	1
	Populating Technical and Managerial Capabilities	O I	1

HR factors conducted from a review of their literature. It is clear from the analysis presented in Tables 4 and 5 that the most challenging factors facing the developing countries include providing services for organizations during construction of new MHDP, planning more flexible funding strategies for more flexible economic construction environment, avoiding continuous change of governmental systems and biased decision making, improving educational knowledge for constructions' obstacles to improve

Table 5
Analysis of Case Studies for MHDP in Developing Countries.

Source	Case Study	Background	HR Factors
[6,13]	Mediterranean Region	UPM University developed a 3 years research to study challenges in developing new cities	<ul style="list-style-type: none"> - Decentralised Workforce - Solution for Rapid Urbanisation - HR Technicalities and Skill Shortage - Lack of Previous Experience - Meeting Sustainable Goals - Scarcity of Resources
[14]	MHDP in Pakistan	MHDP includes 15 major urban centres which are to be completed by 2020. This Includes the development of Lahore City and the Quetta City.	<ul style="list-style-type: none"> - Financial Problems. - Extreme Safety Issues - Week Governmental Institutions. - Scarcity of Resources - Low HR Technical Skills - Lack of Cities Master Plans
[7,9,15]	MHDP in Africa including Tunisia, Morocco, and Egypt	The mega housing development plan is characterized with network engagement workplaces, schools, universities, universal access to power, healthcare facilities, and robust transport networks.	<ul style="list-style-type: none"> - Attracting new investors - Creating thousands of jobs - Integrate IT throughout their economies - Providing more job opportunities - Solution for Population - Improving innovation - Empowering HR Technical Skills - Enhancing Communications - Need for more flexible policies - HR Requires more experience - Solution for rapid urbanization - Providing More Job Opportunities - Gender diversity - Lack of work force with higher technicalities. - Limited Knowledge and Practice - Decentralized Work Force - Harsh Economic Situations - Need of Improving Competencies between Companies - Limited Researches and Approaches
[1,2,3,5,8,10,16]	New Egyptian MHDP-Mega Housing Projects EL-Rehab and Madinaty,	MHDP within the Egyptian context with the aim of testing its validity of application and its underlying implications in the developing countries.	<ul style="list-style-type: none"> - HR Requires more experience - Solution for rapid urbanization - Providing More Job Opportunities - Gender diversity - Lack of work force with higher technicalities. - Limited Knowledge and Practice - Decentralized Work Force - Harsh Economic Situations - Need of Improving Competencies between Companies - Limited Researches and Approaches

innovation, and Engaging more employees into the construction of MHDP activities to avoid diversity problems [7,2,6,8,5,9,10,11,12].

5.2. Application of risk breakdown structure on case studies

Table 6 presents the classification of Case Studies' challenges and opportunities using Risk Breakdown Structure Technique (RBS). These success factors are a combination of the analysis including both different MHDP case studies and stakeholders from Tables 4 and 5. The main target of this analysis is to identify, highlight, analyse and further investigate both challenges and opportunities for each case study, and categorise them accurately. Table 5 below is considered to be a deep focus on human resource success factors regarding different contexts in the light of the review of developing and developed MHDP case studies.

5.3. SWOT analysis for global case studies

SWOT Analysis for Global Case Studies of MHDP is illustrated in Table 7. SWOT stands for Strengths, Weaknesses, Opportunities, and Threats. Simply stated, the SWOT analysis tool is performed to explain the case studies in a narrative way. The analysis process is designed to allow clear identification of internal (strengths) and

Table 6 Review for the Role of (HR) in Design and building of MHDP. Source: Author.

Egypt, Moroco, Tunisia, Mediterranean Region, MHDP in Pakistan	
Mega housing projects human resource Challenges and Opportunities	Role of human resource in the Design and building Industry
<i>HR Challenges</i>	
Stakeholder's Technology	CI4
Government Policy Flexibility	CE2
Governance Instability Systems	CE5
Country Knowledge of Technology	CE4
Economy Weakness	CE6
Lack of Competitiveness	CE3 & CE5
Unbalanced Urban Development	CE2 & CE5
Poor Transportation Facilities	CI6
High Rate of Pollution	CI5
Rapid Growth and Urban Sprawl	CE2 & CE6
Urban Poverty and Inequality	CI2 & CI3
Threats to Cultural Identity	CI3
Low Educational Level HR	CI4 & CE4
Urban Violence and Insecurity	CI5
Resources Scarcity	CI1 & CE1
Work Force Diversity	CI2
Integration of Innovation and Research Within Stakeholders	CI4
Lack of Smart City Data Base	CE3
Skilled Labour Deficiency	CI1 & CE1
Poor Technical Training Application	CI7 & CI4
Interaction Between Change in Institution and Introducing New Design and building System	CE5
Providing a long-term Human Resource Strategy	CI1 & CE1
Government Technology Support	CE4
Work Force Availability	CI1 & CE1
Support of Policy Makers	CE2
Providing Safe Working Environment for Organisations	CI5
Lack of Accurate Data Base	CE3
Poor Governance System	CE5
<i>HR Opportunities</i>	
Increase Design and building Investments	OE4 & OE5
Solution for high population	OE2
Solution for High Population	OE2
Providing More Job Opportunities	OE3
Improving Employee Skills	OI2 & OI4
Providing More Job Opportunities	OE3
Solution for High Population	OE2

external (opportunities) factors case studies has that can contribute to a favourable outcome and what internal (weaknesses) and external (threats) factors is prevented as a favourable outcome. Identifying each group of factors guides mega housing projects stakeholders to allocate future projects strengths and decide course of actions for optimum match between construction opportunities and strengths.

6. Findings of the comparative analysis of case studies

The objective of this analysis is to explore the findings regarding the most important challenges and opportunities highlighted by different MHDP case studies. The results extracted from the developing countries' case studies were compared to those of a previous study done by the authors earlier for analysis of opportunities and challenges of HR in developed countries case study [13].

6.1. Common challenges and opportunities between developing and developed countries

Regarding shared opportunities and threats between developing and developed countries, an overall analysis for the review highlights the most internal and external challenge and opportunity stressed by the literature. This gave way for determining the most human resource challenge affecting the design and building of MHDP through the case studies. As illustrated in the column chart in Fig. 2, the most human resource challenge internally was the availability of suitable work force (CI1), followed by integrating human resource with technology (CI4) and providing suitable safety for employees (CI5) and then globalization and multicultural diversity (CI3), work force diversity (CI2), and decentralized work sites (CI6). On the other hand, Fig. 3 includes the most agreed

Table 7 SWOT Analysis for Global Case Studies of MHDP

Strength	Weakness
S1- Improvement of employee's computer and technical skills.	W1- Capability of HR to cope with technology during execution.
S2- Strengthening the financial status of stakeholders' in execution of mega projects.	W2- Scarcity of Resources
S3- Population of Managerial Capabilities.	W3- Poor Management of Resources
S4- Improving Communication skills between stakeholders'.	W4- Weak management of Workforce Diversity.
S5- Improving management of resources between adjacent mega project facilities	W5- Weak knowledge of innovation and research.
	W6- Lack of Smart Data Base
	W7- Weak Computer Skills
	W8- Absence of Sufficient Training
	W9- Weak HR Hire Strategy
<i>Opportunities</i>	<i>Threat</i>
O1- Solution to massive increase in population.	T1- Flexibility of Countries' Policies
O2- Increase in Competitiveness and Investments.	T2- Change in Governance Systems
O3- Availability of smarter communities with increased level of technology.	T3- Poor capability to access technology
O4- Provided more job opportunities.	T4- Weakness in Economy
O5- Increase in Sustainable Cities.	T5- Lack of Competitiveness
	T6- Unbalanced Urban Development
	T7- Weak Transportation Facilities
	T8- High Rate of Pollution
	T9- Construction close to Urban Sprawl
	T10- Construction threat to Cultural Identity

external challenges, which are flexibility of policy makers (CE2) and inefficient governance system (CE5) followed by available human resources within the country (CE1) and lack of database (CE3) then required knowledge and technology (CE4) and poor economic country situation (CE6).

Whereas, Fig. 4 highlights prioritized internal human resource opportunities in the design and building of MHDP. The most agreed internal opportunity was improving organizational level (OI2), followed by gaining support from the country (OI1) then improving human resource skills (OI4) and attracting talent employees (OI5). As presented in Fig. 5, external opportunities are highlighted as a result of literature review and are prioritized to determine the most agreed external opportunity. The highest agreed external opportunity was solution for high population (OE2), followed by providing more job opportunities (OE3), providing political stability (OE4), increasing investments (OE5), increasing human resource use of technology (OE6), and improving human resource skills (OE1).

6.2. Challenges and opportunities of HR in developing countries

The most challenging factors for HR in design and building of MHDP in developing countries according to literature sources are presented in Fig. 6. These factors are ‘availability of qualified work force’ (CI1) and ‘inefficient governance system’ (CE5). These are followed by the challenges of ‘integrating HR with technology’ (CI4), ‘improving countries human resource skills’ (CE1), and ‘flexibility of policy makers’ (CE2). Challenges which are identified but considered to be least common are both ‘decentralized work sites’ (CI6) and ‘Employees Involvement’ (CI7). On the other hand, Fig. 7 presents key HR Opportunities, where the most agreed opportunity factor is ‘Solution for High Population’ (OE2) followed by ‘providing more job opportunities’ (OE3). Opportunities which are least common include external opportunities ‘providing political stability’ (OE4) and ‘attracting more investments’ (OE5) and internal opportunities ‘Improving organizational level of intelligence’ (OI2) and ‘improving human resource skills’ (OI4).

7. Risk register of key identified HR challenges in construction of SDP

Sigmund Z. identified a list of construction project risks which could affect project scope, cost or time of projects [14]. Eleven categories were used to structure risks presenting risks breakdown

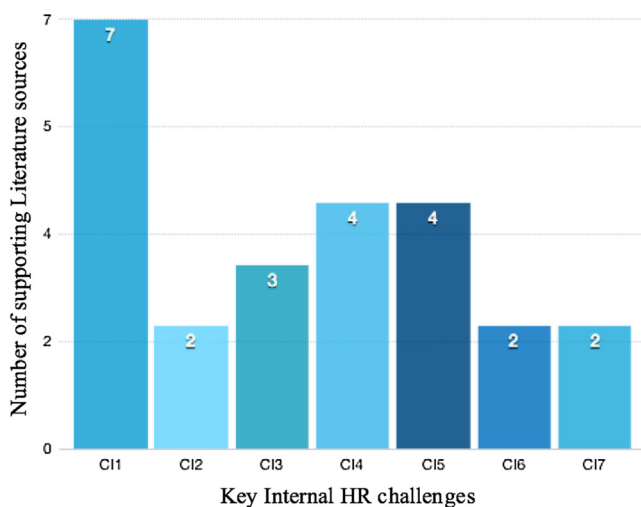


Fig. 2. Internal human resource challenges in design and building of MHDP.

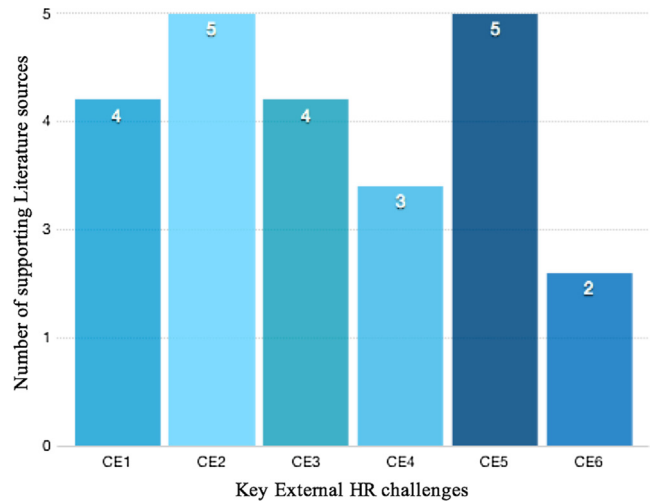


Fig. 3. External human resource challenges in design and building of MHDP.

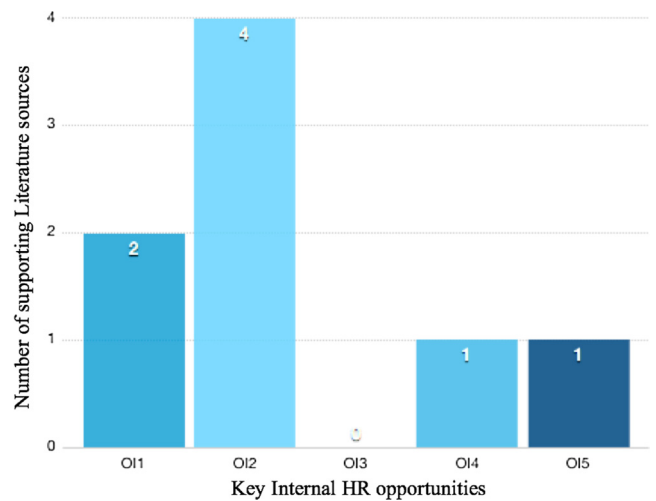


Fig. 4. Internal human resource opportunities in design and building of MHDP.

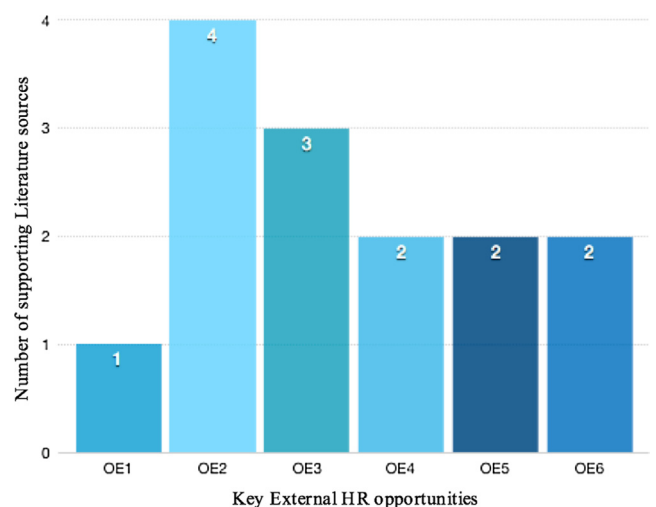


Fig. 5. External human resource opportunities in design and building of MHDP.

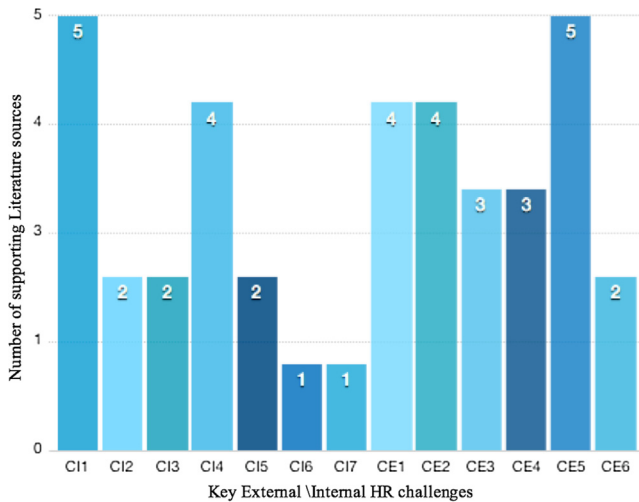


Fig. 6. Human resources challenges for developing countries.

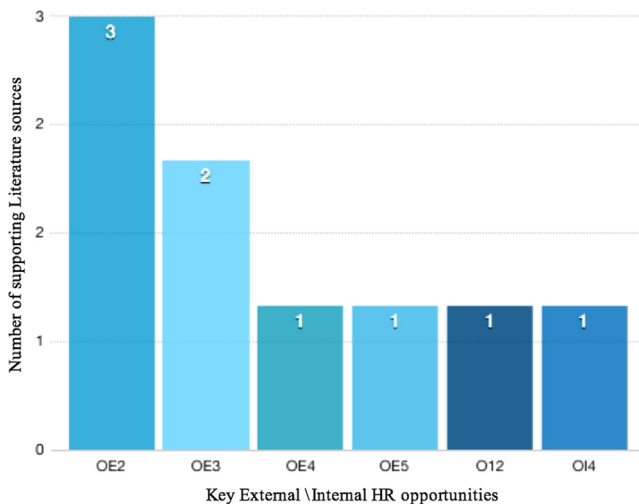


Fig. 7. Human resources opportunities for developing countries.



Fig. 8. Risk register using risk break down structure, Authors.

structure. Fig. 8 presents the risk register after applying a complete risk breakdown structure for previously recognised challenges and opportunities. Identified HR challenges and opportunities in the design and building phases were classified into either external or internal environment-related factors. Internal human resource challenges include challenges facing the HR working within a stakeholder organization which can negatively affect the successful delivery of MHDP. Whereas, external challenges are concerned with the capability of countries to afford capable HR workforce able to construct MHDP.

8. Developed HR management frameworks

A management processes model was developed for construction companies to increase its competitive stability. The model emphasizes the use of more intensive SMART-technologies in design and construction. The study provided a system analysis for construction categories of “competitiveness”, “stability”, “rating of the company” for the construction organizations. The study constructed and an economic model to improve competitiveness and recognized parameters for self-organization of construction companies. The model considered three levels of the analysis for construction businesses. That included macro-level (level of the state), regional -level, and micro-level (level of the company).

The model was developed using an algorithm that finds parameters which will allow to define competitiveness of a construction company. The Model added value by exploiting areas for organizational development, for example, is possible to use for the forecast of adaptation of the enterprise. The model was not oriented to manage HR challenges and opportunities. The model did not provide means of mitigations for challenges that can impact competitive stability. The model was developed for construction projects in general and was not specified for MHDP. Also the model did not consider the context of construction projects [19].

A BIM adoption concept was developed for Iraq construction projects. The study investigated benefits of BIM application and built a measurement model to account for these benefits. The study used quantitative method of questionnaires to test the impact of BIM modelling into improved work performance. The results showed BIM benefits constructed within three key components. The first is knowledge support for management in term of costs, data, and processes. The second is effective design performance and the third is effective construction performance. The

study used these components to develop a measurement model. This study did not include major HR challenges including diversity, technical issues, governance improvement, training, and did not account for opportunities that might improve the performance of workers including availability of experts, technology, and supportive policies. The study was for general construction projects with no evidence of successful improvement for performance in more complex mega projects. The study did not provide solutions for poor performances and did not integrate mitigations [20].

Key success factors are recognized for project management information systems (PMIS) in Industrialized Building Systems (IBS). The paper enhanced managers and analysts to bridge the gap between organization and its information system as well as giving attention to training categories in implementation of information system. The study highlighted success factors including preparing financial supports and human resource in design, development of information system, and strengthening progressive factors. The study enhanced the importance of implementing an information system that has strong managerial, organizational, and technological influence on industrial building methods. The study highlighted success factors but not challenges in design and construction. The study addressed the importance of managing information system but did not implement that into a more complex construction project. The study did not consider HR skills and knowledge in that area and did not address further improvements in HR management capabilities in design and construction of projects [21].

HR studies did not include the impact of construction environment of projects. External HR challenges are to be considered in developing HR models. That includes availability of skilful HR, technologies, and policies. HR models did not consider mitigations to improve HR performance and enhance success in delivery of construction projects. Developed models did not highlight the context influence and did not consider HR performance for mega projects. There is no HR framework that improved management of challenges and opportunities in construction of Egyptian mega housing projects.

9. Application of questionnaire survey

The application of the questionnaire aims at recognising a list of challenges and opportunities facing the HR workforce in constructing MHDP in Egypt. Both challenges and opportunities concluded from this Questionnaire will cover the following categories: Binary, which can appear in the Project during its design and building phase; Dimensional, which has an effect on projects' HR and hence on projects objectives for successful delivery; and Abstract, which can apply even on similar MHDP within the Egyptian Context in the future. Accordingly, the questionnaire objective is:

- To determine Egyptian construction industry relevant HR knowledge regarding MHDP.
- To identify both HR challenges and opportunities by engaging experts into a checklist.
- To highlight weaknesses regarding flexibility of policy makers and the degree of employee's engagement into the process of decision making.
- To highlight current Egyptian external environment factors which could add more challenges to MHDP and HR development.

9.1. Background of survey respondents

Most of the respondents were between twenty-five and thirty-five years of age, nineteen percent were 35–45 years old, and only

thirteen percent of the respondents are below twenty-five, Fig. 9. Most of the respondents were between twenty-five and thirty-five years of age, nineteen percent were 35–45 years old, and only thirteen percent of the respondents are below twenty-five. This emphasizes the reliability of the questionnaire. The construction experience of the respondents is presented in Fig. 10 in terms of years. Twenty-two respondents, representing most of the population had experience ranging from three to five years, which presents the senior engineering level experience. In addition, 10 experts had ten years of experience or more, thus, increasing the reliability of the questionnaire answers.

9.2. Impact of HR management on achieving project objectives

The first set of questionnaire questions aimed to investigate the degree by which the HR management could affect previously set project objectives, Fig. 11. Most experts agreed that poor HR management could lead to project cost overrun, and delay, while good HR management could allow projects to finish ahead of schedule. Experts have been asked whether they previously collaborated with other project parties in managing HR challenges. Nine experts have been engaged in managing HR challenges in construction projects, and nine were not. Eight experts have managed the HR challenges with 1 party. This indicates that despite the collaboration of experts with contractor, consultant, owner, or even all of them, there is still a need for more engagement and collaboration. On judging the opinions about considering Egypt's New Capital project as a mega housing project, with a high percentage of 63%, respondents agreed that HR has an impact on projects' completion time and cost, whereas 31% agreed that if required skills are available the project can finish ahead of schedule. The least agreed that HR impact on the cost is lower since it is most judged by effective management and available planned budget.

9.3. Opportunities and challenges of HR in MHDP

Selected HR challenges and opportunities were shown to experts to judge the general agreement on the HR factors presented. The degrees presented on Y axis range from "highly agree" (1) to "weakly agree" (5), Fig. 12.

The Mean values indicates that the most agreed upon challenges are external represented in the lack of flexibility of policy and internal related to the lack of involvement of employees. The most agreed upon HR opportunities were found to be offering adequate solutions for high population, and in achieving political

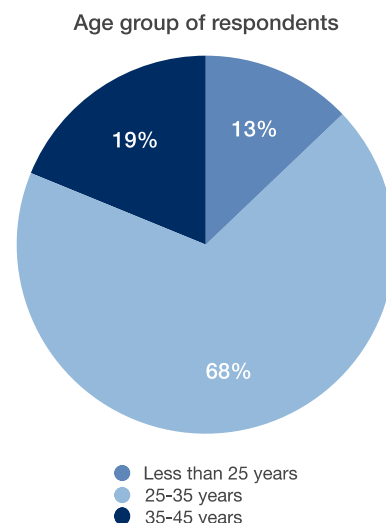


Fig. 9. Age of respondents' sample.

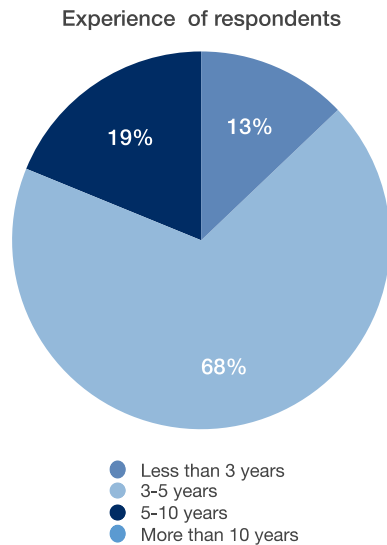


Fig. 10. Years of experience of respondents.

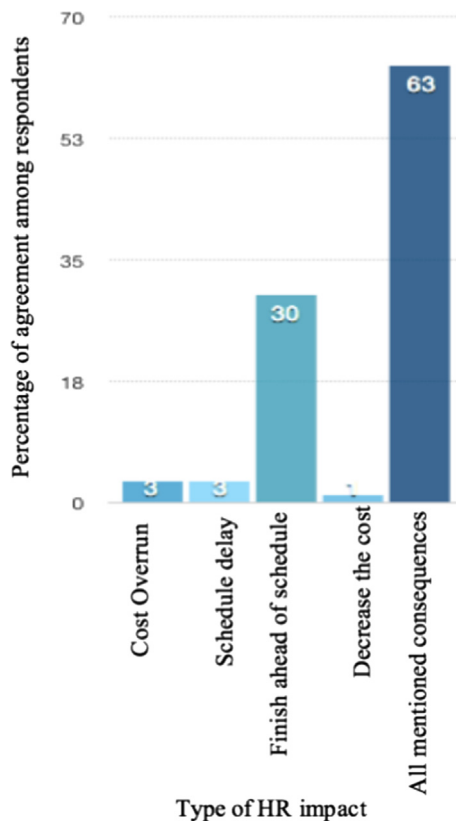


Fig. 11. HR impact (Degree of deviation) on project objectives.

stability, which are highly correlated opportunity factors. The standard deviation for all tested factors was close to one, which proves answers are strongly relevant and reliable

Fig. 13 presents reasons for inefficient governance systems from the respondents' point of view. Most experts agreed that weak governmental policy and standards are the main deficiency of governance. Thirty-four percent of respondents agreed that decision makers' experience is the reason for any governance decision. This infers that decision maker position is very sensitive and must have effective knowledge, skills, and experience to be able to maintain successful development of MHDP in Egypt.

9.4. Methods to overcome HR challenges

The questionnaire included asking respondents about their suggestions for overcoming HR challenges or, in other words, best practices. Fig. 14 presents methods used to provide qualified HR in stakeholder's organizations. Most respondents agreed that training is the best method to qualify HR suitable for development of Egyptian mega housing projects, Most respondents agreed that fresh graduates seeking employment without sufficient experience are in need to improve their computer skills. The improvement can be maintained by achievement of computer training such as Microsoft tools to qualify HR with basic computer skills that is suitable for development of Egyptian mega housing project. Twenty eight percent agreed on engaging HR in the process of decision making. Hunting skilful HR was suggested by twenty-two of the experts, which they considered a solution to face disqualified HR managers who are suitable to MHDP in Egypt. Regarding suggesting methods to integrate HR with technology in developing Egyptian mega housing projects, thirty-one percent of the experts, representing most of the population, agreed that sharing experience with other companies' best enhances HR integration. In addition, twenty-eight percent emphasized the importance of cooperation with organizations using advanced technologies, Fig. 15. The latter suggestion implies that Egyptian employees are to continuously gain experience by working with organizations which are already familiar with technical technologies. Finally, the respondents suggested to start improvement of Egyptian workforce starting from university level, Fig. 16. The university can thus add knowledge including HR and mega housing development education and also improve graduate's communication skills and use of computer software. In addition, most experts agreed that identifying HR Challenges and Opportunities is considered a primary step to get on the right track of developing mega housing projects in Egypt. Among the experts' suggestions were to engage experts from developed countries, o experts from external organizations. In addition, most experts agreed that identifying HR Challenges and Opportunities is considered a primary step to get on the right track of developing mega housing projects in Egypt. Focusing on research that targets HR management and mega housing projects was finally suggested by 10% or respondents.

Shared HR challenges in Egypt and global HR MHDP studies included suitable workforce, HR integration with technology, engagement of employees, inefficient governance. Shared opportunities included government technology support, flexibility of policy makers, improving organizational intelligence, improving HR skills, solution for high population, more job opportunities, and increase in investments.

HR studies in MHDP included mitigations of providing more flexible funding strategies for flexible economic construction environment, avoiding continuous change of governmental systems and biased decision making, improving educational knowledge for constructions' obstacles to improve innovation, and engagement of more employees into the construction of MHDP activities to avoid diversity problems. Mitigations included the hire of suitable work force, integration of human resource with technology, providing suitable safety for employees, improving communication skills to avoid multicultural diversity, and hiring workforce near to working sites, and provide a central communication unit to avoid decentralized working sites.

Improvements suggested by experts in Egyptian MHDP included the use of methods to provide qualified HR in stakeholders' organizations. That included training, engagement in decision making, improving hiring standards, and hunting of more skilful workforce. Integrating HR with required technology in developing Egyptian mega housing projects included sharing experience with others, using smart technologies, and using smart and reliable software's.

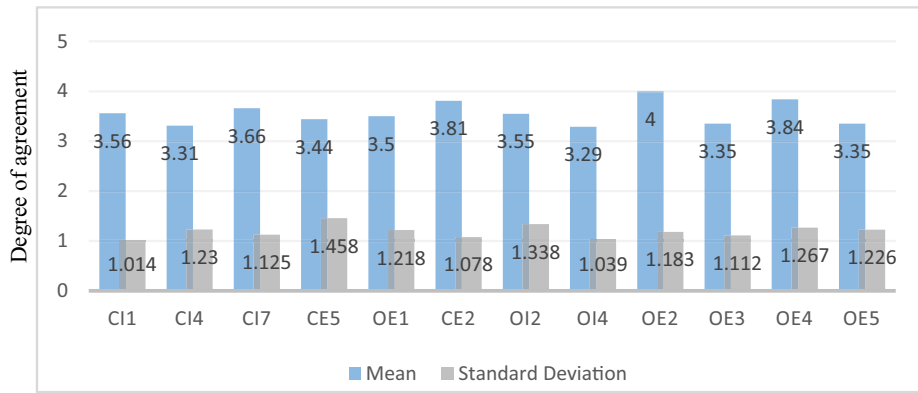


Fig. 12. Agreed HR challenges and opportunities.

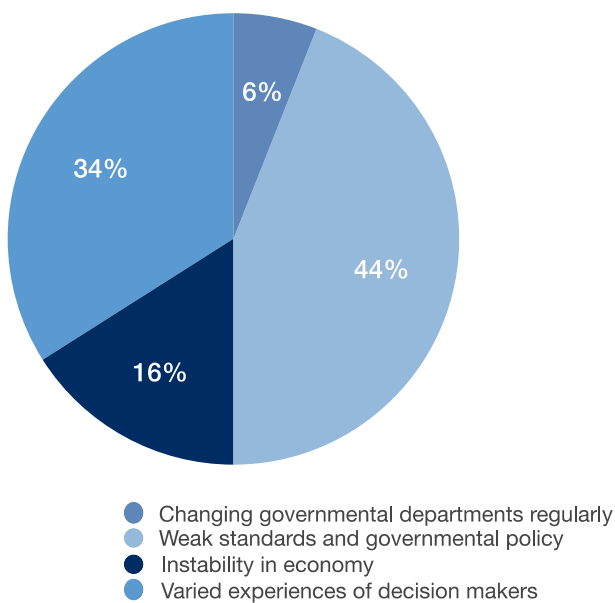


Fig. 13. Reason for inefficient governance system.

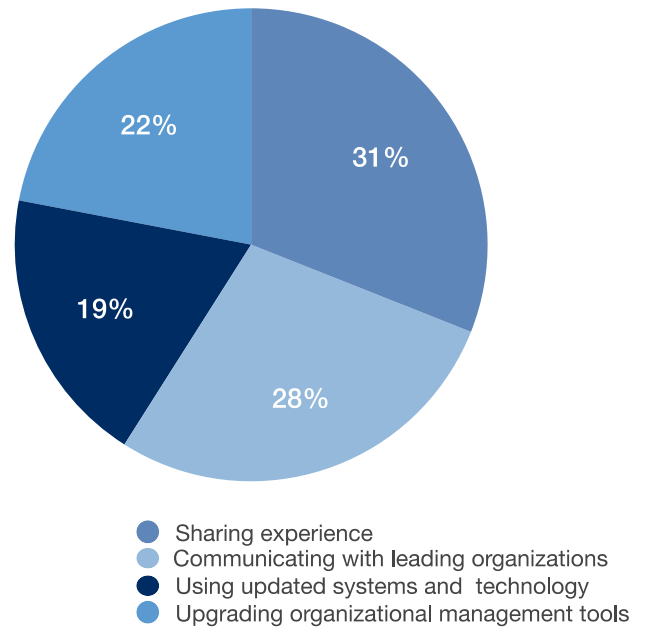


Fig. 15. Integrating HR with required technology in developing Egyptian mega housing.

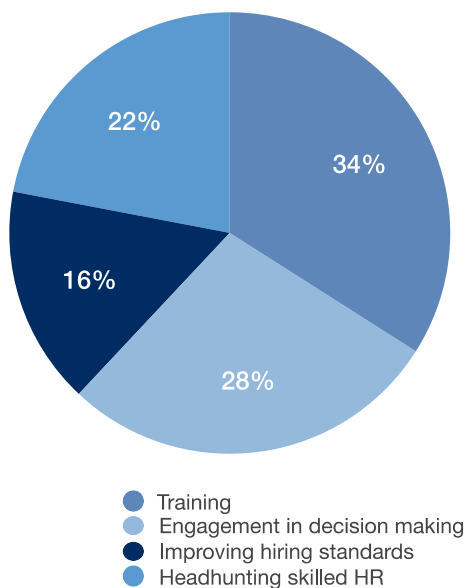


Fig. 14. Methods used to provide qualified HR in stakeholders organizations.

Egypt can improve its work force to best suit mega housing projects development. That included collaboration with developed countries in training HR, and engagement of external source of HR experts.

10. Development of responsive framework

Findings of this paper, either extracted from qualitative analysis of case studies or from the analysis of survey questionnaire, were further analysed and developed into a responsive HR framework, Fig. 17. The framework highlights both opportunities and challenges together with possible responsive strategies and recommended control actions. This framework highlights the importance of identifying, analysing, and adding any new monitored HR Challenges and Opportunities to benefit future Egyptian MHDPs. In addition, it presents a detailed HR platform which is useful for use in both design and construction phases. The developed framework can benefit both smart cities stakeholders and their enterprise project environment.

10.1. Design of the HR framework

The design of the framework comprises 4 main levels that cover both design and construction phases. The levels include identifying

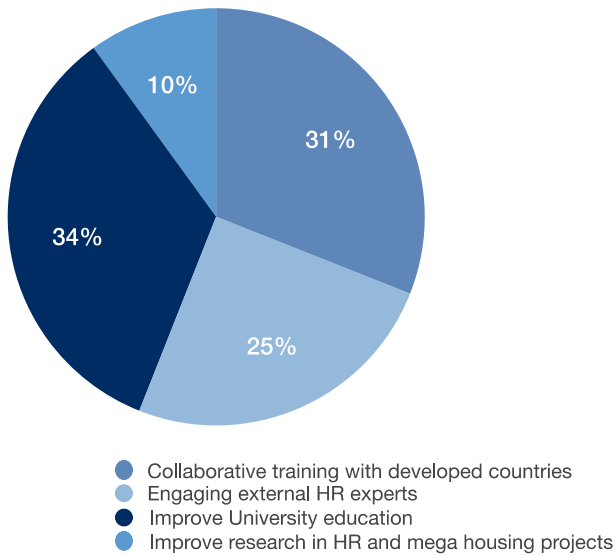


Fig. 16. Methods to improve Egyptian work force to best suit mega housing projects development.

design and construction environments, breakdown of HR factors, identified HR challenges and opportunities, and adopted responsive HR strategies. An additional future level was added following the responsive strategies which should include monitoring and controlling of HR factors and adopted responsive strategies during the execution process in both the design and construction phases. This fifth level is considered to support the developed HR framework. The first level of Framework starts by recognising Internal and External (HR) factors which are related to the development of mega housing project’s Stakeholders and their Enterprise Environment. The second level presents the (HR) factors breakdown into Opportunities and Challenges facing design and construction of Egyptian development of mega housing projects. The third level of the adopted Framework lists the (HR) factors based on the

breakdown performed in the previous level. Furthermore, the responsive strategies highlighted in the Framework’s fourth level suggest strategies to be implemented in order to emphasize the opportunities’ occurrence and minimize the capability of threats’ impacts on both design and construction MHDP phases.

10.2. Responsive strategies

The paper further clarified adopted responsive strategies for MHDP in Egypt as presented in Tables 8 and 9. Table 8 highlighted a developed matrix for responsive strategies for HR challenges. Adopted responsive strategies for HR challenges included avoid, mitigate, transfer, and accept. Table 9 presents the developed matrix for HR Opportunities. Responsive strategies for opportunities included enhancement, exploitation, and share of opportunities. The suggested framework was entitled as responsive for two main reasons. First, because it includes responsive strategies for facing both HR opportunities and challenges. In this paper, authors considered opportunities as positive risks, whereas challenges as negative risks. Thus, risk response strategies were considered by the authors. Second, the fifth level of the framework emphasizes on tracking identified challenges and responses, where new and residual challenges and opportunities are to be monitored and added to the previously developed HR risk register. Thus, it provides a more responsive and reliable platform of HR challenges and opportunities related to both the design and construction phases.

10.2.1. Responsive strategies for HR opportunities

Strategies for HR internal opportunities at the design stage include “exploit”, “share”, and “enhance”. “Exploit” strategy aims to ensure that the opportunity is recognized and make the opportunity definitely happen. It is chosen for opportunities OI2 and OI3 which are ‘improving organizations’ intelligence level’ and ‘increasing organisations’ competency’. Stakeholders are to expose, show, and try to improve their intelligence level by designing mega housing projects in Egypt. This would consequently increase the stakeholder’s level of competency within the Egyptian market.

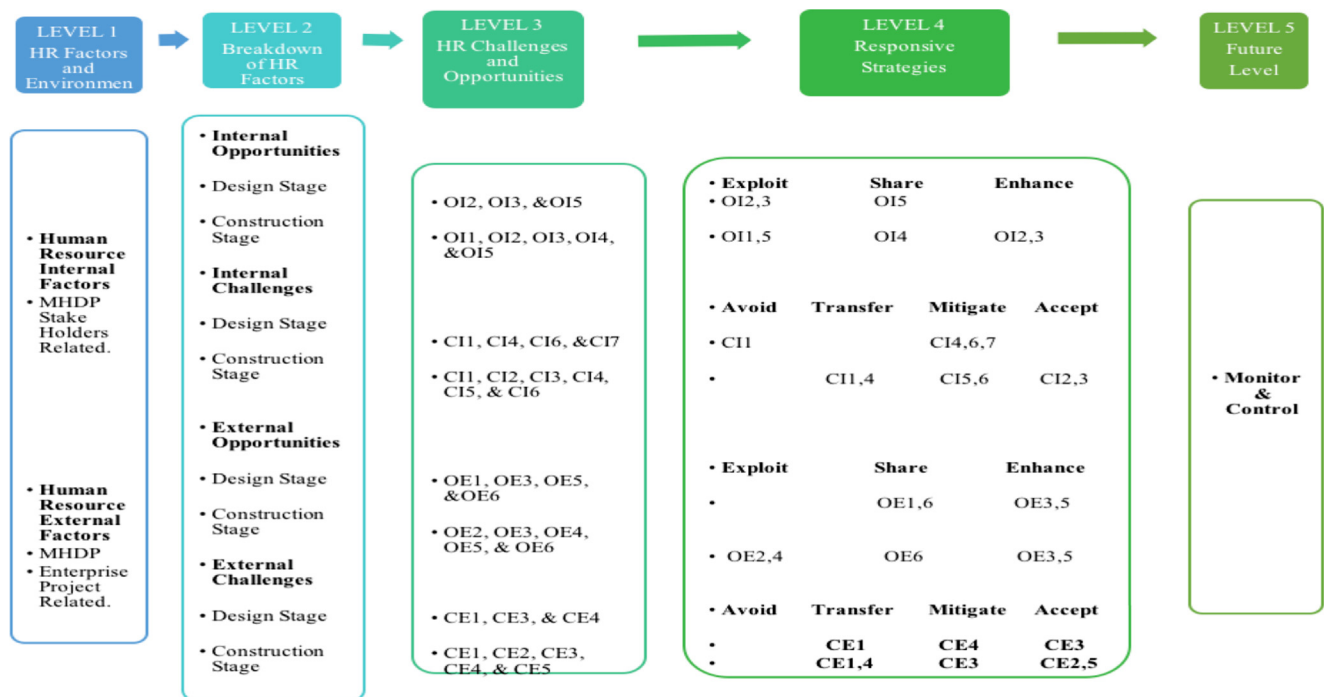


Fig. 17. HR framework for development of mega housings projects in Egypt, Authors.

Table 8
Responsive Strategies Matrix for HR Challenges

Mega Housing Challenges	Responsive Strategies for HR Challenges			
	Mitigate	Accept	Transfer	Avoid
<i>Internal Challenges</i>				
CI1				✓
CI2		✓		
CI3		✓		
CI4			✓	
CI5	✓			
CI6	✓			
CI7	✓			
<i>External Challenges</i>				
CE1			✓	
CE2		✓		
CE3	✓			
CE4			✓	
CE5		✓		

Table 9
Responsive Strategies Matrix for HR Opportunities

Mega Housing Opportunities	Responsive Strategies for HR Opportunities		
	Enhance	Exploit	Share
<i>Internal Opportunities</i>			
OI1		✓	
OI2	✓		
OI3	✓		
OI4			✓
OI5			✓
<i>External Opportunities</i>			
OE1			✓
OE2		✓	
OE3	✓		
OE4		✓	
OE5	✓		
OE6			✓

HR opportunities in the design stage include also “share” strategy, which allocates the ownership to another party that can maximize its occurrence. This strategy is adopted for opportunity OI5, which is ‘attraction of talented employees’. Since MHDP require the use of talented and skilled workers, stakeholders can share this opportunity to another party to maximize and make best use of the required talents needed in the design stage. On the other hand, the Construction stage includes internal opportunities. This comprises strategies of “exploit”, “share”, and “enhance” strategies. “Exploit” strategy is chosen for opportunities OI1 and OI5, which are ‘Support obtained from the Government’ and ‘Attracting Talented Construction Employees’. Stakeholders working on construction of Egyptian MHDP are to seek more flexible policy, rules, and system. Moreover, improving companies’ innovation will help in attracting talented employees required for the construction of mega housing projects in Egypt. Other adopted strategy for HR opportunities include “enhance” strategy. This strategy aims at modifying the ‘size’ of opportunity and maximizing its benefits. As illustrated in the framework’s fourth level, this strategy can be applied on internal construction opportunities OI2 and OI3, external design opportunities OE3 and OE5, and external construction opportunities OE3 and OE5.

10.2.2. Responsive strategies for HR challenges

Regarding HR Challenges, responsive strategies include “Avoid”, “Transfer”, “Mitigate”, or “Accept”. “Avoid” strategy is observed by removal of the challenge cause or managing the HR challenge in a

different way. It could be applied on design stage internal challenge CI1. “Transfer” Strategy aims at finding another party who is willing to be responsible for managing this HR challenge. The transfer strategy can be adopted for construction stage internal challenges CI1 and CI4, design stage external challenge CE1, and Construction stage external challenges CE1 and CE4. “Mitigate” strategy aims at reducing the occurrence to an acceptable level by taking an early action to reduce the HR Challenge instead of repairing it. The mitigation challenge can be applied on design stage internal challenges CI4, CI6, and CI7, and also on construction stage internal challenges CI5 and CI6. Mitigation strategy can be also applied on both design stage external challenge CE4 and construction stage external challenge CE3. The last adopted challenge strategy is “Acceptance”, which is suggested when it is not possible or practical to respond by any other strategy. Through the framework, “acceptance” strategy was adopted for construction stage internal challenges CI2 and CI3. This strategy can also be applied on design stage external challenge CE3 and construction stage external challenges CE2 and CE5.

11. Conclusion

This paper managed to identify human resource challenges and opportunities for design and construction phases of mega housing development projects in Egypt. Hereby, the paper reviewed HR studies related to MHDP and recognized human resource factors that can act as a threat or an opportunity towards the successful delivery of mega housing projects. The identified human resource factors resulted from an interaction between both the literature of HR Challenges and Opportunities and Practical application approaches. The practical approach was conducted by navigating through different case studies related to developing countries, thus, obtaining a strongly related HR Challenges and Opportunities which is closer to the Egyptian context. Furthermore, a detailed risk register was obtained in the benefit of mega housing projects development in Egypt. The risk register was categorized into internal stakeholder’s environment and external enterprise project environment. Results from the statistical analysis of the applied questionnaire in this paper offered a primary evidence that Egypt is still in need to improve the HR development in the design and construction of projects. In addition, the results proved that HR efforts must be capitalized in order to cope with the targets of the Egyptian Strategy 2030. Shared HR challenges in Egypt and global HR MHDP studies included suitable workforce, HR integration with technology, engagement of employees, inefficient governance. Shared opportunities included government technology support, flexibility of policy makers, improving organizational intelligence, improving HR skills, solution for high population, more job opportunities, and increase in investments. A Responsive Framework was further developed by which all HR challenges and opportunities were clearly illustrated. The HR framework improves knowledge of human resource management by adding responsive strategies. The framework improves organizational practice in management of HR challenges by providing an insight for recognition, organizing, and mitigation of HR challenges and opportunities in design and building of MHDP in Egypt. In addition, the framework included risk response strategies. Four main responses for HR challenges included avoid, mitigate, transfer, and accept. The paper includes a limitation represented in the fifth level of the developed Mega Housing Development (HR) Framework. The Author emphasizes the implementation of monitoring and control activities so as to ensure full control and successful delivery of smart city projects. The framework is considered a cyclic process which must be continuously revised in line with the planning and execution processes in both the design and construction phases for the development of mega housing projects in Egypt.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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