

DOI: 10.5281/zenodo.11425150

THE IMPACT OF DEVELOPING CREATIVE CAPACITIES ON ACHIEVING THE REQUIREMENTS OF THE FOURTH INDUSTRIAL REVOLUTION: A CASE STUDY OF KHOZON BUILDING MATERIALS COMPANY

Abdulhaleem Atta Al-Mannan^{1*}, Mortada Ibrahim ELIMAM², Abdelrahim Abbas Musa Gismelseid³, Ibrahim Abdelsalam Ahmed Abdelmutalib⁴, Badreldin Abdelrahim Ibrahim Mohamed⁵, Mohammed Ahmed Osman yousif⁶ and Hosamalden Abdalziz Moustafa Mohammedany⁷

¹Business Management Department, College of Business- University of Hail, Saudi Arabia.

²Business Management Department, College of Business and Economics, Qassim University, Saudi Arabia.

³Business Administration, University of Bisha, Saudi Arabia.

⁴Public Administration, Buraydah Colleges, Saudi Arabia.

⁵Applied College, Qassim University, Saudi Arabia.

⁶Department of Business Administration, College of Business and Economics, Qassim University, Buraidah 52671, Qassim, Saudi Arabia.

⁷Business Administration, Department of Business Administration, Al Salam College of Languages, Translation and Technology, Sudan.

Received: 07/08/2025

Accepted: 30/11/2025

Corresponding author: Abdulhaleem Atta Al-Mannan

ABSTRACT

The study aimed to investigate the impact of developing creative capacities in its various dimensions (education and training, innovative thinking, creative leadership) on meeting the requirements of the Fourth Industrial Revolution. The study utilized a descriptive-analytical approach and selected a sample of 70 employees from Khozon Building Materials Company through comprehensive enumeration. A questionnaire was used as a tool for data collection. The study concluded that the level of development of creative capacities in its dimensions was high, with a calculated average of 4.06, indicating that the company has a work environment that encourages creative thinking and innovation. The requirements of the Fourth Industrial Revolution received a high estimation with an average calculated at 4.10. The study recommends the necessity of continuing to provide programs and initiatives that encourage creative thinking, investing in modern technologies to meet the requirements of the Fourth Industrial Revolution, and adopting strategies to promote innovation within the company, such as establishing multidisciplinary work teams, providing necessary resources to implement creative ideas, and allocating a budget to support innovative projects and implement innovative solutions.

KEYWORDS: Creative Capacity Development, Fourth Industrial Revolution Requirements, Khozon Building Materials Company, Vision 2030.

1. INTRODUCTION

In the rapidly evolving landscape of the Fourth Industrial Revolution (4IR), the development of creative capabilities stands as a pivotal driver for organizational success and adaptation. As advanced technologies reshape industries, fostering creativity becomes imperative for companies targeting to thrive in this era of profound change. Creativity, as defined by Anis *et al.* (2004), encompasses the ability to generate novel solutions, ideas, and products, crucial for addressing the challenges posed by globalization, technological shifts, and intense competition. Investing in creative abilities of employees has emerged as a necessity to drive innovation and sustainable growth within organizations (Maria, 2021).

According to Schwab (2016), the Fourth Industrial Revolution marks a transformative phase in industrial development, integrating digital, physical, and biological technologies to redefine production and consumption paradigms. With its emphasis on technologies like robotics, artificial intelligence, and biotechnology, the 4IR necessitates a paradigm shift in organizational strategies, workforce skills, and technological infrastructure (Elan, 2017). Meeting the requirements of the 4IR involves an updating technological system and fostering innovation and sustainable development across all business domains (Maria, 2021).

In this context, the study by Khozon Building Materials Company in Saudi Arabia gains significance. This study focuses on investigating the impact of developing creative capabilities within the organization to meet the demands of the Fourth Industrial Revolution. Drawing on previous research by Al-Dahshan and Samhan (2020), Maria (2021), and Saniuk *et al.* (2022), which emphasize the importance of creativity and innovative thinking in addressing the challenges of the 4IR, this research aims to explore how education, training, and creative leadership influence the ability of the company to adapt and innovate.

The findings of this study are expected to shed light on how enhancing creative capacities within Khozon Building Materials can lead to improved operational efficiency, product innovation, and adaptation to technological changes. By identifying strategies to cultivate creativity and innovative thinking among employees, the study aims to contribute to the sustainable growth of the company and competitiveness in the dynamic landscape of the Fourth Industrial Revolution.

2. METHODOLOGY

The study aimed to investigate the impact of

developing creative capabilities on meeting the requirements of the Fourth Industrial Revolution at Khozon Building Materials. The main hypothesis was that there would be a statistically significant impact, which was further divided into sub-hypotheses focusing on the impact of education and training, innovative thinking, and creative leadership. These sub-hypotheses collectively explored different aspects that contribute to fulfilling the requirements of the Fourth Industrial Revolution.

To examine these hypotheses, the study employed a descriptive analytical approach alongside a historical methodology. A model was formulated to illustrate the relationship between the independent variable (development of creative capabilities) and the dependent variable (requirements of the Fourth Industrial Revolution). This model served as a framework to effectively achieve the objectives by providing a structured approach to analyzing the collected data.

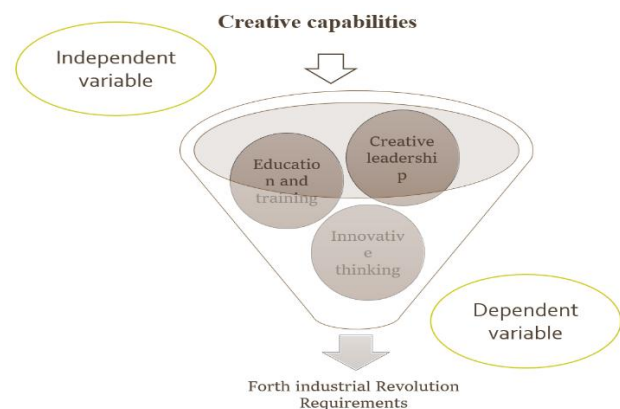


Figure 1: The Model of the Study.

Primary data was collected through surveys distributed among the employees of Khozon Building Materials Company. Secondary sources, including books, scientific research, reports, and relevant conferences, were used to supplement the study, providing comprehensive insights and enhancing the credibility of the findings.

The study population consists of employees at Khozon Building Materials Company, totaling 70 individuals. The study utilized a comprehensive survey method due to the small size of the population. The sample was selected using a complete enumeration method. The questionnaire was distributed to sample members, with 70 questionnaires retrieved, resulting in a retrieval rate of 100%. This constitutes the actual study sample subject to analysis. Table (1) provides a description of the characteristics of the researched individuals in the study sample.

Table 1: Characteristics of Researched Individuals in the Study Sample.

Gender	Count	Percentage
Male	60	85.7
Female	10	14.3
Age Category	Count	Percentage
Less than 30 years	25	35.7
30 and less than 40 years	25	35.7
40 and less than 50 years	15	21.4
50 years and above	5	7.1
Educational Qualification	Count	Percentage
University	55	78.6
Postgraduate	15	21.4
Scientific specialization	Count	Percentage
Engineering	5	7.1
Business Administration	15	21.4
Accounting	7	10.0
Information Technology	7	10.0
Others	36	51.4
Work Experience	Count	Percentage
Less than 5 years	25	35.7
5 and less than 10 years	25	35.7
10 years and above	20	28.6

Table 1 indicates a significant gender disparity, with males comprising 85.7% and females 14.3%, likely reflecting traditional male dominance. Age distribution shows an equal preference for employees "Less than 30 years" and "30 to less than 40 years" (35.7% each), suggesting a focus on youthful energy for innovation. Educational qualifications reveal that 78.6% hold a bachelor's degree and 21.4% possess postgraduate degrees, highlighting a preference for well-educated employees. The diverse "Scientific Specialization" with 51.4% categorized as "Other" suggests a wide range of expertise, essential for the varied demands of the Fourth Industrial Revolution. Work experience is evenly distributed across different levels, with approximately 35.7% in each category (<5 years, 5-10 years, >10 years), indicating a balanced mix of fresh perspectives and seasoned insights. This diversity in gender, age, education, specialization, and experience reflects the strategy of the company to leverage varied skills and adaptability, vital for thriving in the Fourth Industrial Revolution.

2.1. The Statistical Reliability and Validity of the Study Tool

The statistical reliability and validity of the study instrument were assessed using Cronbach's alpha coefficient and split-half reliability. The acceptable statistical value for reliability is 60%, and therefore any value exceeding this threshold is considered very good. From Table (2), it can be observed that the overall reliability coefficient reached 0.939, indicating high reliability. Similarly, the validity value was high for all domains, with a validity coefficient of 0.968 for all questionnaire items. This suggests that the

questionnaire demonstrates a high level of consistency, reassuring the researcher about its applicability to the study sample.

Table 2: Reliability and Validity Coefficients of the Instrument.

Variables	Number of Items	Cronbach's Alpha	Split-Half Reliability
Education and Training	8	0.879	0.937
Innovative Thinking	8	0.930	0.964
Creative Leadership	8	0.969	0.984
Fourth Industrial Revolution Requirements	8	0.978	0.988
Total	32	0.939	0.968

3. RESULTS AND DISCUSSION

3.1. First Axis: Creative Capabilities

To determine the level of creative capabilities within the company, the mean scores, standard deviations, and ranking were calculated to understand the opinions of the study sample, as illustrated in Table (3). From Table (3), it is observed that the overall mean of the independent variable (creative abilities) is significantly high. The total mean was (4.06) with a standard deviation of (0.79), and the arithmetic means ranged between (3.99-4.13) on a Likert five-point scale. This indicates a high level of creative abilities attributed to the company fostering an environment conducive to creative thinking and innovation, reflecting a positive orientation towards transformation and development amid the challenges and opportunities presented by the Fourth Industrial Revolution. Regarding dimensions, the results are as follows: Leadership came first with a mean of (4.13), which is higher than the total mean of (4.06) with a standard deviation of (0.81). This can be attributed to the role of leadership in fostering innovation and development, indicating a visionary leadership supporting technology and innovation and working on developing employees' creative leadership skills through training programs. The last rank was obtained after training with a mean of (3.99), which is lower than the total mean of (4.06) with a standard deviation of (0.86). This is attributed to the company's awareness of the importance of training and skill development, with high mean indicating the availability of training programs meeting employees' needs in technology and innovation fields, contributing to improving their performance and keeping up with developments, as evidenced by the low dispersion (standard deviation), indicating convergence in the views of the sample individuals regarding the dimensions of creative abilities. This is attributed to a common vision, cultural orientation, and managerial consensus within the company. This

result is consistent with the study by Al-Dhahshan (2022), which highlighted the importance of creative and Samhan (2020), Maria (20210), and Saniuk *et al.* abilities in adapting to rapid changes.

Table 3: Descriptive Statistics for Respondents' Agreement on Developing Creative Capabilities within the Company.

Variable	Items	Mean	Standard Deviation	Ranking
Education and Training	Training in your field meets the requirements of the Fourth Industrial Revolution.	3.86	0.82	8
	Training programs are keeping pace with technological advancements.	3.94	0.72	5
	Continuous training contributes to improving the overall performance of employees in the company.	3.97	0.74	4
	You find training opportunities to develop new skills.	3.91	0.65	6
	There is a need to increase training for employees in the field of technology.	3.91	0.90	7
	The company provides training programs that rely on self-learning methods in Fourth Industrial Revolution fields.	4.17	0.54	1
	The company's training programs enhance employees' knowledge of emerging technologies of the Fourth Industrial Revolution such as artificial intelligence, augmented reality, robotics, big data, and others.	4.07	0.79	3
	Current and future needs of employees are studied to adapt to the developments of the Fourth Industrial Revolution.	4.11	0.55	2
Total		3.99	0.71	3
Innovative Thinking	The Fourth Industrial Revolution enhances the need for innovative thinking to develop and improve work.	4.09	0.81	3
	The Fourth Industrial Revolution requires innovative thinking to implement new ideas in work.	4.04	0.81	4
	Innovative thinking represents a competitive advantage in the Fourth Industrial Revolution era.	3.99	0.83	7
	The Fourth Industrial Revolution provides opportunities to generate new ideas.	3.93	0.94	8
	Failure to stimulate innovative thinking within the company hinders success in the Fourth Industrial Revolution era.	4.14	0.91	2
	Innovative thinking is considered one of the key factors contributing to improving production quality in the Fourth Industrial Revolution era.	4.04	0.82	5
	The Fourth Industrial Revolution enables employees to make quick and precise decisions.	4.17	0.87	1
	I have the ability to generate the largest possible number of innovative ideas to address challenges arising in the Fourth Industrial Revolution era.	4.03	0.88	6
Total		4.05	0.86	2
Creative Leadership	The company's leadership adapts to the variables related to the Fourth Industrial Revolution.	4.04	0.79	6
	The company management works on transforming companies to be modern and innovative.	4.24	0.60	2
	The company management encourages the use of modern technology and innovations in the work.	4.04	0.81	7
	The company management has a plan to address the challenges arising from the Fourth Industrial Revolution.	4.14	0.89	4
	The company management is concerned with developing creative leadership skills for employees.	4.01	0.91	8
	The company management works on fostering a culture of innovation within the company.	4.33	0.81	1
	The company management adopts innovative strategies to develop services.	4.07	0.86	5
	The company management contributes to improving customer experience and enhancing their satisfaction.	4.19	0.86	3
Total		4.13	0.81	4
Overall Index for Creative Capabilities Dimensions		4.06	0.79	

3.2. Second Axis: Requirements of the Fourth Industrial Revolution

To determine the level of the Fourth Industrial

Revolution in the company under study, the means, standard deviations, and rankings were calculated to understand the opinions of the study sample participants, as shown in Table (4).

Table 4: Descriptive Statistics of Respondents' Agreement on the Requirements of the Fourth Industrial Revolution.

Items	Mean	Standard Deviation	Ranking
The company is capable of adapting to changes due to digital transformation	4.09	0.79	3
The company considers digital transformation an opportunity for sustainable growth	4.06	0.81	6
Employee skills enhance creative performance	4.26	0.74	1
The industrial revolution supports innovation and product development	4.07	0.69	4
The company's production costs are continuously decreasing	4.07	0.79	5
Technology improves the quality of the company's services and products	4.01	0.88	8
The company responds quickly to market and customer needs	4.20	0.83	2
The company has been able to cope with technological advancements	4.04	0.75	7
Total	4.10	0.78	

It is observed from Table (4) that the overall mean for the requirements of the Fourth Industrial Revolution, as a dependent variable, was (4.10) with a standard deviation of (0.78). This underscores the significance of the Fourth Industrial Revolution in achieving transformation and development within the company. The item (7) "The company responds quickly to market and customer needs" ranked first with a mean of (4.20) and a standard deviation of (0.83). This can be attributed to the company's ability to quickly adapt to market changes and customer requirements due to its flexible structure and capacity for swift and appropriate decision-making. In contrast, the item (6) "Technology improves the quality of the company's services and products" ranked last with a mean of (4.01) and a standard deviation of (0.88). This can be attributed to the fact that the use of technology can lead to improved internal processes, increasing production efficiency and reducing errors, thereby enhancing the quality of the products and services offered. While there is variation in the means of the items under the axis of the Fourth Industrial Revolution requirements, all means were positive from the respondents' perspectives. This reflects the company's readiness to effectively utilize technology and digital transformation to improve

product and service quality and quickly meet market needs. This result aligns with the study by Grabowska & Saniuk (2022), which emphasized the direct impact of Fourth Industrial Revolution technology on business models, reflecting profound market transformations.

3.3. Testing Study Hypotheses

To test the hypotheses, simple regression models were used where the independent variable is the development of creative abilities with its dimensions, and the dependent variable is the requirements of the Fourth Industrial Revolution. To verify the impact of each independent variable on the dependent variable, the following main hypothesis was tested:

Main Hypothesis: There is a statistically significant impact of developing creative abilities on achieving the requirements of the Fourth Industrial Revolution at Khozon Building Materials Company.

To test this hypothesis, a simple regression analysis was conducted on the combined dimensions of developing creative abilities in relation to the requirements of the Fourth Industrial Revolution, as shown in Table (5).

Table 5: Impact of Developing Creative Abilities on Achieving the Requirements of the Fourth Industrial Revolution.

R	R2	F-value	Decision	DF	Regression Coefficient				
					Independent Variable	B	Standard Error	t-value	Sig
.974 ^a	.948	1251.036	Accept	68	Development of Creative Abilities	1.143	.032	35.370	.000

It is evident from Table (5) that the development of creative abilities has a statistically significant impact on achieving the requirements of the Fourth Industrial Revolution at Khozon Building Materials Company. The results of the statistical analysis indicate a significant effect of developing creative abilities on meeting these requirements. The regression coefficient (B) value is 1.143 with a standard error of 0.032, which means that a one-unit increase in the development of creative abilities leads to an increase of 1.143 units in achieving the requirements of the Fourth Industrial Revolution. The coefficient of determination (R²) is 0.948, indicating that 94.8% of the variance in achieving the requirements of the Fourth Industrial Revolution can be explained by the development of creative abilities. The correlation coefficient (R) is 0.974, indicating a very strong correlation between the two variables. Additionally, the calculated t-value is 35.370, which is statistically significant at the 0.000 significance level, demonstrating the

strong impact of the independent variable (development of creative abilities) on the dependent variable (achieving the requirements of the Fourth Industrial Revolution). The calculated F-value is 1251.036, which is also statistically significant at the 0.000 significance level, further reinforcing the reliability of the model used. The final decision, based on the degrees of freedom (DF = 68), is to accept the model, confirming that the development of creative abilities plays a significant and essential role in achieving the requirements of the Fourth Industrial Revolution at Khozon Building Materials Company.

Sub-Hypothesis 1: There is a statistically significant impact of education and training on achieving the requirements of the Fourth Industrial Revolution at Khozon Building Materials Company.

To test this hypothesis, a simple regression analysis was conducted on the impact of education and training on the requirements of the Fourth Industrial Revolution, as shown in Table (6).

Table 6: Impact of Education and Training on Achieving the Requirements of the Fourth Industrial Revolution.

R	R2	F-value	Decision	DF	Regression Coefficient				
					Independent Variable	B	Standard Error	t-value	Sig
.828 ^a	.685	148.017	قبول	68	Education and Training	1.136	.093	12.166	.000

The table (6) indicates the impact of education and training on achieving the requirements of the Fourth Industrial Revolution at Khozon Building Materials Company. The results of the statistical analysis suggest a statistically significant effect of education and training on meeting these requirements. The regression coefficient (B) value is 1.136 with a standard error of 0.093, meaning that a one-unit increase in education and training leads to an increase of 1.136 units in achieving the requirements of the Fourth Industrial Revolution. The coefficient of determination (R²) is 0.685, indicating that 68.5% of the variance in achieving the requirements of the Fourth Industrial Revolution can be explained by education and training. The correlation coefficient (R) is 0.828, suggesting a very strong correlation between the two variables. Additionally, the calculated t-value is 12.166, which is statistically significant at the 0.000 significance level, indicating the strong impact of

the independent variable (education and training) on the dependent variable (achieving the requirements of the Fourth Industrial Revolution). Furthermore, the calculated F-value is 148.017, which is also statistically significant at the 0.000 significance level, reinforcing the reliability of the model used. Based on the degrees of freedom (DF = 68), the final decision is to accept the model, confirming that education and training play a significant role in achieving the requirements of the Fourth Industrial Revolution at Khozon Building Materials Company.

Sub-Hypothesis 2: There is a statistically significant impact of innovative thinking on achieving the requirements of the Fourth Industrial Revolution at Khozon Building Materials Company.

To test this hypothesis, a simple regression analysis was conducted for innovative thinking on the requirements of the Fourth Industrial Revolution, as shown in Table (7):

Table 7: The Impact of Innovative Thinking on Achieving the Requirements of the Fourth Industrial Revolution.

R	R2	F-value	Decision	DF	Regression Coefficient				
					Independent Variable	B	Standard Error	t-value	Sig
.922 ^a	.850	384.530	قبول	68	Innovative Thinking	.957	.049	19.609	.000

The impact of innovative thinking on achieving the requirements of the Fourth Industrial Revolution at Khozon Building Materials Company is evident from Table (7). The statistical analysis results indicate a statistically significant effect of innovative thinking on meeting these requirements. The regression coefficient (B) is 0.957 with a standard error of 0.049, meaning that an increase in innovative thinking by one unit leads to an increase in achieving the requirements of the Fourth Industrial Revolution by 0.957 units. The coefficient of determination (R²) is 0.850, indicating that 85.0% of the variations in achieving the requirements of the Fourth Industrial Revolution can be explained by innovative thinking. Furthermore, the correlation coefficient (R) is 0.922, indicating a very strong correlation between the variables. The computed T-value is 19.609, significant at a level of 0.000, indicating a strong influence of the

independent variable (innovative thinking) on the dependent variable (achievement of Fourth Industrial Revolution requirements). Additionally, the calculated F-value is 384.530, significant at a level of 0.000, enhancing the reliability of the model used. Based on the degrees of freedom (DF = 68), the final decision is to accept the model, confirming that innovative thinking plays a fundamental role in achieving the requirements of the Fourth Industrial Revolution at Khozon Building Materials Company.

Sub-Hypothesis 3: There is a statistically significant impact of creative leadership on meeting the requirements of the Fourth Industrial Revolution at Khozon Building Materials Company.

To test this hypothesis, a simple regression analysis of creative leadership on the requirements of the Fourth Industrial Revolution was conducted, as illustrated in Table (8):

Table 8: The Impact of Creative Leadership on Achieving the Requirements of the Fourth Industrial Revolution.

R	R2	F-value	Decision	DF	Regression Coefficient				
					Independent Variable	B	Standard Error	t-value	Sig
.962	.981 ^a	1736.399	Accept	68	Creative Leadership	.965	.023	41.670	.000

The Table (8) demonstrates the impact of creative leadership on meeting the requirements of the Fourth Industrial Revolution at Khozon Building Materials Company. Statistical analysis results indicate a statistically significant effect of creative leadership on meeting these requirements. The regression coefficient (B) is 0.957 with a standard error of 0.049, indicating that a one-unit increase in creative leadership leads to a 0.957-unit increase in meeting the requirements of the Fourth Industrial Revolution. Moreover, the coefficient of determination (R²) is 0.981, meaning that 98.1% of the variance in meeting the requirements of the Fourth Industrial Revolution can be explained by creative leadership. Additionally, the correlation coefficient (R) is 0.922, suggesting a very strong correlation between the variables. The calculated T-value is 19.609, statistically significant at $p < 0.000$, indicating a strong impact of the independent variable (creative leadership) on the dependent variable (meeting the requirements of the Fourth Industrial Revolution). Furthermore, the computed F-value is 384.530, statistically significant at $p < 0.000$, reinforcing the reliability of the utilized model. Based on the degrees of freedom (DF = 68), the final decision is to accept the model, confirming that creative leadership plays a fundamental role in meeting the requirements of the Fourth Industrial Revolution at Khozon Building

Materials Company.

4. CONCLUSIONS

The study at Khozon Building Materials Company revealed significant conclusions and actionable recommendations centered on creative capabilities and the Fourth Industrial Revolution (4IR). It was found that the company fosters a highly creative environment (mean score of 4.06), values 4IR requirements (mean score of 4.10), and benefits substantially from creative capabilities, education, innovative thinking, and leadership in meeting these requirements, with explanatory coefficients of 94.8%, 68.5%, 85.0%, and 98.1% respectively. Consequently, recommendations include continuing to promote creative thinking through workshops, investing in modern technologies, adopting innovation-promoting strategies, enhancing education and training programs, fostering an environment that encourages calculated risk-taking, and developing leadership training programs focused on innovative leadership. Future studies could explore the impact of transformational leadership on innovation, the role of digital technology adoption in meeting 4IR requirements, responses of companies to these requirements, and strategies for operational adaptation to 4IR.

REFERENCES

- Al-Baroudi, M. A. (2015). *The outstanding leader and the secrets of leadership creativity*. Arab Group for Training and Publishing.
- Al-Dahshan, G. A. K., & Samhan, M. F. (2020). Skills needed for preparation for future professions and jobs to keep pace with the Fourth Industrial Revolution and its requirements. *Industrial Vision, Journal of Education at Sohag University*, 80(80), 1-149.
- Allen, F. D. (2017). Libraries, data, and the Fourth Industrial Revolution (A. M. Helwani, Trans.). *Journal of Information Studies*, 18, 170-198.
- Al-Sarayreh, A. A. M. (2003). The relationship between organizational culture and administrative creativity in the Jordanian potash and phosphate public shareholding companies: A survey study. *Muta for Research and Studies - Series of Humanities and Social Sciences*, 18(4).
- Al-Sayrfi, M. A. F. (2003). *Leading management*. Dar Al-Safaa for Publishing and Distribution.
- Al-Shami, M. A. F. (2017). *Administrative creativity and human capacity development in light of global changes*. Dar Al-Yazouri Scientific.
- Al-Suwaidan, T., & Al-Adlouni, M. A. (2004). *Principles of creativity*. Cordoba for Artistic Production.
- Anis, I., et al. (2004). *Al-Moajam Al-Waseet*. Arabic Language Academy - Al-Shorouk International Library.
- Fisher, R. (2001). *Teaching children to think*. Nelson Thornes Ltd.
- Grabowska, S., & Saniuk, S. (2022). Development of business models in the Fourth Industrial Revolution: Conditions in the context of empirical research on worldwide scope companies located in Poland. *Journal of Open Innovation: Technology, Market, and Complexity*, 2(8), 1-20.
- Al-Dahshan, J. A. (2019). Ethical dilemmas of Fourth Industrial Revolution applications. In *The Ninth International Fourth Scientific Conference, titled Ethical Education in Arab Societies Between Reality and Aspiration* (pp. 8-29). Menoufia University.
- Khairy, O. (2012). *Creativity and innovation management*. Dar Al-Raya for Publishing and Distribution.

- Loumpourdi, M. (2021). The future of employee development in the emerging Fourth Industrial Revolution: A preferred liberal future. *Journal of Vocational Education & Training*, 76(1), 25-45.
- Mohd Mudzar, N. M. B., & Chew, K. W. (2022). Change in labour force skillset for the Fourth Industrial Revolution: A literature review. *International Journal of Technology*.
- Saniuk, S., Grabowska, S., & Grebski, W. (2022). Knowledge and skills development in the context of Fourth Industrial Revolution technologies: Interviews of experts from Pennsylvania State of the USA. *Energies*, 15(7).
- Schwab, K. (2016). *The Fourth Industrial Revolution*. World Economic Forum.