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The availability of open innovation dimensions in the State Company for Northern Cement Industry An applied study in Badoush Cement Factory

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A B S T R A C T

This research aims to assess the extent of open innovation dimensions in the Badoush Cement Plant Expansion by analyzing the degree of collaboration with external parties. The current research problem arises from a main question: What are the perceptions of the research sample regarding the availability of open innovation dimensions in the Badoush Cement Plant, which is the subject of the study? To address this, the researchers adopted a descriptive approach, using a checklist as the main tool for data collection. This checklist was distributed to a sample of the workforce at the plant, with 124 valid responses collected from an initial 127 distributed questionnaires. The data were analyzed using the statistical programs (SPSS v26) and (PLS-Smart v3). The analysis led to several conclusions, including the availability of open innovation dimensions at the studied company. However, this availability was accompanied by some variation in these dimensions, which leads to the proposal that the plant management should increase its focus on open innovation dimensions due to their importance in various activities and processes within the plant.

Introduction:

There are great challenges and intense competition between organizations that made them in a continuous race to ensure their survival in the market and maintain a distinct competitive position, and this is what prompted organizations to search for new and innovative ways to ensure the sustainability of their success and continuity in the market, by finding creative and bold ideas that lead to breaking the rules of traditional competition with others and thus achieving superiority over them, as Open innovation is one of the modern methods that many companies and institutions rely on to achieve continuous progress and development in various fields of work, and open innovation depends on the exchange of knowledge and ideas between the internal and external parties of the institution, including partnerships with universities, other companies, and research centers, in addition to involving employees and the local community in innovation processes, and the State Company for Northern Cement Industry / Cement Plant Badoush Expansion is one of the leading companies in the cement industry in Iraq, as it contributes significantly to meeting the needs of the local market of cement products in light of the increasing competitive and environmental challenges, it has become necessary to adopt the concepts of open innovation to achieve operational efficiency and sustainability, so the research came to stand on four main axes.

1 Study Methodology

1.1 The research problem:

Despite the continuous development in the fields of industry and technology, many industrial companies face great challenges in adopting and implementing the concepts of open innovation effectively, in this context the Badoush Cement Expansion Plant of the State Company for Northern Cement Industry is one of the major factories in Iraq that seeks to improve its performance and expand its production capacity, but it remains There are questions about the availability of the dimensions of open innovation in this lab, especially in the areas of cooperation with external parties, knowledge exchange, employee engagement and the local community, is there a clear strategy to adopt open innovation? Is there actual cooperation with academic institutions, international companies, or research centers? How are factoryworkers and the local community involved in developing innovative ideas and solutions? Hence, the research problem is to know the availability and application of the dimensions of open innovation in the Badoush Cement Expansion Plant, what are the factors that may affect the effective adoption of these practices in the industrial work environment, as well as expressing the problem of the study and its causes by raising the following questions:

1. Does the sample have a clear perception of open innovation and the dimensions that can be adopted as a measure for it?
2. What is the availability of the dimensions of open innovation in the research sample company?

1.2 Importance of the Research

The importance of research is demonstrated through its connection to open innovation and its key aspects for the surveyed company:

1. Theoretical research is crucial for establishing the foundation of the research variable, relying on scientific and modern sources like periodicals, theses, magazines, and internet resources, especially peer-reviewed sites.
2. Field studies contribute to solving community problems and enhancing productivity within the company, supporting its goals and long-term sustainability through the application of research recommendations.
3. In today's highly competitive market, research provides essential strategies for businesses to excel and achieve differentiation in their target markets.

1.3 Research Objectives

The main objective the research is to identify the availability of the dimensions of open innovation in the surveyed company, and to indicate the, and to achieve this goal requires the achievement of the following sub-objectives:

1. Clarifying the basic concepts and dimensions expressing the variable of open innovation.
2. Describe and diagnose the dimensions of the research variable and enhance them with a focus at least available in order to develop them continuously.
3. Statement of the most important factors that have been taken into account in the field studied when developing the open innovation strategy.
4. Reaching accurate results and adopting them as a basis for submitting scientific conclusions, proposals, the mechanism of their implementation and proposed future studies.

1.4 Research Hypothesis

The systematic treatment of the research problem in light of its theoretical framework and field implications requires defining the main hypothesis: "The dimensions of open innovation are not available in the laboratory under study."

1.5 Research methodology and methods of collecting data and information

The descriptive analytical approach was adopted in the current research in order to achieve its objectives, as it relied on many scientific methods to collect data and information related to the current study in its theoretical and field aspects as follows:
A- Theoretical aspect: The research in this aspect relied on the available Arab and foreign sources represented by research, books, conferences, scientific journals, as well as theses, theses and the Internet.
B- Field aspect: The research in this aspect relied on field visits, personal interviews, observation and observation, as well as the checklist for the respondents, which includes the dimensions of open innovation in order to test the hypothesis of the research and achieve its objectives.

1.6 The limits of the research were as follows

1. Spatial boundaries: The spatial search boundaries were represented in Badoush Cement Plant/Expansion.
2. Time limits: The research limits extended from 1/10 2024 to 1/3/2025.
3. Human limits: The opinions of a sample of managers, heads of departments, divisions, their assistants, and those with experience and competence from the employees of the Badoush Cement Expansion Plant were surveyed.

1.7 Statistical methods

In order to accomplish the field side of the research, many statistical methods were relied upon such as frequencies, percentages, arithmetic means, standard deviations, and many methods where required.

2 Theoretical Framework -Open Innovation

2.1 The emergence of open innovation

Organizations have recognized that traditional sources of competitive advantage cannot succeed in the long run. The rules of the game for the business environment have changed due to changes in the behavior of competitors, consumers and suppliers, and administrative and intellectual developments. The need for customers has increased, as has the speed of technological progress, globalization and increased competition in organizations, and these increasing competitive pressures have resulted in fundamental problems centered on the continuous search of business organizations for sources that enable them to achieve excellence and success. [1]

With the passage of time and the changes that have occurred in the field of modern technology, organizations are no longer able to close their doors to new innovations and external knowledge, and the closed innovation model adopted by organizations faces many challenges such as (increasing private investment capital, increasing the speed of access of products and services to the market, and increasing competition among global organizations as a result of globalization), this led to the creation of a model More open to innovation involves collaborating extensively with external beneficiaries and marketing ideas in a variety of different ways.

The term open innovation was coined in 2003 by Henry Chesbrough in his published book Open Innovation: The New Impity for Generating and Leveraging Technology.

(Open Innovation: The New Imperative for Creating and Profiting from Technology), The idea put forward by Chesbrough in his book is that since the late twentieth century, organizations have begun to shift from the closed innovation model, which in turn is limited to developing ideas, products, and services within the organization only, i.e., they rely mainly on their internal research and development (R&D) departments to think about and develop new products or services and introduce them to the market, without cooperating with any external party in the innovation plan, along with the open innovation model, by paying attention to the research and development man-

agement in companies to adopt its view of how to achieve and develop the open innovation model in terms of internal and external flows of innovation, accelerating internal innovation, and absorbing external innovations present in the market. [2].

Open innovation plays an important role in generating innovations and shows how organizations innovate in collaboration with other organizations or R&D units, and the ideas adopted by large organizations can benefit many sectors and not only outsource R&D activities, but also integrate internal and external competencies into both outgoing and incoming knowledge together. [3].

2.2 The concept of open innovation:

Several concepts of open innovation have emerged according to the opinions of many writers and researchers and the different approaches adopted by researchers in looking at the concept of open innovation, some of them defined open innovation as the process of using external and internal ideas and the main paths of the market in order to develop the capabilities of organizations. [4]. Some of them defined open innovation as not just a description of a set of collaborative innovation practices, but rather a comprehensive methodology for managing the innovation process within an organization, by exploring and exploiting a wide range of internal and external sources and opportunities for innovation. [5]. as well as the methodological performance and practical mechanisms for exploring, exploiting and retaining ideas and knowledge within and beyond the boundaries of the organization through the innovation process [6] also [7] .refers to it as a process distributed across organizational boundaries based on managed knowledge flows in a meaningful and beneficial way, using financial and non-financial mechanisms that are in line with the organization's business model.

While [8] appears as a pattern of integration between industrial and productive institutions on the one hand and universities on the other that reflects the increasing importance of knowledge transfer and the need to manage its flows in order to stimulate and promote innovations internally, and expand the scope of their marketing externally, while [9] indicates that it is a more flexible and dynamic model, based on the principles of integrated cooperation to improve the innovation process within business organizations., to maximize the material benefits generated by this innovation.

Based on the above, open innovation is the opposite of closed innovation in obtaining innovative ideas from various parties, whether from inside or outside the organization by buying or participating in intellectual property or by selling it to achieve the goal.

2.3 The importance of open innovation:

Open innovation emphasizes that ideas and inventions cannot bring value to the organization unless they are transformed into real products and services, and if keeping ideas confidential is important, it is more important to be able to exploit those ideas, and through open innovation useful knowledge is widely disseminated, and research and development departments in organizations should Industry, whatever its ability and superiority, can identify external sources of knowledge and utilize them as a necessary indicator of innovation [10].

The importance of open innovation can also be identified by reducing agreement on the internal processes of the organization such as costly internal research and development, gaining time and money, motivating the organization to disseminate its internal ideas in the external environment, enhancing and improving output, continuous learning and development, improving the ability to innovate, interaction and collaboration with others, increasing customer satisfaction., improve the overall performance of the organization. [11]
Thus, open innovation is one of the modern methods that allow companies and organizations to benefit from ideas, resources and knowledge available outside their organizational boundaries, as its importance lies in the ability to accelerate the innovation process and achieve new and effective solutions through cooperation with external partners such as universities, other companies, or even the local community.To access a wide range of advanced ideas and technologies that may not be available internally, helping them to improve their products, reduce costs, increase their efficiency, enhance interaction between different parties and stimulate an interactive and innovative work environment.

2.4 Dimensions of open innovation:

It can be referred to the most important basic dimensions of open innovation, which are shown by the opinions of some writers and researchers, which were (internal open innovation - external open innovation - open innovation [12]

1. Incoming internal open innovation (from the outside to the inside)

This refers to the internal use of external knowledge, as well as the enrichment of the organization's knowledge base, and the flow of knowledge received through the integration of suppliers, customers and external sources of knowledge [13]
It can increase organizational innovation, or in other words attract talent from outside the organization to create innovation within the organization, and is usually used at the organizational level and internal open innovation is often associated with collaborative networks, where universities play an important role in open innovation.[14]
Learning organizations are organizations that are able to acquire knowledge and translate it into new ways of doing business and enable individuals to learn inside and outside the organization and exchange expertise and experiences with a focus on modern technology, [15].
The open innovation contained ranges from obtaining permission to use intellectual property and using collective undertaking in research and development alliances, that is, benefiting from the discoveries of others, and requires openness to other organizations and establishing relationships with them in order to access their technical and scientific competencies to improve the performance and development of innovation in the organization, and is also an enrichment of the organization's knowledge base by integrating both customer suppliers and external sources of knowledge, and the open innovation contained reflects the idea that the place of innovation may not necessarily be the place of establishment Knowledge.[16].

The most important organizational forms of incoming open innovation are: incoming licensing, acquisitions, joint ventures, R&D contracts and research funding, procurement of technical and scientific services, and non-equity-based alliances. [17]

Based on the above, incoming open innovation is the reception of new ideas or innovative solutions from external sources, such as partners, customers, suppliers or competitors, or through the purchase of intellectual property, rather than relying only on internal innovation resulting from research and development within the organization, which aims to accelerate development and achieve efficiency by integrating external resources with internal resources.

2. Open Innovation External or Outbound (Inside Out)

It is the flow of outgoing knowledge, and the pursuit of bringing ideas to the market (sale or patent) It also aims to market knowledge, intellectual property and other technologies by transferring them to the market and the competitive environment and multiplying technology by directing ideas to the external environment and external open innovation is of interest to the academic sector, especially universities .[18]

Open innovation is also associated with earning profits by putting ideas on the market and selling intellectual property, doubling technology by transferring ideas to the external environment, and organizations that carry out the innovation process from the inside out as a basis that focuses on bringing out their knowledge and innovations in order to put ideas on the market faster than possible through internal development, the decision to shift the place of exploitation outside the boundaries of the organization means making profits by licensing intellectual property and or doubling the technology. [19].

Organizations must develop their human capital and continuously stimulate organizational renewal because talents are the basis for innovation, change and outstanding performance of any organization, and that the establishment of organizations depends on the extent of their awareness and learning how to manage their talents by identifying and attracting the human resources they need, developing them, managing their performance and retaining them. [20]

Among the most important regulatory forms of open innovation issued are: license issued new projects, sale of innovation projects, joint ventures, marketing, technology, supply of technology and scientific services, investments, risk to organizations, non-equity alliance. [21]

Based on the above, open innovation issued means the sharing of innovation, technologies, or products developed by the organization with external parties, such as other companies, research and development centers, or the general community, and this can be done through intellectual property licensing, data sharing, or even cooperation in joint projects between organizations.

3. Dual Open Innovation (Dual Activities)

Dual open innovation is a combination of inbound and outbound processes, which connect the outside and the inside by working in alliances with complementary organizations, and allying with external participants to achieve new products and new markets to reach competitive advantage, so open innovation offers multiple pathways to

generate value from knowledge, and how easy knowledge flows across organizational boundaries depends on the quality of relationships between organizations and the absorptive capacity of partner organizations in the field of innovation. Open. [22]
Joint innovation with complementary partners is through alliances, collaborations and joint ventures, in which give and take is crucial to success and organizations that carry out the dual process such as combining the process of innovation from the outside (to gain external knowledge) with the process of innovation from the inside out (to bring ideas to market), in which the development and commercialization of innovation is joint. [23]. In the dual process, incoming and outgoing processes are combined, so the outgoing knowledge flows from the organization towards the external environment, as well as the flow of knowledge from the external environment to the organization are simultaneously. [24].
Based on an applicant, it turns out that open hybrid innovation is a combination of external innovation where the company takes advantage of external ideas, technologies and resources to enhance its innovation processes, and internal innovation where the company allows the ideas and technologies it has developed internally to go out to the market or to external partners to maximize their value and that the goal is to accelerate the pace of innovation and increase competitiveness, and access to wider markets, and this requires achieving a balance between absorbing ideas External and the effective exploitation of internal ideas and the management of external relations effectively in addition to the existence of an organizational culture that supports the exchange of knowledge and ideas between companies and external parties such as customers, suppliers, universities and even competitors.

3 The practical side

Descriptive analysis of research dimensions paragraphs
Arithmetic averages, standard deviations, variation coefficients and response intensity will be extracted for all paragraphs of the resolution dimensions.
Analysis of the paragraphs and dimensions of the open innovation variable
Frequencies, ratios, arithmetic averages, standard deviations, coefficients of variation and response intensity index were calculated for variable dimension paragraphs (open innovation), as follows:

3.1 Open internal innovation:

It is noted from Table (1) that the dimension of open internal innovation was represented by paragraphs (X1_1 to X1_5) and by (28.4%) of the respondents towards saying the availability ofthe total of this dimension and an estimated percentage (40.5%) for those who say partial availability, and the percentage of unavailability by (31.1%) and this enhances the average arithmetic (1.973) with standard deviation (0.759), coefficient of variation (38.8%) and response intensity (65.8%), the highest availability rates (fully available) came at paragraph (X1_5), which states ((Participation in external conferences and workshops is invested to transfer knowledge and technology within the organization)) by (37.9%)) and an arithmetic mean of (2.210), standard deviation (0.713), coefficient of variation (32.3%) and intensity of response

(73.7%), and the lowest availability ratios (fully available) came at paragraph (X1_3) which states ((have an opportunity to purchase licenses for intellectual property)) by (21.0%), arithmetic mean of (1.806) and standard deviation (0.762), coefficient of variation (42.2%) and response intensity (60.2%). As for the probability value, the P-value values in the table indicate that most of the paragraphs are not statistically significant when comparing the mean of the sample with the hypothetical mean 2, as most of the values are greater than 0.05, which means that there is no significant difference between the actual mean and the hypothetical mean. However, the fifth paragraph had P-value = 0.001 which indicates a statistically significant difference, which means that the average of this paragraph froths intrinsically about the hypothetical mean.

Table 1. :Arithmetic Averages and Standard Deviations for Paragraphs After Open Internal Innovation

Paragraphs	Response Scale						Arithmetic mean	Standard deviation	Coefficient of variation %	Response intensity %	p-value
	In stock (3)		Partially Available (2)		Not Available (1)						
	t	%	t	%	t	%					
X1_1	35	28.2	47	37.9	42	33.9	1.944	0.789	40.6	64.8	0.785
X1_2	29	23.4	46	37.1	49	39.5	1.839	0.780	42.4	61.3	0.988
X1_3	26	21.0	48	38.7	50	40.3	1.806	0.762	42.2	60.2	0.997
X1_4	39	31.5	54	43.5	31	25.0	2.065	0.752	36.4	68.8	0.169
X1_5	47	37.9	56	45.2	21	16.9	2.210	0.713	32.3	73.7	0.001
Dimension	28.4%		40.5%		31.1%		1.973	0.759	38.8 %	65.8 %	0.654

Source: Prepared by the authors based on the outputs of SPSS- V26.

3.2 External open innovation:

It is noted from Table (2) that the dimension of external open innovation was represented by paragraphs (X2_1 to X2_6) and by (29.2%) of the respondents towards saying the availability ofthe total of this dimension and an estimated percentage (43.3%) for those who say partial availability, and the percentage of unavailability by (27.5%) and enhances that average arithmetic (2.016) with standard deviation (0.730), coefficient of variation (36.7%) and response intensity (67.2%), and the highest availability ratios (fully available) came at paragraph (X2_1), which states ((supports creative ideas to produce new products)) by (38.7%) and an arithmetic average of (2.250) Standard deviation (0.682), coefficient of variation (30.3%) and response intensity (75.0%), and the lowest availability ratios (fully available) came at paragraph (X2_3),

which states ((Intellectual property licenses are granted to other organizations)) by (18.5%), an arithmetic mean of (1.798), a standard deviation of (0.732) and a coefficient of variation (40.7).%) and responsiveness (59.9%).

P-value values in the table indicate that some paragraphs, such as X2_1 and X2_6, have P-value < 0.001, which means that there is a statistically significant difference that allows the null hypothesis to be rejected and the alternative hypothesis accepted, i.e. the arithmetic mean of these paragraphs is significantly greater than 2. In contrast, the rest of the paragraphs have a P-value > 0.05, which means that there is not enough statistical evidence to reject the null hypothesis, and therefore there is no significant difference from the hypothetical mean.

Table 2. :Arithmetic Averages and Standard Deviations for Paragraphs After External Open Innovation

Paragraphs	Response Scale						Arithmetic mean	Standard deviation	Coefficient of variation %	Response intensity %	p-value
	In stock (3)		Partially Available (2)		Not Available (1)						
	t	%	t	%	t	%					
X2_1	48	38.7	59	47.6	17	13.7	2.250	0.682	30.3	75.0	<0.001
X2_2	31	25.0	40	32.3	53	42.7	1.823	0.807	44.3	60.8	0.992
X2_3	23	18.5	53	42.8	48	38.7	1.798	0.732	40.7	59.9	0.999
X2_4	30	24.2	56	45.2	38	30.6	1.935	0.741	38.3	64.5	0.835
X2_5	39	31.5	49	39.5	36	29.0	2.024	0.780	38.6	67.5	0.366
X2_6	46	37.1	65	52.4	13	10.5	2.266	0.639	28.2	75.5	<0.001
Dimension	29.2%		43.3%		27.5%		2.016	0.730	36.7%	67.2%	0.404

Source: Prepared by the authors based on the outputs of SPSS- V26.

3.3 Double open innovation:

It is noted from Table (3) that the dimension of dual open innovation was represented by paragraphs (X3_1 to X3_5) and by (38.2%) of the respondents towards saying the availability ofthe total of this dimension and an estimated percentage (46.1%) for those who say partial availability, and the percentage of unavailability by (15.7%) and enhances that average arithmetic (2.226) with standard deviation (0.694), coefficient of variation (31.3%) and response intensity (74.2%), and the highest availability ratios (fully available) came at paragraph (X3_5), which states ((Have close cooperation relations with universities and technical institutes)) by (45.2%) and an arithmetic average of (2.298)) and standard deviation (0.721), coefficient of variation (31.4%) and intensity of response (76.6%), and the lowest availability ratios (fully available) came at paragraph (X3_4), which states ((offer innovative projects to their partners)) by (29.0%), arithmetic mean of (2.065), standard deviation (0.718) and coefficient of

variation (34.8)%) and responsiveness (68.8%). P-value values indicate that most paragraphs have P-value < 0.001, which means that there is a statistical significant difference that allows rejecting the null hypothesis and accepting the alternative hypothesis, that is, the arithmetic mean of these paragraphs is significantly greater than 2, the only paragraph that did not achieve statistical significance is X3_4 as P-value = 0.158, which means insufficient evidence to reject the null hypothesis, and therefore there is no significant difference between the average of this paragraph and the hypothetical mean.

Table 3. : Arithmetic Averages and Standard Deviations for Paragraphs after Double Open Innovation

Paragraphs	Response Scale						Arithmetic mean	Standard deviation	Coefficient of variation %	Response intensity %	p-value
	In stock (3)		Partially Available (2)		Not Available (1)						
	t	%	T	%	t	%					
X3_1	47	37.9	55	44.4	22	17.7	2.202	0.721	32.8	73.4	0.001
X3_2	47	37.9	67	54.0	10	8.1	2.298	0.611	26.6	76.6	<0.001
X3_3	51	41.1	55	44.4	18	14.5	2.266	0.700	30.9	75.5	<0.001
X3_4	36	29.0	60	48.4	28	22.6	2.065	0.718	34.8	68.8	0.158
X3_5	56	45.2	49	39.5	19	15.3	2.298	0.721	31.4	76.6	<0.001
Dimension	38.2%		46.1%		15.7%		2.226	0.694	31.3%	74.2%	<0.001

Source: Prepared by the authors based on the outputs of SPSS- V26.

The data of Table (4) indicate that there is a availability of (31.9%) of the respondents on the total paragraphs expressing the three dimensions of the open innovation variable , which are represented by (internal open innovation, external open innovation, dual open innovation) with an arithmetic mean of (2.072), standard deviation (0.728) and a coefficient of difference (35.6%) and a response rate (69.1%) The dimension of (dual open innovation) achieved the highest availability rate and in a way that made it ranked first compared to other dimensions with an availability rate of (38.2%), while after (external open innovation) it ranked second with an availability rate of (29.2%)) and after (internal open innovation) ranked third with an availability rate (28.4%).

Table 4. :Summary of the description and diagnosis of the open innovation variable

Dimensions	Availability	Arithmetic mean	Standard deviation	Coefficient of variation	Response Rate	Order
Internal Open Innovation	28.4%	1.973	0.759	38.8%	65.8%	Third

External Open Innovation	29.2%	2.016	0.73	36.7%	67.2%	Second
Dual Open Innovation	38.2%	2.226	0.694	31.3%	74.2%	The first
Rate	31.9%	2.072	0.728	35.6%	69.1%	-

Source: Researcher preparation based on SPSS- V26 outputs.

4 Conclusions and Proposals

4.1 Conclusions:

1. There appears to be availability of the dimensions of open innovation at the level of the surveyed company, noting that this availability was accompanied by a state of disparity in these dimensions, as the dual open innovation dimension achieved the highest percentage in the field of availability compared to other dimensions.
2. The results of the research showed that Badoush Cement Plant adopts some basic dimensions of open innovation such as collaborations with external parties such as universities and other companies, but more institutional support may be needed to expand this collaboration.
3. Challenges arise facing the factoryin implementing open innovation effectively, such as a lack of knowledge or experience in this field by some employees, and a lack of resources allocated to these activities.
4. The factorymay be in the rudimentary or intermediate stages of their interaction with customers and suppliers, which means that there is an opportunity to expand this interaction to take advantage of the ideas and modern technology that may exist in other parties.
5. Although some innovative tools and methods have been applied to a limited extent, there is considerable scope for using more digital technologies and tools that support more open innovation.
6. Leadership and management at Badoosh Cement plant are found to play an important role in stimulating open innovation, but there is a need to raise awareness and provide appropriate training to employees to encourage this type of innovation at all levels.
7. The results of the research show that there is an importance in cooperating with academic and research institutions to provide innovative solutions and new technology that enhance production efficiency and reduce costs.

4.2 Proposals:

1. Promoting a culture of open innovation within the factorythrough training programs and workshops aimed at raising employees' awareness of the importance of open innovation and ways to apply it in various industrial processes.
2. Encourage collaboration with local and international universities and research centers to develop innovative solutions in line with the requirements of modern indus-

try, including research and development in areas such as sustainable production technologies and alternative materials.

3. Encourage the exchange of knowledge with suppliers and customers and develop interactive platforms that facilitate the exchange of knowledge and ideas with suppliers and customers, thus enhancing opportunities for innovation and development in the products and services provided.
4. Establishing multidisciplinary teams to accelerate the innovation process Multidisciplinary teams that include engineers, researchers, and specialists in different fields can be formed to exchange ideas and develop innovative solutions.
5. Motivate leadership to embrace innovation by supporting new initiatives and allocating the necessary resources to achieve innovation within the lab.
6. Stimulate internal employee engagement by establishing mechanisms to encourage employees to submit their ideas and suggestions to improve production processes, such as organizing competitions or questionnaires on innovation.

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