Using the Balanced Scorecard Scale in Building, a Four-Track Measurement Model to Predict the Intellectual Capital of Industrial Stockholder Companies Listed on the Amman Stock Exchange for the Period (2016–2020)

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Abstract: - The goal of this study was to investigate the use of the balanced scorecard scale in the development of a four-track measuring model to estimate the intellectual capital of industrial joint stock businesses listed on the Amman Stock Exchange. The sample for this study is made up of 59 industrial public joint stock businesses registered on the Amman Stock Exchange (ASE) between 2016 and 2020. A multiple linear regression analysis using EVIEWS software and the findings suggest that the balanced scorecard has a favourable influence on intellectual capital from the financial, customer, internal-business-process, learning, and growth perspectives. According to the study, make suggestions based on the results of our inquiry to increase the intellectual capital of these companies. This might involve revising the company's human capital management methods, strengthening customer relationships, or concentrating more on innovation and learning. The current study is the first of its kind to be conducted in a developing nation, such as Jordan, and the findings might be useful to other underdeveloped nations.

Key-Words: - Balanced Scorecard scale, four-track measurement, intellectual capital, industrial sector, Amman Stock Exchange.

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1 Introduction

Intellectual capital, sometimes known as an organization's "hidden worth," refers to the intangible assets that contribute to its success, such as information, expertise, skills, and inventive ideas. These assets might be difficult to define, but they are essential for gaining a long-term competitive edge, [25]. Measuring and maintaining intellectual capital is so critical for firms seeking to improve performance and sustain development. The Balanced Scorecard is one instrument that has been frequently utilized for this purpose. Furthermore, the Balanced Scorecard is a management tool that assists firms in aligning their company operations with their vision and strategy. This is accomplished by monitoring performance from four perspectives: financial, customer, internal processes, and learning and growth, [14].

The balanced scorecard was created as a performance measurement framework that combined strategic non-financial performance measures with traditional financial metrics to provide managers and executives with a more complete picture of organizational performance. Its initial application as a simple performance measurement framework has evolved into a full strategic planning and management system, [32]. The balanced scorecard application entails strategizing the use of available resources, such as the human workforce, finances, and other resources to achieve set goals. Profitability is an important link in maximizing an organization's wealth; it is critical because it is the measure of performance in the production of goods or services and the means by which the firm's future is ensured. Long-term financial results and shareholder wealth are expected to improve because of operational improvements, [34].

To apply the Balanced Scorecard scale in developing a four-track assessment model to forecast intellectual capital, define important indicators and goals relevant to an organization's intellectual capital within each of these four perspectives. Metrics such as working knowledge and skills, the success of training and development programs, the effectiveness of innovation and R&D activities, and the extent to which intellectual property is safeguarded and utilized might be included, [13]. Once the essential metrics and objectives have been determined, a system for tracking and assessing these metrics on a regular basis must be developed. This may entail gathering information from a variety of sources, including staff surveys, consumer feedback, financial records, and other sources. This data would then need to be analyzed to establish how well the company is performing in each of the four perspectives, and this information would be used to identify areas for improvement and set new objectives for future performance, [12], [35].

The novelty of the concept of intellectual capital, as well as the increased interest in it in the modern era, the fact that it does not appear separately or as a value in enterprise financial statements, and the difficulty of disclosing it and indicating its impact on companies, all make this a topic worthy of research, as it has value but is difficult to determine. Therefore, this study seeks to know the relationship between the application of the balanced scorecard from its four perspectives (financial perspective, customer perspective, learning and growth perspective, and the perspective of the internal business process) and the prediction of intellectual capital as a point from which intellectual capital can be measured by conducting an applied study on industrial stockholder companies listed on the Amman Stock Exchange. Thus, the problem of the study is to answer the following main question: "Is there an impact of the application of the balanced scorecard on the prediction of intellectual capital in industrial stockholder companies listed on the Amman Stock Exchange?"

This study's technical contribution is to improve decision-making. Organizations may make better-informed decisions about how to allocate resources and prioritize activities to optimize the value of their intellectual capital by tracking and measuring key indicators connected to intellectual capital. Furthermore, through defining goals and analyzing success in each of the Balanced Scorecard's four perspectives, firms may discover areas for improvement and take action to increase employee knowledge and skills, customer happiness, internal procedures, and innovation. Likewise, firms may improve their competitiveness by better understanding and managing their intellectual capital and exploiting their unique expertise and talents to produce value for customers and other stakeholders. Ultimately, companies may demonstrate responsibility to stakeholders and increase transparency around their operations and performance by measuring and reporting on their intellectual capital performance on a regular basis.

The relationship between both intellectual capital and the balanced performance measure is interrelated and very important, as it is necessary to align intangible assets with the business organization strategy, and it is also important to focus on the learning and growth processes factor for the balanced performance measure since human resources are the main reason that drives the other factors for the balanced performance measure. In addition, the market value of the organization stems from its intangible assets, which are necessary for its continuation, [30]. This study intends to use the balanced scorecard performance measure to construct a four-track measurement model to predict intellectual capital in industrial joint stock companies listed on the Amman Stock Exchange, as well as to identify the concept of intellectual capital and the models used to measure it by employing a variety of financial tools that are compatible with the available data and information announced by industrial joint stock companies listed on the Amman Stock Exchange.

The paper is then structured in four sections: Section 2 is devoted to reviewing literature; Section 3 tackles the theoretical framework and hypotheses; Section 4 outlines the research methodology; and finally, the conclusion and recommendations are given in Section 5.

2 Literature Review

2.1 Balanced Scorecard Scale

The Balanced Scorecard (BSC) is a strategic planning and management approach for aligning business operations with an organization's vision and strategy, improving internal and external communication, and tracking organizational performance against strategic goals, [19]. The Company Strategy Canvas (BSC) is a framework that considers four viewpoints: financial, customer, internal business processes, and learning and growth, [8]. These four perspectives are used to create a set of measurements and goals for assessing the organization's progress. The Balanced Scorecard scale denotes the extent to which it is used inside a firm. It may be used at several levels, from strategic to operational. The Balanced Scorecard is used at the strategic level to translate an organization's vision and strategy into a set of defined, measurable, achievable, relevant, and time-bound (SMART) objectives and activities. These objectives and initiatives are subsequently passed down to lower levels of the organization, where they may be used to guide and monitor team and individual performance, [15], [24].

Each of the Balanced Scorecard's four perspectives is measured using a set of key performance indicators (KPIs). The particular KPIs that will be utilized will be established by the organization's goals and objectives, as well as the industry and market in which it operates. Financial measurements like sales, profit, return on investment, and cash flow is examples of common KPIs in finance. Customer KPIs might include indications of customer enjoyment, loyalty, and retention. Internal process KPIs might include efficiency, productivity, and quality metrics. Employee engagement, training, and development indicators may be included in learning and growth KPIs, [21], [36]. Organizations may acquire an understanding of how well they are performing in each of the four perspectives by tracking and measuring these KPIs over time and making adjustments as needed to stay on track and meet their objectives. It is critical to remember that the Balanced Scorecard is not a one-size-fits-all solution and that organizations should customize their scorecard to meet their specific requirements and goals. It is also vital to analyze and update the KPIs being measured on a regular basis to ensure that they remain relevant and linked to the firm's overall strategy, [16], [45].

In the Balanced Scorecard, performance is measured using no specific scale. Organizations, on the other hand, often define their own objectives and standards for each of the indicators included in their Balanced Scorecard, [44]. These targets and benchmarks should be based on the organization's unique goals and objectives while being consistent with the organization's overall strategy. If a company uses the Balanced Scorecard to track its financial performance, it can set goals for revenue growth, profitability, and cash flow. If it uses the Balanced Scorecard to measure customer performance, it may set goals for customer satisfaction, loyalty, and retention. Organizations often begin by establishing their vision and strategy, as well as determining the primary goals and objectives that they want to achieve, before developing a four-track measuring model based on, [37]. They can next choose the important indicators that they wish to track in each of the Balanced Scorecard's four viewpoints. After identifying the indicators, companies may create objectives and benchmarks for each indication and measure progress toward these targets over time. It is critical to evaluate and update the indicators in the Balanced Scorecard on a regular basis to ensure that they are

successfully assessing progress toward the organization's goals, [42].

Intellectual capital refers to the intangible assets of a company, such as its knowledge, skills, and experience. It is often considered to be a key source of competitive advantage and can take many forms, including patents, trademarks, copyrights, and proprietary technology. Intellectual capital is also closely tied to a company's human capital, or the knowledge and expertise of its employees. Intellectual capital can be a difficult concept to measure and quantify, as it is not a tangible asset like property or equipment. However, companies may seek to manage and leverage their intellectual capital in order to generate economic value and improve their overall performance. This can be done through activities such as investing in employee training and development, building strong partnerships and networks, and protecting intellectual property through patents and other legal means, [16], [45].

2.2 Intellectual Capital

Human capital, structural capital, and social capital are the three major kinds of intellectual capital. Human capital refers to a company's employees' knowledge, abilities, and experience. Education and training, as well as on-the-job experience and skill, are examples of this. Human capital is frequently regarded as a crucial engine of innovation and productivity, and businesses may spend on training and development programs to create and retain highly trained staff, [10]. The methods, procedures, and infrastructure that a corporation has in place to develop, manage, and use its intellectual capital are referred to as structural capital. Intellectual property rights, research and development projects, and data management systems are examples of this. Social capital refers to a company's ties and networks with external stakeholders such as customers, suppliers, and other partners, [38]. These connections may be valuable sources of information, knowledge, and other resources that can help a business innovate and expand. Managing and exploiting intellectual capital may be a difficult process since it requires managing, not just real assets like property and equipment, but also intangible assets such as knowledge and experience. However, it may also be a significant source of competitive advantage, assisting businesses to innovate, expand, and outcompete their competitors, [22].

Intellectual capital would include examining and assessing the topic's existing body of knowledge. Examining scholarly research papers, books, and other sources to gain a better understanding of intellectual capital and its different components, such as human capital, structural capital, and social capital, [17]. When reviewing the literature on intellectual capital, researchers may want to look at how different writers and researchers have defined and conceptualized the term, as well as how it has been assessed and evaluated. Individuals might also look at how intellectual capital has been connected to other outcomes like innovation, productivity, and performance. Furthermore, individuals may investigate the numerous methodologies and frameworks that have been established for managing and utilizing intellectual capital, including training and development programs, intellectual property protection, and R&D funding, [5], [41].

There have been numerous techniques for measuring intellectual capital, including financial metrics; some studies have utilized financial indicators to examine the influence of intellectual capital on a company's success, such as return on investment or market value. Other studies have utilized non-financial criteria to quantify the quantity of intellectual capital within a firm, such as the number of patents filed or the number of staff training programs, [26]. Balanced scorecards, which are performance evaluation systems that track both financial and non-financial metrics, have been used by some academics to examine the influence of intellectual capital on a company's overall success, [20]. It is crucial to emphasize that there is no single "right" technique to evaluate intellectual capital, and different approaches may be more or less appropriate depending on the study's unique context and objectives. A literature study on intellectual capital could look at how it might be managed and used to improve performance and produce value, in addition to the many assessment methodologies. This might involve methods like investing in staff training and development, preserving intellectual property, forming strong relationships and networks, and investing in R&D, [18], [39].

2.3 Hypotheses Development

Despite the extreme importance of the relationship between both intellectual capital and the balanced performance measure, few studies have addressed how to integrate them. According to [35], the balanced scorecard is a management model (not just a measurement tool) that enables companies to define their strategy and vision and translate them into particular actions controlled by a coherent set of action performance measures. It provides responses across internal business processes and external results, advancing strategic performance and results

indefinitely. A balanced scorecard is used by organizations all over the world to translate strategy and vision into measurable goals.

Nonetheless, [10] argue that a balanced scorecard is advantageous because it combines a business organization's direction, foundation, and sight to create organizational performance measures that combine the old with the new while converting long-term objectives and strategies (such as satisfying customers) into tangible actions that can be taken internal or external. Some clever managers organized, communicated, and managed their plans using the balanced scorecard approach, which places a larger focus on strategy than on control. The balanced scorecard has progressed from an improved measuring system to a central management system. Furthermore, [40] argued that the measuring performance system encompasses all organizational tasks, referring to the financial perspective because it relates to corporate finance and accounting from the customer perspective since it relates to marketing, the internal-business-process perspective, and the value addition world in general, and the perspectives of learning and development for staff members and human capital.

On the other hand, the study conducted by [3] concluded that the balanced scorecard could provide managers with the advantages they need to accurately assess themselves, thus improving their competitiveness. Businesses' primary goal is to develop overall performance and profit. When managers use the balanced scorecard as a performance measurement tool, they can achieve this goal. Despite the limitations identified by some researchers, the balanced scorecard is beneficial when implemented by organizations because it incorporates both financial and non-financial variables in measuring performance at any given time. Organizations should use the balanced scorecard model as a performance measurement tool because it provides the most benefits.

Despite its effectiveness and broad adoption in many businesses, the balanced scorecard, like other assessment methods, has attracted criticism from a number of sources. Academics made up the vast majority of these complaints. According to [4], one of the balanced scorecard's shortcomings is that the causation linkages between the areas of measurement in the balanced scorecard are overly basic and unidirectional. Some authors have pointed out that a few of the proposed components of assessment in the balanced scorecard do not have a causation link, citing the connection between client loyalty and financial success as an illustration of these limits. Nonetheless, [7] demonstrated that the balanced scorecard disregards the sequence. This critical point of the balanced scorecard assumes that the relationship between different points in time must be interpreted. In this view, a balanced scorecard does not explain the role of time in its cause-and-effect relationships. A balanced scorecard does not include time in cause-and-effect relationships, nor does it separate cause-and-effect relationships in time. Moreover, the traditional balanced scorecard concept is ineffective for enhancing corporate sustainability according to [43]. Likewise, [11] studied the relationship between intellectual capital and competitive advantage. They found that intellectual capital has been defined as a collection of intangibles (capabilities, competencies, and resources) that elevate organizational performance and value creation. This suggests that there are causal relationships between intellectual capital and the creation of organizational value. Furthermore, this system allows for an in-depth analysis of a company's performance (from the standpoint of intellectual capital) in order to identify possible opportunities for enhancing competitiveness. Nevertheless, unfortunately, many organizations focus on stocks or resources primarily or exclusively because they are relatively easy to measure.

Besides, [28] have explained the importance of intellectual capital by comparing it to technological advances. It is regarded as one of the intangible assets that have replaced machines and natural resources, as well as one of the most valuable factors in a company's financial performance growth. Intellectual capital is the difference between a company's market value and book value. It constitutes an intangible asset through which creative ideas and the necessary knowledge stock can be enhanced to promote companies, improve their overall performance, increase their market share, and increase their competitiveness. In addition, [31] agree that intellectual capital is a critical component in achieving organizational performance. A process of changing the capital structure is underway in order to establish a substantial share of essential intangible resources. As a result, these intangible resources (the capacity to use knowledge and workplace structure) play a role in increasing the company's financial capability and contributing to the production of valuable resources inside the business. Furthermore, [29] agree with the specifically carried and add that knowledge management is a company's capacity to capitalize on chances to boost competitiveness and increased investments. Multilevel assessment, which combines individual and collective knowledge and

abilities with institutional and collaboration processes, is widely used in this vantage point. Furthermore, [9] demonstrated that brains and information stock are transformed into innovation when the power of academic freedom generates specific financial rewards for businesses through properly coordinating and appropriate investment for intangible resources. These perspectives and underlying principles are a wonderful place to start while learning about intellectual capital.

The balanced scorecard, with its own structure, contributes to the formation and operation of companies of innovation, according to [33]. Moreover, [23] discovered that the balanced scorecard's educational perspective, period to make, and customer capital are factors in the growth of intellectual capital's technological capability and social resources; the balanced scorecard's company internal perspective, process capital; and the balanced scorecard's customer, customer assets. According to [27], the common technique of Taiwanese intellectual capital firms of enhancing quality, internal-business-process, and studying perspectives there at expense of quick financial results helped contribute to intellectual wealth creation and, thus, long-term competitive nature.

This study is based on the following assumptions, which are influenced by the investigation of past and conceptual studies linked to the basis of this study and are based on the study problem and its goals:

H01: There is no statistically significant effect of using the balanced scorecard scale in building a four-track measurement model to predict the intellectual capital of industrial stockholder companies listed on the Amman Stock Exchange.

The main hypothesis has the following sub-hypotheses:

H01-1: There is no statistically significant effect of applying the financial perspective of the balanced scorecard to predict intellectual capital in industrial stockholder companies listed on the Amman Stock Exchange.

H01-2: There is no statistically significant effect of applying the customer perspective of the balanced scorecard to predict intellectual capital in industrial stockholder companies listed on the Amman Stock Exchange.

H01-3: There is no statistically significant effect of applying the internal-business-process perspective of the balanced scorecard to predict intellectual capital in industrial stockholder companies listed on the Amman Stock Exchange.

H01-4: There is no statistically significant effect of applying the learning and growth perspective of the balanced scorecard to predict the capital in industrial stockholder companies listed on the Amman Stock Exchange.

3 Study Methodology

The study community consists of all Jordanian industrial public joint stock companies listed on the Amman Stock Exchange, as there are (77) companies according to the 2014 company guide published on the website of the Amman Stock Exchange (www.exchange.jo). The sample of the study included all Jordanian industrial public joint stock companies listed on the Amman Stock Exchange from 2016–2020, with the exception of the following companies: 1. companies that were merged or liquidated during the study period. 2. Companies that did not publish their financial statements regularly during the study period. Accordingly, the final sample size that met the previous conditions is equal to (59) companies, which constitute 76% of the community's size.

While the dependent variable, intellectual capital, is the method of the ratio of market value to book value that will be used to measure intellectual capital. On the other hand, independent variables, the balanced scorecard is measured as shown in Table 1.

Table 1. Independent variables

From the financial perspective,	**From the customer perspective,**	**From the internal-business-process perspective,**	**The learning and growth perspective,**
Earnings per share (EPS)	The ratio of marketing expenses to sales	The proportion of research and development costs to sales	The ratio of training expenses to sales
Rate of return on assets (ROA)	Sales growth	Asset turnover rate	The percentage of sales allocated to employees
The rate of return on equity (ROE)	Market share		The ratio of salaries to expenses

3.1 Methods for Measuring Study Hypotheses

Measurement of the first main hypothesis: There is no statistically significant effect of using the balanced scorecard scale in building a four-track measurement model to predict the intellectual capital of industrial stockholder companies listed on the Amman Stock Exchange. The basic model of this study is represented by the following equation:

$$IC= \alpha + (\beta 1X1) + (\beta 2X2) + (\beta 3X3) + (\beta 4X4) + e$$

Whereas:

IC: Intellectual Capital
α: Constant of the regression relationship
X1: The financial perspective of the balanced scorecard
X2: The customer perspective of the balanced scorecard
X3: The internal-business-process perspective of the balanced scorecard
X4: The learning and growth perspective of the balanced scorecard
UIT: The number of random changes that the model does not explain
β: Regression coefficients for independent variables
e: Random error
However, the model proposed, developed, and used in this study is:

$$IC = \alpha + (\beta 1\ EPS) + (\beta 2\ ROA) + (\beta 3\ ROE) + (\beta 4\ GRev) + (\beta 5\ MktSh) + (\beta 6\ RD) + (\beta 7\ AT) + (\beta 8\ TrExp) + (\beta 9\ SaExp) + e$$

Whereas:
α: Constant of the regression relationship
β: Regression coefficients for independent variables
EPS: Earnings per share
ROA: Return on asset
ROE: Return on equity
GRev: Sales growth
MktSh: Market share
RD: Research and Development Costs to Sales
AT: Asset turnover rate
TrExp: The ratio of training expenses to sales
SaExp: The ratio of salaries to expenses
e: Random error

Measurement of the first sub-hypothesis: There is no statistically significant effect of applying the financial perspective of the balanced scorecard to predict intellectual capital in industrial stockholder companies listed on the Amman Stock Exchange. This hypothesis includes the financial perspective of the balanced scorecard in order to measure performance indicators based on the financial perspective. The following indicators will be used: earnings per share (EPS), rate of return on assets (ROA), and rate of return on equity (ROE).
To test this hypothesis, the following model will be constructed:

$$IC = \alpha + (\beta 1\ EPS) + (\beta 2\ ROA) + (\beta 3\ ROE) + e$$

Measurement of the second sub-hypothesis: There is no statistically significant effect of applying the customer perspective of the balanced scorecard to predict intellectual capital in industrial stockholder companies listed on the Amman Stock Exchange. This hypothesis includes the customer perspective of the balanced scorecard. The following indicators will be used to measure the performance indicators based on the customer perspective: The ratio of marketing expenses to sales, sales growth, and market share
To test this hypothesis, the following model will be constructed:

$$IC = \alpha + (\beta 1\ GRev) + (\beta 2\ MktSh) + e$$

Measurement of the third sub-hypothesis: There is no statistically significant effect of applying the internal-business-process perspective of the balanced scorecard to predict intellectual capital in industrial stockholder companies listed on the Amman Stock Exchange. This hypothesis includes the internal-business-process perspective of the balanced scorecard. To measure the performance indicators based on the internal business process perspective, the following indicators will be used: the ratio of research and development costs to sales and the asset turnover rate.
To test this hypothesis, the following model will be constructed:

$$IC = \alpha + (\beta 1\ RD) + (\beta 2\ AT) + e$$

Measurement of the third sub-hypothesis: There is no statistically significant effect of applying the learning and growth perspective of the balanced scorecard to predict the capital in industrial stockholder companies listed on the Amman Stock Exchange. This hypothesis includes the learning and growth perspective of the balanced scorecard. To measure performance indicators based on the learning and growth perspective, the following indicators will be used: The ratio of training expenses to sales, the percentage of sales allocated to employees, and the ratio of salaries to expenses.
To test this hypothesis, the following model will be constructed:

$$IC = \alpha + (\beta 1\ TrExp) + (\beta 2\ SaExp) + e$$

4 Findings and Discussion

Testing the validity of data for statistical analysis: The models of this study belong to the general linear model (GLM), which requires the availability of many conditions before its application; therefore, the data of this study should be examined to verify their compliance with the conditions of the (GLM). On the contrary, a false correlation arises between the independent and dependent variables of the study, and therefore the correlation loses its ability to explain or predict the phenomenon in question. Therefore, before starting to find regression equations and do data analysis, these data should be examined to verify that they are free of statistical problems that may negatively affect the results of testing the study hypotheses. To ensure linearity

assumption, independence assumption, and normal distribution assumption, which contribute to the selection of appropriate statistical methods for testing hypotheses within the selected sample.

Table 2. Shows the Anderson-Darling test of the normal distribution

Variable	Anderson-Darling	P-value
Intellectual capital	1.334	0
Earnings Per Share	**4.55**	0
Return on Assets	0.76	0
Return on Equity	0.5656	0
Sales growth	**0.7**	0
Market share	0.5743	0
Research and Development Costs to Sales	0.7729	0
Asset turnover rate	0.7122	0
The ratio of training expenses to sales	0.3111	0
The ratio of salaries to expenses	0.211	0

The values of observations must follow the normal distributions to be valid for the general linear model (GLM), and if this criterion is not satisfied, the information is processed with the arithmetic mean or its sum of squares. It has been verified that the private data follows a normal distribution based on the Anderson-Darling test, and the decision rule is to accept the nihilistic hypothesis (H0): the data is normally distributed) if the probability of the Anderson-Darling test is greater than (0.05).

From Table 2, we note that the probability of the Anderson-Darling parameter test is greater than 0.05, which indicates that all study variables follow the normal distribution

The generalized linear model (GLM) is predicated on the premise of variable independence, and if this is not satisfied, the model suffers from multi-collinearity. To address this issue, a parameterization procedure is performed, in which the Collinearity Diagnosis scale is used to compute the variance inflation factor (VIF) from among study variables. In [19], author demonstrated that a VIF score greater than 10 signifies the presence of an issue with a linear plurality of the independent variable. According to [19], the value of the variance inflation coefficient in Table 2 was larger than 1 and less than 10, indicating that the research models are free of the problems of linear interference.

In this part of the study, we discuss the description of the study variables after the validity of the data has been verified to test the hypotheses, and the process of describing the variables is based on the use of statistical measures that clarify the most important main characteristics of the dependent and independent study variables. The following is a presentation of the measures used to describe the variables of the study.

Table 3. Descriptive statistics of Intellectual capital

Measurement	Intellectual capital
Means	27.736
Maximum value	87.967
Minimum value	7.6565
Standard Deviation	34.342

The average intellectual capital amounted to 27.736, with a standard deviation of 34.342. While the highest value recorded during the period was (87.967), the lowest value was (7.6565) as shown in Table 3. This apparent disparity in intellectual capital efficiency may be due to the industrial companies' differing awareness of the importance of intellectual assets and their contribution to adding value to the institution, which was reflected in the policies followed in generating revenue through intellectual value added to its operations. Table 4 shows the values of the descriptive statistical measures of the independent variables of the study.The average return on assets amounted to (0.0075), with a standard deviation of (0.0290). While the highest value recorded during the period was (0.032), the lowest value was (-0.0372). The decrease in this percentage may be attributed to the large size of the investment industrial companies' assets, which exceeded $6 billion in 2020. The relatively high standard deviation value compared to the arithmetic mean also indicates a discrepancy in the industrial companies to exploit its assets, and this is confirmed by the maximum return on assets, which amounted to (0.0315) for the year 2013. On the other hand, the average return on equity amounted to (0.2272), with a standard deviation of (0.3015). While the highest value recorded during the period was (0.5286), the lowest value was (-0.1166). Here, the value of the standard deviation that exceeded the value of the arithmetic means indicates a clear discrepancy in this ratio, and this is due to the industrial company's exposure to several losses during the said period, but it recovered from these losses and made profits again, as the maximum value of the return on income.

Table 4. Descriptive statistics of independent variables

Measurement	Means	Maximum value	Minimum value	Standard Deviation
Return on Assets	0.0075	0.0315	-0.037	0.029
Return on Equity	0.2272	0.5286	-0.117	0.3015
The ratio of marketing expenses to sales	0.0201	0.0367	0.0133	0.0096
Sales growth	0.5727	2.5122	-0.186	1.0972
Research and development costs to sales	0.0039	0.0049	0.002	0.0012
Asset turnover rate	0.052	0.0613	0.0347	0.0105
The ratio of training expenses to sales	0.0008	0.0011	0.0004	0.0003
The ratio of salaries to expenses	0.246	0.3502	0.0336	0.1331

The average value of marketing expenses to sales was (0.0201), with a standard deviation of (0.0096). While the highest value recorded during the period was (0.0367), the lowest value was (0.0133). This indicates that the industrial companies followed a consistent marketing policy during the same period. While, the average sales growth values amounted to 0.5727, with a standard deviation of 1.0972. While the highest value recorded during the period was (2.5122), the lowest value was (-0.1860).

This is a sign of the significant variation in the industrial companies' ability to generate income during the period, and this was clearly reflected in the returns. In addition, the average ratio of research and development costs to sales was (0.0039), with a standard deviation of (0.0012). While the highest value recorded during the period was (0.0049), the lowest value was (0.0020). This is a reference to the industrial companies' consistent policy of supporting research and development. The average value of the asset turnover rate was (0.0520), with a standard deviation of (0.0105). While the highest value recorded during the period was (0.0613), the lowest value was (0.0347). This indicates that industrial companies maintain their operational performance by exploiting available assets and resources to achieve revenue.

Besides, the average value of training expenses to revenues was (0.0008), with a standard deviation of (0.0003). While the highest value recorded during the period was (0.0011) and the lowest value was (0.0004). This is an indication of the stability of the training plans required by the industrial companies, and the significant decrease in training expenses compared to revenues may be attributed to the relative stability of revenue sources as well as to the increased dependence of the industrial companies on the use of consultants to make decisions. Moreover, the average salary-to-expense ratio was (0.2460), with a standard deviation of (0.1331). While the highest value recorded during the period was 0.3502, the lowest value was 0.3336. Here, the relatively high standard deviation value as well as the maximum and minimum values indicates the increasing need for the human element, especially since the maximum value.

In Table 5, the autocorrelation problem appears in the model if adjacent views are interconnected, which will affect the validity of the model, and therefore the effect of independent variables on the dependent variable will be greatly increased due to that correlation. To verify this, the Durbin-Watson (D-W) test was used. The value (DW) is calculated according to a complex relationship, and it is obtained through statistical programs. After calculating the value (DW), it is compared with the two tabulated values (DL), which represents the minimum lack of autocorrelation, and (DV), which represents the maximum lack of autocorrelation, depending on the number of observations and the number of independent variables in the model for each level of significance, and one of the two hypotheses is accepted or rejected based on some mathematical rules. The value of the median (DW) is two, and when there is no autocorrelation, the correlation coefficient is equal to zero. In addition, the nihilistic hypothesis (H0) is accepted or rejected based on some statistical comparisons.

Table 5. Autocorrelation Test

Hypotheses	Calculated D-W value	DL	DV.	Result
$H_0$1-1	1.92	0.61	1.4	There is no autocorrelation problem
H01-2	1.666	0.61	1.4	There is no autocorrelation problem
H01-3	2.736	0.61	1.4	There is no autocorrelation problem
H01-4	2.893	0.61	1.4	There is no autocorrelation problem

The Durbin-Watson null hypothesis and the alternative hypothesis will be tested: H0: The model has no autocorrelation problem. Ha: Autocorrelation exists in the model.

We observe that the D-W values of the variables in all of the hypotheses are greater than dV, indicating that the data are free of autocorrelation and that there is no correlation between the random error limits in the regression model. We also note that the value of (DW) does not fall within the range, since (dL<dV), and therefore the model does not suffer from the autocorrelation problem.

The strength of the general linear model depends mainly on the hypothesis of the independence of each of the independent variables. If this condition is not met, the model suffers from the problem of linear interference (multicollinearity), then the general linear model is then not suitable for the application, and it cannot be considered good for the process of estimating parameters. To achieve this, the Collinearity Diagnostics scale is used by calculating the coefficient of variation Inflation Factor (VIF) for each of the independent variables. This test is a measure of the effect of correlation between independent variables. According to [2] showed that obtaining a value (VIF) higher than (10) indicates the existence of a problem of linear multiplicity of the independent variable in question. It is shown in the following Table 6, 7, 8, 9.

Table 6. Multiple linear correlations testing of financial perspective variables

Variable	Variance Inflation Factor (VIF)
Earnings Per Share	2.733
Return on Assets	1.232
Return on Equity	3.9

From Table 6. It is noted that the value (VIF) of the independent variables of the financial dimension is below (10), this indicates the absence of the problem of multiple linear correlations between the variables.

Table 7. Multiple linear correlations testing of customer perspective variables

Variable	Variance Inflation Factor (VIF)
Sales growth	3.373
Market share	3.345

From Table 7. It is noted that the value (VIF) of the independent variables of the financial dimension is below (10), this indicates the absence of the problem of multiple linear correlations between the variables

Table 8. Multiple linear correlations testing of internal-business-process perspective variables

Variable	Variance Inflation Factor (VIF)
Research and Development Costs to Sales	3.111
Asset turnover rate	2.033

From Table 8. It is noted that the value (VIF) of the independent variables of the financial dimension is below (10), this indicates the absence of the problem of multiple linear correlations between the variables

Table 9. Multiple linear correlations testing of variables related to learning and growth perspectives

Variable	Variance Inflation Factor (VIF)
The ratio of training expenses to sales	2.053
The ratio of salaries to expenses	4.053

From Table 9. It is noted that the value (VIF) of the independent variables of the financial dimension is below (10), this indicates the absence of the problem of multiple linear correlations between the variables

The study hypotheses were subjected to multiple linear regression analysis using EVIEWS software, and the results were as follows: Main hypothesis H0: There is no statistically significant effect at the significance level ($\alpha \leq 0.05$) of applying the balanced scorecard on intellectual capital. The sub-hypotheses of this hypothesis were subjected to multiple regression analysis, and the results were as follows:

First sub-hypothesis H01: There is no statistically significant effect at the significance level ($\alpha \leq 0.05$) of applying the financial perspective of the balanced scorecard on intellectual capital.

Table 10. Results of testing the impact of the application of the financial perspective on intellectual capital

The dependent variable	R^2	Adjusted R^2	F	Sig F*	Regression coefficient				
					V	β	Standard error	T	Sig t*
Intellectual capital	0.816	0.735	22.302	0.043	Return on assets	-2261	397.47	-5.688	0.03
					Return on Equity	137.26	38.233	3.59	0.07
					Constant slope	13.515	7.613	1.775	0.218

* The effect is statistically significant at the level of ($\alpha \leq 0.05$)

The results of Table 10, indicate that the effect of the independent variables of the financial perspective on the dependent variable (intellectual capital) is statistically significant, where the calculated value of F was (22.302), at a significant level (Sig F = 0.043), which is less than 0.05, and the value of the determination coefficient was (R2 = 0.816), which indicates that (81.6%) of the variation in (intellectual capital) is due to the other variables being constant. The high value of the determination coefficient is due to the small sample size of the study and the period of the study, which require high values of the determination coefficient to reach the significance of the effect. As for the regression coefficient β=-2260.71, it indicates the effect of the return on intellectual capital assets, which is a significant effect, where the value of t was (-5.688) and at an indicative level (Sig = 0.030), and the value of the regression coefficient at the return on revenue β=137.259 (it indicates the effect of that variable, which is not significant, where the value of t was (3.590) and at an indicative level (Sig = 0.070), we, therefore, reject the first sub-hypothesis and accept the alternative, which states that: There is a statistically significant effect at the level of ($\alpha \leq 0.05$) for the application of the financial perspective of the balanced scorecard on intellectual capital. Depending on Table 10, the relationship between the model variables can be written as follows:

IC1 = 13.515 – 2260.710 (ROA) + 137.259 (ROE)

Our first result suggests there is no statistically significant effect at the significance level ($\alpha \leq 0.05$) of applying the financial perspective of the balanced scorecard on intellectual capital. Furthermore, the financial perspective of the balanced scorecard can be used to assess the value of intellectual capital. One approach is to track the financial returns generated by the organization's intellectual capital, such as the revenue or profits generated by new products or services that are developed using intellectual capital. Another approach is to measure the value of intellectual capital through intangible asset valuation methods, such as the market or income approach, which can be used to estimate the present value of future cash flows generated by intellectual capital.

Table 11. Results of testing the impact of the application of the customer perspective on intellectual capital

The dependent variable	R2	Adjusted R2	F	Sig F*	Regression coefficient				
					V	β	Standard error	T	Sig t*
Intellectual capital	0.892	0.886	291.04	0.003	The ratio of marketing expenses to sales	3471.5	148.83	23.326	0.002
					Sales growth	-6.516	1.297	-5.026	0.037
					Constant slope	-38.31	3.366	-11.38	0.008

* The effect is statistically significant at the level of ($\alpha \leq 0.05$)

This discovery is in line with the findings of [1], [10], [35]. This discovery, however, contradicts the conclusions of [4], [6], [11].Second sub-hypothesis H02: There is no statistically significant effect at the level ($\alpha \leq 0.05$) of applying the customer perspective of the balanced scorecard on intellectual capital.

The results of Table 11, indicate that the effect of the independent variables of the customer perspective on the dependent variable (intellectual capital efficiency) is statistically significant, where the calculated value of F was (291.036), at the significance level (Sig F = 0.003), which is less than 0.05, and the value of the determination coefficient was (R2 = 0.892), which indicates that 89.2% of the variation in (intellectual capital efficiency) can be explained all other variables are constant. The high value of the determination coefficient is due to the small sample size of the study and the period of the study, which require high values of the determination coefficient to reach the significance of the effect. As for the regression coefficient β=3471.542, it indicates the effect of the ratio of marketing expenses to revenues on intellectual capital, which is a significant effect, where the value of t was (23.326) and at an indicative level (Sig = 0.002), and the value of the regression coefficient (β=-6.516) when revenue grew, it indicates the effect of that variable, which is a significant effect, where the value of t was (-5.026) and at the level denotation (Sig = 0.037), and therefore we reject the second sub-hypothesis and accept the alternative, which states that: "There is a statistically significant effect at the level of ($\alpha \leq 0.05$) for the application of the customer perspective of the balanced scorecard on intellectual capital." Depending on Table 11, the relationship between the model variables can be written as follows:

IC2 = -38.314 +3471.542 (ME-REV) -6.516 (SG)

Our second result suggests there is no statistically significant effect at the significance level ($\alpha \leq 0.05$) of applying the customer perspective of the balanced scorecard on intellectual capital. Furthermore, the customer perspective of the balanced scorecard can be used to assess the value of intellectual capital. One approach is to track the customer-related metrics that are influenced by intellectual capital, such as customer satisfaction or customer retention. Another approach is to conduct customer surveys or focus groups to gather feedback on the organization's products and services and how they are meeting the needs and expectations of customers. It can help the organization identify areas where intellectual capital can be used to improve the customer experience and drive customer satisfaction. This discovery is in line with the findings of [9], [28]. This discovery, however, contradicts the conclusions of [27], [33].

Third sub-hypothesis H03: There is no statistically significant effect at the level ($\alpha \leq 0.05$) of applying the internal-business-process perspective of the balanced scorecard on intellectual capital.

Table 12. Results of testing the impact of the application of the internal-business-process perspective on intellectual capital

The dependent variable	R2	Adjusted R2	F	Sig F*	Regression coefficient				
					V	β	Standard error	T	Sig t*
Intellectual capital	0.872	0.845	69.636	0.014	Research and development costs to sales	10957	2526.3	4.337	0.049
					Asset turnover rate	-2792	278.62	-10.02	0.01
					Constant slope	130.52	19.034	6.857	0.021

* The effect is statistically significant at the level of ($\alpha \leq 0.05$)

The results of Table 12 indicate that the effect of the independent variables of the internal-business-process perspective on the dependent variable (efficiency of intellectual capital) is statistically significant, where the calculated value of F was (69.636) and at the level of significance (Sig F = 0.014), which is less than 0.05, and the value of the determination coefficient was (R2 = 0.872), it indicates that (87.2%) of the variation in (efficiency of intellectual capital) is due to all other variables being constant. The high value of the determination coefficient is due to the small sample size of the study and the period of the study, which require high values of the determination coefficient to reach the significance of the effect. As for the regression coefficient β=10956.8, it indicates the impact of the ratio of R & D expenses to revenues on intellectual capital, which is a significant effect, where the value of t was (2526.299) and at a significant level (Sig = 0.049), and the value of the regression coefficient at the asset turnover β=-2792.02 (it indicates the impact of that variable, which is a significant effect, where the value of t -10.021) at the level of significance (sig = 0.010), and therefore we reject the third sub-hypothesis and accept the alternative, which states that: "There is a statistically significant effect at the level of (α≤0.05) for the application of the internal-business-process perspective of the balanced scorecard on intellectual capital.

Depending on Table 12, the relationship between the model variables can be written as follows:

IC3 = 130.517 +10956.8 (R&D-REV) -2792.02 (ATO)

Our third result suggests there is no statistically significant effect at the significance level (α≤0.05) of applying the internal-business-process perspective of the balanced scorecard on intellectual capital. Furthermore, the internal-business-process perspective of the balanced scorecard can be used to assess the value of intellectual capital. One approach is to track the internal-business-process metrics that are influenced by intellectual capital, such as process efficiency or process effectiveness. Another approach is to conduct process audits or process improvement initiatives to identify areas where intellectual capital can be used to optimize the organization's core business processes. This can help the organization identify areas where intellectual capital can be used to improve process efficiency, effectiveness, and innovation. This discovery is in line with the findings of [9], [35]. This discovery, however, contradicts the conclusions of [11], [27].

Fourth sub-hypothesis H04: There is no statistically significant effect at the level (α≤0.05) of applying the learning and growth perspective of the balanced scorecard on intellectual capital.

Table 13. Results of testing the impact of applying the learning and growth perspective on intellectual capital

The dependent variable	R2	Adjusted R2	F	Sig F*	Regression coefficient				
					V	β	Standard error	T	Sig t*
intellectual capital	0.745	0.604	11.395	0.081	Training expenses for sales	-4102	25022	-0.164	0.885
					Salaries to expenses	-245.2	53.176	-4.612	0.044
					Constant slope	91.136	21.235	4.292	0.05

* The effect is statistically significant at the level of ($\alpha \leq 0.05$)

The results of Table 13 indicate that the effect of the independent variables of the learning and growth perspective on the dependent variable (intellectual capital efficiency) is statistically non-significant, where the calculated value of F was (11.395) and at the level of significance (Sig F = 0.081), which is greater than 0.05, and the value of the determination coefficient was (R2 = 0.745), which indicates that (74.5%) of the variation in (intellectual capital efficiency) can be explained by the variation in the model variables, with all other variables remaining constant. As for the regression coefficient β=-4101.698, it indicates the effect of the ratio of training expenses to revenues on intellectual capital, which is an insignificant effect, where the value of t was (-0.164) and at the level of significance (Sig = 0.885), and the value of the regression coefficient at salaries to expenses β=-245.233 (it indicates the effect of that variable, which is a significant effect, where the value of t -4.612 at the level of significance (sig = 0.044), and therefore we accept the fourth sub-hypothesis, which states that: "There is no statistically significant effect at the level of ($\alpha \leq 0.05$) of applying the learning and growth perspective of the balanced scorecard on intellectual capital. Depending on Table 13, it is not possible to write down the relationship between the model variables.

IC4 = 91.136 +-4102 (TREXP) -245.2 (SAEXP)

Our fourth result suggests there is no statistically significant effect at the significance level ($\alpha \leq 0.05$) of applying the internal-business-process perspective of the balanced scorecard on intellectual capital. Furthermore, the learning and growth perspective of the balanced scorecard can be used to assess the value of intellectual capital. One approach is to track the learning and growth metrics that are influenced by intellectual capital, such as employee satisfaction or employee retention. Another approach is to invest in employee training and development programs that help to build and enhance the organization's intellectual capital. This can help the organization to develop the knowledge, skills, and expertise that are needed to support future growth and success. This discovery is in line with the findings of, [6], [7]. This discovery, however, contradicts the conclusions of, [9], [40].

5 Conclusion

In general, every measuring model or instrument must be used appropriately and in a balanced manner. While the Balanced Scorecard scale may be a valuable tool for estimating intellectual capital, it is critical to examine the company's particular context and needs and to apply the model in a manner that is compatible with the company's strategic goals and objectives. Excessive use of the model, or dependence on it at the expense of other relevant criteria, might result in skewed or erroneous forecasts of intellectual capital. It is also critical to assess any potential biases or limits of the measuring model and take action to reduce their influence on the results.

This study's findings show that when utilizing the balanced scorecard scale to create a four-track measuring model to forecast intellectual capital, practically all factors are positive. The research recommends that you determine the essential elements of intellectual capital that are most relevant to your sector and market conditions. Considerations may include the company's competitive edge, strategic goals, and the specific

qualities of its business model. Create a collection of measurements or indicators that may be used to assess the success of each dimension of intellectual capital in the future. These indicators should be relevant and actionable, and they should be connected with the company's strategic goals. Using suiTable statistical and analytical approaches collect and evaluate data on the relevant parameters. This may entail collecting information from a range of sources, like financial documents, consumer surveys, staff performance reviews, and other relevant data sources. Furthermore, utilize the analysis findings to spot patterns and trends in the data and make educated judgments on the company's intellectual capital. This may entail comparing the company's performance to industry benchmarks or similar firms' performance.

Subsequently, the subjectivity of the criteria employed to assess intellectual capital may restrict the credibility of the Balanced Scorecard scale. Individuals may interpret the metrics differently, resulting in conflicting findings. Subsequently, the Balanced Scorecard scale's validity may be constrained by the fact that it is supposed to assess both financial and non-financial performance. While these indicators may be significant to intellectual capital, they may not fully capture all of its characteristics. Subsequently, data on the performance of industrial joint stock businesses listed on the Amman Stock Exchange may be restricted, and the analysis's accuracy and thoroughness may suffer as a result.

Determine the primary intellectual capital drivers for these firms. These may include elements such as the company's human capital's quality and diversity, the depth of its customer ties, the efficacy of its internal procedures, and the organization's innovation and learning. Create a set of metrics to track each of these factors as well. These indicators should be measurable and related to the vision and strategy of the firm. Use the insights gathered from your investigation to make recommendations for increasing these firms' intellectual capital. This might include adjusting the company's human capital management procedures, improving customer connections, or focusing more on innovation and learning.

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Contribution of Individual Authors to the Creation of a Scientific Article (Ghostwriting Policy)

-Laith Akram Al-Qadah, Hanan Ahmad Qudah and Emilio Martin Conducted the Simulation, Original Writing and Optimization.
-Mohammad Mahmoud Humeedat and Khawla Kissed Abdo Has Implemented Statistical Analysis.
-Hanan Ahmad Qudah has Organized and Executed the Experiments of Section 4.
-Laith Akram Al-Qadah was Responsible for the Conclusion.

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