# “The impact of intellectual capital on company financial performance: Evidence from the Omani industrial sector”


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# THE IMPACT OF INTELLECTUAL CAPITAL ON COMPANY FINANCIAL PERFORMANCE: EVIDENCE FROM THE OMANI INDUSTRIAL SECTOR

## Abstract

The article aims to investigate, using the VAIC and MVAIC models, the impact of intellectual capital on the financial performance of Omani companies listed on the Muscat Stock Exchange from 2017 to 2021. Regression analysis revealed a significant positive influence of VAIC and MVAIC only on the Asset Turnover Ratio at a 10% significance level. This suggests that an increase in VAIC or MVAIC by one unit could lead to a respective increase in earnings for Omani listed industrial companies by 0.0017 and 0.0016. However, the overall impact of VAIC and MVAIC on financial performance appears limited, necessitating measures for enhanced efficacy. Moreover, company size and leverage were found to significantly influence EBITDA and Return on Assets, suggesting the positive effect of increased activity and resource utilization. Conversely, Return on Customer Equity negatively affected only Asset Turnover Ratio, implying that investments in marketing and advertising may not significantly enhance financial performance. Human Capital Efficiency showed no significant impact on financial performance measures, highlighting the necessity for Omani industrial enterprises to focus on enhancing employee skills and experience for improved value-creation processes. These findings underscore the intricate relationship between intellectual, physical, and financial capital in shaping financial performance, necessitating targeted strategies for enhancement. Further analysis of suggested models indicated the significance of company size on EBITDA, highlighting the importance of scaling activities for performance improvement. VAIC and MVAIC structural elements showed mixed results, while Capital Employed Efficiency negatively affected Return on Equity, Structural Capital Efficiency positively impacted EBITDA and Asset Turnover Ratio.

**Keywords** intellectual capital, value added intellectual coefficient, financial performance, Omani industrial companies

**JEL Classification** G17, O34

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## INTRODUCTION

The modern economic environment is characterized by an accelerated growth of competitiveness due to the rapid development of knowledge and technology. The knowledge-based economy has spurred a shift from a labor-based business strategy to a knowledge-based one. A company's intellectual capital, which is formed from the knowledge and experience of employees, databases and information systems, business connections, as well as other intangible factors, becomes the driving force for research and development.

The formation of an economic paradigm based on knowledge, which has been taking place over the last two decades, further increases the interest in the study of intellectual capital as the main resource for creating firm value. First of all, this is justified by the loss of significance of a company's traditional resources, based on material assets

in the processes of creating the added value of the company and maintaining competitive advantages (Andriessen, 2004). In today's economic era, intellectual capital is becoming the most important factor in ensuring business success, as it is represented by the value of ideas, abilities, and high-tech infrastructure that create value and unique competitive advantages for a company in the market. Research on the role of intangible factors in creating the value of companies reduces investment risks, which accordingly increases their market attractiveness on the market (Sveiby, 1997). All such changes in the perception of the role of intellectual capital in the knowledge economy lead to an increase in the amount of scientific literature on the methods of managing it and analyzing its impact on the performance of companies, taking into account the regional and industry contexts.

Studying the role of intellectual capital in industrial companies in Oman is important for owners, corporate governance actors, and managers seeking to increase competitiveness and ensure the sustainable development of companies. The management of intellectual capital itself is becoming increasingly important for industrial companies in Oman and the GCC (Gulf Cooperation Council) region, as they face increasing competition in the global market in recent years and need to constantly innovate and improve their products and services. Industrial companies in Oman are facing challenges in a changing economic environment, driven both by the need to diversify the economy away from oil dependence and the need to integrate technology into their operations (Food and Agriculture Organization of the United Nations, 2019). Better intellectual capital management will help companies overcome these challenges, by enabling them to adapt to new conditions and processes, adopt innovative business models, and shape policies and strategies to develop new products and services that will meet market demands. Firms with higher levels of intellectual capital tend to have better financial performance and are more likely to grow steadily over time (Bontis, 1998). Understanding the relationship between intellectual capital and business performance makes it important to study the practical application of intellectual capital management methods.

One of the most important aspects of intellectual capital management is its impact on the financial results of companies. In addition, effective management of intellectual capital allows companies to reduce the risks associated with the loss of knowledge and the outflow of talented and experienced employees. By investing in human capital development, knowledge-sharing mechanisms, and organizational learning initiatives, companies can develop a culture of continuous improvement and knowledge creation that promotes sustainable and progressive financial development.

## 1. LITERATURE REVIEW

Intellectual capital includes various sources of value creation that contribute significantly to the overall value of a company. This phenomenon is due to the fact that intellectual capital covers a wide range of components such as knowledge, experience, unique technologies, innovations, trademarks, relationships with customers and suppliers, etc. Together, these elements have a powerful potential to help maintain existing and create new competitive advantages for the company in the market.

A significant number of articles studying intellectual capital management and its impact on financial performance focus on the activities of technological enterprises from developing countries such as India, Indonesia, Malaysia, and Taiwan. This feature also confirms the feasibility of analyzing the impact of intellectual capital on the financial performance of companies using the example of a developing country like Oman.

There are few direct studies analyzing the impact of intellectual capital on the financial performance of Omani companies, as Mohamed and Al Ani (2020) confirm. Therefore, the research object in this paper are also works devoted to similar issues in the GCC countries and in the countries of the Arab region, since in general such countries have similar economic structures largely dependent on oil exports and government support. This makes them vulnerable to fluctuations in world oil prices and increases


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the importance of economic diversification efforts. These countries simultaneously face similar problems of intellectual capital development and technology adoption (Al-Musali et al., 2016; Al-Hamadany et al., 2020). Thus, by studying the processes of intellectual capital management at enterprises in the Gulf countries and the Arab region, one can obtain important information about its role in improving the efficiency of the functioning of Omani companies. In addition, a harmonized regulatory framework has been created in the GCC countries (GCC Standardization Organization, 2023) to develop a unified business environment and entrepreneurial activity, aimed at ensuring consistency in terms of intellectual capital management practices, which also confirms the expediency of taking into account the experience of GCC and Arab region countries in this study.

A number of modern studies consider the issue of the influence of intellectual capital on various types of financial performance of companies from Oman, GCC and Arab region countries. Thus, Al-Musali and Ku Ismail (2016) analyzed the features of the influence of intellectual capital on the performance of banks in the GCC countries for the period from 2008 to 2010 and established the positive impact of VAIC on financial performance in all GCC countries. The impact of the modified VAIC model (MVAIC) and its components on the financial performance of 49 Islamic banks from 2014 to 2018 was also studied by Asutay and Ubaidillah (2023). The authors found that MVAIC has a positive and significant effect on profitability (ROA, ROE), but is inconclusively associated with productivity (ATO). CEE and HCE have the most significant impact on financial performance, while SCE has no impact.

Dzenopoljac et al. (2017) studied the impact of intellectual capital (VAIC and its elements) on the corporate performance of top 100 companies of the Arab region, which was measured using a whole group of indicators (EBIT, EBITDA, ROE, ROA, NPM, GPM, EBITDA, ATO, Market to Book Value). In general, their findings do not confirm a direct positive relationship between all the analyzed factors, although the main impact on earnings of companies is exerted by SC and CEE. Dalwai et al. (2018) examined the impact of VAIC and its subcomponents on the financial performance (ROA, ROE) of 35 Omani financial sector enterprises from 2012 to 2016. They also found no significant relationship between VAIC and financial performance indicators, but confirmed the important role of CEE in the value creation process, suggesting that intellectual capital rarely creates value independently of physical capital.

Hamdan (2018) analyzed the relationship between intellectual capital and firm performance based on a study of 198 firms from GCC countries (Kingdom of Saudi Arabia and Kingdom of Bahrain) over the period 2014–2016. The author also used VAIC elements as independent variables, and ROA and Tobin's Q as independent variables. If all VAIC elements have a significant relationship with ROA, then only HCE has a positive impact on Tobin's Q and only for enterprises from the Kingdom of Bahrain. Mohamed and Al Ani (2020) also examined the effect of calculated intangible assets (Excess Returns) of Omani industrial companies listed on the MSE on Tobin's Q and found a positive and significant relationship between them at the 0.01 level.

Dalwai and Salehi (2021) examined the impact of the Augmented VAIC model (A-VAIC) and its elements on the performance and risk of bankruptcy of Omani non-financial sector companies using 380 companies listed on the MSE from 2015 to 2019. Empirical results indicated no effect of A-VAIC on firm performance Altman Z-score and established a positive relationship between SCE and ROA.

Dalwai and Sewpersadh (2023), based on a regression analysis of 45 listed travel companies from nine Middle Eastern countries for the period 2014–2018, analyzed the impact of intellectual capital performance on capital structure. The authors found that the performance of intellectual capital is not closely related to firm performance, but CEE has a more significant effect on travel firms along with leverage. Another study on the effectiveness of intellectual capital and working capital management in the industrial sector of the GCC countries and its potential impact on the performance of companies was carried out by Habib and Dalwai (2023). Having studied 40 industrial firms for the 2015–2019 period, they

found that intellectual capital and working capital significantly and positively affect ROE and ROA at a significance level of 0.01. However, the authors emphasize that most companies in the industrial sector of the GCC countries do not effectively use their intellectual investments, and therefore their management methods need to be improved.

This research paper aims to investigate the impact of intellectual capital on the financial performance of Omani companies within the context of a developing economy. While prior literature has extensively explored this relationship in technological enterprises of developing countries like India, Indonesia, Malaysia, and Taiwan, there is a scarcity of direct studies focusing on Omani firms. This study aims to fill this gap by examining intellectual capital management practices and their effects on financial performance. It draws insights from similar contexts within the Gulf Cooperation Council (GCC) countries and the wider Arab region. By leveraging harmonized regulatory frameworks and economic structures, the study seeks to provide valuable insights into enhancing the efficiency of Omani companies through effective intellectual capital management.

# 2. METHODS

## 2.1. Sample selection

Analysis of the impact of intellectual capital on financial performance measures was carried out using regression analysis of panel data. The industrial sector of Oman is chosen as the object of study in the paper, in particular, the activities of 34 industrial companies for the period 2017–2021 listed on the MSE. A total of 36 industrial companies are registered on the MSE, but two of them (Omani Euro F.Ind and Al Hassan Eng.) were excluded from the study object due to the lack of all the necessary panel data on them for regression analysis. Financial information to shape the data panel on the activities of industrial companies in Oman was obtained from the official MSE website, which publishes indicators characterizing the financial performance of companies, as well as from the published financial statements of such companies (Balance Sheet, Income Statement) and notes thereto.

## 2.2. Variables

As characteristics of the financial performance of industrial companies in Oman (PERF), a number of dependent variables were used, reflecting various aspects of such performance – earnings (Earnings before interest, taxes, depreciation and amortization (EBITDA)), profitability (Return on Assets (ROA), Return on Equity (ROE)), and productivity (Asset Turnover Ratio (ATO)). These financial performance measures are quite often used by scientists when conducting such studies (Xu & Wang, 2018; Xu & Wang, 2019; Öner et al., 2021; Lehenchuk et al., 2022, Serpeninova et al., 2022). Based on suggestions by Xu and Wang (2019), this paper also uses the logged value of EBITDA. The procedure for calculating all dependent variables is given in Table 1.

The influence of intellectual capital on the selected dependent variables was analyzed using the Value Added Intellectual Coefficient (VAIC) developed by Pulic (2000), its modified version, MVAIC, and the structural elements of these indicators. Their use is justified by the possibility of their calculation based on indicators published by companies, as well as by the connection with the basic provisions of the theory of intellectual capital in terms of understanding its structural elements.

According to Pulic's approach, VAIC consists of three types of capital efficiency, namely capital employed efficiency (CEE), human capital efficiency (HCE), and structural capital efficiency (SCE), which numerically characterize the efficiency of using a specific type of capital at an enterprise. To determine the effectiveness of each type of intellectual capital, the calculation procedure for which is given in Table 1, the VA indicator is used, i.e., the sum of value added for the company (net income, wages and salaries, interest expenses, and taxes paid).

Since the Pulic VAIC approach includes only two elements of intellectual capital – human capital (HC) and structural capital (SC) – a number of researchers have proposed expanding the classical VAIC model by adding new types of efficiency of individual intellectual capital elements to its composition. In particular, the most common options for the formation of MVAIC are the addi-


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tion of VAIC with new elements such as Research and Development Capital Efficiency (RDCE) and Relational Capital Efficiency (RCE) (Alazzawi et al., 2018; Xu & Wang, 2018; Xu & Wang, 2019; Dalwai & Salehi, 2021; Aybars & Öner, 2022; Asutay & Ubaidillah, 2023). However, to date, accounting systems in many countries do not allow smooth calculation of RDCE and RCE (Hyk et al., 2021; Serpeninova et al., 2022), which limits the ability to identify their impact on financial performance. In this study, RCE is used as an independent variable to analyze the impact of relational capital on the financial performance of industrial companies in Oman. To calculate RCE, relational capital is understood as the sum of a company's marketing, selling and advertising costs.

To control the impact of additional variables that can also affect financial performance measures, in addition to independent variables characterizing intellectual capital (intellectual capital variables), the paper uses two control variables – Size of the company (l_SIZE) and Leverage (LEV). To avoid data distribution skewness, the Size of the company is calculated as the natural logarithm of its total assets (Serpeninova et al., 2022), while Leverage is calculated as the ratio of a company's total debt to its assets (Ievdokymov et al., 2020). The general procedure for calculating all dependent and independent variables used in the article is given in Table 1.

## 2.3. Models

This study aims to explore the impact of VAIC, MVAIC and its elements on financial performance of Omani industrial companies. Based on the set of dependent and independent variables used, the following functional representation of this effect can be provided using four types of PERF models:

*Model type 1:*

$$PERF_{it} = \alpha + \beta_1 VAIC_{it} + \beta_2 l\_SIZE + \beta_3 LEV_{it} + \varepsilon_{it}. \quad (1)$$

Model type 2:

$$PERF_{it} = \alpha + \beta_1 MVAIC_{it} + \beta_2 l\_SIZE + \beta_3 LEV_{it} + \varepsilon_{it}. \quad (2)$$

Model type 3:

$$PERF_{it} = \alpha + \beta_1 CEE_{it} + \beta_2 HCE_{it} + \beta_3 SCE_{it} + \beta_4 l\_SIZE + \beta_5 LEV_{it} + \varepsilon_{it}. \quad (3)$$

Model type 4:

$$PERF_{it} = \alpha + \beta_1 CEE_{it} + \beta_2 HCE_{it} + \beta_3 SCE_{it} + \beta_4 RCE_{it} + \beta_5 l\_SIZE + \beta_6 LEV_{it} + \varepsilon_{it}. \quad (4)$$

**Table 1.** Summary of all dependent and independent variables, calculation methods, and abbreviations used in the study

| Variable | Calculation Method | Abbreviation |
|---|---|---|
| **Dependent Variables** | | |
| Earnings before interest, taxes, depreciation and amortization | Logarithm of (Operating Income + Depreciation costs + Amortization costs) | l_EBITDA |
| Return on Assets | Net Turnover / Total Assets | ROA |
| Return on Equity | Net Profit / Total Equity | ROE |
| Assets Turnover Ratio | Revenue / Total assets | ATO |
| **Independent Variables (Intellectual capital variables)** | | |
| Value Added Intellectual Coefficient | *CEE + HCE + SCE* | VAIC |
| Modified Value Added Intellectual Coefficient | *CEE + HCE + SCE+ RCE* | MVAIC |
| Capital Employed Efficiency | Sum of value added for the company / Capital employed | CEE |
| Human Capital Efficiency | Sum of value added for the company / Human capital | HCE |
| Structural Capital Efficiency | Structural capital / Sum of value added for the company | SCE |
| Relational Capital Efficiency | Relational capital / Book value of common stocks | RCE |
| **Control Variables** | | |
| Size | Logarithm of Total Assets | l_SIZE |
| Leverage | (Long-term Debts + Short-term Debts) / Total Assets | LEV |

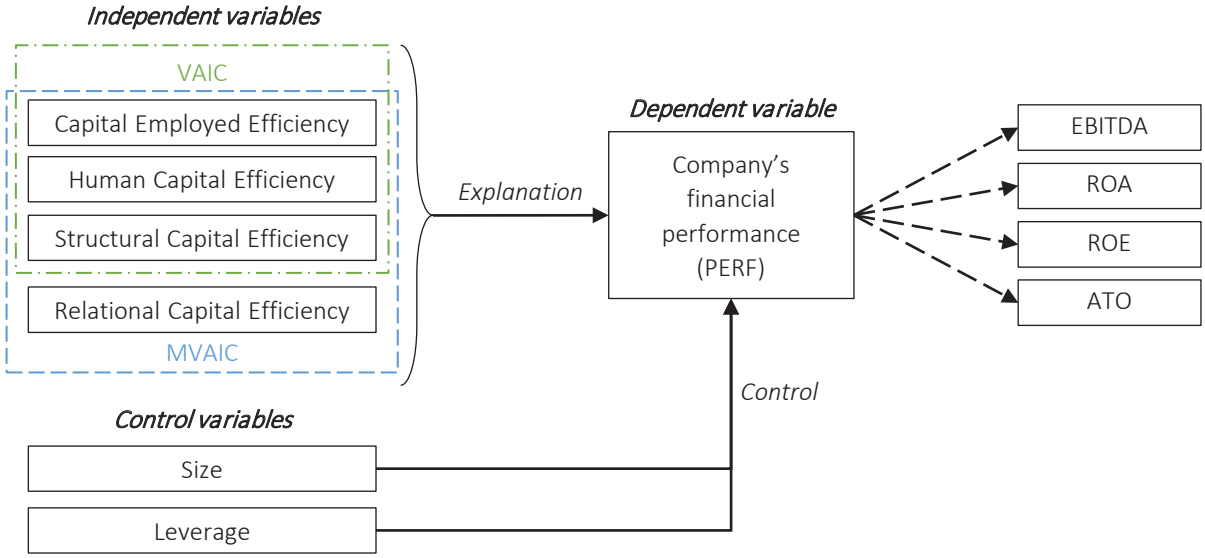


**Figure 1.** Conceptual framework of the study

where *PERF* are different types of dependent variables, *i* – entity, and *t* – time, *α* – identifier, *β* – regression coefficient, *CEE*, *HCE*, *SCE*, *RDE*, and *RCE* – independent variables, *LEV*, l_*S*, *DVS* – control variables, where $_i$ = entity and $_t$ = time, $\varepsilon_{it}$ – error term.

Since this paper discusses the impact of VAIC, MVAIC and its elements on four types of dependent variables (l_EBITDA, ROA, ROE, and ATO), based on the four types of PERF models given, 16 direct models were built, subject to regression analysis using the Gretl software package. This will make it possible to determine the influence of a larger number of independent variables on various types of indicators characterizing the financial efficiency of the enterprise (profitability, profitability, productivity).

The conceptual framework used in this study is shown in Figure 1.

# 3. RESULTS

## 3.1. Descriptive statistics and correlations

Table 2 provides descriptive statistics for all variables from the 16 analyzed models.

Based on the values of descriptive statistics for 34 companies (Table 2), it was found that since all the

**Table 2.** Explanation of the selected variables and descriptive statistics (based on observations: 1:1 – 34:5)

Source: Calculated using the Gretl software package.

| Variables | Observations | Mean | Median | St. Dev. | Minimum | Maximum |
|---|---|---|---|---|---|---|
| l_EBITDA | 170 | 13.3 | 13.8 | 2.29 | 2.20 | 16.4 |
| ROA | 170 | 0.133 | 0.130 | 0.554 | –5.61 | 3.64 |
| ROE | 170 | 0.0745 | 0.0423 | 0.666 | –1.35 | 8.01 |
| ATO | 170 | 1.04 | 0.725 | 3.56 | 0.0536 | 46.9 |
| VAIC | 170 | 21.5 | 7.90 | 56.3 | –7.56 | 458. |
| MVAIC | 170 | 21.55 | 7.970 | 56,25- | –7,514 | 458,2 |
| CEE | 170 | 1.36 | 1.01 | 1.76 | –10.6 | 9.64 |
| HCE | 170 | 19.4 | 5.85 | 56.0 | 0.000 | 454. |
| SCE | 170 | 0.788 | 0.829 | 0.269 | –1.36 | 0.998 |
| RCE | 170 | 0.037 | 0.008 | 0.080 | 0,000 | 0.800 |
| l_SIZE | 170 | 16.3 | 16.4 | 1.90 | 10.9 | 19.4 |
| LEV | 170 | 0.550 | 0.437 | 0.772 | 0.000161 | 6.96 |


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**Table 3.** Correlation coefficients, based on observations 1:1 – 34:5

Source: Calculated using the Gretl software package.

| | VAIC | MVAIC | CEE | HCE | SCE | RCE | l_SIZE | LEV |
|---|---|---|---|---|---|---|---|---|
| VAIC | 1.0000 | 1.0000 | 0.1263 | 0.9995 | 0.2114 | –0.1107 | 0.1217 | 0.0655 |
| MVAIC | | 1.0000 | 0.1260 | 0.9995 | 0.2114 | –0.1093 | 0.1215 | 0.0655 |
| CEE | | | 1.0000 | 0.0954 | –0.0132 | –0.1964 | –0.1466 | 0.1170 |
| HCE | | | | 1.0000 | 0.2080 | –0.1047 | 0.1261 | 0.0619 |
| SCE | | | | | 1.0000 | –0.0626 | 0.1497 | 0.0388 |
| RCE | | | | | | 1.0000 | –0.1425 | 0.0080 |
| l_SIZE | | | | | | | 1.0000 | –0.0890 |
| LEV | | | | | | | | 1.0000 |

mean values of dependent variables (l_EBITDA, ROA, ROE, ATO) are positive, this means that most of these companies have positive financial performance. The presence of a significant deviation between the minimum and maximum HCE values indicates significant differences in the effectiveness of managing available human resources. In particular, individual companies (Jazeera Steel Prod) have a very high level of this indicator or publish unreliable information about the costs of maintaining and developing human resources. The excess of the mean over the standard deviation for some variables (l_EBITDA, SCE, l_SIZE) indicates that the data in these variables has a small distribution. Close mean and median values for l_EBITDA (13.3 and 13.8), ROA (0.133 and 0.130), SCE (0.788 and 0.829), and l_SIZE (16.3 and 16.4) confirm the presence of a high level of symmetry in the distribution of range values.

As a result of the analysis of multicolinearity problem between the independent variables used to build four types of models, it was found that it does not exist. The existing high values of correlation coefficients were found only between independent variables (VAIC and MVAIC, HCE and VAIC, MVAIC), which were not simultaneously used in any of the four types of models identified in the article (Table 3).

## 3.2. Selection of an estimate panel data parameter

To ensure adequate processing of panel data in the process of regression analysis, for each of the 16 generated models, it is necessary to choose the most relevant estimate panel data parameter. For this, panel diagnostic tools were used such as the F-statistics test, the Breusch-Pagan test and the Hausman test, which made it possible to obtain the following results (Table 4).

The use of parameters determined based on applying the F-statistics test, the Breusch-Pagan test and the Hausman test panel data estimate parameters (Table 4) ensures adequate correlation of models with the data used in the corresponding model. Along with Pooled OLS, the expediency of using FEM as an estimate parameter for individual models was justified. This involves taking into account the presence of various object-specific constants, as well as REM, which considers, when determining the influence of independent variables on the dependent variable, the effect of omitted or unobserved variables that describe the individual characteristics of the studied objects.

**Table 4.** Results of panel data estimate parameter selection for each of the models used in the study

| Panel data estimate parameter | PERF models | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Model type 1 | | | | Model type 2 | | | | Model type 3 | | | | Model type 4 | | | |
| | 1.l_EBITDA | 1.ROA | 1.ROE | 1.ATO | 2.l_EBITDA | 2.ROA | 2.ROE | 2.ATO | 3.l_EBITDA | 3.ROA | 3.ROE | 3.ATO | 4.l_EBITDA | 4.ROA | 4.ROE | 4.ATO |
| Pooled OLS method (OLS) | | + | + | | | + | + | | | + | | | | + | | |
| Fixed effects method (FEM) | | | | + | | | | + | | | + | + | | | + | + |
| Random effects method (REM) | + | | | | + | | | | + | | | | + | | | |

## 3.3. Assumption test results

The adequacy of panel data on the activities of industrial companies in Oman was assessed based on testing three classical assumptions, namely normality, autocorrelation, and heteroscedasticity. As a result of applying the normality test, the absence of a normal distribution of residuals was found for all analyzed models. Using the Wooldridge test, the autocorrelation problem was found only for those models in which the dependent variable is the ATO productivity indicator – 1.ATO, 2.ATO, 3.ATO, and 4.ATO. For models that used Pooled OLS as a panel data estimate parameter, heteroscedasticity was tested using the Wald test, and for models that used FEM, using the White test. As a result, heteroscedasticity was found for models 1.ROA, 1.ATO, 2.ROA, 2.ATO, 3.ROE, 3.ATO, 4.ROE, and 4.ATO. To eliminate the negative impact of outliers in models in the presence of heteroscedasticity, it is proposed to use the robust standard errors (RSE) technique to adjust the estimate parameters used (Pooled OLS, FEM), which is also proposed to be carried out in similar studies by Öner et al. (2021) and Serpeninova et al. (2022).

## 3.4. Panel data regression results

Appendix A presents the results of applying panel data regression analysis, grouped by types, and 16 types of selected models (p-value and significance level). Independent variables with more asterisks (*) have the most significant impact on the independent variable in each analyzed model.

As a result of the regression analysis of the impact of indicators characterizing intellectual capital (VAIC and MVAIC) and its elements on financial performance measures of industrial companies in Oman, only one of the indicators was found to be affected. In particular, VAIC and MVAIC have a significant positive impact (at the 10% level) only on ATO, without affecting other financial performance measures. Thus, the positive impact of VAIC and MVAIC on ATO suggests that if a company creates VAIC or MVAIC for one more unit, Omani listed industrial companies' earnings are expected to increase by 0.0017 and 0.0016 units, respectively.

In general, the results obtained regarding the influence of VAIC and MVAIC indicate that the role of intellectual capital in ensuring the financial performance of industrial companies in Oman is not very important, and necessitate the development of a number of measures that will increase the efficiency of its use. In addition, the analysis of PERF models of the first and second types made it possible to establish the presence of a significant influence at the 1% level of the control variable l_SIZE on l_EBITDA, which indicates the expediency of scaling the activities of industrial companies in Oman to increase this indicator.

Analysis of the impact of VAIC and MVAIC structural elements on financial performance measures has yielded rather contradictory results regarding the role of some of them. Analysis of models 3.ROE(RSE) and 4.ROE(RSE) allowed the establishment of a negative significant effect at the 1% level of CEE on ROE. This indicates that the physical capital involved in using industrial companies in Oman is not used very efficiently, and the increase in its volume negatively affects ROE.

Analysis of the models 3.l_EBITDA and 4.l_EBITDA revealed a positive significant impact (1% and 5% level) of SCE on l_EBITDA. A similar positive relationship was found in the 4.ATO(RSE) model regarding the effect of SCE on ATO. Thus, SCE, as an integral part of VAIC and MVAIC, plays an important positive role in improving the performance of Omani industrial companies, along with physical and financial assets. Also, for PERF models of the third and fourth types, a significant effect of l_SIZE on l_EBITDA and ROA (1% and 5% level), as well as the effect of LEV on ROA (1% level) was revealed. The data obtained indicate the positive role of increasing the activity of industrial companies in Oman and increasing the share of resources attracted to improve certain financial performance measures.

The analysis of PERF models of the fourth type revealed that RCE has a significant and negative impact only on ATO and does not affect other financial performance measures at all. This indicates that investments in marketing and ad-


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vertising activities do not play a significant role, and in some cases even harm financial performance, which justifies the expediency of their reduction.

The study found no significant impact of HCE on all financial performance measures used in the article (EBITDA, ROA, ROE, and ATO). This indicates the need for industrial enterprises in Oman to pay more attention to improving the skills, abilities, and experience of employees, which should potentially lead to improved value creation processes.

## 4. DISCUSSION

In contrast to publications that confirmed the positive and significant role of intellectual capital in creating the long-term value of industrial enterprises (Xu & Li, 2020; Öner et al., 2021; Asutay & Ubaidillah, 2023; Habib & Dalwai, 2023), the results of this study largely deny the importance of VAIC and MVAIC to the financial performance of Omani industrial companies. However, as noted by Mohamed and Al Ani (2020), a large number of industrial companies have a significant amount of intangible assets, which indicates a lack of efficiency in their use. The findings correlate with those of Dalwai and Salehi (2021), who argue that MVAIC does not affect the performance of non-financial sector companies listed on the MSE. At the same time, Dalwai et al. (2018) and Asutay and Ubaidillah (2023), in contrast, found a positive significant impact of VAIC and MVAIC on financial performance measures for banks in Oman and Islamic banks. This indicates that the role of intellectual capital in ensuring financial performance varies significantly for different sectors of the Omani economy.

In general, the results of the analysis of the impact of VAIC and MVAIC on the financial performance of Omani industrial companies confirm the conclusion of Habib and Dalwai (2023) that such companies inefficiently use their own investments in intellectual capital, as a result of which the existing management policies need to be improved in terms of its individual types.

The study of the influence of the VAIC and MVAIC elements showed more variable results, which are characterized by a different focus and strength of influence on different types of financial performance measures, confirming the findings of Dzenopoljac et al. (2017). Thus, scientists explain the predominant influence of CEE on the financial performance of companies by the fact that the industrial sector still does not change its traditional production patterns in the process of economic transformation (Xu & Li, 2020). However, the significant negative impact of CEE on ROE found in this article refutes this statement in the context of Omani companies, contradicting the results of Al-Musali and Ku Ismail (2016) and Asutay and Ubaidillah (2023) for Omani and Islamic banks. Comparing such contradictory conclusions with the results of other scientists, it can be assumed that an excess amount of attracted physical and financial capital slows down the processes of creating value for enterprises due to the existence of a U-inverted relationship between CEE and financial performance measures.

The complete absence of an effect of HCE on VAIC and MVAIC fully confirms the conclusions of Dzenopoljac et al. (2017) that human capital does not affect company revenues in the Arab region. Comparing these results with the findings of Al-Musali and Ku Ismail (2016), Hamdan (2018), Dalwai, Mohammadi and Al Siyabi (2018), Asutay and Ubaidillah (2023), who found that firms from two GCC countries and Oman's banking and financial sector are heavily influenced by HCE, one can also find that for the industrial sector, the abilities, special knowledge and skills of employees are not a significant factor in creating value. On the other hand, the revealed lack of influence of SCE on ROA confirms the results of studies by Dalwai et al. (2018) and Asutay and Ubaidillah (2023), which is typical for Oman's industrial and financial sector.

The analysis performed does not confirm the results of Habib and Dalwai (2023) regarding the positive significant impact of LEV on ROE. At the same time, a positive effect of LEV on ROA has been found, which calls into question Mohamed and Al Ani's (2020) proposals regarding the feasibility of reducing dividends for stockholders to improve the processes of value creation and use of dividends as a source of finance for industrial companies in Oman.

## CONCLUSION

The study scrutinized the nexus between intellectual capital and the financial performance of listed industrial entities in Oman. Employing the Value Added Intellectual Coefficient (VAIC) model and panel data regression analysis, the study aimed to furnish a scholarly understanding of this intricate relationship.

The contribution of the study firstly consists of expanding the previous literature in terms of quantifying the influence of intellectual capital on financial performance, in particular, in relation to Omani enterprises. Secondly, in comparison with the majority of previous studies, the paper analyzed the influence of intellectual capital on financial performance measures using the extended MVAIC model.

The findings unveiled a nuanced panorama regarding the impact of intellectual capital on financial performance indicators. Notably, while VAIC and MVAIC exhibited a discernible positive influence solely on Asset Turnover (ATO), signifying the potential for heightened earnings concomitant with augmented VAIC or MVAIC units, the broader role of intellectual capital in bolstering financial metrics emerged as circumscribed. Such outcomes suggest a current limited salience of intellectual capital in fortifying the financial prowess of Omani industrial firms. The dissection of constituent elements within VAIC and MVAIC yielded variegated results. While certain components, exemplified by structural capital efficiency (SCE), evinced a constructive impact on financial performance metrics like Earnings Before Interest, Taxes, Depreciation, and Amortization (EBITDA) and ATO, others, such as customer capital efficiency (CEE), manifested deleterious effects on indices like Return on Equity (ROE), spotlighting inefficiencies in resource allocation paradigms.

Furthermore, the study underscored the pivotal import of scalability endeavors and astute resource management strategies in enhancing financial performance metrics. The affirmative ramifications stemming from organizational expansion initiatives and judicious fiscal resource utilization underscored the potential dividends of strategic diversification and prudent financial stewardship in ameliorating overall performance benchmarks.

The study has certain limitations that should be addressed in future research. First, data were used from Omani industrial companies for the period 2017–2021 registered on the MSE. However, the lack of data for some reporting periods led to the exclusion of some companies from the scope of the study. Therefore, the research results can be more accurate and relevant if they are based not only on the analysis of the activities of Omani industrial companies listed on the MSE, but also cover a longer time horizon. Secondly, financial performance was analyzed using four dependent variables (EBITDA, ROA, ROE, and ATO) in the context of selected areas such as earnings, profitability, and productivity. The range of such variables and directions can be expanded depending on those aspects of financial performance to which scientists will directly pay attention. Thirdly, to analyze the impact on the financial performance measures used, in addition to RCE, other elements of MVAIC can be used that characterize the intellectual capital of an enterprise.

## AUTHOR CONTRIBUTIONS

Conceptualization: Serhii Lehenchuk, Dmytro Zakharov, Iryna Vyhivska.
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# APPENDIX A

**Table A1.** Analyzed PERF models (Pooled OLS, FEM, REM)

Source: Calculated using the Gretl software package.

| Variables | PERF models | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Model type 1 | | | | Model type 2 | | | |
| | 1.l_EBITDA | 1.ROA(RSE) | 1.ROE | 1.ATO(RSE) | 2.l_EBITDA | 2.ROA(RSE) | 2.ROE | 2.ATO(RSE) |
| Const | 0.0105** | 0.2481 | 0.7105 | 0.2833 | 0.0105** | 0.2481 | 0.7103 | 0.2833 |
| VAIC | 0.8425 | 0.7383 | 0.6995 | 0.0589* | | | | |
| MVAIC | | | | | 0.8420 | 0.7385 | 0.7010 | 0.0592* |
| CEE | | | | | | | | |
| HCE | | | | | | | | |
| SCE | | | | | | | | |
| RCE | | | | | | | | |
| l_SIZE | 8.81e-020*** | 0.2172 | 0.8125 | 0.2740 | 8.80e-020*** | 0.2172 | 0.8122 | 0.2740 |
| LEV | 0.7687 | 0.2039 | 0.5923 | 0.2103 | 0.7687 | 0.2039 | 0.5924 | 0.2103 |
| R- / LSDV R- squared | x | 0.113495 | 0.003127 | 0.711305 | x | 0.113495 | 0.173066 | 0.711301 |
| **Variables** | **PERF models** | | | | | | | |
| | **Model type 3** | | | | **Model type 4** | | | |
| | **3.l_EBITDA** | **3.ROA** | **3.ROE(RSE)** | **3.ATO(RSE)** | **4.l_EBITDA** | **4.ROA** | **4.ROE(RSE)** | **4.ATO(RSE)** |
| Const | 0.0094*** | 0.0329** | 0.9229 | 0.2419 | 0.0092*** | 0.0476** | 0.9429 | 0.2334 |
| VAIC | | | | | | | | |
| MVAIC | | | | | | | | |
| CEE | 0.9481 | 0.3129 | 0.0005*** | 0.3319 | 0.9067 | 0.2847 | 0.0007*** | 0.2886 |
| HCE | 0.9450 | 0.8172 | 0.8462 | 0.1387 | 0.9596 | 0.8366 | 0.8499 | 0.2617 |
| SCE | 0.0093*** | 0.8695 | 0.7480 | 0.1075 | 0.0110** | 0.8795 | 0.7572 | 0.0973* |
| RCE | | | | | 0.6865 | 0.6862 | 0.5259 | 0.0473** |
| l_SIZE | 2.08e-017*** | 0.0228** | 0.9296 | 0.2318 | 5.14e-017*** | 0.0293** | 0.9154 | 0.2250 |
| LEV | 0.7505 | 7.20e-05*** | 0.8152 | 0.2060 | 0.7243 | 7.27e-05*** | 0.8149 | 0.2060 |
| | | | | | | | | |
| R- / LSDV R- squared | x | 0.119225 | 0.712966 | 0.723722 | x | 0.120109 | 0.713171 | 0.731514 |

*Note:* * Significant at the 10 % level; ** Significant at the 5 % level; *** Significant at the 1 % level.