ความหลากหลายของคณะกรรมการบริษัทและทุนทางปัญญา: กลุ่มอุตสาหกรรมเกษตรและอาหารในตลาดหลักทรัพย์แห่งประเทศไทย

Board Diversity and Intellectual Capital: An Analysis of Thai Listed Agriculture and Food Companies

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บทความนี้มีวัตถุประสงค์เพื่อศึกษาความสัมพันธ์ระหว่างความหลากหลายของคณะกรรมการบริษัท (เพศและสัญชาติ) และผลการดำเนินงานด้านทุนทางปัญญา ในขณะที่การศึกษาส่วนใหญ่ก่อนหน้านี้มุ่งเน้นไปที่ความสัมพันธ์ระหว่างทุนทางปัญญาและผลการดำเนินงานทางการเงิน รวมถึงมองข้ามตัวแปรหรือปัจจัยที่อาจส่งผลต่อการบริหารจัดการประสิทธิภาพของทุนทางปัญญาในองค์กร โดยเฉพาะคุณลักษณะของคณะกรรมการบริษัท งานวิจัยนี้เก็บรวบรวมข้อมูลจากบริษัทในกลุ่มอุตสาหกรรมเกษตรและอาหารในตลาดหลักทรัพย์แห่งประเทศไทย จำนวน 45 บริษัทในช่วงปี 2560-2563 โดยใช้แบบจำลอง MVAIC เพื่อวัดผลการดำเนินงานของทุนทางปัญญา และจากการวิเคราะห์ผลวิจัยด้วย fixed-effects regression พบว่าทุนทางปัญญาสามารถอธิบายในเชิงบวกได้จากความหลากหลายทางเพศของคณะกรรมการบริษัท หรืออาจกล่าวได้ว่าบริษัทที่มีกรรมการเพศหญิงในสัดส่วนมากขึ้นสร้างความหลากหลายในกลุ่มคณะกรรมการ โดยมีแนวโน้มที่จะเพิ่มประสิทธิภาพของทุนทางปัญญาสูงขึ้นด้วย ผลการศึกษานี้ให้ข้อมูลและมีส่วนช่วยในการสร้างความตระหนักถึงความสำคัญของความหลากหลายในองค์ประกอบของคณะกรรมการบริษัท สอดคล้องกับ G20/OECD หลักการกำกับดูแลกิจการในหมวดความรับผิดชอบของคณะกรรมการ อย่างไรก็ตามความหลากหลายของสัญชาติอาจไม่ใช่ปัจจัยหลักในการบริหารจัดการหรือการเพิ่มผลการดำเนินงานด้านทุนทางปัญญาในบริษัทของกลุ่มตัวอย่างที่มีสัดส่วนของกรรมการชาวต่างชาติน้อยมาก

คำสำคัญ: ความหลากหลายของคณะกรรมการบริษัท ทุนทางปัญญา อุตสาหกรรมเกษตรและอาหาร

Abstract

The research herein examines the nexus between board diversity (gender and nationality) and intellectual capital (IC), whereas previous studies have focused on the relationship between IC and financial performance, overlooking the factors that affect IC. Data were obtained from the annual reports of 45 agriculture and food companies listed on the Stock Exchange of Thailand (SET) from 2017 to 2020. This study uses the modified

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value-added intellectual coefficient (MVAIC) model to measure each firm's IC performance. The fixed-effects regression analysis showed a significant relationship between board gender diversity and IC performance, which implies that IC performance can be positively explained through gender diversity. The presence of female directors on corporate boards is more likely to have better IC efficiency. This study contributes to strengthening the importance of gender diversity on boards. It is aligned with G20/OECD corporate governance guidance on board responsibilities to promote gender diversity in the boardroom and within management. Unexpectedly, foreign directors did not affect IC performance. The findings indicate that nationality diversity may not be the main determinant of IC performance due to the very limited foreign presence on the boards of directors of Thai agriculture and food-listed enterprises.

Keywords*:* Board Diversity Intellectual Capital Agriculture and Food Companies

Introduction

With the emergence of the knowledge-based economy, intellectual capital (IC) has become an important factor in the growth and development of enterprises (Al-Musali & Ismail, 2015) as an essential strategic resource (Appuhami & Bhuyan, 2015). IC is a source of competitive advantage, as it is one of the unique and superior resources that cannot be easily replicated (Soewarno & Tjahjadi, 2020). Researchers have performed extensive research to investigate the impact of IC on business performance as evaluated by profitability, productivity, and market value across many sectors and countries (Smriti & Das, 2021). For example, (Appuhami, 2007) determined that IC has a significant positive relationship with investors' capital gains in Thai banking, finance, and insurance sectors. According to Alipour, 2012; Vishnu & Gupta, 2014; there was a significant association between IC and corporate profitability in insurance companies (Iran) and pharmaceutical firms (India). Nimtrakoon, 2015; Xu & Li, 2019; Weqar et al., 2020, further confirmed that IC significantly improves profitability, productivity, and market value.

The above studies emphasize the importance of IC in terms of firm value and performance improvement; however, what influences IC is limited in current literature (Nadeem et al., 2019). In summary, scholars have overlooked the factors affecting IC. According to Massaro et al., 2018; as cited in Smriti & Das, 2021; researchers should shift their focus from the importance of IC to investors, customers, and society; to the management of IC within the organisation. Although IC improves performance and adds value to an organisation as a strategic resource, there are still IC management and control

issues within most companies. Notably, managing IC remains a key challenge regarding accounting due to its complexity (Appuhami & Bhuyan, 2015). This obstacle includes identifying, measuring, and reporting the firm's IC in their financial statements, as a part of the accounting standards' influence (Ulum et al., 2014; Nimtrakoon, 2015). Accordingly, recent studies emphasized the need for understanding the corporate role in properly deploying, managing, and sustaining the firm's IC (Appuhami & Bhuyan, 2015; Nadeem et al., 2019; Smriti & Das, 2021).

Regarding the board of directors (BOD) having significant influence over firm strategies, board composition may account for the majority of the differences in IC efficiency among organisations (Nadeem et al., 2019). Berezinets et al. (2016) claimed that IC is generated not just by firm employees but also by governmental authorities, particularly within the BOD, whose members are not always contractually bound to the organisation. Members of the board leverage their knowledge, experience, and networking connections to develop IC; to monitor, advise, and offer resources to the organisation. In this sense, the BOD acts as a source of IC for a company by performing as the main internal mechanism that results in value creation within a corporation while taking the stakeholders' interests into account.

A large majority of research has examined the relationship between the BOD and performance in terms of corporate social responsibility and financial performance (Hassan & Marimuthu, 2017; Isola et al., 2020; Issa et al., 2021), thus overlooking the prominence of intangibles, namely, IC. Interestingly, limited studies have been conducted to investigate the association between BOD characteristics and IC performance, often with contradictory results. For example, the prior research by Nadeem et al., 2019; Shahzad et al., 2020; and Smriti & Das, 2021; demonstrated that board gender diversity positively affects IC in the context of the UK, US, and India. In addition, the authors indicated that female representation in the BOD improves IC performance, which is critical for firms to create value and maintain a competitive edge in today's knowledge-economy era. The main cause for these phenomena is recent research demonstrating that female executives are more risk-averse than their male counterparts regarding investment decision-making. Moreover, female directors are more circumspect and detail-oriented than male directors (Hassan & Marimuthu, 2017; Nadeem et al., 2019; Smriti & Das, 2021). However, gender diversity had no positive influence on the IC performance of South African listed companies in the investigation of Swartz & Firer, 2005. Similarly, Nadeem et al., 2017; Scafarto et al., 2021; found no significant association between gender diversity and the IC performances of Chinese-listed enterprises and Italian-listed firms.

Another board observable attribute, Swartz & Firer, 2005 discovered that nationality diversity also significantly impacted IC performance. Hassan & Marimuthu, 2017; Issa et al., 2021; further indicated that board diversity in terms of nationality significantly affected financial performance. According to the resource dependence theory, foreign directors from various cultures provide a variety of views, thinking styles, information, expertise, and viewpoints to boardroom discussions; which encourages effective decision-making (Issa et al., 2021). Contrastingly, Al-Musali & Ismail (2015) found that nationality diversity was unrelated to IC performance in their study of six Middle Eastern Gulf Cooperation Council (GCC) countries (Saudi Arabia, Kuwait, the United Arab Emirates, Qatar, Bahrain, and Oman).

In summary, it appears that, due to the limited number of studies, the relationship between board diversity and IC is still ambiguous and requires further examination. Moreover, most of the studies mentioned above focused primarily on gender diversity (Nadeem et al., 2017; Nadeem et al., 2019; Shahzad et al., 2020; Smriti & Das, 2021) or nationality diversity (Al-Musali & Ismail, 2015). A single article by Swartz & Firer, 2005; studied board diversity in terms of both gender and nationality. However, they evaluated the financial data for only a single year and measured IC by the value-added intellectual coefficient (VAIC) model, similarly to the previous studies of Al-Musali & Ismail, 2015; Nadeem et al., 2017; and Scafarto et al., 2021. The study herein addresses the limitations of the existing VAIC model by using the modified value-added intellectual coefficient (MVAIC) model and through the collection of data over four years.

To the author's knowledge, no empirical study has examined the association between board diversity and IC performance in Thailand. Drawing on the resource dependence theory (RDT), upper echelon theory (UET), and several board diversity and IC studies; this study developed hypotheses about the nexus between two aspects of board diversity (gender diversity and nationality diversity) and IC performance. The findings provide insight into how the dynamics of a corporate board affect IC performance. Furthermore, from a practical standpoint, this study bridges the gap between theory and practice by informing the firms' policymakers, stakeholders, and regulatory bodies about the critical role of female and foreign members on their board of directors in leveraging the firm's intangible performance.

The rest of the article is organised as follows: Section 2 briefly reviews the underlying theoretical concepts, IC, and the development of the two hypotheses. Section 3 discusses methodology; including sample selection, data sources, variable measurement, and the empirical model. The empirical findings, as well as a discussion, are presented in Section 4. The final section outlines the research conclusion, implications, and limitations of the study.

Literature review

Underlying Theoretical Concepts

Previously, boards of directors were viewed as a homogeneous group of leaders who shared similar socioeconomic backgrounds, graduated from similar schools, received comparable educational and professional qualifications, and hence shared relatively similar opinions on suitable corporate practices (Westphal & Milton, 2000; as cited in Swartz & Firer, 2005). Concomitantly, a conflicting viewpoint considers group diversity (heterogeneous members) to foster creativity, innovation, and problem-solving. Several studies have suggested that board gender diversity is favorably related to firm performance (Hassan & Marimuthu, 2017). It is argued that variety enhances creativity and innovation since these traits are not randomly distributed in the group but rather varied systematically with demographic factors (Campbell & Mnguez-Vera, 2008, as cited in Scafarto et al., 2021). The study herein study proposes that board diversity in terms of observable aspects (namely, gender and nationality) influences important board decisions.

The resource dependence theory (RDT), concerned with the benefits obtained by personnel within a business due to their connections with external organisations (Pfeffer & Salancik, 1978), and the upper echelon theory (UET) could describe the relationship between board diversity and IC. According to Pfeffer & Salancik, 1978; a firm's existence is contingent upon the assets managed by external stakeholders. Thus, an enterprise's reliance on external forces for such resources is jeopardised. From the board's perspective, RDT considers that these risks can be reduced or eliminated through the board's responsibility in associating the corporation with these external factors (Smriti & Das, 2021). Companies dependent on their environment, corporate directors, and commissioners play a role in sustaining relationships with external organisations to overcome this dependency. Therefore, the BOD is considered a resource provider rather than an assessor of management. Additionally, the directors' and commissioners' demographic and cognitive diversities are likely to contribute to this competency, as diverse boards have greater access to information and networks (Bryant & Davis, 2012, as cited in Sutarti et al., 2021). In support of the RDT, Nadeem et al., 2019; Shahzad et al., 2020; and Smriti & Das, 2021; discovered that female board directors can use their knowledge and skills to improve the firm's overall efficiency. Hassan & Marimuthu, 2017; and Issa et al., 2021; further determined that board diversity in terms of nationality had a considerable, positive impact on performance.

The upper echelon theory (UET) proposes that top management characteristics influence organisational outcomes, including strategic choices (Hambrick & Mason, 1984; Hambrick, 2007). The experience, values, and personality of a board of directors as the top management team significantly impact meeting deliberations and strategic formulation. Thus, strategic decisions are often more influenced by behavioral components and reflect the decision maker's peculiarities, such as their cognitive basis (Sutarti et al., 2021). Diverse boards may effectively supervise management teams, strengthen board independence, establish more successful strategies, and make high-quality innovative judgments (Al-Musali & Ismail, 2015). As a result, the UET may be used to understand how management makes strategic decisions based on a group's characteristics that in turn affect IC performance.

Intellectual Capital (IC)

Intellectual capital, a critical component of a firm's asset value, is an intangible and mental asset, as well as a resource that the organisation leverages to create value through the development of new product and service processes (Ni et al., 2020). Stewart, 1997; defined IC as integrating knowledge, information, skills, experience, and learning capacity. However, Edvinsson & Malone, 1997; contended that IC is disguised between a firm's market and book values. Although the definition of IC is inconsistent in literature, it is indeed an intangible asset that can generate wealth for businesses (Jardon & Martinez-Cobas, 2021).

IC is commonly defined as a group consisting of human capital (HC), structural capital (SC), and relational capital (RC). HC refers to the characteristics of an organisation's employees; such as knowledge, expertise, experience, commitment, and motivation. SC is a term that refers to all non-human knowledge resources within firms that deal with information technology and organisational structure, resulting in business intellect (Alipour, 2012; Weqar et al., 2021). RC is the value of a business' connections with individuals and organisations that are directly or indirectly linked to the business' value generation. Measuring and evaluating IC remains a challenge in business research. Additionally, the limited provisions of IC accounting standards have prompted experts to measure IC (Ulum et al., 2014) using a variety of models developed by researchers from diverse fields; including the Skandia Navigator (Edvinsson & Malone, 1997), the Intangible Assets Monitor (Sveiby, 1997), the Balanced Scorecard approach (Kaplan & Norton, 1996), the Market Capitalization Method, and the VAIC model (Pulic, 1998, 2000). The VAIC model, which is based on the value-added concept, is the sum of intangible assets and physical capital efficiency. It analyses the efficiency of a firm's capital employed efficiency (CEE), human capital efficiency (HCE), and structural capital efficiency (SCE). Pulic's model is considered to be the most appropriate method, as it uses financial data rather than subjective

measurement to generate the intellectual coefficient (Alipour, 2012; Isola et al., 2020). Additionally, the audited financial data increase the information's reliability and availability (Nadeem et al., 2019). This model can be implemented without requiring the use of subjective scoring or grades or the use of judgment scales (Phusavat et al., 2011) and calculates and compares firms and industries broadly and straightforwardly (Alipour, 2012; Isola et al., 2020).

Hypotheses Development

Board gender diversity (BGD)

Since gender involvement remains a topic of discussion in both the business sector and in current literature, the subject of gender participation as an essential factor continues to be debated (Hassan & Marimuthu, 2017). Today's literature implies that women's representation significantly impacts several aspects of financial performance using leverage on tangible asset-based accounting ratios, yet overlooks the importance of intangible assets like IC (Smriti & Das, 2021). Few studies have directly examined the relationship between BGD and IC performance, and the results, therefore, remain inconclusive.

Shahzad et al., 2020; researching US-based enterprises, demonstrated that the presence of female directors has a significant effect on IC as measured by the VAIC model. Similarly, Nadeem et al., 2019; discovered a statistically significant effect of BGD, measured by the percentage of female directors on IC for UK-listed companies between 2007 and 2016. In addition, Smriti & Das (2021) revealed that female presence on boards significantly impacts IC as assessed by the MVAIC of Indian firms listed on the National Stock Exchange between 2007 and 2019. The authors emphasised the need to bring female members on board as a critical aspect of enhancing a firm's intangible performance. On the other hand, Swartz & Firer, 2005; reported no significant effect of BGD on the IC performance of a group of South African listed enterprises. Similarly, Nadeem et al., (2017) found no significant association between BGD and the IC of Chinese-listed companies. In a study based on Italian-listed corporations, Scafarto et al., 2021; examined the association between BGD and IC performance as defined by Blau's index (Blau, 1977). The authors discovered a negative effect on IC performance, though it was not statistically significant.

From a theoretical viewpoint, RDT claims that gender-diverse boards are helpful for businesses operating in the twenty-first century for ethical reasons and to maintain a positive connection with the external environment to acquire resources (Nadeem et al., 2017). According to this view, female directors are unique and valuable resources for boards; they serve as a potential connection among enterprises, their existing environment, and competing external resources (Salehi & Zimon, 2021). Moreover, based on UET, scholars

have considered that diversified boards make more efficient decisions than homogeneous boards (Hambrick & Mason 1984; Hambrick, 2007). Firms may attract, retain, and gain a competitive advantage from varied expertise by first expanding diversity among top management teams. In light of the UET and RDT, Hassan & Marimuthu, 2017; ascertained that gender diversity, age profile, foreign involvement, and interacting effects among board members substantially influenced company performance (Tobin's Q). The study by Ren & Zeng, 2022; also contributed profoundly to UET by outlining the economic implications of increasing BGD. As a result, the current study anticipates a positive relationship between BGD and IC performance. Given the scant and mixed evidence, this study hypothesises:

H1: Board gender diversity is positively associated with intellectual capital performance.

Board nationality diversity (BND)

Previous research has demonstrated that foreign membership on corporate boards significantly affected the firm performances of several Malaysian-listed companies (Hassan & Marimuthu, 2017). The authors advised that businesses should encourage foreign directors; that would bring their skills, ideas, and diverse educational and cultural backgrounds to the table. Issa et al. (2021) further revealed that board diversity in terms of nationality greatly impacts the MENA bank performance. They suggested that having multiple nationalities on boards with expertise and knowledge of international markets could bring new insights and views that promote effective decision-making and, ultimately, improve financial performance. Furthermore, since they are regarded as less obedient to management, cultural diversity on boards could serve a vital monitoring function by boosting the board's independence and transparency.

In the context of IC performance, Swartz & Firer, 2005; revealed a significant, positive association between the percentage of ethnic members on boards of directors and IC. They also stated that South African publicly traded corporations could benefit from an ethnically diversified BOD. However, nationality diversity could be a double sword, causing cross-cultural communication challenges, misunderstandings, and conflict issues (Chiucchi et al., 2018). Al-Musali & Ismail, 2015; found that diversity in nationality negatively correlates with IC performance, yet was insignificant in the GCC countries. According to RDT, foreign directors from various cultures bring distinct views, cognitive styles, information, expertise, and viewpoints to boardroom discussions, promoting effective decision-making. Coles et al., 2020; suggested that variations in demographic backgrounds strengthen BOD and minimize the influence of groupthink, thereby improving financial performance. As a result, this study anticipates that having diverse nationalities on the corporate board will benefit

the company, increase the quality of decisions; and, consequently, boost the firm's performance. Given the limited and contradictory evidence, the second hypothesis is tested:

H2: Board nationality diversity is positively associated with intellectual capital performance.

Methodology

Data Sources and Sample Selection

Agriculture and food companies are the subjects of this study, as they are one of Thailand's long-standing sectors that directly and indirectly impact employment and living costs for the country's population (Hatane et al., 2021; Pongpanich et al., 2017). Moreover, agricultural and food product exports play a vital role in Thailand's economy, as the country remains a net exporter of agri-food goods (Thammachote & Trochim, 2021). Due to the difficulties in obtaining information from private companies, it was decided to confine this study to publicly traded companies on the Stock Exchange of Thailand (SET). Data were gathered through the company's website or other electronic databases, such as SETSMART and Thomson Reuters for four years from 2017 to 2020. The initial sample included 61 agricultural and food companies. Following the screening and removal of firms with missing variables, a total of 45 firms provided 180 firm-year observations to be analysed.

Variable measurement

Independent variables

This study investigates the relationship between board diversity and IC performance. There are two diversity indices in terms of board diversity: gender diversity and nationality diversity. Board gender diversity (BGD) is measured via the Blau diversity index (Blau, 1977), which is calculated as $1 - \Sigma (P_i)^2$, where P_i is the percentage of board members in each category (men and women) on the board. The Blau index ranges from 0 to a maximum of 0.5 when the board comprises an equal number of men and women. This measurement aligns with the relevant studies of Al-Musali & Ismail, 2015; Nadeem et al., 2017, 2019; and Smriti & Das, 2021. To test the result's robustness, the study also estimates BGD by the percentage of female directors to the total number of directors.

Similarly, board nationality diversity (BND) is calculated as $1 - \Sigma (P_i)^2$, where P is the percentage of board members in each nationality category and i is the number of different nationality categories represented within the board. This study identifies two categories to capture nationality diversity: locals and foreigners. This measurement is in keeping with the

studies by Al-Musali & Ismail, 2015; and Isola et al., 2020. To check the robustness of the model, another alternative proxy for BND was the percentage of foreigners on the boards.

Dependent variables

The VAIC model, developed by Ante Pulic, 1998, 2000; has become widely accepted as an indicator of IC performance in academic and professional communities. However, the VAIC model omits a critical component of IC, namely RC (Ståhle et al., 2011). Therefore, this study uses the modified value-added intellectual coefficient (MVAIC) model as depicted in Nazari & Herremans, 2007; with the addition of RC, which has been used in previous IC research studies (e.g., Nazari & Herremans, 2007; Vishnu & Gupta, 2014; Ulum et al., 2014; Nimtrakoon, 2015; Xu & Li, 2019; Buallay et al., 2020; Smriti & Das, 2021). MVAIC represents the sum of both intangible and tangible assets of the firm consisting of capital employed efficiency (CEE), human capital efficiency (HCE), structural capital efficiency (SCE), and relational capital efficiency (RCE); and is expressed as follows:

$$MVAIC = CEE + HCE + SCE + RCE$$
$$CEE = VA / CE$$
$$HCE = VA / HC$$
$$SCE = SC / VA$$
$$RCE = RC / VA$$

Where the company's value-added (VA) = total revenue (OUTPUT) minus total expenses minus employee expenses (INPUT). Capital employed (CE) includes both physical and financial capital. Human capital (HC) is the total employee expenses. A corporation's VA is generally generated from HC and structural capital (SC); SC is calculated by subtracting HC from VA. Lastly, RC is determined by the marketing, selling, and advertising expenses.

Control variables

The study's control variables were chosen based on prior research on board diversity and IC. Because larger firms may lead to significant IC performance as a result of increased financial solvency (Appuhami & Bhuyan, 2015), a firm's ability to acquire capital (Smriti & Das, 2021), and improved IC management (Nadeem et al., 2019); the study herein uses size as a control variable. The natural log of total assets is used as the firm size (SIZE). Firms with high performance might have an incentive to create and use IC more efficiently (Appuhami & Bhuyan, 2015); thus, the study identifies firm performance as a control variable and uses return on assets (ROA) as a proxy for performance (Nadeem et al., 2017; Scafarto et al., 2021; Smriti & Das, 2021). Larger boards are an important resource for the organisation aiding in the creation of value through IC (Dalwai & Mohammadi, 2020). Hence, board size

(BODZ) is another control variable that estimates the total number of board members (Smriti & Das, 2021). Firm age may have an impact on the IC profile; for example, between HC and SC, more established enterprises may have found it easier to convert HC to SC (Nimtrakoon, 2015). Lastly, as proposed in prior studies (Shahzad et al., 2020; Smriti & Das, 2021), the firm's age (AGE) is included in the model.

Table 1 Definition of variables

Variable	Definition	Measurement
Board diversity (Independent) variables		
BGD	Board gender diversity	Measured through two different proxies: 1) GEND: The Blau index is calculated as the percentage of board directors in each category (male/female) 2) P_GEN: the percentage of female directors to total directors on board
BND	Board nationality diversity	Measured through two different proxies: 1) NATD: The Blau index is calculated as the percentage of board directors in each category (locals/foreigners) 2) P_NAT: The percentage of foreign directors to total directors on board
Dependent variable		
MVAIC	Intellectual capital	MVAIC is the sum of CEE, HCE, SCE, and RCE
Control variables		
BODZ	Board size	The total number of members of the BOD
SIZE	Firm size	Natural logarithm of total assets at year-end
AGE	Firm age	The total years of the firm's existence
ROA	Firm performance	Operating income/average total assets

The Empirical Model

The following regression model is used to examine the relationship between board diversity and IC performance:

$$MVAIC_{it} = \alpha + \beta_1 GEND_{it} + \beta_2 NATD_{it} + \beta_3 BODZ_{it} + \beta_4 SIZE_{it} + \beta_5 AGE_{it} + \beta_6 ROA_{it} + \varepsilon_{it}$$

Where MVAIC is the measure of IC performance, **α** is the constant term, **β**$_1$ to **β**$_6$ represents the parameters to be estimated, *i* is the firm, and *t* is the year the firm's data is collected, respectively, while **ε** is the error term. After testing the assumptions, the appropriate regression analysis was chosen. The data were analysed using EViews software. Redundant fixed effects and the Hausman test were used to select the most appropriate estimation technique. Furthermore, to make the results more robust, the primary independent variables, GEND and NATD, were substituted with alternative proxies (P_GEN and P_NAT).

Results and Discussion

Descriptive Analysis

Table 2 presents the summary statistics of the dependent, independent, and control variables. The sample firms' MVAIC values varied from -9.980 to 15.240, with a mean value of 3.117. The results indicate that the firms generate 3.117 units of MVAIC for every unit of IC asset used. The average for Blau's index (GEND), a proxy of board gender diversity (BGD), was 0.324, with a minimum value of 0 and a maximum value of 0.50. The women's percentage (P_GEN) varied from 0 to 63.0 percent, with an average of 23.7 percent, representing the boards of directors in agriculture and food firms, which are dominated by men. However, the women's percentage on BOD in the current study (23.7%) was greater than those reported in Chinese listed firms (10.98% for the period 2010-2014, Nadeem et al., 2017), Indian firms listed on the National Stock Exchange (8.58% from 2007-2019, Smriti & Das, 2021), and banks listed in Nigeria (15.75% for the period 2008-2017, Isola et al., 2020).

The average value of Blau's index (NATD) for board nationality diversity (BND) was 0.099, with a minimum value of 0.00 and a maximum value of 0.50, which is significantly lower than the findings of Hassan & Marimuthu, 2017; and Issa et al., 2021; where the average values for board nationality diversity in GCC countries and in the Middle East and North African region were 0.22 and 0.19, respectively. Furthermore, the foreign percentage (P_NAT) ranged from 0.00 to 55.0 percent, with a mean of 6.9 percent, which is lower than the findings of previous studies; for example, Malaysian listed companies (59.4 % from 2009 to 2013, Hassan & Marimuthu, 2017) and South African listed companies (66.0% for the 2013 fiscal year, Swartz & Firer, 2005).

The mean for board size (BODZ) was 10.672 with a minimum of seven directors and a maximum of 21 directors, which is comparable with Isola et al., 2020; having a mean

value for board size of 9.16 among the GCC countries. The SIZE and AGE means were 15.826 and 34.116, respectively. The average rate of ROA was 5.890 percent, with the lowest negative return of -30.520 percent and a wide variance of 8.218 percent from the average value.

Table 2 Descriptive statistics

Variables	Mean	S.D.	Min	Max
MVAIC	3.117	2.964	-9.980	15.240
GEND	0.324	0.140	0.000	0.500
NATD	0.099	0.157	0.000	0.500
P_GEN	0.237	0.139	0.000	0.630
P_NAT	0.069	0.123	0.000	0.550
BODZ	10.672	2.652	7.000	21.000
SIZE	15.826	1.374	13.798	20.451
AGE	34.116	11.752	4.000	59.000
ROA	5.890	8.218	-30.520	27.200

Table 3 Pearson correlation matrix

Variables	MVAIC	GEND	NATD	P_GEN	P_NAT	BODZ	SIZE	AGE	ROA
MVAIC	1								
GEND	.068*	1							
NATD	-.162*	-.182*	1						
P_GEN	.123*	.923**	-.179*	1					
P_NAT	-.152*	-.210**	.967**	-.203**	1				
BODZ	.206**	-.106	.042	-.157*	.035	1			
SIZE	.401**	-.280**	.083	-.299**	.166*	.481**	1		
AGE	-.086	.025	-.014	.028	-.030	.092	.048	1	
ROA	.586**	.067	-.123	.071	-.119	.124	.222*	-.123	1

Note: N=180, the correlation is significant at the following levels: * 5%; ** 1%.

Correlation Analysis

The correlation matrix, presented in Table 3, shows that almost all of the explanatory variables are significantly correlated with the dependent variable. The results provide evidence of a very high degree of correlation (0.923) between GEND and P_GEN. Similarly, NATD and P_NAT were significantly associated with each other, with a strong

correlation of 0.967. However, these outcomes pose no regression analysis problem, as both serve as alternating independent variables. There were no multicollinearity issues in the explanatory variables of this research, as they are all less than 0.60. In addition, the variance inflation factors (VIFs) test confirms no multicollinearity issues (Hair et al., 2010; Kline, 2005).

Before model estimation, the first step was to determine whether the regression is a regular or a panel-type model. For this purpose, this study employed the Redundant fixed effects test to determine the estimation method (integrated or panel). As expressed in Table 4, the probabilities associated with the two tests evaluating the common significance of cross-section effects (Cross-section F and Cross-section Chi-square) are less than 0.05, which suggests that the null hypothesis (that individual effects are redundant) should be rejected, which means that it is acceptable to include individual effects. The next step was to decide between fixed (FE) and random effects (RE). In this respect, the Hausman test was used. Table 4 shows the probability associated with the chi-square test, which is less than 0.05. As a result, the null hypothesis that the random-effects model is better than the fixed-effects model is rejected, indicating that the fixed-effects model is the appropriate choice.

Table 4 The results of Redundant fixed effects and Hausman tests

Tests	Results		Model estimation method
Redundant fixed effects:	*Statistic*	*Sig.*	
Cross-section F	1.572	0.026	
Cross-section Chi-square	76.803	0.001	Fixed effects
Hausman test:	*Chi-Sq. Statistic*	*Sig.*	
Cross-section random	13.119	0.022	Fixed effects

Panel Regression Analysis

The empirical results of FE regression are presented in Table 5. The F-value of the model is statistically significant at the one percent level. Additionally, an adjusted R^2 of 46.9 percent demonstrated a model fit for the data, confirming that the model is stable and adequate as a basis for testing the hypotheses. The first hypothesis (H1) is that board gender diversity is associated with IC performance. The results indicate that GEND significantly and positively determines MVAIC (6.375, p-value < 0.01). This conclusion supports H1 and is consistent with recent research (e.g., Nadeem et al., 2019; Shahzad et al., 2020; Smriti & Das, 2021), which also found that board gender diversity positively influences IC. Furthermore, the findings revealed that female directors on corporate boards

are more likely to have better IC performance in Thailand's agricultural and food industry. However, this finding contradicts the works of Swartz & Firer, 2005; Nadeem et al., 2017; and Scafarto et al., 2021. Swartz & Firer, 2005; which found an insignificant impact of gender-diverse boards on the IC efficiency of South African listed firms, which could be a result of deficient female representation on African boards (6.4 percent); and that the study was based on only a single year (2003). Nadeem et al., 2017; and Scafarto et al., 2021; also failed to find a significant relationship between gender diversity and the IC efficiency of Chinese and Italian-listed firms, respectively.

Table 5 Panel data fixed effect regression results

Variable	Coefficient	Std. error	t-statistic	p-value
Constant	-3.939	5.678	-0.693	0.489
GEND	6.375	1.683	3.787	0.000
NATD	-1.148	1.424	-0.806	0.421
BODZ	-0.105	0.100	-1.052	0.294
SIZE	0.787	0.201	3.901	0.000
AGE	-0.211	0.147	-1.438	0.152
ROA	0.167	0.026	6.240	0.000
Model summary:				
R^2 = 0.617, Adjusted R^2 = 0.469, *F*-statistic = 4.167, *Sig.* = 0.000, Durbin–Watson = 2.475				

Unexpectedly, this study found that NATD does not have a significant relationship with MVAIC (-1.148, p-value > 0.05); thus, the second hypothesis (H2) is not supported. The findings suggest no evidence to support the hypothesis that increasing the number of foreign boardroom participants enhances IC performance. The result is consistent with the findings of Al-Musali & Ismail, 2015; which determined that nationality diversity is negatively related to IC efficiency, and was proven insignificant in GCC countries. However, these results contrast with the findings of Swartz & Firer, 2005; that found a positive relationship between the BOD's ethnic diversity and IC performance. In addition, in the context of financial performance, Hassan & Marimuthu, 2017; and Issa et al., 2021; indicated that board diversity related to nationality had a significant positive impact on performance in Malaysia and the MENA countries. The insignificant association may be explained by the low foreign presence in the BOD (a mean of 6.9 percent), which is lower than in other countries. Furthermore, international directors have greater knowledge of asymmetries concerning corporate activities than domestic directors, since they are not as well embedded in the host country's information networks (Zaheer, 1995, as cited in Al-Musali & Ismail, 2015).

Consequently, foreign directors in the agricultural and food sectors may be unable to make significant contributions related to IC improvement.

SIZE and ROA are two of the control variables that are found to be linked to MVAIC at a five percent level of significance. The findings imply that the size of agricultural and food firms and their financial performance significantly impact IC performance. Contrastingly, BODZ and AGE had no significant association with IC performance. Robustness analyses are not reported for brevity but are available upon request to verify that the primary findings are correct. The alternate proxies replaced GEND and NATD, the percentage of women on BOD (P_GEN), and the percentage of foreigners on BOD (P_NAT). The results remain consistent with previous findings, suggesting that the conclusion is sound.

Conclusion

This study investigates the nexus between board diversity and intellectual capital in Thailand's agricultural and food industry using a panel data set of 45 Thai listed firms from 2017 to 2020, which were analysed using the FE estimation approach. The results indicate that having female members on an organisation's boards of directors enhances the firm's IC. Female directors have been found to leverage their expertise and abilities to improve the overall efficiency of the firm, which is consistent with the resource dependence theory (RDT) and upper echelon theory (UET), and is consistent with the previous studies of Nadeem et al., 2019; and Smriti & Das, 2021. As a result, the findings contribute to the theories in the context of board gender diversity. However, this study fails to support these mentioned theories in terms of the association between nationality diversity and the IC performance of the Thai-listed agricultural and food companies. It implies that in some organisational situations, RDT and UET may not adequately explain board diversity mechanisms and IC performance. In other words, in a setting of inadequate foreign representation in a BOD, national diversity may not be the main determinant of IC performance.

Gender equity or diversity has been recognised as a critical driver of a firm's intellectual resources, which in turn influences firm performance (Shahzad et al., 2020). This article provides a deeper understanding of the effects of female participation on the IC performance of agricultural and food enterprises in Thailand. The findings are guided toward encouraging female boardroom participation, as it has been discovered that women are stronger factors in a firm's IC performance. The results are in line with the G20/OECD principles of corporate governance, which emphasise the implications of formulating a diverse board of directors (OECD, 2020). Moreover, Thailand is a member of the Equal

Futures Partnership, which utilises policies to eliminate discrimination against women, enhance women's health, create female entrepreneurs, expand women's engagement in business and society, and advance workplace gender equality (Deloitte, 2021). Thus, policymakers should promote increased female participation to maximize the potential economic gains from such engagement on the board. For example, capital market regulators in the majority of European countries require that 40% of board members of publicly traded companies be women (Reguera-Alvarado et al., 2017, as cited in Ren & Zeng, 2022).

At the ASEAN level, Malaysia targets 30% female directors on BODs, whereas Thailand has not yet specified this issue in law. Compliance with disclosure rules regarding board composition is a critical component of many countries' frameworks for increasing women's representation in executive positions (OECD, 2020). In this regard, Thai regulatory bodies (such as the Securities and Exchange Commission: SEC) may consider the rules on disclosure of the gender composition of corporate boards and diversity policies following the OECD's guidelines. However, it should be noted that board diversity is not limited to gender and nationality. It also involves relevant knowledge, independence, competence, and experience (ICGN, 2021). Accordingly, the composition and appointment of the BOD should consider these additional aspects.

According to the general accounting framework, it may be difficult to account for most intangibles as defined in the International Accounting Standard (IAS 38: Intangible Assets). As a result, IC is generally not recorded on the balance sheet and is referred to as a firm's hidden value (Shahzad et al., 2020). Thus, firms should report IC information, since failure to do so may negatively affect the quality of shareholder decisions or result in material misstatements (Roslender et al., 2006). In addition, capital market authorities may assist firm managers, shareholders, creditors, and other stakeholders to become more aware of IC performance. For instance, investors and shareholders could compare the IC performance of listed companies as they consider investing in them (Buallay et al., 2020). Similarly, firms should focus more on the role of the board in managing and strengthening IC performance rather than concentrating only on financial performance indicators (Nadeem et al., 2019; Smriti & Das, 2021).

Recognition of the study's limitations includes the use of Thai-listed companies in the agricultural and food industry, which raises issues about generalizing the research findings. Thus, the findings must be interpreted with caution. Subsequent research, therefore, may extend to different industries or cross-country samples. And, as the research focuses on gender and nationality diversity boards, further research could consider other

types of diversity; such as education, skill, tenure, and experience. Lastly, given that this research examines the relationship between board diversity and the composite MVAIC model, it would be interesting to evaluate each component of IC separately.

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