OPEN ACCESS

IQTISHODUNA: *Jurnal Ekonomi Islam* 15, no. 2 (October 1, 2026): 699-720
DOI: doi.org/10.54471/iqtishoduna.v14i2.4035

E-ISSN: 2443-0056, P-ISSN: 2252-5661
Accredited *Sinta 2* Number 2/C/C3/KPT/2026

Sustainability in Islamic Banking: How Green Intellectual Capital and Competitive Pressure Shape Green Banking in Aceh

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ABSTRACT

Background and research gap – Research on sustainability in Islamic banking in Aceh specifically, contextualized through the lens of green intellectual capital and the competitive pressures shaping "green banking" remains very scarce, rendering this study both theoretically and empirically significant.

Purpose – This study aims to examine the influence of green intellectual capital consisting of green human capital (GHC), green structural capital (GSC), and green relation capital (GRC) on green banking (GB) in Sharia Commercial Banks in Aceh, as well as examine the role of competitive pressure (CP) moderation in these relationships.

Design/methodology/approach – This quantitative research involved 200 employees from six Sharia Commercial Banks operating in Aceh, including Bank Syariah Indonesia, Bank Aceh Syariah, and Bank Muamalat. Data was collected through a Likert scale questionnaire consisting of 54 statement items distributed through Google Forms, and analyzed using partial least squares structural equation modelling (PLS-SEM) with the help of SmartPLS software.

Key Findings – Of the 54 items, 42 items qualified for validity (outer loading above 0.70) and were retained for analysis, while 12 items were eliminated. The structural model showed strong predictive power, explaining 84.0% of the variance in GB (R^2 = 0.840). GSC had a significant positive effect on GB and was the most dominant predictor, while GHC and GRC had no significant effect directly on GB. CP itself did not have a significant direct effect on GB, but played an important role as a moderator: CP significantly strengthened the GSC–GB relationship, while significantly weakened the GRC–GB relationship. The role of CP moderation on the GHC–GB relationship was found to be insignificant.

Research limitations/implications – This study was limited to 200 respondents from Islamic banks in Aceh, using a cross-sectional design that relies on respondents' perceptions. Future research is suggested to expand the sample to other regions and institutions, using longitudinal designs, as well as miningulate findings with objective data from the bank's sustainability report.

Originality/value – This study provides new evidence that competitive pressures have a contrasting moderation effect reinforcing the role of structural capital while weakening the role of relational capital in the typical context of Islamic banking in Aceh.

Keywords: green banking, green intellectual capital, competitive pressure, islamic banking, sustainability.

INTRODUCTION

Sustainable development is the world's ideal. Its emergence is a form of human conscious efforts against environmental degradation as illustrated through extreme weather phenomena, global warming, and the threat of species extinction to the loss of habitable places for living things on the earth's sea surface.[1]

An important point in the concept of sustainable development is the relationship between economics and ecology. Sustainable development can be said to be a form of compromise between conservation interests and the use of natural resources for

[1] Michael Redclift, "Sustainable Development and Global Environmental Change: Implications of a Changing Agenda," *Global Environmental Change* 2, no. 1 (1992): 32–42.

Received 2026-06-13, Revised 2026-07-30, Approved 2026-09-24, Available online on 2026-09-30
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commercial purposes. In the legal doctrine in dubio pro natura, it is emphasized that in doubt, policies that benefit the environment must be taken.[2]

The concept of sustainable development in Indonesia has been started since the 1970s. However, in practice, it still tends to economic development and only focuses on short-term economic growth and its economic activities tend to focus on natural resources, resulting in the quality of economic growth deteriorating.[3] Therefore, the concept of sustainable development that not only concentrates on environmental issues but also includes three main pillars, namely economic development, social development, and environmental development, needs to be upheld and applied by various parties and stakeholders.[4]

The green economy, which is a follow-up step in the application of the concept of sustainability, is a stepping stone in an effort to abandon economic practices that only care about short-term profits and begin to minimize negative effects on the environment. According to Lymperopoulos, green banking is an operational activity of banks that are responsible for the environment and are able to develop inclusive bank strategies in an effort towards sustainable economic development.[5]

In principle, green banking will seek to strengthen the ability of banking management related to the environment and society.[6] The various ways of green banking carried out through online banking have a good impact on the environment and are also beneficial for companies related to operational efficiency, reduction of errors made manually and fraud as well as cost deficits related to banking activities.[7]

The legal regulations that underlie green banking include the 2011-2013 MOU issued by BI (Bank Indonesia) with the Ministry of Environment and Environment (MoEF) where green banking is carried out through environmental impact analysis activities such as EIAs. Other legal rules related to green banking are based on the Financial Services Authority Regulation (POJK) number 51/POJK.03/2017 concerning sustainable finance.[8]

The initiation of the concept of green banking in the banking world can be carried out for various reasons, including economic reasons, policies that have been set, loan

[2] Jeffrey Kartz, "Green Growth Economic as New Environmental Paradigm," *International and Comparative Law Quarterly Journal* 70, no. 1 (2015).

[3] Bappeda, "Green Economy to Support Sustainable Development in Bangka Belitung Islands Province," 2020, https://bappeda.babelprov.go.id/content/ekonomi-hijau-green-economy-untuk-mendukung-pembangunan-berkelanjutan-di-provinsi-kepulauan.

[4] Sustainable Housing, "Green Economy: The Future of Sustainable Development," 2021, https://rumahberkelanjutan.id/ekonomi-hijau-masa-depan-pembangunan-berkelanjutan/.

[5] Constantine Lymperopoulos, Ioannis E. Chaniotakis, and Magdalini Soureli, "A Model of Green Bank Marketing," *Journal of Financial Services Marketing* 17, no. 2 (2012): 177–186, https://doi.org/10.1057/fsm.2012.10.

[6] Diah Anggraini, Dwinita Aryani, and Irawan Budi Prasetyo, "Analisis Implementasi Green Banking Dan Kinerja Keuangan Terhadap Profitabilitas Bank Di Indonesia (2016-2019)," *JBMI: Jurnal Bisnis, Manajemen, Dan Informatika* 17, no. 2 (2020): 141–161, https://doi.org/https://doi.org/10.26487/jbmi.v17i2.11264.

[7] Nigamananda Biswas, "Sustainable Green Banking Approach: The Need of the Hour," *Business Spectrum* 1, no. 1 (2011): 32–38.

[8] Lulu Lugina Kurniawan, "Pengaruh Kinerja Keuangan Terhadap Green Banking Disclosure dengan Mekanisme Kontrol sebagai Variabel Moderasi,"*Jurnal Ilmiah Wahana Akuntansi* 16, no. 1 (2021): 1–16, https://doi.org/10.21009/wahana.16.011.

requests, pressure from stakeholders, and relevance to the environment.[9] However, based on a survey reported by the Katadata Insight Center (KIC), there are only four banks that are widely perceived by the public to have applied the principle of green banking, namely Bank Central Asia (BCA) with 25.7% of respondents, Bank Rakyat Indonesia (BRI) with 23.7% of respondents, Bank Negara Indonesia (BNI) with 12.6% of respondents, and finally Bank Mandiri with 12.1% of respondents. Meanwhile, other banks are not widely perceived as green banking actors where they are only under 2% of respondents. This survey involved 3,105 respondents spread throughout Indonesia with age criteria over 17 years old and users of financial/banking products (Databoks, 2022). Another study conducted by Indonesia's Climate Policy Initiative (CPI) on 13 national and foreign banks shows that the allocation of banking funding for 11 green categories cumulatively reached 27%, while the majority (73%) is allocated to MSME social activities.[10]

The adoption of green banking implemented in the banking world to achieve sustainability, of course, is inseparable from the existing challenges. Some of the challenges identified by banks are related to technology applications, customer acceptance, costs incurred, data that must be protected, and also employee knowledge.[11]

To be able to survive in the midst of the green issue movement, employees are one of the determining factors. According to Becker, employees are a profitable investment that is not only a resource where expenditures are made to improve the quality and quantity of employees.[12] Employees in a company are referred to as intellectual capital. Intellectual capital is an intangible asset that is believed to be able to guarantee an organization to survive.[13] Intellectual capital includes insights, employee capabilities, technology, experience, and capacity to apply innovation so that the company's goals can be realized.[14] The integration of intellectual capital with the concept of the environment is then known as green intellectual capital into three dimensions, namely green human capital, green structural capital and green relational capital.[15]

Green intellectual capital, which is an environment-oriented intellectual capital, is a very effective investment, but in Indonesia, intellectual capital has not received more attention.[16] In fact, green intellectual capital will help organizations in meeting

[9] Mahadi Ahmad, "Sustainability-Oriented Innovation and Governance Effectiveness in Islamic Financial Institutions," *Journal of Islamic Accounting and Business Research* 14, no. 5 (2023): 722–740.

[10] Bisniscom, "CPI Indonesia: Perbankan Lebih Tertarik UMKM Dibandingkan Sektor Hijau," 2022.

[11] Jeena Gupta, "Role of Green Banking in Environment Sustainability: A Study of Selected Commercial Banks in Himachal Pradesh," *International Journal of Multidisciplinary Research and Development* 2, no. 8 (2015): 349–353.

[12] Nanda Safarida and Saparuddin Siregar, "Humans as Assets or Costs? Disclosure of Human Resources in Financial Statements," *ACCESS: Journal of Economics and Business* 15, no. 2 (2020): 72–81, https://publikasiilmiah.unwahas.ac.id/index.php/AKSES/article/view/3780.

[13] Bernard Acquah Obeng and Paul Robson, . "Strategic Entrepreneurship and Small Firm Growth in Ghana," *Int. Small Bus. J* 32, no. 5 (2014): 501–524.

[14] Ching-Lung Huang and Fan-Hua Kung, "Environmental Consciousness and Intellectual Capital Management: Evidence from Taiwan's Manufacturing Industry," *Management Decision* 49, no. 9 (2011): 1405–1425.

[15] Yu-Shan Chen, "The Positive Effect of Green Intellectual Capital on Competitive Advantages of Firms," *J. Bus. Ethics* 77, no. 3 (2008): 271–86, https://doi.org/https://doi.org/10.1007/.

[16] Qurrotul A'yuni and Muafi, "Pengaruh Green Intellectual Capital Terhadap Keunggulan Kompetitif Dengan Pemediasi Green Human Resource Management," *Jurnal Bisnis: Teori Dan Implementasi* 11, no. 2 (2020): 81–97.

international environmental regulations, creating value for organizations, and meeting high demands from customers related to environmental issues.[17]

On the other hand, the demand for regulation to make financial institutions grow and sustainable with the concept of green banking makes banks compete to improve and improve themselves in order to achieve the status of green banking. This then creates a competitive environment in the financial industry, especially banking.

Fierce competition begins when an industry or company introduces a new product to gain market opportunities or to meet the needs of very diverse customers that will be challenging for the company. It is important to investigate how an industry or company responds to competitive pressures in the presence of a large number of competitors. The response given to competitive pressures will be different, whether it will be perceived as an opportunity or even as Liu and Atuahene-Gima; Tyler et al.[18] In the banking world, with fierce competition related to environmental issues, banks will focus on building competitive image by creating customer awareness of the bank's efforts in environmental protection, as well as participating and showing themselves to be more responsible in activities related to the environment, customers, investors, and other stakeholders. Zahra in his research on a number of banks in Pakistan, precisely in Rawalpindi and Islamabad, stated that the variable competitive pressure is able to moderate the relationship between green intellectual capital and the sustainability of green banking.[19]

If examined further, the green banking theory has relevance to the theory of Islamic banking which is based on Islamic law. In Islamic banking, green banking behavior has been carried out in real terms before the concept of green banking was formed. The theory of Al-Maqashid al-sharia which supports the behavior of Islamic banking reveals the benefits of the ummah, both in this world and in the hereafter. This means that to be able to realize the benefits of the ummah, it must participate in protecting the environment, especially in the industrial or business field.[20] Thus, Islamic banks should be at the forefront of the implementation of green banking.

Aceh, on the basis of Qanun number 11 of 2018 concerning Islamic finance, has enforced sharia principles for all its financial institutions. Therefore, an in-depth study related to the extent to which Islamic banking in Aceh has applied the green banking theory needs to be carried out. Especially in terms of the use of intangible assets that are environmentally oriented.

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[17] Ching-Lung Huang and Fan-Hua Kung, "Environmental Consciousness and Intellectual Capital Management: Evidence from Taiwan's Manufacturing Industry."

[18] Wei Liu and Kwaku Atuahene-Gima, "Enhancing Product Innovation Performance in a Dysfunctional Competitive Environment: The Roles of Competitive Strategies and Marketbased Assets," *Industrial Marketing Management* 73, no. August 2018 (2018): 7–20, https://doi.org/10.1016/j.indmarman.2018.01.006. Beverly B. Tyler et al., "SME Managers' Perceptions of Competitive Pressure and the Adoption of Environmental Practices in Fragmented Industries: A Multi-Country Study in the Wine Industry," *Organization & Environment* 33, no. 3 (2018), https://doi.org/10.1177/1086026618803720.

[19] Azin Zahra, Huma Ayub, and Abdullah, "Impact of Green Intellectual Capital on Sustainable Green Banking: Moderating Role of Competitive Pressure," *Journal of Accounting and Finance in Emerging Economies* 8, no. 2 (2022): 251–62, www.publishing.globalcsrc.org/jafee.

[20] Hanif, Nur Wahyu Ningsih, and Fatullah Iqbal, "Green Banking Terhadap Profitabilitas Bank Umum Syariah di Indonesia," *Jurnal Ilmiah Keuangan Dan Perbankan* 3, no. 2 (2019): 2621–2447.

The research gap underlying this study can be explained as follows. First, Zahra et al.'s research examines the influence of green intellectual capital on the sustainability of green banking in aggregate in conventional banking in Pakistan, while this study examines each dimension of green intellectual capital (GHC, GSC, GRC) partially in the context of Islamic banking in Aceh which has its own sharia legal basis through Qanun Number 11 of 2018. Second, Yusoff et al.'s research focuses on the SME sector in Malaysia, so the results do not necessarily apply to the more regulated banking sector. Third, the latest study shows that the study of intellectual capital and green banking in Islamic banking is still developing and has not integrated much of the moderation variable of competitive pressure. Thus, this study fills the gap by offering new empirical evidence on how the green intellectual capital dimension affects green banking in Sharia Commercial Banks in Aceh, with competitive pressure as a moderation variable.

Based on the phenomenon described above, this study aims to test and re-analyze the extent to which the influence of green human intellectual, green structural intellectual and green relational intellectual partially on green banking in Aceh? Second, to what extent does the variable competitive pressure moderate the relationship between green human intellectual, green structural intellectual and green relational intellectual partially on green banking in Aceh?

Literature Review

Several previous studies have been conducted related to this research topic. Yusoff et al. have conducted research on elements related to green intellectual capital that contribute to business sustainability in Malaysian SMEs. From the results of the study, it was found that green structural capital and green relational capital have a positive relationship with business sustainability.[21] Furthermore, Zahra et al. conducted research with the aim of examining the effects of green intellectual capital on the sustainability of green banking by using competitive pressure as a moderation variable in a number of banks in Pakistan. Zahra's research found that green intellectual capital positively contributes to the achievement of green banking sustainability. The competitive pressure variable is able to moderate the relationship between the two variables.[22]

Research conducted by A'yuni and Muafi on Batik SMEs Paguyuban Kebon Indah. A'yuni examined the role of green human resources management in mediating the influence of green intellectual capital on competitive advantage.[23] Then Setiawan et al. also raised the topic of green banking at one of the Islamic banks in the city of Palangkaraya. The results of the study show that Islamic banks that are the object of research have applied the concept of green banking in terms of products produced, financing, cards, and portfolios.[24] It is different with Rachman who researched the

[21] Y. M. Yusoff et al., "Do All Elements of Green Intellectual Capital Contribute toward Business Sustainability? Evidence from the Malaysian Context Using the Partial Least Squares Method," *Journal of Cleaner Production* 234 (2019): 626–637, https://doi.org/10.1016/j.jclepro.2019.06.153.

[22] Zahra, Ayub, and Abdullah, "Impact of Green Intellectual Capital on Sustainable Green Banking: Moderating Role of Competitive Pressure."

[23] A'yuni and Muafi, "Pengaruh Green Intellectual Capital Terhadap Keunggulan Kompetitif Dengan Pemediasi Green Human Resource Management."

[24] H. Setiawan et al., "A Green Banking for Sustainable Development in Sharia Banking," *Annual Conference on Social Sciences and Humanities (ANCOSH 2018) - Revitalization of Local Wisdom in Global and Competitive Era*, 2018, 82–86.

influence of green banking on the profits obtained by banks. The study found that green banking applications positively affect the profits obtained by the bank, by reducing the costs incurred by the bank.[25] Recent studies also continue to expand the study of green banking in the context of Indonesian Islamic banking. Sutrisno et al. (2024) found that green credit plays a positive role in the profitability and stability of banks in Indonesia, while Widiyanti et al. mapped the performance of green banking in Islamic banks and showed that its implementation is still diverse between banks.[26] Candra Ningluthfi and Nurohman also emphasized the role of Islamic green banking in supporting the Sustainable Development Goals in Indonesia, while Widiastuti et al. through a systematic literature review highlighted that the integration of intellectual capital into the development of green Islamic finance is still a growing area and requires more empirical evidence in diverse regional contexts.

Sustainable Development

Sustainable development is a system that is interrelated and affects each other.[27] Basically, sustainable development has the concept of ensuring equitable development between generations in the present and future. According to Heal, there are at least two dimensions contained in the concept of sustainability, namely the time dimension because sustainability is none other than what will happen in the future and the dimension of interaction between the economic system and the natural resource and environmental systems.[28]

According to Hapsoro, sustainable development itself is built on three main pillars that are interconnected and mutually reinforcing: (1) *Economic growth*. Development that is able to produce goods and services continuously to maintain the continuity of the government and avoid sectoral imbalances that can damage agricultural and industrial production. (2) *Social sustainability*. An environmental sustainability system must be able to maintain stable resources, avoid exploitation of natural resources and environmental absorption functions. (3) *Environmental sustainability*. A system capable of achieving equality, the provision of social services including health, education, gender, and political accountability.

The three pillars that have been mentioned have an inseparable relationship. The relationship between the economy and society is expected to create an equitable relationship. The relationship between the economy and the environment is expected to

[25] Andry Arifian Saudi Rachman and M. H, "Green Banking and Profitability (Banks Registered on The Sri-Kehati Index in Indonesia Stock Exchange 2015 - 2019," *Turkish Journal of Computer and Mathematics Education* 12, no. 8 (2021): 473–486.

[26] S. Sutrisno and A. Widarjono, "Maqashid Sharia Index, Banking Risk and Performance Cases in Indonesian Islamic Banks," *Asian Economic and Financial Review* 10, no. 6 (2020): 639–651, https://doi.org/10.18488/journal.aefr.2020.106.639.651.

[27] M. Carmela, L. Bue, and S. Klasen, "Identifying Synergies and Complementarities Between MDGs: Results from Cluster Analysis," *Social Indikator Research* 113, no. September 2013 (2013): 647–670, https://doi.org/https://doi.org/10.1007/.

[28] A. Fauzi, *Ekonomi Sumber Daya Alam dan Lingkungan, Teori dan Aplikasi* (Gramedia Pustaka Utama, 2004).

be viable. Meanwhile, the relationship between social and the environment aims to be bearable. The three pillars will create sustainable conditions.[29]

Green Banking

Green banking has different meanings. Every researcher and organization tries to define green banking according to their understanding.[30] According to Hanif, green banking is a financial institution that prioritizes sustainability in its bank behavior.[31] From this definition, green banking can be understood as a combination of well-being, economy and society. Lako added that green banking is a bank's operational activities that are able to maintain environmental quality and provide financing to eligible customers so as not to damage the environment.[32] The negative impact of financial institution operating activities can be minimized by considering environmental aspects in business decision-making so as to help corporate social responsibility efforts and achieve sustainability.[33] According to RBI, green banking aims to make the bank's internal processes, physical infrastructure and IT as effective and efficient as possible, with the least impact on the environment.[34] Conceptually, green banking is part of a broader idea of sustainable banking, i.e. how the banking sector integrates environmental considerations into all its business processes.[35]

The impact caused by banks on the environment can be divided into two, namely the impact caused by the bank's internal (business processes within the bank) and the impact caused by external banks (bank products).[36] The adoption of green banking in the banking world not only changes bank operations but also the culture of the bank. Green banking involves guidelines and policy making for the restructuring of bank operations. Although bank operations remain the same, there is an increase in bank operational activities related to a sustainable environment.[37]

Shaumya and Arulrajah have developed 16 indicators of green banking including: environmental awareness training and education, environmental performance evaluation, environment-based reward system, saving on paper, use of energy-efficient equipment, waste/recycling management, green banking, green loans, green project financing, green company facilities, environmental credit evaluation, green branch management, green policies, green partnerships, environment-based strategic planning, Green Procurement.[38]

Green Intellectual Capital

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[29] Arief Hapsoro, N., and B. Kresensia, "Perkembangan Pembangunan Berkelanjutan Dilihat Dari Aspek Ekonomi di Indonesia," *Jurnal Arsitektur* 3, no. 2 (2020): 88–96.

[30] H. Park and J. D. Kim, "Transition towards Green Banking: Role of Financial Regulators and Financial Institutions," *Asian Journal of Sustainability and Social Responsibility* 5, no. 5 (2020): 2–25, https://doi.org/10.1186/s41180-020-00034-3.

[31] Hanif, W., and Iqbal, "Green Banking Terhadap Profitabilitas Bank Umum Syariah di Indonesia."

[32] A. Lako, *Green Economy* (Erlangga, 2015).

[33] K. Shaumya and A. Arulrajah, "Measuring Green Banking Practices: Evidence from Sri Lanka," *13th International Conference on Business Management 2016*, 2016, https://doi.org/10.2139/ssrn.2909735.

[34] I.D.R.B.T., *Institute of Development and Research in Banking Technology* (IDRBT, 2014).

[35] M. Jeucken, *Sustainability in Finance: Banking on the Planet* (The Netherlands: Eubron Academic Publisher, 2004).

[36] J. J. Bouma, M. Jeucken, and L. Klinkers, *Sustainable Banking: The Greening of Finance* (Routledge, 2017).

[37] Zahra, Ayub, and Abdullah, "Impact of Green Intellectual Capital on Sustainable Green Banking: Moderating Role of Competitive Pressure."

[38] Shaumya and Arulrajah, "Measuring Green Banking Practices: Evidence from Sri Lanka."

To achieve better performance, the industrial world must focus more on intangible assets than tangible assets.[39] The term intangible assets refers to intellectual capital.[40] In achieving company goals, intellectual capital becomes the link between the company and employee mobility.[41]

According to Stewart, intellectual capital is a number of knowledge known by every individual in a business that is an advantage of the company's competition or total capital which includes knowledge, information, technology, ownership, experience, learning and organizational competencies, team communication systems, relationships with customers and brands that are able to create value for the organization.[42] Intellectual capital is a concept about human resources and technology that is used as intangible assets. The concept of intellectual capital is important because of the decrease in the influence of fixed assets and financial assets compared to the influence of intangible assets.[43]

Intellectual capital is a concept that has different dimensions, namely experience, ability, and practical knowledge to extract value for organizations through the availability of non-physical and non-monetary resources.[44] With high consumer awareness of efforts to reduce environmental impacts and climate change, organizations are encouraged to create and find better strategies in accordance with environmental trends by integrating environmental management to improve green image.[45] Thus, more organizations behave responsibly towards green practices which is an effective step towards the development of green intellectual capital.[46]

Chen is the first researcher to carry out the concept of green intellectual capital as the total of all intangible assets owned by a company, consisting of knowledge, capabilities, and relationships associated with environmental protection and green innovation both at the individual level and at the organizational level of a company.[47] Green intellectual capital focuses on sustainability while carrying out the main role in the

[39] L. Agostini, A. Nosella, and R. Filippini, "Does Intellectual Capital Allow Improving Innovation Performance? A Quantitative Analysis in the SME Context," *J. Intellect. Cap* 18, no. 2 (2017): 400–418, https://doi.org/10.1108/JIC-05-2016-0056.

[40] R. Petty and J. Guthrie, "Intellectual Capital Literature Review: Measurement, Reporting and Management," *J. Intellect. Cap* 1, no. 2 (2000): 155–176.

[41] L. Rothenberg, *Political Economy and Public Policy* (PT Gramedia Pustaka Utama, 2003).

[42] T. A. Stewart, *Brainpower Intellectual Capital Is Becoming Corporate America's Most Valuable Asset and Can Be Its Sharpest Competitive Weapon. The Challenge Is to Find What You Have and Use It* (Fortune, 1991).

[43] L. M. Gogan et al., "The Impact of Intellectual Capital on Organizational Performance," *Procedia - Social and Behavioral Sciences* 221 (2016): 192–202.

[44] S. M. Allameh, "Antecedents and Consequences of Intellectual Capital: The Role of Social Capital, Knowledge Sharing, and Innovation," *Journal of Intellectual Capital* 19, no. 5 (2018): 858-874, https://doi.org/10.1108/JIC-05-2017-0068.

[45] Fei Chuan Chen, Zhi-Jian Liu, and Qian Long Kweh, "Intellectual Capital and Productivity of Malaysian General Insurers," *Econ. Modell* 36 (2014): 413–420, https://doi.org/https://doi.org/10.1016/.

[46] M. D. Lopez-Gamero, J. F. Molina-Azorin, and E. Claver-Cortes, "The Relationship between Managers'Environmental Perceptions, Environmental Management and Firm Performance in Spanish Hotels: A Whole Framework," *International Journal of Tourism Research* 13 (2011): 141–163.

[47] Chen, "The Positive Effect of Green Intellectual Capital on Competitive Advantages of Firms."

company, through the transfer of knowledge in accordance with regulations, technology, best practices and initiating to achieve sustainability goals believed by the company.[48]

Chen further classifies green intellectual capital into three components, namely green human capital, green structural capital and green relational capital.[49] Green human capital is the final presentation of employee knowledge, expertise, abilities, experience, behavior, wisdom, creativity, and commitment to environmental protection or green innovation.[50] Human capital is inherent in employees rather than in the organization, so it can be lost if employees leave the company.[51] According to Huang and Kung, the indicators of green human capital are that employees are involved in productivity and positive contributions related to environmental protection, employees have adequate competencies related to environmental protection, employees provide high quality products and services related to environmental protection, employees show high teamwork related to environmental protection, each manager is able to fully support employee achievements related to environmental protection.[52]

Green structural capital is a component of an organization that is described through organizational infrastructure and organizational processes aimed at obtaining goods and services.[53] Chen added that green structural capital is organizational ability, organizational commitment, knowledge management system, managerial philosophy, organizational culture, corporate image, patents, copyrights, and trademarks for environmental protection or green innovation in a company.[54] The indicators of green structural capital are that the company has a superior environmental protection management system, the company has a good ratio of environmental management employees to its total employees, the company makes adequate investments in environmental protection facilities, the entire operation process towards environmental protection in the company operates efficiently, the knowledge management system in the company supports for the accumulation and sharing of knowledge about environmental management, the company has established committees for the advancement of important issues in environmental protection, the company has established detailed rules and regulations on environmental protection, the company has established a reward system for completing environmental tasks.[55]

Green relational capital refers to the company's ability to build relationships with stakeholders and markets in a sustainable and stable environment, the ability to build individual relationships, and the ability to develop relationships on the basis of trust.[56] Indicators of green relational capital, according to Huang and Kung, are that companies

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[48] A. Firmansyah, "Pengaruh Green Intellectual Capital Dan Manajemen Lingkungan Organisasi Terhadap Green Organizational Identity Dan Dampaknya Terhadap Green Competitive Advantage," *Jurnal Substansi* 1, no. 1 (2017).

[49] Chen, "The Positive Effect of Green Intellectual Capital on Competitive Advantages of Firms."

[50] Gogan et al., "The Impact of Intellectual Capital on Organizational Performance."

[51] Chen, "The Positive Effect of Green Intellectual Capital on Competitive Advantages of Firms."

[52] Huang and Kung, "Environmental Consciousness and Intellectual Capital Management: Evidence from Taiwan's Manufacturing Industry."

[53] V. P. Ivashchenko, G. E. Dotsenko, and V. A. Petrenko, "Intellectual Capital as a Factor of Competitiveness Increasing," *Metallurgical and Mining Industry* 3 (2017).

[54] Chen, "The Positive Effect of Green Intellectual Capital on Competitive Advantages of Firms."

[55] Huang and Kung, "Environmental Consciousness and Intellectual Capital Management: Evidence from Taiwan's Manufacturing Industry."

[56] S. Rezaei et al., "The Relationship Between Green Intellectual Capital and Competitive Advantages," *International Business Management* 10, no. 20 (2016): 4742–4748.

design their products or services according to the environmental wishes of their customers, customers are satisfied with the company's environmental protection, the company's cooperative relationship with its suppliers for stable environmental protection, the company's cooperative relationship with its clients for stable environmental protection, the company's cooperative relationship with its strategic partners for stable environmental protection.[57]

Competitive Pressure

According to Kuncoro, competition occurs when organizations and individuals compete with each other to achieve the goals that have been set, either in terms of consumers, market share, survey level or resources needed.[58] How a company or industry responds to a large amount of competition will be a pressure in itself for the company. According to Lertwongsatien and Wongpinunwatana, competitive pressure is the level of competition atmosphere that occurs within the company when the company operates.[59]

The response given to competitive pressure will be different, whether it will be perceived as an opportunity or even as a threat.[60] Therefore, Sophonthummapharn defines competitive pressure as the level of intensity of competition that allows a person to perform poorly for the company.[61]

According to David, competitive pressure has several indicators, namely the threat of new entrants, competition among competitors, the bargaining power of suppliers, the bargaining power of buyers, the threat of substitute products.[62]

Sharia Commercial Banks

Islamic banks are often also called Islamic banks. The initiative to establish Islamic banks in Indonesia began in 1980 through a discussion on the theme of Islamic banks as a pillar of Islamic economics. To be precise, Islamic banks emerged after Law No. 7 of 1992, which was revised by Banking Law No. 10 of 1998, in the form of a bank that operates with a profit-sharing system or Islamic bank.[63]

Islamic banks were born as one of the alternative solutions to the debate between bank interest and usury. According to Sjahdeiny, Islamic banks are financial institutions that function as intermediaries, namely collecting funds from the community and

[57] Huang and Kung, "Environmental Consciousness and Intellectual Capital Management: Evidence from Taiwan's Manufacturing Industry."

[58] Mudrajad Kuncoro, *Strategi Bagaimana Meraih Keunggulan Kompetitif* (Erlangga, 2005).

[59] Chonlawit Lertwongsatien and Nitaya Wongpinunwatana, "E-Commerce Adoption in Thailand: An Empirical Study of Small and Medium Enterprises (SMEs," *Journal of Global Information Technology Management* 6, no. 3 (2003): 67–83.

[60] Liu and Atuahene-Gima, "Enhancing Product Innovation Performance in a Dysfunctional Competitive Environment: The Roles of Competitive Strategies and Marketbased Assets."

[61] Kitipong Sophonthummapharn, "The Adoption of Techno-Relationship Innovations," *Marketing Intelligence & Planning* 27, no. 3 (2009): 380–412, https://doi.org/10.1108/02634500910955254.

[62] Fred R. David, *Strategic Management A Competitive Advantage Approach, Concepts and Cases*, 16th ed. (Pearson Education, 2017).

[63] Setia Budi Wilardjo, "Peran dan Perkembangan Bank Syariah di Indonesia," *Value Added* 2, no. 1 (2005): 1–10.

redistributing them to the needy community in the form of interest-free financing on the basis of Islamic sharia principles.[64]

According to Abdurahman, the purpose of Islamic banks is to direct the economic activities of the people to be converted in Islam, to create justice in the economic field, to improve the quality of life of the people, to overcome the problem of poverty, to maintain monetary economic stability.[65]

Sharia Commercial Banks (BUS) in Indonesia whose business activities are based on sharia principles, consisting of PT. Bank Aceh Syariah, PT. BPD Nusa Tenggara Barat Syariah, PT. Bank Muamalat Indonesia, PT. Bank Victoria Syariah, PT Bank BRI Syariah, PT. Bank Jabar Banten Syariah, PT. Bank BNI Syariah, PT. Bank Syariah Mandiri, PT. Bank Mega Syariah, PT. BCA Syariah, PT. Bank Panin Dubai Syariah, PT. Bank Syariah Bukopin, PT. Bank Tabungan Pensiunan Nasional Syariah, PT. Maybank Syariah Indonesia and PT Bank Syariah Indonesia.

Hipotesis

The hypothesis of this research is as follows:

H01 : Green Human Capital has no significant effect on green banking.

Ha1: Green Human Capital has a significant effect on green banking.

H02: Green Structural Capital has no significant effect on green banking.

Ha2: Green Structural Capital has a significant effect on green banking.

H03 : Green Relation Capital has no significant effect on green banking.

Ha3 : Green Relation Capital has a significant effect on green banking.

H04 : Competitive Pressure is not able to moderate the relationship between Green Human Capital and green banking.

Ha4: Competitive Pressure is able to moderate the relationship between Green Human Capital and green banking.

H05 : Competitive Pressure is not able to moderate the relationship between Green Structural Capital and green banking.

Ha5 : Competitive Pressure is able to moderate the relationship between Green Human Structural and green banking.

H06 : Competitive Pressure is not able to moderate the relationship between Green Relation Capital and green banking.

Ha6 : Competitive Pressure is able to moderate the relationship between Green Relation Capital and green banking.

METHODS

This research is a type of field research that uses a mixed methods approach. The mixed methods approach is also called a combination approach that combines qualitative methods and quantitative methods for the purpose of more comprehensive, valid, reliable and objective data.[66]

A qualitative approach was carried out to analyze the typology of green banking in Islamic commercial banks in Aceh. In this section, data collection was carried out by interviewing all key informants who were determined based on purposive procedures based on the criteria needed by the researcher. The data that had been collected was

[64] Sutan Remy Sjahdeini, *Islamic Banking* (PT Pustaka Utama Graffiti, 2007).

[65] Warkum Sumitro, *Azaz-Azaz Perbankan Islam Dan Lembaga-Lembaga Terkait Bumi Dan Takaful Indonesia* (PT Grafindo Persada, 2006).

[66] Sugiyono, *Metode penelitian kombinasi (Mixed Methode* (Alfabeta, 2015).

explained by a descriptive method and a comparison was made between the theory revealed on the theoretical basis with the facts that apply at the research site. Further assessment was carried out to see the extent of the bank's achievements in the application of green banking aspects so that it could be decided later on the green banking typology that applies to the bank.

Meanwhile, the quantitative method is used to measure the causality and significance of the influence between exogenous and endogenous variables and the role of the moderator variable. Data collection is carried out using a questionnaire that is distributed to all respondents/research samples. The questionnaire is a formulation of a number of questions/written statements that will be answered by the respondents.[67] The questionnaire in this study was made in google form format to facilitate its dissemination. The researcher will visit the predetermined research location directly and distribute the questionnaire via whatsapp or other supporting applications. The respondents then return the questionnaire that has been answered according to the predetermined time limit.

The questionnaire measurement was carried out on the Likert scale. The Likert scale is used to measure the attitudes, opinions, opinions or perceptions of respondents regarding social events or phenomena. On the Likert scale, the variables to be measured must first be described into variable indicators. Next, a number of statements are made based on these indicators. Each statement is given an alternative with a score of value. This is intended to make it easier to manage and analyze the data that comes in from respondents. The score is based on 5 alternative responses/answers, namely 1 for strongly disagree responses, 2 for disagree responses, 3 for disagree responses, 4 for agrees and 5 for strongly agree responses.

Meanwhile, the population in this study is all employees of Sharia Commercial Banks in Aceh whose exact number is unknown. Population is a complete group of elements which are usually in the form of people, transaction objects and events that the researcher is interested in studying and making them as research objects.[68] While samples are a subset of population units. The number of samples in this study was determined using the Cohnran formula because the number of populations is not known for sure. The sampling technique is carried out by the convinience sampling method. The technique is a sample determination based on chance where the population members met by the researcher are willing to be respondents or used as samples.[69]

After the data is collected, data analysis is then carried out using the Partial Least Square (PLS) approach with the help of SmartPLS 3.3.3 software. PLS is a multivariate statistical technique that compares multiple exogenous variables with multiple endogenous variables. Obtaining latent variable relationships and predicting construct structural indicators is the goal of PLS. PLS does not assume a specific distribution for parameter estimation, so parametric techniques to test parameter significance are not required. The PLS evaluation model is based on non-parametric predictions.[70]

[67] Uma Sekaran, *Metode penelitian untuk bisnis*, 4th ed. (Salemba Empat, 2006).

[68] Mudrajad Kuncoro, *Metode riset untuk bisnis dan ekonomi*, 3rd ed. (Erlangga, 2009).

[69] Bambang Trianto, *Modeling Research (Second)* (Ad-Dhuha Institute, 2016).

[70] Imam Ghozali, *Aplikasi analisis multivariat dengan menggunakan SPSS* (Badan Penerbit UNDIP, 2014).

The data analysis technique in more detail includes the following three stages: (1) *Descriptive Statistics*. Descriptive statistics aim to analyze data based on respondents' answers through questionnaires reviewed from mean values, standard deviation, maximum, minimum, sum, range, kurtosis and skewness.[71] (2) *Measurement Method or Outer Model*. The measurement model or often called the outer model aims to assess the level of validity and reality of a number of statements in a questionnaire, so that the data obtained is valid and reliable. The measurement model consists of validity tests (convergent and discriminant) and reliability tests (composite and cronbach's alpha).[72] (3) *Structural Model or Inner Model*. Structural or inner model describes the relationship or strength of estimation based on substantive theory between latent variables or constructs. Structural models consist of R-Square, Q-Square Predictive Relevance, Quality Index, and Boostrapping.[73]

RESULTS

This research involved as many as 200 employees of Sharia Commercial Banks operating in Aceh as respondents. The banks involved included Bank Syariah Indonesia (BSI), Bank Aceh Syariah, Bank Muamalat, Bank Tabungan Pensiunan Nasional Syariah (BTPNS), Bank Syariah Nasional, Bank Mega Syariah, and Bank Central Asia Syariah (BCAS). Based on the data collected, as many as 58% of respondents were male and 42% were female. In terms of age, 51% of respondents were 31-40 years old, 39% were 21-30 years old, and the rest were over 40 years old. In terms of education, the majority of respondents (57%) had a bachelor's degree (S1), 14% had a diploma education (D-III), and the rest had postgraduate education (S2).

Regarding the knowledge and application of the concept of green banking, as many as 41% of respondents stated that they had heard about green banking studies, 24% stated that they had implemented green banking in their workplaces, 14% stated that they understood green banking in theory, 13% stated that they did not know, and 8% stated that they often heard about the study. This picture shows that the understanding and application of green banking among employees of Sharia Commercial Banks in Aceh still needs to be improved in a more massive and structured manner.

Validity and Reliability Test (Outer Model)

This research questionnaire initially consisted of 54 statements covering all research variables. After the validity test was carried out, as many as 12 statements were declared invalid because they had an outer loading value below 0.70 so they had to be excluded from the analysis. Thus, only 42 statements were valid and used in the next test.

The results of the convergent validity test showed that all remaining indicators were eligible with an outer loading value of > 0.70 and an Average Variance Extracted (AVE) value of > 0.50, as seen in Table 1. The AVE value for the Competitive Pressure (CP) variable was 0.717; Green Banking (GB) was 0.683; Green Human Capital (GHC) was 0.630; Green Relation Capital (GRC) was 0.724; and Green Structural Capital (GSC) was 0.695. All AVE values have exceeded the minimum threshold of 0.50 required.[74]

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[71] Imam Ghozali, *Struktural Equation Modling metode alternatif dengan Particial Least Square* (Badan Penerbit UNDIP, 2008).

[72] Imam Ghozali, *Struktural Equation Modling metode alternatif dengan Particial Least Square*.

[73] Imam Ghozali, *Struktural Equation Modling metode alternatif dengan Particial Least Square*.

[74] Claes Fornell and David F. Larcker, "Evaluating Structural Equation Models with Unobservable Variables and Measurement Error," *Journal of Marketing Research* 18, no. 1 (1981), https://doi.org/10.1177/002224378101800104.

Table 1. Construct Validity and Reliability Test Results

Variabel	Cronbach's Alpha	rho_A	Composite Reliability	AVE
CP	0.934	0.940	0.946	0.717
GB	0.964	0.967	0.968	0.683
GHC	0.915	0.921	0.931	0.630
GRC	0.944	0.947	0.954	0.724
GSC	0.889	0.897	0.919	0.695

Source: SmartPLS Data Processing, 2025

The reliability test showed that all the study variables had a Cronbach's Alpha value of > 0.70 and a Composite Reliability value of > 0.70, which means that the entire construct had an excellent level of reliability. The Composite Reliability value for the CP variable reached 0.946; GB was 0.968; GHC was 0.931; GRC was 0.954; and GSC was 0.919. These results show that the research instruments used are consistent and trustworthy.

The discriminant validity test was carried out through the Fornell-Larcker criteria and the HTMT (Heterotrait-Monotrait Ratio) ratio. The results showed that the AVE square root value of each variable was greater than the correlation between other constructs. The HTMT ratio value between the study variables was also below 0.90, which confirmed that each construct was conceptually different from the other constructs.

Inner Model Test

The R-Square (R^2) value for the Green Banking (GB) variable is 0.840, which indicates that 84.0% of the variance of the GB variable can be explained simultaneously by the variables GHC, GSC, GRC, CP, as well as the moderation interaction variables. The adjusted R^2 value of 0.821 confirms the high predictive power of the model. The Q^2 (predictive relevance) value for the GB variable of 0.555 indicates that the model has substantial predictive relevance.[75]

The results of the model fit test showed an SRMR value of 0.088 which was below the threshold of 0.10, so that the model could be declared fit and suitable for further hypothesis testing.

Hypotesis Test (Path Coefficients)

Hypothesis testing was carried out through a bootstrapping procedure using SmartPLS 3.0. The results of the path coefficients test are presented in Table 2 below.

Table 2. Path Coefficients Test Results

Variable Relationships	Koef. Pathway	Sample Mean	Std. Deviation	t Statistics	Values
CP → GB	0.077	0.095	0.085	0.901	0.368
GHC → GB	-0.008	-0.012	0.124	0.067	0.947
GRC → GB	0.257	0.248	0.158	1.632	0.103
GSC → GB	0.632	0.650	0.157	4.034	0.000***
Mod_GHC_CP → GB	-0.125	-0.161	0.162	0.777	0.438
Mod_GRC_CP → GB	-0.417	-0.378	0.198	2.102	0.036**
Mod_GSC_CP → GB	0.494	0.473	0.209	2.365	0.018**

Description: *** p < 0.001; ** p < 0.05

Source: SmartPLS Data Processing, 2025

[75] Joseph F. Hair et al., *Multivariate data analysis*, 8th ed. (Cengage, 2019).

DISCUSSION

Based on the results of hypothesis testing as presented in Table 2 above, this study produced several important findings that will be described in detail below.

Green Human Capital vs. Green Banking

The test results showed that Green Human Capital (GHC) had no significant effect on Green Banking (GB) with a path coefficient of -0.008 and a p value of 0.947 ($p > 0.05$). Thus, H1 stating that GHC had a significant effect on GB was rejected.

These findings indicate that the environment-based human capital owned by Sharia Commercial Bank employees in Aceh including individual knowledge, skills, behaviors, and commitment to the environment has not been directly able to significantly encourage the implementation of green banking at the institutional level. This phenomenon can be interpreted that even though employees have good environmental awareness and commitment individually, it is not enough to drive green banking transformation without adequate organizational system and infrastructure support. This finding is in line with the argument of Yusoff et al. who stated that green human capital does not always have a direct impact on business sustainability, but rather requires strong institutional support. On the other hand, these results differ from the research of Zahra et al. in Pakistan which found a significant positive influence of green intellectual capital in aggregate on the sustainability of green banking. This difference can be explained through the cultural context and characteristics of Islamic banking in Aceh which have its own peculiarities, where the implementation of green banking is driven more by institutional systems and regulations than by individual capacity.

Green Structural Capital terhadap Green Banking

The test results showed that Green Structural Capital (GSC) had a positive and significant effect on Green Banking (GB) with a path coefficient of 0.632 and a p value of 0.000 ($p < 0.001$). Thus, H2 stating that GSC had a significant effect on GB was accepted. The value of the GSC path coefficient was the highest among all predictor variables, indicating that the environmentally oriented organizational structure was the most dominant factor in encouraging the realization of green banking in Sharia Commercial Banks in Aceh.

These findings show that the existence of an integrated environmental management system, a firm environmental policy, a special committee that handles environmental issues, an environmental performance-based reward system, and investment in facilities and processes that support environmental protection are the main foundations that are clearly able to encourage the implementation of green banking. These results reinforce the theory put forward by Chen that green structural capital represents organizational capabilities and institutional commitment to green innovation. These findings are also in line with Zahra et al. and Huang & Kung who affirm that structured organizational systems and processes to support environmental protection significantly contribute to the sustainability of financial institutions. In the context of Islamic banking in Aceh, regulatory support through Qanun Number 11 of 2018 concerning Islamic Finance provides a strong foundation for banks to improve their structural systems to meet the principles of sustainability. The findings of this dominant structural role are also in line with the recent evidence on Islamic banking in OIC countries, where intellectual capital

particularly structural and relational dimensions contributes significantly to the stability and performance of banks when supported by adequate governance mechanisms.[76]

Green Relation Capital terhadap Green Banking

The test results showed that Green Relation Capital (GRC) had no significant effect on Green Banking (GB) with a path coefficient of 0.257 and a p value of 0.103 (p > 0.05). Thus, H3 stating that GRC had a significant effect on GB was rejected.

Although the GRC line coefficient value shows a positive direction (0.257), the relationship is not statistically significant. This result can be interpreted as the bank's ability to build and maintain environment-based relationships with stakeholders including customers, suppliers, and strategic partners is still in the development stage and is not strong enough to directly influence green banking practices as a whole. This finding is different from Yusoff et al. who found a positive relationship between green relational capital and business sustainability in Malaysian SMEs. This difference can be caused by the difference in context between the SME sector and the more regulated banking sector, as well as the immature green financing ecosystem among partners and customers of Islamic banks in Aceh.

Competitive Pressure (CP) terhadap Green Banking (GB)

The test results showed that Competitive Pressure (CP) did not have a significant direct effect on Green Banking (GB) with a path coefficient of 0.077 and a p-value of 0.368 (p > 0.05). These findings indicate that competitive pressure between banks does not directly encourage the implementation of green banking. However, the role of CP as a moderation variable has actually proven to be significant in several relationships, as discussed in the following sub-section.

The Role of Competitive Pressure Moderation in the Relationship between GSC and Green Banking

The test results showed that Competitive Pressure (CP) significantly moderated the relationship between Green Structural Capital (GSC) and Green Banking (GB) with a moderation coefficient of 0.494 and a pvalue of 0.018 (p < 0.05). Thus, H5 was accepted. The direction of the positive coefficient indicated that competitive pressure strengthened the positive influence of GSC on the implementation of green banking.

These findings show that when Sharia Commercial Banks in Aceh face higher competitive pressures, environmentally oriented organizational systems and structures will be more effective in encouraging the implementation of green banking. This means that competitive dynamics encourage banking institutions to strengthen their green policies, procedures, and management systems as a differentiation and competitive advantage. These findings are in line with Zahra et al. who stated that competitive pressure is able to moderate the relationship between green intellectual capital and the sustainability of green banking in Pakistan. In the context of Aceh's Islamic banking, the increasing intensity of competition encourages banks to increasingly seriously internalize sustainability practices into their organizational structures.

The Role of Competitive Pressure Moderation in the Relationship between GRC and Green Banking

[76] Muhammad Aslam and Razali Haron, "Corporate Governance, Risk Management, and Profitability of Islamic Banks," *International Journal of Islamic and Middle Eastern Finance and Management* 13, no. 4 (2020): 587–603, https://doi.org/10.1108/IMEFM-11-2018-0371.

The test results showed that Competitive Pressure (CP) significantly moderated the relationship between Green Relation Capital (GRC) and Green Banking (GB) with a moderation coefficient of -0.417 and a p-value of 0.036 ($p < 0.05$). Thus, H6 was accepted. However, the direction of moderation was negative, which means that competitive pressure actually weakened the influence of GRC on green banking.

This finding is one of the original contributions of the research that is interesting and has not been widely documented in the previous literature. This negative moderation effect can be explained through several arguments. First, under high competitive pressure, banks tend to prioritize strengthening internal systems and short-term profitability rather than building environment-based external relationships that require more time and resources to produce real impact. Second, fierce competition can encourage banks to focus more on financially profitable customer segments without giving too much consideration to the green relationship aspect. Third, competitive pressures can distort banks' strategic priorities so that environment-based relationships with stakeholders become less prioritized. These findings open up new discussion spaces that need to be further elaborated in future research.

The Role of Competitive Pressure Moderation in the Relationship between GHC and Green Banking

The results of the last test showed that Competitive Pressure (CP) did not significantly moderate the relationship between Green Human Capital (GHC) and Green Banking (GB) with a moderation coefficient of -0.125 and a pvalue of 0.438 ($p > 0.05$). Thus, H4 was rejected.

The insignificance of CP moderation in the GHC–GB relationship can be explained by the argument that the capacity and commitment of the employee environment are internal and intrinsic, so that they are not directly affected by the dynamics of external competition. Competitive pressures are more effective in influencing the structural and relational dimensions than the human capital dimension. This indicates that in order to bridge the individual capacity of employees with the impetus of competition to jointly encourage green banking, more systematic and programmatic interventions are needed, such as intensive training, green certification programs, and ongoing internal socializatio

CONCLUSION

This study aims to analyze the influence of Green Intellectual Capital which includes Green Human Capital (GHC), Green Structural Capital (GSC), and Green Relation Capital (GRC on Green Banking (GB) in Sharia Commercial Banks in Aceh, with Competitive Pressure (CP) as the moderation variable. Based on the results of testing 200 respondents using PLS-SEM analysis through SmartPLS, several important conclusions can be formulated as follows.

First, Green Human Capital (GHC) does not have a significant effect on Green Banking, indicating that the capacity and environmental commitment of individual employees has not been able to directly encourage green banking transformation at the institutional level. Second, Green Structural Capital (GSC) has proven to have a positive and significant effect on Green Banking with the highest path coefficient value (0.632; $p < 0.001$), making it the most dominant and critical factor in the implementation of green banking in Aceh Sharia Commercial Bank. Third, Green Relation Capital (GRC) does not have a significant effect on Green Banking, indicating that relationships with

environmentally-based stakeholders are still in the development stage and have not yet produced a measurable impact on green banking practices.

Fourth, Competitive Pressure (CP) does not have a significant direct effect on Green Banking, but has been shown to play an important role as a moderation variable. Fifth, CP significantly amplifies the positive influence of GSC on GB (coefficient = 0.494; p = 0.018), suggesting that competitive pressure encourages banks to maximize environmentally friendly organizational systems and structures as a competitive advantage. Sixth, CP significantly weakens the influence of GRC on GB (coefficient = -0.417; p = 0.036), which is a unique finding suggesting that competitive pressures actually inhibit the effectiveness of environmentally-based relational capital in encouraging green banking. Seventh, CP does not significantly moderate the relationship between GHC and GB.

For the management of Sharia Commercial Banks in Aceh, the finding that GSC is the most dominant factor provides a clear direction for management to prioritize strengthening the internal environmental management system. Banks need to develop green banking policies that are explicitly stated in the standard operating procedures (SOPs), establish special committees or divisions responsible for sustainability implementation, and establish a reward system that encourages employees to actively contribute to environmental achievements. In addition, banks also need to take advantage of the dynamics of competition as a momentum to strengthen the internal green system.

For Regulators and Financial Services Authorities (OJK), this study recommends the need to strengthen regulations related to green banking that are more operational and measurable for Islamic Commercial Banks. OJK needs to set minimum standards for the implementation of green banking that include structural aspects, ranging from policies, management systems, to integrated environmental performance reporting systems. Firm regulatory support will encourage banks to not only meet minimum requirements, but also innovate in the development of green banking products and services.

For the Government of Aceh, in the context of Aceh's privileges based on sharia principles, the government can integrate the principles of green banking into the framework of Islamic finance Qanun. The synergy between the principles of Maqashid al-Syariah which emphasizes nature protection (hifdzul bi'ah) and the concept of green banking need to be strengthened through technical regulations that encourage Islamic banks to become pioneers of sustainable banking.

For academics, this study provides a theoretical contribution by confirming that the green intellectual capital component does not function homogeneously in encouraging green banking; each dimension has a different role and dynamics. The findings on the negative moderation effect of CP on the GRC-GB relationship open up new discussion spaces in the green banking literature that need to be explored further.

This study has a number of limitations that need to be considered. First, this study only involved 200 respondents from the employees of Sharia Commercial Banks in Aceh, so generalization of the findings needs to be done with caution. Future research is suggested to expand the sample to include more respondents from various regions in Indonesia, including Bank Perkreditan Rakyat Syariah (BPRS) and non-bank Islamic financial institutions.

Second, this study uses a questionnaire-based survey method that relies on the subjective perception of respondents. Future research can combine a quantitative approach with objective data from the bank's sustainability report to get a more comprehensive picture. Third, the design of this study is cross-sectional and only takes a picture at one point in time. Longitudinal research will provide a deeper understanding of the dynamics of the development of green banking as regulations and competition intensity change.

Fourth, the green intellectual capital variables in this study only include three dimensions (GHC, GSC, GRC). Future research can expand the model framework by including mediation variables such as green innovation, green organizational culture, or corporate environmental commitment to gain a more complete understanding of the linking mechanism between green intellectual capital and the implementation of green banking. Fifth, following the recommendations of the latest systematic literature review (Widiastuti et al., 2026), future research can also integrate corporate governance variables as mediators or additional moderators, given their proven significant role in the relationship between intellectual capital and the performance of Islamic banks in various countries.

Author Contributions

Nanda Safarida, Alfian, Zubir: Contribute to formulating research ideas, collecting data, processing data, and interpreting data

Nanda Safarida, Zubir: Contributing to writing systematics, researchmethods, analysing interpretation results.

Rini Meliana, Azka Nur Diana, Hairul Azrin Haji Besar: Contribute to the language editing and proofreading..

Acknowledgements

The author is grateful to those who helped in the completion of this article, especially during the data collection process and article review.

Declaration of Competing Interest

The author declares that there is no conflict of interest.

Ethical Approval

Ethical approval No patient-identifying parts in this paper were used or known to the authors. Therefore, no ethical approval was requested.

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