



POTENTIAL AND READINESS TO PARTICIPATE IN HIGH-INTEGRITY FOREST CARBON MARKET IN SON LA PROVINCE, VIETNAM

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Abstract. This study evaluates the potential and readiness of Son La province to participate in the high-integrity forest carbon market (HIFCM). Utilizing a Multi-Criteria Analysis (MCA) framework, the research employs 44 specific indicators across three core pillars encompassing institutional, technical, and social dimensions aligned with international carbon standards and local implementation realities. Results indicate significant project potential, with approximately 86,000 hectares eligible for afforestation/reforestation (AR) and 59,000 hectares for REDD+ initiatives. The province achieved an overall readiness score of 0.54, placing it in the preparatory phase. While the institutional pillar is relatively advanced (0.6), significant bottlenecks remain in the technical (0.48) and social (0.46) dimensions. To enhance readiness, policy recommendations focus on establishing a common domestic carbon reserve mechanism and improving local technical capacity for scientific baseline monitoring. Socially, the province must prioritize transparent benefit-sharing frameworks and substantive community engagement to ensure long-term sustainability. These findings provide a strategic roadmap for local authorities to align with Vietnam's Net Zero 2050 commitments and international integrity requirements.

Keywords: high-integrity forest carbon markets, readiness, potential, Son La

1. Introduction

More than 18 percent of the global anthropogenic CO₂ emissions originate from land-use sectors particularly forestry [1]. Simultaneously, enhancing carbon sinks, and reducing deforestation are vital strategies for mitigating climate change and boosting ecological resilience. It means that forests and forest ecosystems play a dual role in not only sequestering greenhouse gases but also protecting the habitats of millions of species, and providing essential services such as watershed protection, soil erosion prevention, and livelihood support [1].

Vietnam possesses significant forest resources, with approximately 42% of its land area covered by forests. Despite substantial reductions in illegal deforestation (51%) and forest fires (77%) between 2015 and 2024, the country still faces persistent conservation challenges [2], [3]. Forest carbon markets have emerged as a valuable mechanism to promote conservation while improving local livelihoods. This is evidenced by the national scale-up of pilot initiatives like Reduction of Emissions from Deforestation and Forest Degradation (REDD+) which has been implemented in provinces such as Son La since 2017 [4], [5].

Despite the growing interest in carbon forestry, a significant research gap remains in understanding the systemic "readiness" of sub-national entities to transition from traditional forest management to more rigorous international standards. Most existing literature focuses on macro-level policy frameworks or purely technical carbon stock estimations, often overlooking the integrated institutional, technical, and social readiness required for localized implementation.

Son La province provides a representative yet unique case study for addressing this gap. As the third-largest province in Vietnam by forest area, it plays a critical ecological role in national energy security by providing watershed protection for major hydropower projects along the Da River [6]. Furthermore, the forest ecosystem is fundamentally important to the socio-economic stability of the region, directly supporting the livelihoods of approximately 85% of the province's rural population [6]. The province's social fabric is particularly distinctive, with ethnic minority groups comprising approximately 83.6% of the population [7]. This demographic complexity makes Son La an ideal model for evaluating the "social pillar" of carbon markets, specifically regarding transparent benefit-sharing and substantive community engagement—areas where many international REDD+ projects have historically struggled. Son La has experience with Payment for Forest Environmental Services (PFES) and REDD+ action plans, such as an action plan for REDD+ for the period 2017–2020 with a vision to 2030, and formulated a pilot project on forest carbon credit (FCC) trading in 2023 [4], [6]. These actions create a crucial foundation for Son La's future participation in high-integrity forest carbon markets. However, it still faces significant bottlenecks in monitoring, reporting, and verification (MRV) capacity and local legal alignment with international requirements, while the high-integrity forest carbon market (HIFCM) is a rapidly growing trend due to the reliability and transparency of FCC [8].

It can be seen that participation in HIFCM depends on not only forest area or carbon absorption potential but also requires a synchronized and ready institutional, technical, and

social system [9]. Therefore, this study contributes to the academic literature by developing a Multi-Criteria Analysis (MCA) framework comprising 44 indicators based on the Core Carbon Principles (CCP). By bridging the gap between international integrity standards and provincial-level realities, this research provides a strategic roadmap for local authorities to align with Vietnam's Net Zero 2050 commitments and international HIFCM requirements and aiming towards sustainable carbon finance development.

2. Materials and methods

2.1. Study area

Son La, a hilly province with a total natural area of 1,410,983 hectares (ha), is situated in the northwest region of Vietnam. Forest resource data, compiled up to the end of 2024, indicate that the total forest area in Son La Province reached 748,758.7 ha, which constitutes 53.1% of the province's total natural land mass. Consequently, the official forest cover rate for the region was documented as 47.6% [10]. The documented forest area is further categorized by type: natural forests constitute the largest proportion at 591,687.1 ha, while planted forests cover 79,909.2 ha. Additionally, 77,162.37 ha of land are officially designated for forestry use but remain unforested at the time of reporting.

The demographic composition of the province is characterized by a significant concentration of ethnic minority groups with approximately 80% of the total population [7]. The principal ethnic minority communities identified within the region include the Thai, Hmong, Dao, and Muong, alongside several other smaller groups [7]. This high proportion underscores the area's ethno-cultural complexity, which is an important consideration for studies related to forest management and participate in HIFCM. The livelihood of local communities in the study area is primarily predicated upon traditional subsistence agriculture, augmented by the harvesting of non-timber forest products such as bamboo shoots, medicinal plants, and honey [1].

2.2. Theoretical and analytical framework

2.2.1. Theoretical framework

Vietnam currently is in the process of building rules or regulations pertaining to the issuing of FCC, and the country's current FCC transfer schemes are being carried out in accordance with international standards. Successful forest carbon credit projects demonstrate that to facilitate the issuance of FCC, forestry projects must undergo formal registration and

receive validation and verification in accordance with international standards, most notably the Clean Development Mechanism (CDM), the Gold Standard (GS), and the Verified Carbon Standard (VCS), which collectively account for approximately 98.7% of all registered projects globally that were synthesized from seven international standards [11], [12], [13]. Therefore, the main criteria of the three standards, CDM, GS, and VCS, as mentioned in Table 1, were used to evaluate the potential of AR projects and REDD+ programs.

Table 1. Main criteria applied to assess the potential of FCC projects

Criteria	AR projects	REDD+ program
Type of the forest	At the time the FCC project commenced, there was no forest/no forest cover for 10 years.	Primary forests, secondary forests, or agroforestry systems meet the definition of "forest".
Status of the forest	Forests are degraded, depleted, abandoned, and hills are barren.	The forest is threatened with loss/degradation. The land has been classified as "forest" for at least 10 years prior to the project start date.
Additionality	Without the FCC project, this project would not be possible.	Without the FCC project, this project would not be possible.

Source: [14], [15], [16], [17]

The CCPs, established by the Integrity Council for the Voluntary Carbon Market in 2024 [18], represent the definitive framework for ensuring the high integrity of carbon credits. According to the ICVCM, carbon credits must adhere to these principles to guarantee transparency, additionality, and sustainability [8]. The framework is systematically structured into three core pillars—governance, emission impact, and sustainable development—which align with the institutional, technical, and social dimensions of carbon market readiness. Furthermore, Kingsly (2024) [9] investigated the roadmap for carbon market readiness, asserting that such preparedness transcends mere technical proficiency to encompass the capacity for rapid adaptation to emerging policies and technological innovations. His study introduced a systematic assessment framework comprising 22 indicators with 48 parameters organized within five readiness dimensions; however, these metrics primarily prioritize policy,

legal, and institutional capacities, leaving broader social dimensions less emphasized. Conversely, the research by Roy and Bhan (2024) [19] on forest carbon mechanisms underscores the necessity of establishing social principles as a fundamental requirement for achieving high-integrity forest carbon markets. They argue that addressing socio-economic requirements and local community needs is essential to ensure that market-based instruments deliver sustainable, long-term benefits for both climate action and human well-being.

Therefore, this study used a set of 44 indicators developed from CCP criteria combined with experience from REDD+ readiness studies [9], [19], [20] as mentioned in Table 2 and combined with the method of MCA, studied by Mai et al. (2020) [20]. It is particularly effective for evaluating the readiness to participate in HIFCM within the specific context of Vietnam, as it enables the systematic quantification of qualitative factors derived from localized implementation practices, as in Son La province. This approach is instrumental in bridging the gap between rigorous international carbon standards and the socio-technical realities found at the provincial level.

Table 2. Set of indicators to assess the readiness to participate in HIFCM

Dimension		Symbol	Indicator	Grading scale
Governance (Institution)	Effective governance	T1	Board of Directors	1. No
		T2	Annual Report Publication Platform	2. Planning
				3. Constructing
				4. Pilot operation
				5. Official operation
T3	Local Stakeholder Consultation	1. No 2. Disclosure with mandatory		
T4	Global Stakeholder Consultation	3. Disclosure with voluntary		
T5	Complaint Resolution	1. No 2. No know 3. Yes		
				1. No 2. Yes but no public 3. Public

			1. No
	T6	Participation in IP&LC Complaint Resolution	2. Participation with mandatory 3. Participation with voluntary
Monitoring carbon	T7	Registration System	1. No
	T8	Credit granting/cancellation /compensation process	2. Planning 3. Constructing 4. Pilot operation 5. Official operation
Transparent information	T9	Data and Information Evaluation for Project Document Writing	1. No 2. Yes
	10	Platform for Public Disclosure of Project Document Writing	1. No 2. Planning 3. Constructing 4. Pilot operation 5. Official operation
Verification/assessment by a third independent party	T11	Approved verification/validation body (VVB)	1. No 2. Yes
	T12	VVB Capabilities	1. No 2. Yes
Emission impact (Technique)	K1	Legal regulations for carbon credit issuance	1. No 2. Yes but no clear 3. Clear
	K2	Prior consideration	1. No 2. Yes
	K3	REDD+ plan	1. No 2. Yes, but just submitted to the government/investors.

			3. Yes, but submitted for registration/issuance
	K4	Estimated revenue from REDD+	1. No 2. Medium 3. High
	K5	The permanence of FCC projects	1. No 2. Yes
	K6	Establish a common carbon reserve for the REDD+	1. No 2. Planning 3. Constructing 4. Pilot operation 5. Official operation
Permanent	K7	Compensation for reversal	1. No 2. Planning 3. Constructing 4. Pilot operation 5. Official operation
	K8	Minimum monitoring time	1. 40 years 2. End of the credit period 3. Both, whichever comes first.
	K9	Approval of new/amended methods	
Accurately quantify the amount of emission reduction/elimination	K10	Method removal/revocation process	1. No 2. Yes
	K11	Method updates	
	K12	Definition of carbon credits	
	K13	Credit period	1. No 2. Apply according to

			international standards
			3. Yes
		K14	Credit extension period
		K15	Uncertainty
		K16	Conservative quantity of tCO ₂
		K17	Emission sources and boundaries
		K18	Baseline, project activity and leakage method
		K19	Monitoring method
		K20	Registration standard
	No duplicates	K21	National goals
		K22	Credits cancelled
Sustainable development (Society)	Benefits and protection of sustainable development	X1	Ensuring FPIC

	X2	Working Conditions	1. No safety 2. Less 3. Safety 4. Very safe
	X3	Equality to workers	1. No 2. Medium 3. Equality 4. Very equal
	X4	Protecting workers	
	X5	Ensuring human rights	1. No
	X6	Gender equality	2. Medium
	X7	Sharing benefits with IP&LC	3. Good 4. Very good
	X8	Transparent benefit sharing	
	X9	Reporting on Cancun assurance measures for REDD+	1. No 2. Building 3. Yes
Contributing to net zero emissions for the nation	X10	Contributing to net zero emissions	1. No 2. Not know 3. Yes

Source: [18]

2.2.2. Analytical framework

To systematically assess the potential and the readiness of Son La Province to participate in HIFCM, this study develops an analytical framework that bridges the gap between international integrity requirements and provincial implementation realities. This framework conceptualizes readiness as a synchronized system of institutional, technical, and social dimensions necessary for successful market engagement.

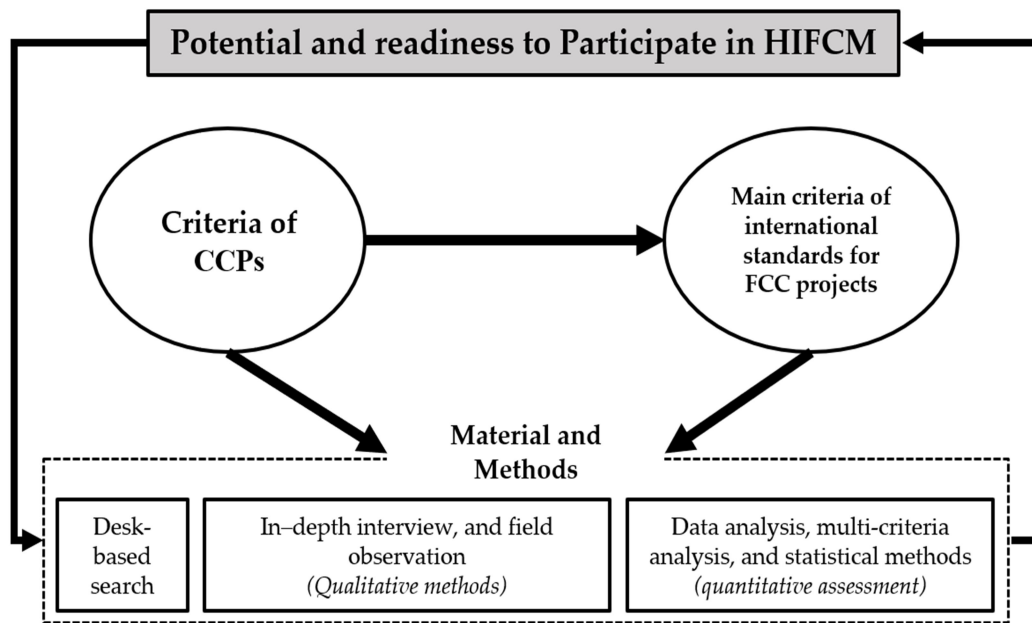


Figure 1. Analytical framework

Source: Proposed by the author group

As illustrated in Figure 1, the methodology integrates two primary reference systems: the CCPs and the established criteria of prominent global FCC standards, including CDM, GS, and VCS. These benchmarks provide the theoretical foundation for evaluating the environmental integrity, governance capacity, and social safeguards associated with localized carbon initiatives. Building upon this foundation, the study employs a mixed-methods approach, combining qualitative desk-based documentation analysis and in-depth stakeholder interviews with quantitative MCA utilizing 44 specific indicators. This integrated methodology facilitates a comprehensive evaluation of both forest carbon project potential and the province's systemic readiness to transition into high-value international carbon finance.

2.3. Sociological survey and data analysis

Primary data were collected through in-depth interviews and questionnaires with 25 stakeholders (48% female) across provincial, commune, and private sectors. Including the provincial government representatives consisted of 14 members with 36% women, and 11 individuals from the commune government and the private sector with 63% being women. The questionnaire was designed according to the research framework outlined in Figure 1.

Collected data was statistically synthesized and calculated using Microsoft Excel Office version 2013. Before that they were coded and normalized (0–1 scale) using min–max [21], [22]. Data normalization is proportional to the readiness to participate in HIFCM determined according to equation (1). Each dimension of institution, technique, and society was determined as an average value of all relevant indicators. Equation (2) was used to calculate the average point of each dimension.

$$x_{ij} = \frac{X_{ij} - \text{Min}X_{ij}}{\text{Max}X_{ij} - \text{Min}X_{ij}} \quad (1) \qquad R = \frac{\sum_1^n R_i}{n} \quad (2)$$

where, x_{ij} represents the normalized value of indicator i of person j , X_{ij} denotes the actual value of indicator i of person j . Max and min values refer to the highest and lowest values for each indicator.

A five-point Likert scale was used in the quantitative assessment approach to classify level of readiness to participate in HIFCM in Son La province [23], [24]. As a result, the readiness scale was 0 to 1, where 0 represented no readiness and 1 the highest readiness.

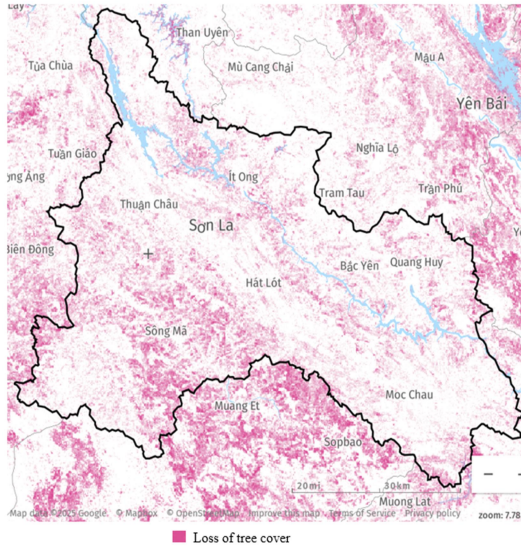
3. Results

3.1. The potential of forest carbon projects

Statistical results show that the province has the potential to implement AR projects with a minimum area of approximately 86,000 hectares. In addition, forest data related to AR projects has been available for the past 10 years through forest inventory data (Figure 2) [25]. This additionality of the forest carbon projects is particularly becoming clearer through the 2022 NDC report. The minimum area required for REDD+ projects is approximately 59,000 hectares. Furthermore, forest data for REDD+ project implementation has been available for the past 10 years through forest inventory data from 2013 and data published annually on Global Forest Watch (Figure 3) [25], [26].

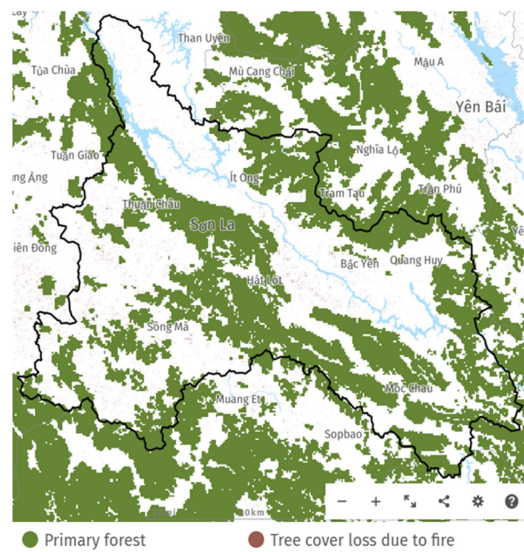
Furthermore, the potential for developing two types of FCC projects, AR and REDD+, has been assessed by JICA (2012, 2017) [27], [28], and the results show that the province has great potential to implement these types of projects. Thus, FCC projects in Son La province can be implemented and registered according to international standards. Although all standards have strict criteria to assess carbon credits [29], forest carbon projects still need to be clearly evaluated through criterion of CCPs [18]. It is being considered an independent criterion used

to classify carbon credits, thereby ensuring the transparency of the credit types according to the registration standards for participation in HIFCM.



Source: [30]

Figure 2. Forest area due to loss of tree cover, period 2001 – 2024



Source: [30]

Figure 3. Forest area due to firing, period 2001 – 2024

According to the 2023 draft scheme for the “Pilot Forest Carbon Credit Trading in Son La Province until 2030”, the annual carbon credits are estimated at 1,173,143 tCO₂/year [6]. This figure was calculated by the provincial authorities based on sequestration coefficients and forest inventory data available at the time of reporting. Furthermore, provisional estimates of FCC volumes can be derived using a sequestration rate of 7.5 tCO₂/ha/year for AR projects (specifically for Acacia plantations) [31] and an average value of 5.72 tCO₂/ha/year for REDD+ initiatives [6]. Consequently, applying these coefficients to the potential forest areas identified in this study yields an estimated annual credit volume of 982.283 tCO₂/year. Nevertheless, these figures remain predictive and serve primarily as reference. To accurately determine carbon sequestration, empirical field measurements must be conducted, alongside the application of rigorous calculation methodologies and adherence to specific international accreditation standards.

3.2. Readiness to participate in HIFCM

The results of the data analysis reveal that the readiness level to participate in HIFCM in Son La province is at an average level (0.54), also known as being in the preparation stage and not yet ready (Figure 4). The social pillar has the lowest score of 0.46 among the three pillars, while the highest-scoring pillar is institutions at 0.6 with result for evaluating each specific indicator shown in Figure 4.

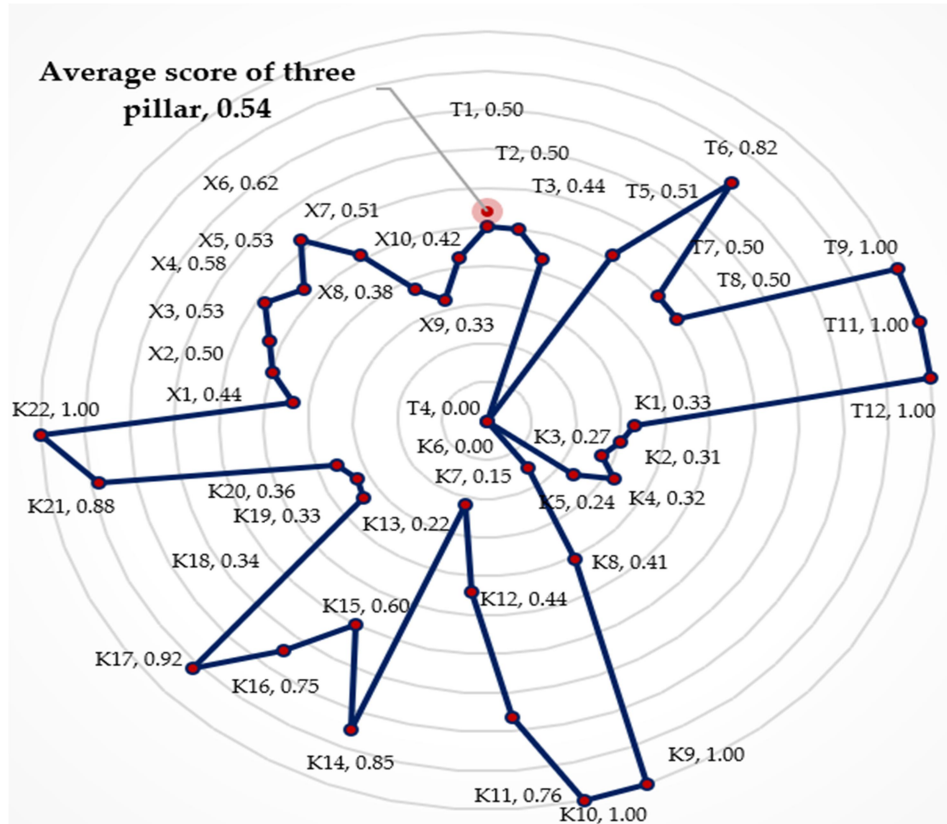


Figure 4. Results for evaluating each specific indicator and average score of three pillars

3.2.1. Institution pillar

Institution pillar, also known as governance, that reflects the capacity to manage, coordinate, and interact with stakeholders during the implementation of forest carbon projects. The average score for this pillar is 0.68, indicating that it is at a ready level with results for evaluating each specific dimension of the institution pillar given in Figure 5.

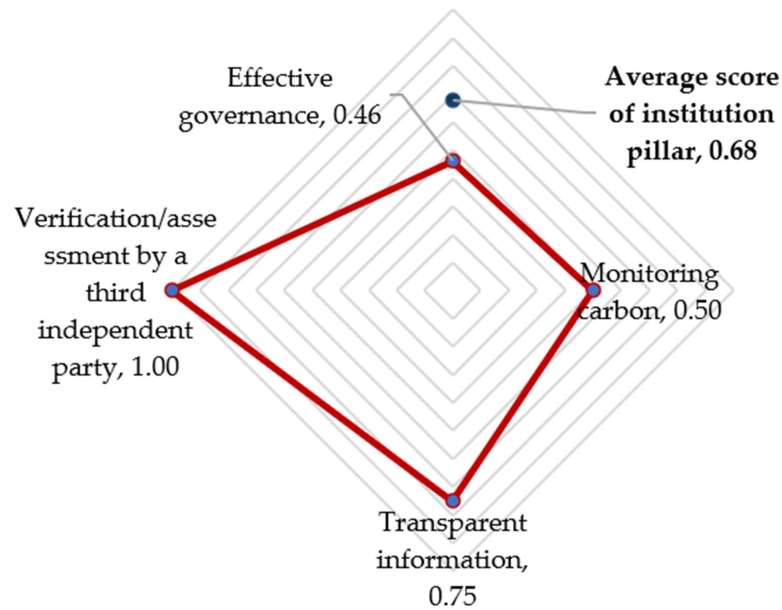


Figure 5. Results for evaluating each dimension and average score of institution pillar

The most significant strength lies in the "Verification by a third independent party" dimension, which achieved a perfect score of 1.0. This is a direct result of Decree 199/2025/ND-CP, which establishes stringent requirements for independent validation/verification (T11) and regular capacity assessments of validation and verification bodies (T12) [32]. Similarly, the "transparent information" dimension scored 0.75, bolstered by mandated data accessibility for project documentation (T9: 1.0), although the full public disclosure platform (T10) remains under construction to meet international standards.

The province developed a REDD+ action plan in 2016 for the period 2017-2020, aiming towards 2030, and conducted a two-year review of the REDD pilot project and has 25 hydropower projects that have been registered/issued carbon credits according to international standards such as GS, VCS, and CDM since 2010 [4], [11], [12], [13]. This reveals that the province has experience working with indigenous peoples and local communities (IPLCs), resulting in a relatively high T6 score of 0.82 (Figure 4). However, the province is very constrained in consulting with stakeholders at the global level (T4), so this score is only 0 points because the implemented carbon credit projects have all been carried out by international consultants and buyers, while the province's participation has been simpler, such as providing documentation or planning work, and similar administrative tasks (Figure 4). This reflects a

lack of international connection and consultation, which is essential for accessing HIFCM. Therefore, the dimension of effective governance has the lowest value (0.46) and is at the preparation level (Figure 5).

The assessment results show that the Institution/Governance pillar of the province reached 0.68, reflecting a relatively high level of readiness in managing and coordinating FCC projects. The main strength comes from the increasingly complete legal framework, such as building infrastructure for the domestic carbon market in accordance with Decree 199/2025/ND-CP and building a pilot model for trading FCC combined with experience from REDD+ programs and credit projects according to international standards, helping the province to have relatively good capacity in establishing a legal framework to support the development of HIFCM [6], [32]. However, the biggest limitation lies in the lack of consultation/connection with stakeholders at the international level, and the information disclosure platform, although regulated, is still being perfected. Therefore, the province needs to continue to strengthen transparency, and multi-level consultation and proactively integrate internationally to be ready to participate in HIFCM.

3.2.2. Technique pillar

The technique pillar primarily relates to the issue of calculating carbon emission reductions, but it must ensure additionality, non-duplication, and long-term sustainability. The average score for this pillar is 0.48, indicating that it is at the preparatory stage level with results for evaluating each specific dimension of the technique pillar given in Figure 6.

The most significant technical barriers are found in the "Permanence" (0.2) and "Additionality" (0.31) dimensions (Figure 6). The absence of a common carbon reserve mechanism (K6) to mitigate reversal risks—such as forest fires or pest outbreaks—undermines the long-term reliability of potential credits. The Ground Truth report also emphasized that most current protocols do not adequately handle the risk of permanent loss, and the development of a reserve fund mechanism along with long-term monitoring is essential [8]. Furthermore, limited local expertise in independent REDD+ planning (K2, K3) contributes to low additionality scores, reflecting a historical reliance on international partners rather than autonomous project implementation.

Conversely, dimensions related to emission quantification and the prevention of double-counting demonstrate higher readiness, bolstered by the regulatory procedures established in Decree 199/2025/ND-CP (K9, K10, K22) [32]. The province also shows strong performance in

identifying emission boundaries (K17: 0.92) and credit renewal processes (K14: 0.85), largely due to technical knowledge transferred during previous collaborations with international consultants.

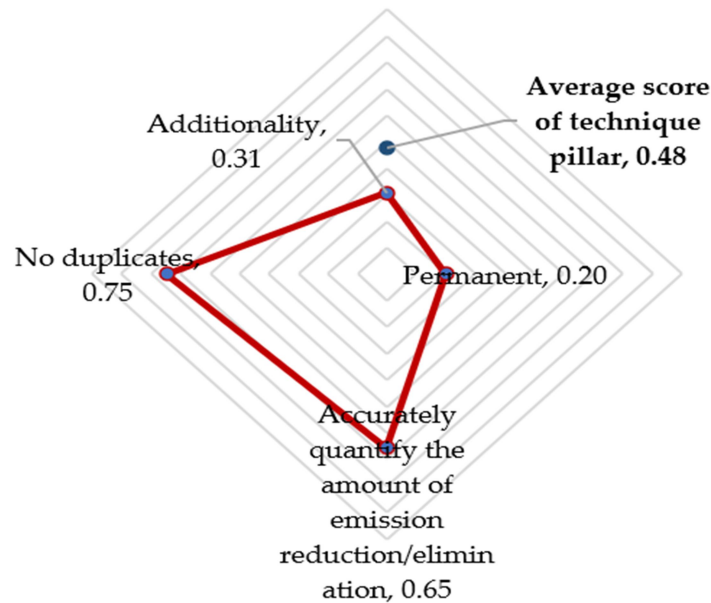


Figure 6. Results for evaluating each dimension and average score of technique pillar

Despite these foundational strengths, specialized technical indicators—specifically baseline calculation (K18) and scientific monitoring methods (K19)—remain critically low, with both scoring below 0.40. This disparity highlights that while Son La has basic quantification capabilities, it lacks the sophisticated expertise required for the inherent complexity of forest carbon projects. Unlike the renewable energy projects previously managed by the province, forest carbon initiatives necessitate a higher level of technical rigor that is currently hindered by an over-reliance on foreign intermediaries.

3.2.3. Society pillar

The Society pillar primarily relates to human protection issues such as working environmental conditions, ensuring the rights and benefits of IPLC, ensuring gender equality, benefit sharing, and the actual contribution to a net-zero national emissions. The average score for this pillar is 0.46, indicating it is at a preparatory stage with result for evaluating each specific dimension of the technique pillar indicated in Table 3.

Table 3. Results for evaluating each dimension and average score of society pillar

Dimension	Value
Benefits and protection of sustainable development	0.49
Contributing to net zero emissions for the nation	0.42
Average score of society pillar	0.46

The assessment results show that the province achieved relatively high scores in several core social criteria, reflecting favorable initial foundations for the implementation of HIFCM. The X6 indicator on gender equality reached 0.62, indicating that the province has initially integrated gender equality issues into forestry and livelihood programs (Figure 4). In addition, the X4 indicator on worker protection, with a score of 0.58, reflects the emphasis on principles prohibiting forced labor, child labor, and protecting third-party hired workers (Figure 4). The X3 and X2 indices, with slightly lower scores (0.50), also show certain efforts in ensuring relatively equal access to opportunities and safe working conditions in forestry activities (Figure 4). These results show that the province has established a basic social policy framework, consistent with the minimum requirements of HIFCM.

Conversely, significant bottlenecks remain in social governance and benefit allocation. The most critical deficiency is the transparency of benefit sharing (X8: 0.38), which reveals a lack of disclosure regarding the allocation of rights and revenues from carbon credits. Furthermore, while principles related to human rights (X5) and IPLC benefit sharing (X7) are present at the policy level, they have yet to be concretized into verifiable operational processes at the community level. These weaknesses pose substantial risks to project sustainability. As seen in global REDD+ failures, such as in the Democratic Republic of Congo, a lack of transparent, participatory benefit-sharing and accessible grievance mechanisms can lead to local discontent and project collapse [33]. Finally, the low score for contribution to national Net Zero targets (0.42) suggests that the province's capacity to integrate forest carbon projects into the broader national climate roadmap remains limited (Table 3).

The social pillar is at an average level (equivalent to the preparation stage), reflecting certain potential but not enough to fully meet the increasingly stringent requirements of HIFCM. While criteria related to labor protection and gender equality have formed an initial foundation, bottlenecks in transparent benefit sharing, ensuring substantive human rights, and

contributing to the net zero emissions target remain core challenges. Therefore, the province needs to overcome and improve mechanisms to ensure the rights and interests of society to increase its accessibility to HIFCC standards [18], [34].

4. Discussion

4.1. Participating the domestic HIFCM

Vietnam is currently developing a legal framework and moving towards operating a national carbon credit exchange by 2029 [5], [32]. From an academic perspective, this study contributes a novel methodological framework by integrating international "high integrity" standards into a sub-national readiness assessment. While existing literature often focuses on macro-level policy or isolated carbon stock estimation, this research fills a critical gap by conceptualizing "readiness" as a synchronized system of institutional, technical, and social pillars.

For provinces like Son La, participation in the domestic market is essential. FCC projects registered under CDM, JCM, and the Paris Agreement's Mechanism 6.4 will be eligible for the future national exchange [5], [32]. Consequently, FCC projects registered under remaining mechanisms or standards will be ineligible for the domestic carbon market in Vietnam.

Participating in the PFES program since 2008, combined with FCC projects, will increase the economic value through additional revenue from selling FCC. Scientifically, this study explores the synergy between existing payment for ecosystem services (PES) models and emerging carbon markets, providing an empirical basis for "stacked" conservation financing. Therefore, the province can implement AR projects through the Paris Agreement's Mechanism 6.4 to participate in the domestic carbon market. Domestic market participation reduces transaction costs and simplifies implementation by passing international brokerage and foreign-party complexities. Conducting transactions domestically also makes it easier for sellers to find and communicate with buyers, often without brokerage fees, and shortens the implementation time, reducing the risk of capital tie-up. Currently, carbon credit transactions for domestic projects mainly involve a third party (broker), and the implementation time is lengthy. The third party typically covers implementation costs and provides comprehensive support throughout the project lifecycle. Even the FCC transfer project under the ERPA program, funded by the World Bank (WB), uses the WB as a broker. In addition to the selling price, the World Bank will cover all project implementation costs and the project registration process,

with the seller providing supporting documentation. However, this study frames this dependence as a "learning phase" in the organizational lifecycle, where local entities gain the requisite "tacit knowledge" to eventually achieve independent project implementation.

Participating in the domestic market faces challenges like incomplete infrastructure and a lack of legal transparency. Beyond policy implications, this study contributes to the theory of "Market Readiness" in developing nations by demonstrating that technical bottlenecks (e.g., baseline calculation and scientific monitoring) are as significant as institutional ones. To minimize risks, Son La must: (1) Enhance autonomous technical capacity to reduce reliance on external manpower; (2) Utilize international support as a catalyst for knowledge exchange and negotiation skills; and (3) Adopt a "dual-market strategy" (domestic and international) to maximize options and institutional resilience.

4.2. Participating the international HIFCM market

The international forest carbon market is a large market, encompassing both compliance and voluntary markets with stricter requirements regarding environmental, social, and governance integrity. Based on the analysis, the province has significant potential for developing AR and REDD+ projects that can meet the three standards of CDM, VCS, and GS suitable for international markets with diverse needs. Developing FCC projects under the CDM model will help the province participate in both domestic and international markets simultaneously. It will offer flexibility in choosing buyers as well as sell with a higher price and demand volume. However, the demand for CDM projects is being limited, and the number of FCC projects registered under CDM is decreasing, leading to a limit the number of buyers compared to other mechanisms. Furthermore, the selling price may be lower due to limited buyer demand.

Registering under other mechanisms such as VSC, GS, or similar mechanisms will enhance the opportunities for buyer selection, and demand also will be more diverse. Consequently, the selling price is also likely to increase, boosting FCC sales revenue due to the stricter requirements of these standards [35]. In addition, the parties will have access to advanced measurement technologies, promoting improved forest governance and standardizing national data.

Given the province's current capabilities, participating in the international HIFCM will present challenges such as the risk of being excluded from the market if requirements are not met, significant price fluctuations directly impacting project revenue, and high FCC registration

and issuance costs [27], leading to limited long-term capital mobilization capacity, especially in competition with countries with large and experienced suppliers such as China, Brazil, etc. Faced with these major challenges, the province needs to (1) build a standardized data system and ensure transparency and openness; (2) seek external support to increase investment capital and learn from international experience; (3) reinvest a portion of revenue into green livelihoods, biodiversity conservation, and rural infrastructure to enhance social value and credit quality; and (4) develop FCC through HIFCC to increase market competitiveness by improving the legal framework, such as building a benefit-sharing plan combined with a transparent and public complaint resolution system, fully implementing FPIC before project implementation, having documentation in ethnic languages, and ensuring women's participation.

5. Conclusion

This study focuses on analysing the potential and the readiness to participate in HIFCM in the context of Vietnam aiming for net emissions of “zero” by 2050 and building a national carbon market [32]. This research contributes to the literature by conceptualizing “high integrity” not merely as a set of technical benchmarks but as a synchronized system of institutional, technical, and social readiness at the sub-national level. By aligning 44 localized indicators with the CCP, the study provides a MCA framework that bridges the theoretical gap between global standards and provincial-level implementation [18], [20].

The assessment results show that the province possesses significant quantitative potential, with 86,000 ha eligible for AR and 59,000 ha for REDD+ projects. While the CDM model offers initial flexibility for dual-market participation, its shrinking global demand necessitates a strategic transition toward voluntary standards like VCS or GS. Scientifically, this finding highlights the “standardization pathway”—where the adoption of stricter voluntary standards serves as a catalyst for advanced measurement technologies and improved forest governance. Therefore, Son La province needs to approach it step by step by building legal bases through a pilot project on trading FCC and starting to implement pilot projects [4], [6].

Although the province has the potential to develop HIFCC projects, the province’s overall readiness score of 0.54 reveals significant systemic challenges. The study’s academic value lies in identifying specific implementation bottlenecks, particularly in the social pillar (0.46) and technical pillar (0.48), which often remain hidden in macro-level policy evaluations. These findings underscore those technical hurdles, such as scientific baseline monitoring (K19), are as critical as institutional ones for international market entry.

Furthermore, the study still has some limitations, such as an insufficiently large sample size for the most accurate assessment due to limitations in accessing interview locations and communication with local people, as the primary language of communication is indigenous. The determination of estimated carbon credits is based only on reference materials and has not been actually calculated using specific methods approved by international standards. However, the sample size relatively reflects the reality of each locality for the research problem by combining both primary and secondary data along with qualitative and quantitative methods for evaluation. By integrating these dimensions, this research offers a replicable methodology for other forested regions in developing nations striving for international high-integrity carbon market alignment.

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