# The Assessment of the Backcasting Technique's Role in Thai Regenerative Design Practice as a Built Environment Design Tool

Sasiprapa Srikraiphak

Department of Architecture, Faculty of Architecture, Chiang Mai University, 239 Huay Kaew Rd, Suthep,50200, Thailand, E-mail: sasiprapa.sri@cmu.ac.th

https://doi.org/10.29227/IM-2025-02-02-057

Submission date: *2025-04-04* | Review date: *2025-05-08*

*Abstract*

*Thai Regenerative Design Practice serves as a tool in the built environment design and planning process, specifically tailored to the Thai socio-environmental context. This practice integrates the principles of regenerative design, the Thai Rating of Energy and Environmental Sustainability (TREES), and the backcasting technique to address existing gaps in regenerative design practices, enhancing efficiency in design and planning strategies for comprehensive sustainability. Existing studies indicate that regenerative design principles and TREES share ideological and procedural similarities, guiding genuinely sustainable design. Meanwhile, the backcasting technique is primarily utilised to establish desirable goals within strategic planning processes. Fundamentally, backcasting involves creating a normative vision of the future and then designing pathways back to the present to determine the steps necessary to achieve these goals. This approach ensures that present-day decisions facilitate long-term sustainable change. However, in Thailand, the backcasting technique has not yet been applied within the built environment design and planning process. This study regards it as an opportunity and seeks to evaluate the effectiveness of the backcasting technique as a fundamental component of the Thai Regenerative Design Practice, examining its role in enhancing the credibility of this approach. The research methodology involved a three-day workshop on built environment design for Nong Bua, Chiang Mai, Thailand, with the participation of 17 stakeholders. Data collection was conducted through observation, surveys, and interviews. The results indicate that participants expressed satisfaction with the workshop facilitated by the Thai Regenerative Design Practice, which, according to the empirical evidence, presented as a built environment design and planning initiative for the case study area. Based on a five-point Likert scale, the findings indicate that Thai Regenerative Design Practice and its components received ratings within the "very satisfied" range. Overall, the Thai Regenerative Design Practice scored 4.80, while the regenerative design principle, TREES, and the backcasting technique received scores of 4.46, 4.23, and 4.42, respectively. Additionally, participants highlighted the significance of the backcasting technique in verifying a project's comprehensiveness. They noted that this technique effectively refines discussions, narrowing broad conversations into key focal points, and can be applied in future built environment development charrettes. In conclusion, the findings suggest that the backcasting technique contributes to developing a normative and accurate design planning strategy. However, its role within Thai Regenerative Design Practice requires further validation through repeated applications in future studies to ensure its most comprehensive and effective implementation.*

**Keywords:** *Backcasting technique, Thai Regenerative Design, Built Environment Design Tool, TREES*

## 1. Introduction

Regenerative design, within the Thai context, seeks to restore the abundance of Thailand's ecosystems by integrating universal regenerative design principles with local beliefs, cultural values, and traditional ways of life. This approach encompasses both architectural and landscape design, providing context-specific guidance for sustainable development practices. It emerged in response to notable gaps identified in existing regenerative design frameworks [1].

The development of Thai Regenerative Design is rooted in prior research that critiques the current regenerative design paradigm. Critics argue that although regenerative design is underpinned by a rich array of theoretical premises advocating genuine sustainability, its practical application remains ambiguous. Moreover, the concept often lacks tangible strategic articulation, rendering it difficult for practitioners to grasp its full scope when applying it to real-world projects. Consequently, the global application of regenerative design remains limited in the built environment disciplines [2].

The analysis of existing frameworks, in comparison with prevailing sustainable design practices in Thailand, supports the development of a new, culturally appropriate regenerative design framework. This is especially pertinent given Thailand's National Strategy, which promotes sustainable development tools and practices. Despite its growing global relevance, regenerative design remains relatively unfamiliar among Thai practitioners [3]. This study proposes a Thai Regenerative Design Practice intended to develop a novel framework that addresses the limitations identified in previous research. Regenerative design remains relatively unfamiliar to design practitioners in Thailand, and this approach has yet to be implemented in the context of Thai built environment projects.

The structure of the Thai Regenerative Design Practice integrates the principles of regenerative design with the Backcasting technique and the Thai Rating of Energy and Environmental Sustainability (TREES), thereby enhancing its credibility and practical applicability. Therefore, this study contends that developing a Thai-specific regenerative design framework is both timely and necessary. The primary aim of this study is to investigate and adapt the principles of regenerative design for application within Thailand's built environment. Through a comprehensive review and refinement of existing models, the study seeks to establish a robust framework tailored to Thai ecological, social, and cultural contexts—ultimately enhancing regenerative design practice in the region.

## 2. Literature review

Cole and colleagues (2012) emphasise that regenerative design and development are inherently difficult to evaluate using conventional

metrics. This is because the success of such design hinges on the co-evolutionary relationship between humans and nature—aiming to re-establish ecological and social systems disrupted by resource depletion. As such, its outcomes are not immediately measurable and typically require time to manifest in the form of ecological enhancement and human well-being [4].

A fundamental challenge in assessing regenerative design lies in its holistic vision: It aims to benefit both people and the planet by promoting socio-ecological and economic health. Thus, the most meaningful impacts of regenerative design are often intangible or long-term in nature [4]. Reed (2007) posits that instead of relying on quantifiable performance indicators, it is more important to assess regenerative design through its capacity to foster stakeholder awareness and experiential learning, supporting the co-evolutionary process between humans and natural systems [5].

An analysis of existing frameworks—such as the Regenesis Approach, the REGEN and LENSES frameworks, and the Perkins+Will model—reveals that many are proprietary or overly complex for those without a background in environmental design. This complexity hinders widespread adoption, particularly when compared to more mainstream sustainable and green design methodologies. Additionally, the lack of specific metrics or tools for measuring regenerative performance further restricts their applicability [2, 4, 6-9]. This study identifies three primary gaps that inhibit the broader implementation of regenerative design:-

*Potential Assessment Tool*. As mentioned, regenerative design requires time to evaluate its full potential. While some existing frameworks include decision-making tools, no standardised assessment mechanism remains to validate the outcomes of regenerative building and landscape practices. The absence of such tools is a key limitation when comparing regenerative design with other established built environment approaches.

*Credibility of Results*. Although regenerative design holds promise for addressing environmental challenges and promoting ecosystem health, its delayed impact and lack of assessment tools undermine its credibility. Consequently, many stakeholders remain hesitant to adopt this design methodology, viewing its outcomes as uncertain or unverified.

*Performance Measurement*. Current research highlights the need for long-term observation and a deep understanding of regenerative principles to evaluate their effectiveness properly. Regenerative design considers both human and ecological performance. However, the lack of performance indicators—capable of capturing changes before and after implementation—makes it challenging to quantify improvements in areas such as biodiversity, human quality of life, environmental health, and systemic sustainability. This absence of measurable criteria represents a significant barrier to stakeholder investment and adoption.

### *2.1 Thai Regenerative Design Practice as a Built Environment Design Tool*

Regenerative design is an alternative approach to sustainable design that reimagines how the relationship and interaction between humans and nature can be re-established, aiming to enable their co-evolution within a truly sustainable environment. Beyond drawing upon foundational principles, this research has developed a contextualised framework to address key gaps identified in existing regenerative design methodologies. This study intends to apply the concept of regenerative design to a case study within the Thai context.

Thailand has been selected as the primary case study for this investigation to explore the potential of regenerative design when applied to a specific socio-ecological and cultural setting. This study introduces a Thai Regenerative Design Practice grounded in regenerative design and development principles and positioned as a practical tool for application in the built environment design process. The aim is to guide architectural and landscape design in prioritising the holistic function and condition of natural systems, thereby enabling the creation of sustainable environments that are both ecologically responsive and attuned to the needs of local communities.

This newly developed practice integrates the core regenerative design principle with two key elements: the Backcasting technique, drawn from global sustainable planning practices, and TREES (Thailand's Rating of Energy and Environmental Sustainability), a national green building assessment tool. This integration addresses the previously identified limitations of existing frameworks. As illustrated in Fig. 1, which presents the structural diagram of the Thai Regenerative Design Practice, regenerative design serves as the foundation upon which the entire framework is built, guiding the implementation of design processes across the built environment. The TREES rating system contributes to addressing the gaps related to the "Potential Assessment Tool" and "Performance Measurement", as it is already established for evaluating the performance and environmental quality of green buildings in the Thai context. Meanwhile, the Backcasting technique addresses the gap concerning the "Credibility of Results". Widely used in sustainable development planning, Backcasting provides a method for defining desirable future outcomes and then planning backwards to identify necessary steps, thereby enhancing stakeholder engagement and trust in the process.

The combination of these three elements—regenerative design principles, the TREES rating system, and the Backcasting method—forms the foundation of the Thai Regenerative Design Practice. This integrated framework aims to enhance regenerative design's credibility, applicability, and measurable outcomes within the Thai built environment.

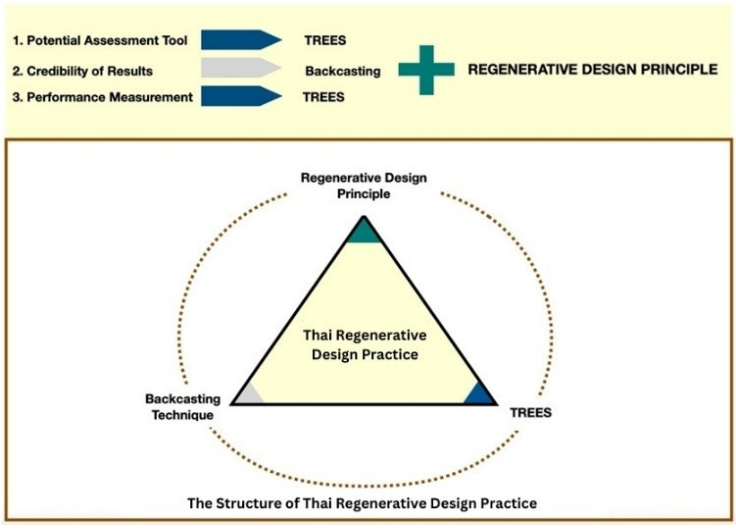



Fig. 1. The Structure of Thai Regenerative Design Practice

The regenerative design approach will serve as a guiding framework for the built environment design process. It will be complemented by the TREES (Thailand's Rating of Energy and Environmental Sustainability) requirements to enhance the relevance and suitability of the design within the specific context of the Thai case study. Following this, the Backcasting technique will be employed to shape policy directions and future development pathways, thereby contributing to a higher quality-built environment. Additionally, this process is expected to enhance the credibility of the project among stakeholders involved in its implementation.

Stakeholder engagement is a critical factor that significantly influences the success of regenerative design in development projects [2, 8-10]. In this study, regenerative design and development principles have been used as a framework to identify and refine the group of potential stakeholders for meaningful participation in the engagement process. Implementing regenerative design within the Thai context presents a challenge, given the lack of documented examples of its application in Thai built environment projects.

### *2.2 A Role of Backcasting Technique*

The Backcasting technique was first introduced in the 1970s as a strategic planning tool for analysing and developing energy systems. Traditionally, it has been employed to evaluate long-term scenario changes over 20 to 100 years. Since its inception, the technique has been increasingly applied to broader areas within the field of sustainability, including buildings, land use, transportation, and food systems. It is especially relevant to sustainable development planning, where change depends on the active involvement of social structures [11-17].

At its core, Backcasting is a normative planning technique whereby a desirable future is envisioned, and strategic steps are then mapped in reverse to the present day to enable that future to be achieved. In essence, it highlights how present-day decisions can shape and facilitate transformative change over time [18]. This approach assumes that future outcomes are not merely to be predicted but can be purposefully designed and strategically pursued.

The key distinction between Forecasting and Backcasting lies in their orientation. Forecasting extrapolates from current trends to predict future scenarios, often as a warning or preparation for potential developments. It is typically reactive in nature. In contrast, Backcasting is proactive: it starts by envisioning a preferred future and works backwards to identify actions that could make that future feasible. It helps define a strategic path toward a desired outcome, anticipates potential obstacles, and proposes methods to mitigate or avoid them [18]. In doing so, it enables implementation planning that is both visionary and grounded in practical steps.

Scenario development in this context is a proactive exercise that allows for adaptability in response to emerging challenges or opportunities [19-21]. It provides flexibility in decision-making, allowing strategies to evolve in line with changing circumstances [22]. Furthermore, scenario-based planning offers a valuable tool for integrating feedback across scales and facilitating multilevel discussions [23].

To summarise, Backcasting is widely used within the sustainable development field [24-26]. As illustrated in Fig. 2, the methodology involves envisioning a normative future scenario developed by stakeholders, tracing potential pathways back to the present, and identifying alternative strategies to avoid undesirable outcomes [25]. Contemporary applications generally use a planning horizon of 25 to 50 years. This extended timeframe allows sufficient conceptual distance from present conditions to imagine transformative future possibilities [10, 27]. Research has also indicated that most individuals are capable of envisioning the future within a 20–50-year window as it relates to their own lifespan or that of their children [28].

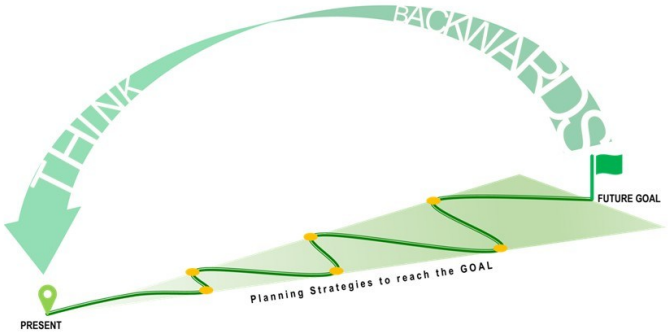



Fig. 2. The Backcasting Technique

The following studies have developed and refined the Backcasting technique to suit specific circumstances and improve its accuracy. Wangel (2011) distinguished two main approaches to Backcasting: (1) a result-oriented research approach and (2) a participation-oriented creative workshop technique. The key difference lies in the methodology. The result-oriented approach prioritises achieving the intended outcome, often at the expense of extensive participatory processes. In contrast, the participation-oriented workshop technique allows for greater flexibility, adapting the process to the insights gained through stakeholder engagement [26]. Nonetheless, participation is vital in both approaches, as it introduces diverse perspectives and knowledge that enrich scenario development. It also fosters consensus-building, facilitates the resolution of conflicts, and empowers communities through capacity-building. These outcomes enhance the legitimacy and acceptability of the final scenarios [29].

Previous research similarly suggests that participatory approaches are particularly effective in scenario planning, especially when dealing with complex socio-ecological systems. Stakeholder engagement introduces multiple sources of knowledge, improving planning outcomes' robustness [30]. Thus, participation is a key component of the Backcasting technique, instrumental in formulating consensual policies, guidelines, and future development directions [24-26]. However, Backcasting has not yet been widely applied in Thailand within built environment design and planning. This study sees this as an opportunity to evaluate its effectiveness as a core element of the Thai Regenerative Design Practice, particularly in enhancing the credibility of regenerative design.

## 3. Case study area

The Chiang Mai World Heritage Initiative team (CMWHI) is one of the key contributors to the GREEN BOOK project, which advocates for Chiang Mai City's nomination as a UNESCO World Heritage Site. As of now, the city has been placed on UNESCO's Tentative List [31]. In 2020, the CMWHI team initiated plans for environmental development within the boundaries proposed for nomination. This study had the opportunity to collaborate and exchange ideas with CMWHI regarding environmental enhancement

strategies for Chiang Mai, during which the team expressed a strong interest in applying the Thai Regenerative Design Practice to the Nong Bua area, Chiang Mai, Thailand. As illustrated in Fig. 3, Nong Bua holds significant historical value for Chiang Mai City. Historically, it was one of the city's seven sacred sites used for religious worship. Moreover, it functioned as a critical wetland, receiving water from Suthep Mountain and distributing it through a natural canal network that supported the city and local communities [32].

Chiang Mai City, originally designed with careful consideration of flood mitigation, has undergone substantial transformation through periods of urbanisation and industrial development, mainly since the reign of King Rama V. Regrettably, these developments have led to the degradation of vital natural water systems, including the irreplaceable Nong Bua wetland. The loss of this essential hydrological feature has had far-reaching consequences, contributing to frequent urban flooding and reduced irrigation capacity during dry periods. Moreover, expanding transportation infrastructure without adequate attention to water management has compounded these issues. Roads and ground surfaces constructed at inconsistent elevations hinder adequate water drainage during the monsoon season, overwhelming local sewer systems and resulting in persistent flooding and deteriorating water quality.

According to historical maps and previous studies (see Fig. 3), Nong Bua disappeared around 1904 due to urban transformation [33]. Today, the area once occupied by Nong Bua comprises residential and commercial developments as well as sections of the Chiang Mai Rajabhat University campus. Fig. 4 shows a freeform, green-shaded area representing approximately 41,248 m² of vacant land currently awaiting development. Recognising the historical and ecological importance of Nong Bua, the CMWHI has expressed a desire to regenerate the area to evoke its former identity as a biodiverse wetland [32, 34]. With funding support from the Chiang Mai Provincial Administrative Organisation, the CMWHI aims to transform the site into a new green space for the city—a vision aligned with the broader goals of the GREEN BOOK project [31].

Fig. 3. The old map of Chiang Mai City in 1893 (Modified from an original picture from The Payap University Archives [33])

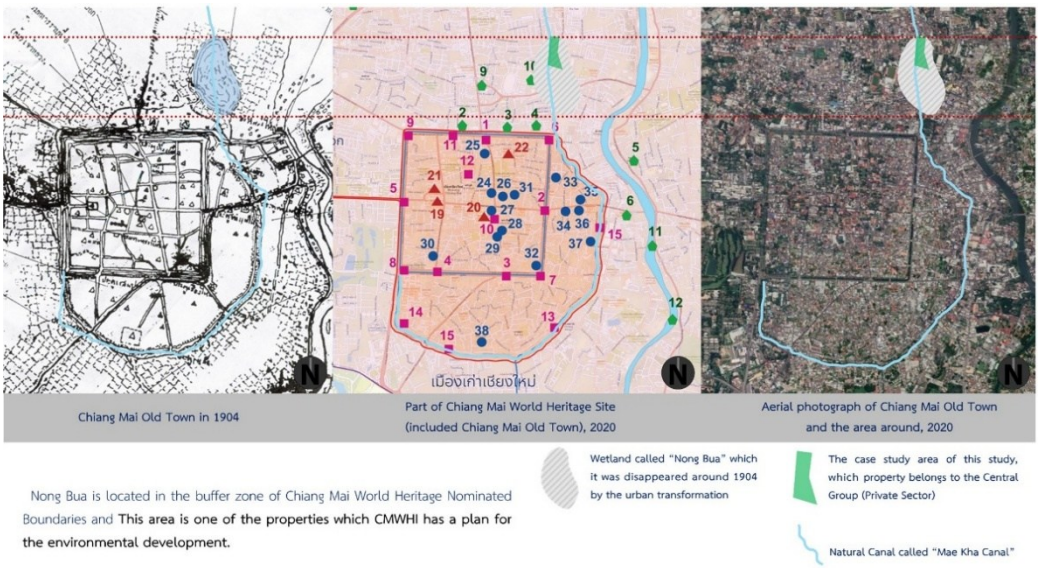



Fig. 4. The map shows a transformation of the Nong Bua area between 1893 and 2020

The Nong Bua area is strategically located in proximity to several key urban features, including Chiang Mai Old Town, Chiang Mai Rajabhat University, Chiang Mai Municipal Stadium, Jing Jai Market, Mueang Mai Market, Pa Phaeng Temple, and several natural water systems, such as Huay Chang Khian Creek, Mae Kha Canal, and the Ping River. These waterways have been negatively affected by the disappearance of the original Nong Bua wetland, resulting in disrupted hydrological flow and contributing to persistent flooding issues.

Fig. 5 provides an aerial photograph of the Nong Bua area, sourced from the GIS database. It reveals that the remaining portion of the former wetland is currently undeveloped. This vacant land lies adjacent to major roads that provide direct access to other vital parts of Chiang Mai City. Topographically, the site resembles a natural low basin, sitting at a lower elevation than the surrounding roads. In the absence of adequate water management infrastructure, stormwater runoff from these higher road surfaces flows into the area during the rainy season. This causes seasonal flooding and the accumulation of stagnant water, contributing to water pollution and the proliferation of waterborne diseases.

Fig. 5. The connection between the Nong Bua area and the surroundings (Retrieved from the GIS database on 21st September 2020)

In this regard, the study identified an opportunity to select the Nong Bua area as a case study for testing the applicability and effectiveness of the Thai Regenerative Design Practice within the built environment design and planning process. Furthermore, the CMWHI team initiated discussions with the Central Group as the owner of this area to exchange ideas and explore the potential development of the Nong Bua site. The Central Group was subsequently invited to participate in a three-day workshop alongside other key stakeholders, including community architects, landscape architects, TREES specialists, residents, a Chiang Mai historian, an ecologist, and a botanist. The workshop used the Thai Regenerative Design Practice as the guiding methodology, providing a valuable opportunity to apply and observe the framework in a real-world context. This collaborative engagement functioned as a practical trial of the Thai Regenerative Design Practice, facilitating comprehensive data collection, outcome analysis, and the development of conclusions pertinent to this study. The following section outlines the structure and methodology of the three-day workshop in detail.

## 4. Methodology and implementation

As previously discussed, both existing regenerative design frameworks and the Backcasting technique require stakeholder engagement as a critical element for ensuring the reliability of design outcomes in the Thai Regenerative Design Practice [18, 20, 35]. This study conducted a three-day built environment design engagement workshop to test the practical application of the new practice. The case study focused on the Nong Bua area in Chiang Mai City, Thailand, aiming to develop a context-sensitive design that benefits the local community and ecosystem.

The engagement process was modelled on previous frameworks such as LENSES and Perkins+Will. Day 1 focused on on-site visits to understand the spatial and cultural context. Days 2 and 3 were dedicated to design and policy-making activities, with the latter guided by the Backcasting technique. The workshop, titled "Environmental Regenerative Design: Case Study Nong Bua, Chiang Mai," was held from 28–30 September 2020 at the Social Research Institute, Chiang Mai University, in collaboration with the Chiang Mai World Heritage Initiative Project (CMWHI). 17 participants attended, including CMWHI team members, property owners, architects, TREES specialists, residents, historians, ecologists, and botanists.

On Day 1, participants were introduced to the Thai Regenerative Design Practice and prompted to reflect on sustainable design and the human-nature relationship. An open discussion followed, allowing participants to share knowledge and experiences related to Nong Bua. This exchange revealed challenges such as land management difficulties and urban transformation impacts. A site visit provided further insight into current conditions, including flooding and pollution from the Mae Kha Canal. These observations laid the foundation for the design process.

Day 2 centred on developing design concepts based on insights from the previous day. Discussions focused on regenerative design principles and TREES requirements. Participants mapped natural flows and incorporated local beliefs and ecological history into their designs. Two schematic designs emerged, reflecting shared values such as biodiversity enhancement, historical preservation, and community benefit. These designs served as target visions for the final day.

Day 3 involved policy and guideline development using the Backcasting technique. Participants identified pathways and potential barriers to realising the schematic designs. Discussions included governance, community participation, regulatory reform, and further

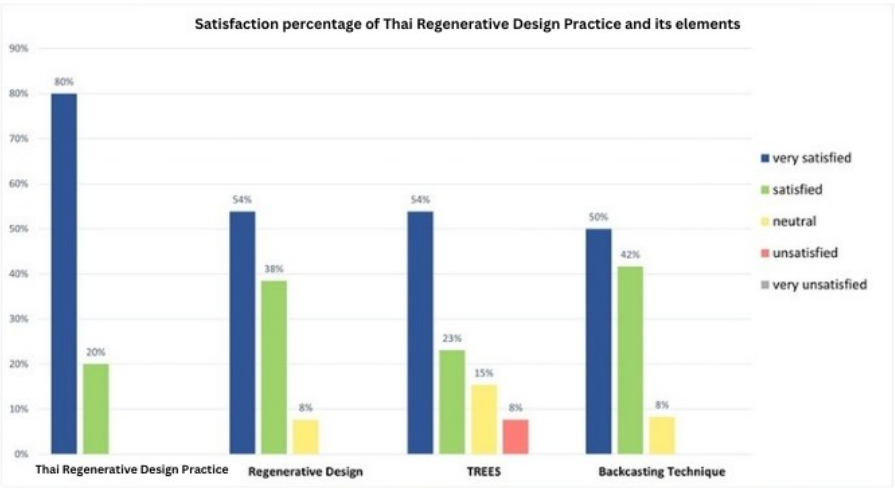
research needs. Consensus was achieved on development strategies aligned with regenerative design and TREES. Despite occasional digressions, the Backcasting approach effectively refocused the group and facilitated structured planning.

At the conclusion of the workshop, a survey was administered to assess participant satisfaction with the Thai Regenerative Design Practice. The survey was informed by literature highlighting gaps in existing frameworks and aimed to evaluate the perceived value and limitations of the Thai Regenerative Design Practice model. The feedback collected from 13 of the 17 participants was analysed to assess the framework's effectiveness and replicability.

## 5. Results

The study demonstrated the practical viability of the Thai Regenerative Design Practice, producing a coherent design and planning strategy tailored to the Thai context. The involvement of diverse stakeholders enriched the design outcomes, with particular contributions from architects, landscape architects, and TREES specialists.

Survey results revealed intense satisfaction with the Thai Regenerative Design Practice. As shown in Fig. 6, 80% of participants were "very satisfied" with the overall Thai Regenerative Design Practice. Satisfaction with individual components was also high: 54% were "very satisfied" with the regenerative design principle and TREES, and 50% with the Backcasting technique. An additional 20% of participants expressed satisfaction with the overall practice, while neutral or unsatisfied responses were limited to TREES (15% neutral, 8% unsatisfied).




| Number | Thai Regenerative Design Practice | Regenerative Design | TREES | Backcasting Technique |
|---|---|---|---|---|
| The number of respondents | 10 | 13 | 13 | 12 |
| The total number of respondents | 13 | 13 | 13 | 13 |
| The total number of workshop participants | 17 | 17 | 17 | 17 |

Fig. 6. The graph of an average satisfaction score of the Thai Regenerative Design Practice and its elements

Fig. 7 presents average satisfaction scores on a 5-point Likert scale, with scores of 4.80 for the overall practice, 4.46 for regenerative design, 4.42 for Backcasting, and 4.23 for TREES—all falling within the "very satisfied" range. These findings suggest that the Thai Regenerative Design Practice is a promising tool for built environment design, capable of integrating ecological, social, and cultural values into sustainable development processes in Thailand.

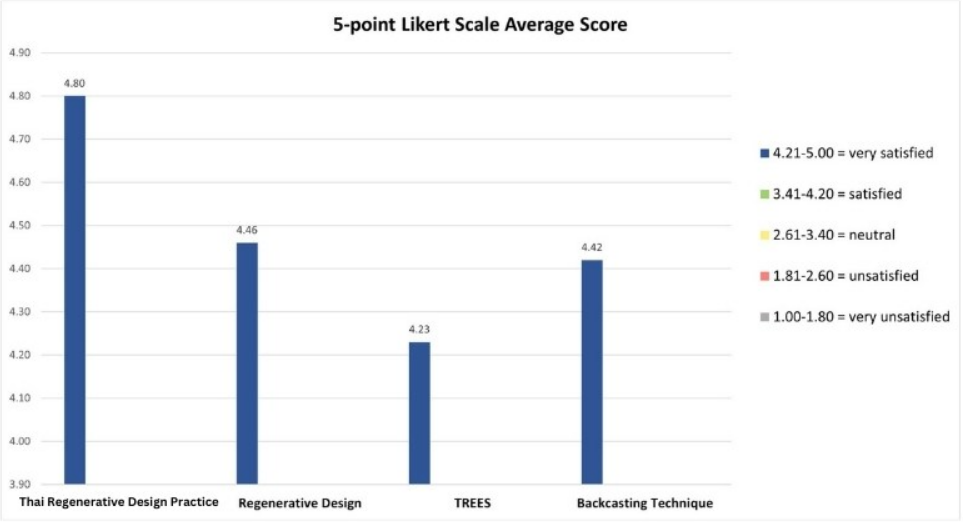



Fig. 7. The 5-point Likert scale survey of satisfaction in the Thai Regenerative Design Practice and its elements

Furthermore, participants' additional feedback on using the Backcasting technique indicated that it holds considerable potential for application in other projects. Specifically, it was recognised as an effective tool for facilitating policy-oriented discussions and verifying individual agenda items' coherence and validity throughout the development planning process.

## 6. Conclusion

In summary, the evaluation of the Thai Regenerative Design Practice demonstrates that this practice can produce both built environment design solutions and development guidelines tailored to a specific case study. Each practice component plays a distinct role within the stakeholder engagement process. Notably, the regenerative design principle and the TREES assessment tool proved integral to developing the two schematic design proposals, reflecting all workshop participants' collaborative efforts.

Furthermore, the findings suggest that the Backcasting technique is a valuable mechanism for guiding discussions during the policy and guideline development process. It effectively supported participants in focusing on key priorities, thereby contributing to a more structured and outcome-oriented dialogue. Ongoing research and broader implementation of this framework could further promote the understanding and legitimacy of regenerative design principles, thereby enhancing the credibility of the Thai Regenerative Design Practice among practitioners in the built environment field. These foundational insights offer a basis for future investigations and have the potential to inform the continued evolution of regenerative design frameworks—positioning them as viable alternatives for advancing sustainability goals both within Thailand and in the global context.

## References


1. Srikraiphak, S., Developing a regenerative design framework for the built environment : a case study in Chiang Mai, Thailand.
2. Miller, D., Regenerative Design an Exploration of Process, Practice, and the Role of Planners. 2012.
3. National Strategy 2018-2037. 2018: National Strategy Secretariat Office. Office of the National Economic and Social Development Board.
4. Cole, R.J., et al., A regenerative design framework: Setting new aspirations and initiating new discussions. Building Research and Information, 2012. 40(1): p. 95-111.
5. Reed, B., Shifting from 'sustainability' to regeneration. Building Research & Information, 2007. 35(6): p. 674-680.
6. Mang, P. and B. Reed, Designing from place: a regenerative framework and methodology. Building Research & Information, 2012. 40(1): p. 23-38.
7. Mang, P. and B. Reed, Designing from place : a regenerative framework and methodology. Building Research & Information, 2012. 40(1): p. 37-41.
8. Svec, P., R. Berkebile, and T. Joel Ann, REGEN : toward a tool for regenerative thinking. Building Research & Information, 2012. 40: p. 81-94.
9. Plaut, J.M., et al., Regenerative design: the LENSES Framework for buildings and communities. Building Research & Information, 2012. 40(1): p. 112-122.
10. Quist, J. and P. Vergragt, Past and future of backcasting: The shift to stakeholder participation and a proposal for a methodological framework. Futures, 2006. 38(9): p. 1027-1045.
11. Åkerman, J. and M. Höjer, How much transport can the climate stand?—Sweden on a sustainable path in 2050. Energy Policy, 2006. 34(14): p. 1944-1957.
12. Anderson, K.L., et al., The Tyndall decarbonisation scenarios—Part II: Scenarios for a 60% CO2 reduction in the UK. Energy Policy, 2008. 36(10): p. 3764-3773.
13. Geurs, K. and B. Van Wee, Backcasting as a Tool to Develop a Sustainable Transport Scenario Assuming Emission Reductions of 80-90%. Innovation: The European Journal of Social Science Research, 2000. 13(1): p. 47-62.
14. Green, K. and P. Vergragt, Towards sustainable households: a methodology for developing sustainable technological and social innovations. Futures, 2002. 34(5): p. 381-400.
15. Höjer, M. and L.-G. Mattsson, Determinism and backcasting in future studies. Futures, 2000. 32(7): p. 613-634.
16. Mander, S.L., et al., The Tyndall decarbonisation scenarios—Part I: Development of a backcasting methodology with stakeholder participation. Energy Policy, 2008. 36(10): p. 3754-3763.
17. Robinson, J.B., Futures under glass: A recipe for people who hate to predict. Futures, 1990. 22(8): p. 820-842.
18. Köves, A., G. Király, and G. Pataki, Transition to Sustainable Employment: Using Backcasting Technique for Designing Policies. Managing Global Transitions, 2013. 11(2): p. 119-139.
19. Huss, W.R., A move toward scenario analysis. International Journal of Forecasting, 1988. 4(3): p. 377-388.
20. Palacios-Agundez, I., et al., The Relevance of Local Participatory Scenario Planning for Ecosystem Management Policies in the Basque Country, Northern Spain. Ecology and Society, 2013. 18(3).
21. Wollenberg, E., D. Edmunds, and L. Buck, Using scenarios to make decisions about the future: anticipatory learning for the adaptive co-management of community forests. Landscape and Urban Planning, 2000. 47(1): p. 65-77.
22. Peterson, G.D., G.S. Cumming, and S.R. Carpenter, Scenario planning: a tool for conservation in an uncertain world. Conservation biology, 2003. 17(2): p. 358-366.
23. Zurek, M.B. and T. Henrichs, Linking scenarios across geographical scales in international environmental assessments. Technological Forecasting and Social Change, 2007. 74(8): p. 1282-1295.
24. Miola, A., Backcasting Approach for Sustainable Mobility. Scientific and Technical Research Series. 2008.
25. Quist, J., Backcasting for a sustainable future: the impact after 10 years. 2007: Eburon Academic Publishers.
26. Wangel, J., Change by whom? Four ways of adding actors and governance in backcasting studies. Futures, 2011. 43(8): p. 880-889.

27. Vergragt, P.J. and J. Quist, Backcasting for sustainability: Introduction to the special issue. 2011, Elsevier. p. 747-755.

28. Robinson, J., et al., Envisioning sustainability: Recent progress in the use of participatory backcasting approaches for sustainability research. Technological Forecasting and Social Change, 2011. 78(5): p. 756-768.

29. Wangel, J., Exploring social structures and agency in backcasting studies for sustainable development. Technological Forecasting and Social Change, 2011. 78(5): p. 872-882.

30. Whitfield, S., H.J. Geist, and A.A.R. Ioris, Deliberative assessment in complex socioecological systems: recommendations for environmental assessment in drylands. Environmental Monitoring and Assessment, 2011. 183(1): p. 465-483.

31. Jai Bann, S., Green book : 2021 Public Policy for Greening Chiangmai Vision. 2019.

32. Charney, M.W., The Chiang Mai Chronicle. Translated by David Wyatt and Aroonrut Wichienkeeo. Chiang Mai, Thailand: Silkworm Books, 1995. Pp. xxxvi, 225. Maps, Tables, Index, Revised Index, Insert. Journal of Southeast Asian Studies, 2011. 31(2): p. 450-451.

33. Satsue, S., Spatial Configuration and Community's Composition in Chiang Mai Citadel Area. 2018.

34. Chiang Mai World Heritage, I. Chiangmai World Heritage Initiative - Chiang Mai World Heritage Initiative. 2020 [cited 2020; Available from: https://chiangmaiworldheritage.org/.

35. Kishita, Y., et al., Designing backcasting scenarios for resilient energy futures. Technological Forecasting and Social Change, 2017. 124: p. 114-125.