

ENHANCING THE PROVINCIAL INNOVATIVENESS INDEX OF THAI NGUYEN PROVINCE, VIETNAM IN THE CONTEXT OF DIGITAL TRANSFORMATION**Nguyen Thi Huong¹, Nguyen Thi Van², Nguyen Thanh Minh³,**^{1,2,3}Thai Nguyen University of Economics and Business Administration**Nguyen Huu Phuong⁴**⁴The People's Committee of Yen Son District, Tuyen Quang Province**ABSTRACT**

In the context of digital transformation, the imperative to boost innovation at the provincial level is critical for sustainable development. Thai Nguyen Province, Vietnam, has emerged as a notable player in this domain, achieving commendable rankings in the Provincial Innovativeness Index (PII). This paper delves into the current status and proposes strategic interventions to further elevate Thai Nguyen Province's PII amidst the ongoing digital transformation.

Keywords:

Provincial Innovativeness Index (PII), Thai Nguyen Province, Vietnam, digital transformation, enhancement.

1. INTRODUCTION

The Provincial Innovativeness Index (PII) stands as a crucial measure meticulously designed to capture the intricate dynamics of innovation and creativity across diverse regions of the nation. It serves as a comprehensive reflection of progress, highlighting the interplay of various factors crucial for socio-economic advancement. Comprising seven foundational pillars—namely institutions, human capital, research and development, infrastructure, market sophistication, business sophistication, and knowledge, technology, and creative outputs—the PII offers a panoramic view of each province's or city's journey in leveraging science, technology, and innovation.

This holistic metric not only provides a nuanced snapshot of the socio-economic landscape but also acts as a guiding compass for stakeholders navigating the development terrain. By identifying strengths, weaknesses, latent potentials, and necessary prerequisites, the PII presents a roadmap for policymakers and strategists. Its inception in 2023 marked a pivotal moment, signaling a systematic approach to evaluating and enhancing the nation's innovative capacities.

In the context of Vietnam's steady progress on the Global Innovation Index (GII), reaching the 46th position in 2023—an impressive leap of two spots from the previous year—the PII gains renewed significance. It reflects Vietnam's dedication to fostering an innovation-friendly ecosystem, driving its transition towards a knowledge-based economy. More than just a gauge, the PII acts as a catalyst, inspiring localities to intensify their efforts in creating an environment conducive to innovation.

Each step towards strengthening this foundation not only benefits individual provinces and cities but also resonates across the national landscape, fostering collective advancement. In essence, the PII symbolizes Vietnam's evolution as it navigates towards integration and prosperity, embodying a nation on the brink of transformative change.

2. THE CURRENT STATUS OF THE PROVINCIAL INNOVATIVENESS INDEX (PII) OF THAI NGUYEN PROVINCE

Inaugurated by the Ministry of Science and Technology in 2023, the Provincial Innovativeness Index (PII) emerges as a pivotal instrument casting light upon Vietnam's socio-economic terrain, providing a meticulous overview of progress propelled by science, technology, and innovation across the nation. Its introduction marked a significant juncture, furnishing a nuanced perspective to scrutinize the evolving dynamics of development unfolding throughout the country. Reflecting upon the data, it becomes evident that the standout performers within this distinguished roster of innovation are invariably regions where industries thrive, serving as formidable pillars within the economic framework. The Provincial Innovativeness Index (PII) in 2023 comprises 52 indicators, categorized into 7 pillars following the principles of the Global Innovation Index (GII). These pillars include 5 input pillars reflecting factors

conducive to socio-economic development based on institutions; human capital, research and development; infrastructure; market sophistication; and business sophistication. Additionally, there are 2 output pillars reflecting the impact of knowledge, technology, and innovation on socio-economic development (knowledge, technology, and creative outputs; impact). According to the announced results, the top 10 provinces and cities with the highest PII scores nationwide (in descending order) are: Hanoi (62.86), Ho Chi Minh City (55.85), Hai Phong (52.32), Da Nang (50.70), Can Tho (49.66), Bac Ninh (49.20), Ba Ria - Vung Tau (49.18), Binh Duong (48.64), Quang Ninh (48.03), and Thai Nguyen (47.75).

Thai Nguyen's ascent in 2023 serves as a testament to its unwavering determination, leading the charge among its counterparts in the midland and northern mountainous regions within the echelons of the PII. With an admirable score of 47.75, securing its place among the nation's top 10, Thai Nguyen's achievement transcends mere investment in research and development. It represents a symphony of collaborative endeavors resonating across spheres such as business environment, infrastructure enhancement, and the cultivation of a skilled workforce. The province's narrative is one of harmonizing economic expansion with the forefront of innovation, prominently highlighted in burgeoning sectors like information technology, high-tech agriculture, and education. This resounding endorsement within the PII framework heralds a dawn of progress, underscoring Thai Nguyen's substantial strides in cultivating an environment ripe for innovation.

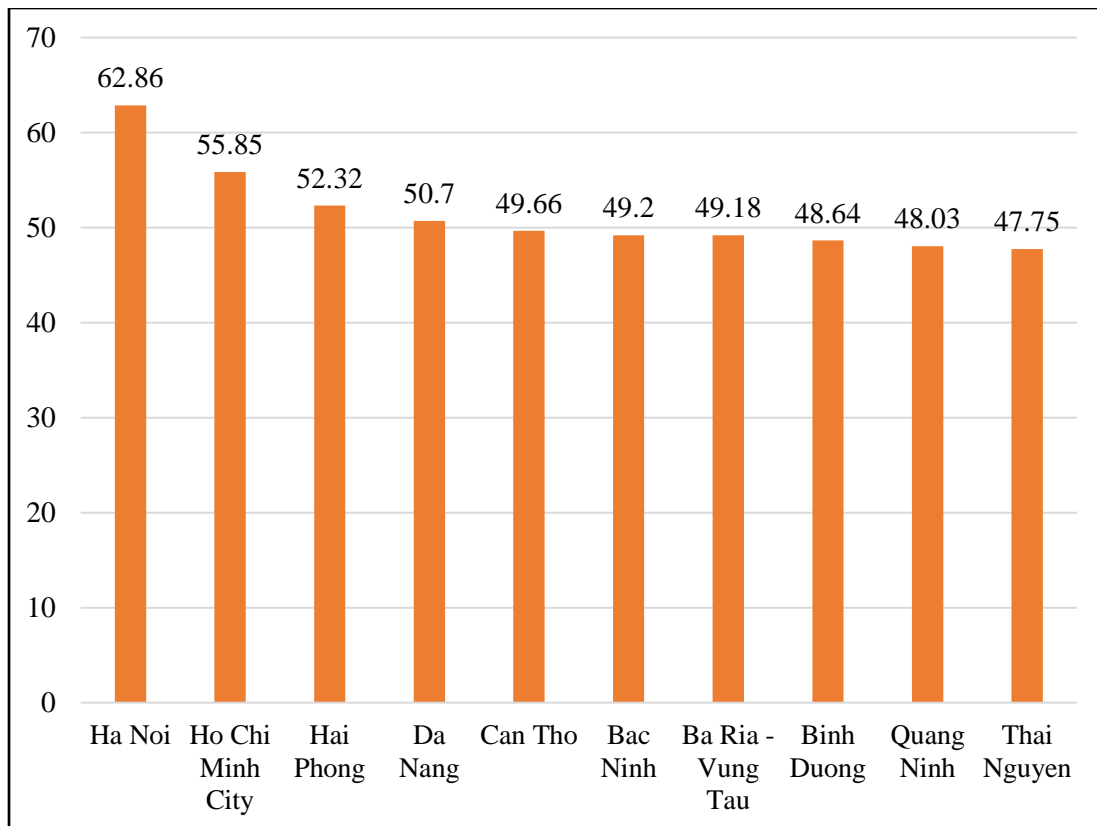


Figure 1. Top 10 localities with the highest PII index in 2023

(Source: Ministry of Science and Technology, 2023)

Positioned as the fulcrum of the midland and northern mountainous regions, Thai Nguyen's journey towards enhancing its Provincial Innovativeness Index (PII) epitomizes a collective endeavor, reflecting the province's resilience, consensus-building, and effective governance. However, amid the accolades, the province confronts certain challenges that necessitate addressing to further enhance its competitive advantage and anchor sustainable growth. Chief among these challenges is the lack of a comprehensive and up-to-date statistical framework, hindering efforts to accurately

assess and refine innovation-centric metrics. This challenge, emblematic of a broader national issue, highlights the scarcity of resources and expertise required for data collection and analysis. Furthermore, despite its commendable position in the PII rankings, Thai Nguyen finds itself on the brink of further refinement, particularly in leveraging science and technology for production and governance. This calls for a more robust commitment to infrastructure investment, intensification of research and development initiatives, and the fostering of an ecosystem conducive to collaborative partnerships between academia, research institutions, and businesses. In essence, Thai Nguyen's journey within the realm of the PII transcends mere demonstration of its innovation prowess; it serves as a rallying cry for collective action, emphasizing the imperative of strengthening the province's innovation ecosystem to fully realize its potential amidst Vietnam's transformative journey.

3. STRATEGIES FOR ENHANCING THE PROVINCIAL INNOVATIVENESS INDEX (PII) OF THAI NGUYEN PROVINCE

Nestled as a pivotal nexus of industrial prowess and educational excellence within Vietnam, Thai Nguyen province finds itself at the threshold of numerous opportunities to elevate its Provincial Innovativeness Index (PII) to unprecedented heights. To embark on this transformative odyssey, a multifaceted approach is imperative, requiring the implementation of a diverse array of strategic interventions spanning from augmented investments in education and research to fostering synergistic collaborations among businesses, research institutions, and local governance bodies. Delving into the realm of possibilities, Thai Nguyen province can chart a course towards PII enhancement through the following strategic imperatives:

Formulating a Robust Innovation Strategy

Formulating a robust innovation strategy is paramount for Thai Nguyen to thrive in today's rapidly evolving global landscape. Such a strategy should encompass multifaceted approaches aimed at fortifying the province's human capital, invigorating the business milieu, and fostering international partnerships. By leveraging its resources effectively and fostering collaboration across various sectors, Thai Nguyen can unleash its full innovation potential and propel itself towards sustainable growth and prosperity.

One of the cornerstones of a successful innovation strategy is the cultivation of a highly skilled and adaptable workforce. Thai Nguyen possesses a wealth of educational institutions, research hubs, and vocational training centers that can serve as fertile grounds for nurturing local talent and fostering innovation. By strategically leveraging these resources, the province can create an ecosystem where aspiring innovators have access to cutting-edge knowledge, mentorship, and practical experience. To achieve this, Thai Nguyen must invest in strengthening educational curricula and vocational training programs to align them with the evolving needs of the job market and emerging industries. By incorporating modules on entrepreneurship, problem-solving, and critical thinking into the curriculum, educational institutions can instill a culture of innovation and empower students to become future innovators and entrepreneurs. Furthermore, fostering collaboration between educational institutions, businesses, and governmental bodies is crucial for tailoring training initiatives to align with market demands and technological advancements. By establishing collaborative frameworks and partnerships, Thai Nguyen can bridge the gap between academia and industry, facilitating knowledge transfer, technology commercialization, and the development of innovative solutions to local and global challenges. In addition to nurturing local talent, Thai Nguyen must also create an enabling environment for entrepreneurship and innovation to flourish. This involves streamlining bureaucratic processes, reducing regulatory barriers, and providing incentives for startups and innovative enterprises. By fostering a supportive ecosystem that encourages risk-taking and experimentation, the province can attract investment, talent, and resources essential for driving innovation-led growth. Moreover, fostering international partnerships and collaborations is essential for accessing global markets, attracting foreign investment, and leveraging external expertise and resources. Thai Nguyen should actively seek opportunities to collaborate with international research institutions, businesses, and governmental bodies to exchange knowledge, expertise, and best practices in innovation and technology transfer.

Expediting Access to Cutting-Edge Resources and Market Intelligence

Expediting access to cutting-edge resources and market intelligence is paramount for Thai Nguyen to stay ahead in today's competitive landscape. By ensuring that enterprises and research entities have expedited access to the latest technologies, information, and market insights, the province can foster a culture of innovation and drive economic growth. One effective approach to facilitating access to cutting-edge resources is the establishment of innovation hubs

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where businesses and researchers can synergize their efforts and collaborate on innovative projects. These hubs serve as dynamic ecosystems where ideas are exchanged, partnerships are formed, and resources are shared, ultimately leading to the development of novel products, services, and solutions. By providing state-of-the-art facilities, funding opportunities, and networking events, these hubs can catalyze innovation and create a conducive environment for entrepreneurship and growth.

Moreover, streamlining the business landscape is essential for reducing barriers to entry and fostering innovation diffusion, particularly for startups operating in the technology domain. Thai Nguyen should prioritize initiatives aimed at simplifying legal and administrative processes, reducing regulatory burdens, and enhancing access to financing and support services for startups and innovative enterprises. By creating a more favorable environment for entrepreneurship and innovation, the province can attract talent, investment, and resources, thereby accelerating the pace of innovation and driving economic development. In addition to fostering collaboration and streamlining processes locally, Thai Nguyen should also leverage external networks and partnerships to access cutting-edge resources and market intelligence. By forging strategic alliances with leading research institutions, technology companies, and industry associations, the province can tap into global expertise, knowledge, and networks, gaining insights into emerging trends, technologies, and market opportunities. These partnerships can also facilitate technology transfer, research collaboration, and access to funding and markets, positioning Thai Nguyen at the forefront of innovation and competitiveness. Furthermore, investing in education and skill development is crucial for equipping the workforce with the knowledge and expertise needed to leverage cutting-edge resources effectively. Thai Nguyen should prioritize initiatives aimed at enhancing STEM education, digital literacy, and technical skills training to ensure that its workforce remains competitive in the digital age. By empowering individuals with the skills and capabilities to harness emerging technologies and market intelligence, the province can unlock new opportunities for innovation, growth, and prosperity.

Fostering Interconnected Networks

Fostering interconnected networks that encompass businesses, academia, research institutions, and local communities is not just beneficial but imperative for Thai Nguyen's innovation ecosystem to thrive. By creating robust connections and collaborations among these diverse stakeholders, the province can leverage collective expertise, resources, and perspectives to drive innovation, economic growth, and social development. Convening regular events, seminars, and exchange programs presents a promising avenue for fostering collaboration and knowledge transfer among stakeholders. These platforms provide opportunities for networking, sharing best practices, and exploring potential synergies for collaborative projects and initiatives. By facilitating dialogue and interaction between businesses, academic researchers, policymakers, and community leaders, Thai Nguyen can create a vibrant ecosystem where ideas flourish, partnerships form, and innovation thrives. Moreover, augmenting international collaborations is crucial for Thai Nguyen to tap into global expertise, access new markets, and stay abreast of international best practices and trends. By forging strategic alliances with foreign counterparts, the province can glean valuable insights, pool resources, and foster an ethos of open innovation. Collaborating with leading research institutions, technology companies, and innovation hubs abroad can facilitate technology transfer, research collaboration, and access to funding and markets, thereby enhancing Thai Nguyen's competitiveness and innovation capacity on the global stage. In addition to formal collaborations, fostering informal networks and communities of practice can also play a pivotal role in driving innovation and knowledge exchange. Thai Nguyen should encourage the formation of industry clusters, innovation networks, and entrepreneurial ecosystems where individuals and organizations with shared interests and goals can collaborate, share resources, and support each other's growth and success. By nurturing these networks, the province can create a supportive environment for innovation and entrepreneurship to flourish, attracting talent, investment, and opportunities from both within and outside the region. Furthermore, investing in digital infrastructure and technology platforms can facilitate communication, collaboration, and knowledge sharing among interconnected networks. By leveraging digital tools and platforms such as online collaboration tools, social media, and virtual reality, Thai Nguyen can overcome geographical barriers, facilitate remote collaboration, and create new opportunities for interaction and collaboration among stakeholders.

Nurturing a Culture of Innovation and Creativity

Nurturing a culture of innovation and creativity is not only essential but indispensable for Thai Nguyen to thrive in today's rapidly changing world. Instituting policies and programs that foster an environment where innovation is celebrated and creativity is encouraged can unleash the full potential of the province's human capital and drive sustainable growth and development. One of the key strategies for nurturing a culture of innovation is to support and recognize nascent ideas and projects at their early stages of development. Thai Nguyen should establish funding programs, grants, and awards that provide financial support and recognition to individuals and organizations with innovative ideas and projects. By investing in promising initiatives and providing validation and encouragement to innovators, the province can catalyze the development and implementation of groundbreaking solutions to local and global challenges. Furthermore, providing avenues for diverse expression of creativity is crucial for nurturing a culture of innovation. Thai Nguyen should encourage experimentation, risk-taking, and exploration across various domains, from arts and culture to science and technology. This can be achieved through initiatives such as innovation festivals, maker spaces, hackathons, and interdisciplinary collaboration programs that bring together individuals from different backgrounds and disciplines to collaborate on creative projects and explore new ideas. Financial incentives, support mechanisms, collaborative spaces, and ancillary services are also vital for nurturing the growth of startups and integrated enterprises. Thai Nguyen should establish incubators, accelerators, and co-working spaces that provide entrepreneurs with access to mentorship, networking opportunities, funding, and business support services. By creating a supportive ecosystem that fosters entrepreneurship and innovation, the province can attract and retain talent, stimulate economic activity, and drive job creation and wealth generation. Moreover, integrating innovation and creativity into the educational curriculum is essential for cultivating a new generation of innovators and problem solvers. Thai Nguyen should prioritize initiatives aimed at promoting STEAM education (Science, Technology, Engineering, Arts, and Mathematics) and project-based learning that encourages critical thinking, creativity, and collaboration. By equipping students with the skills and mindset needed to thrive in the innovation economy, the province can ensure a steady pipeline of talent and innovation for the future.

Fostering a Conducive Ecosystem for Entrepreneurship and Innovation

Fostering a conducive ecosystem for entrepreneurship and innovation is crucial for Thai Nguyen to unlock its full economic potential and drive sustainable development. By creating an environment where startups and innovators can thrive, the province can stimulate economic growth, create jobs, and address pressing social and environmental challenges.

One of the key pillars of a conducive ecosystem for entrepreneurship is the establishment of startup incubators, accelerators, and comprehensive support services. These platforms provide aspiring entrepreneurs with access to mentorship, networking opportunities, funding, and business support services, helping them navigate the complexities of starting and scaling a business. Thai Nguyen should prioritize initiatives aimed at nurturing startup incubators and accelerators, either independently or in partnership with local universities, research institutions, and private sector organizations. By providing a supportive infrastructure for startups to grow and succeed, the province can attract and retain entrepreneurial talent and foster a vibrant startup ecosystem. In addition to providing infrastructure and support services, Thai Nguyen should also focus on galvanizing the entrepreneurial spirit within the province through initiatives such as startup competitions, hackathons, and entrepreneurship training workshops. These events not only provide aspiring entrepreneurs with opportunities to showcase their ideas and talents but also foster a culture of risk-taking, innovation, and collaboration. By organizing and promoting such initiatives, the province can inspire and empower individuals from diverse backgrounds to pursue entrepreneurship as a viable career path, driving innovation and economic growth. Moreover, fostering collaboration and knowledge exchange between startups, established businesses, academia, and government is essential for creating a thriving entrepreneurial ecosystem. Thai Nguyen should facilitate partnerships and networking opportunities that enable startups to access expertise, resources, and market opportunities. By bridging the gap between different stakeholders and fostering a culture of collaboration and co-creation, the province can accelerate innovation and drive economic transformation across various sectors.

Furthermore, providing access to financing and investment opportunities is critical for fueling the growth of startups and innovative enterprises. Thai Nguyen should explore avenues for attracting investment capital, such as venture capital funds, angel investors, and government grants and incentives. By providing financial support and incentives for entrepreneurship and innovation, the province can stimulate investment in high-potential startups and foster a culture of innovation-driven entrepreneurship.

Leveraging Emerging Technologies

In the era of rapid technological advancement, Thai Nguyen has a unique opportunity to leverage emerging technologies like artificial intelligence (AI), blockchain, and the Internet of Things (IoT) to catalyze innovation across diverse sectors of the economy. By strategically harnessing the potential of these disruptive technologies, the province can not only enhance efficiency and productivity but also foster new avenues for economic growth and development. Artificial intelligence, with its ability to analyze vast amounts of data and extract actionable insights, holds tremendous promise for revolutionizing various industries, from manufacturing and agriculture to healthcare and transportation. By integrating AI-driven solutions into processes such as predictive maintenance, personalized healthcare, and autonomous vehicles, Thai Nguyen can optimize resource utilization, improve decision-making, and unlock new opportunities for innovation and competitiveness. Similarly, blockchain technology offers unprecedented levels of transparency, security, and trust in transactions, making it ideal for applications in finance, supply chain management, and governance. By implementing blockchain-based solutions for secure digital transactions, transparent supply chain tracking, and efficient land registry management, Thai Nguyen can streamline processes, reduce fraud, and enhance accountability, thereby creating a conducive environment for business growth and investment.

Moreover, the Internet of Things (IoT) presents exciting possibilities for connecting physical devices and enabling seamless communication and data exchange. By deploying IoT-enabled sensors and devices in areas such as smart agriculture, smart infrastructure, and smart energy management, Thai Nguyen can optimize resource usage, enhance sustainability, and improve quality of life for its residents. From precision farming techniques to intelligent traffic management systems, the potential applications of IoT are vast and transformative. To harness the full potential of these emerging technologies, Thai Nguyen should consider establishing specialized innovation hubs and research centers dedicated to AI, blockchain, and IoT. These hubs can serve as focal points for collaboration between academia, industry, and government, fostering a vibrant ecosystem of innovation and entrepreneurship. By investing in research and development initiatives, providing training and capacity-building programs, and offering incentives for technology adoption, the province can position itself at the forefront of the digital transformation landscape and reap the benefits of technological innovation.

Prioritizing Sustainability and Green Innovation

Emphasizing sustainability and green innovation as fundamental elements of the province's innovation agenda holds immense potential for fostering eco-friendly practices and addressing environmental challenges sustainably. By prioritizing research and innovation in areas such as renewable energy, waste management, and eco-friendly manufacturing processes, we can unlock new avenues for green entrepreneurship and drive sustainable development forward. Investing in renewable energy technologies not only reduces our dependence on fossil fuels but also mitigates environmental degradation and contributes to combating climate change. Through initiatives aimed at developing and implementing renewable energy solutions, such as solar, wind, and hydroelectric power, Thai Nguyen can establish itself as a hub for clean energy innovation and attract investment in this burgeoning sector. Furthermore, effective waste management strategies are essential for safeguarding our environment and public health. By promoting research and innovation in waste reduction, recycling, and sustainable disposal methods, we can minimize the environmental footprint of our communities and create a circular economy where resources are utilized efficiently and waste is minimized. Additionally, integrating eco-friendly manufacturing processes into our industrial sector not only reduces pollution and resource consumption but also enhances competitiveness in the global market. By adopting sustainable production practices, such as lean manufacturing and green supply chain management, Thai Nguyen can position itself as a leader in environmentally responsible manufacturing and attract eco-conscious consumers and investors. Moreover, fostering a culture of innovation and entrepreneurship in green technologies and sustainable practices can spur economic growth and job creation while safeguarding our natural resources for future generations. By providing support and incentives for green startups and initiatives, we can nurture a vibrant ecosystem of innovation and drive positive change towards a more sustainable future.

Enhancing Digital Infrastructure and Connectivity

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Investing in digital infrastructure and connectivity can facilitate the adoption of digital technologies and innovation. Building robust broadband networks, digital platforms, and smart city infrastructure can empower businesses, entrepreneurs, and citizens with access to digital tools and resources, unlocking new avenues for innovation-driven growth and improving overall quality of life.

Through the implementation of these strategic solutions, Thai Nguyen province can accelerate its journey towards enhancing the Provincial Innovativeness Index (PII) and solidify its position as a beacon of innovation and progress within Vietnam. Bold initiatives, collaborative partnerships, and a steadfast commitment to fostering a culture of innovation will unlock new opportunities for economic prosperity, social development, and sustainable growth in the years to come.

4. CONCLUSION

Thai Nguyen emerges as a burgeoning hub of innovation within Vietnam, poised to transcend conventional boundaries and drive advancements across diverse industries. This transformative journey holds the promise of enhancing the quality of life for its residents while presenting attractive opportunities for both domestic and international investors. The province's climb in the Provincial Innovativeness Index (PII) ranking marks a significant milestone in this trajectory, highlighting its potential for sustained progress. To maintain and build upon its achievements, Thai Nguyen must continue to prioritize collaboration among local authorities, businesses, and the scientific community. This collaborative effort is essential in fostering an ecosystem conducive to innovation and creativity. Investments in education and training, alongside efforts to attract and retain top-tier talent, are crucial not only for sustaining Thai Nguyen's position in the PII ranking but also for driving further progress towards sustainable development. As Thai Nguyen strives to become a beacon of innovation, cultivating a culture of collaboration and synergy among stakeholders becomes paramount. By nurturing an inclusive environment where ideas flourish and partnerships thrive, the province can establish itself as a significant player on the global innovation stage. Embracing a holistic approach that integrates advancements in education, technology, and governance will be key to catalyzing Thai Nguyen's journey towards a future filled with opportunities. With unwavering dedication, strategic foresight, and a shared commitment to progress, Thai Nguyen is poised to leave a lasting mark on the landscape of innovation, ushering in a new era of prosperity and advancement for its residents and beyond.

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