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Governance of High-Tech Industrial Project Portfolios in Hanoi City

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Abstract: This article assesses the empirical basis and proposes a framework for governing portfolios of high-tech industry (HTI) projects in Hanoi City under conditions of limited land supply and a new institutional framework. The study uses the Hanoi Statistical Yearbook 2025, policy documents and management survey materials from 2026; the methods comprise descriptive statistics, chain-linking of the Index of Industrial Production (IIP), an indicator matrix and policy analysis. The findings show that: (i) in 2021–2025, the high-technology industries increased output but did not outperform the processing and manufacturing industry as a whole; (ii) investment resources increased, but the financial performance of enterprises did not improve continuously; (iii) the existing indicator system mainly reflects scale and inputs and is insufficient for monitoring technological outcomes at the project level. On this basis, the article proposes a three-stage governance framework comprising entry screening, life-cycle monitoring, and ex-post review and restructuring, together with a set of monitoring indicators and implementation conditions. Owing to the lack of project-level data, the evidence of this study is indirect, and the proposed framework requires further testing in future research.

Keywords: *industry, high technology, governance, ex-post review, technological capability, Hanoi*

I. Introduction

The transition to a knowledge economy and a digital economy is changing the basis of value creation in industry. Unlike production based mainly on capital, labor and cost advantages, high-tech industry (HTI) creates value through research and development (R&D), design, intellectual property and the commercialization of technology (Romer, 1990; Lall, 1992). Accordingly, the quality of HTI project development depends not only on the scale of investment but also on the recipient country's capacity to absorb, master and accumulate technology.

At present, Hanoi has favorable conditions for developing HTI projects. In the 2025–2026 academic year, the City has 79 universities with about 881 thousand students; there are 824 science and technology organizations in the area; and the proportion of employed workers who have received training reaches 75.3% (Hanoi Statistical Office, 2026). The Hoa Lac High-Tech Park has 111 projects with total registered capital of nearly VND 116 trillion. However, Hanoi faces a major constraint in urban land, so it cannot compete on industrial land area or low-cost labor; its more suitable advantage lies in the value created per unit of land, knowledge content, and the capacity to link with the university–research institute system. At the same time, the 2024 Capital Law and the transfer of the Hoa Lac High-Tech Park to the management of the City People's Committee have expanded the authority of the City government in selecting, supporting and supervising projects.

In this context, the policy question is not only how many projects the City attracts, but also how projects should be selected, monitored and handled so that land, infrastructure and incentives generate technological capability. Data for 2021–2025 show that the high-technology (HT) industries have not achieved a clear growth advantage over the processing and manufacturing industry (MFG) as a whole, while MFG has 1,080 cumulative FDI projects, yet current statistics do not allow technology transfer, on-site R&D or domestic value to be quantified. The gap between data that measure scale and data that measure technological outcomes is precisely the governance problem that this article addresses.

Domestic studies of HTI have mainly taken a national-level approach or have addressed individual aspects separately. Tran Thanh Thuy (2007) developed a list of HTI products; Lai Tran Tung and Phung Van Nhu (2023) drew from the experience of the United States the requirements for the enabling role of the State and for core technologies; Bui Nhat Le Uyen (2019) analyzed the factors affecting the innovation capability of HTI enterprises; Ngo Thuy Quynh (2022)

and Nguyen Cao Lanh (2022) assessed the development of industrial zones. For Hanoi in particular, Nguyen Ba Van and Do Hong Quan (2022) emphasized the need for coordinated development of enterprise capability, infrastructure, human resources and linkages, while Nguyen Thi Nguyet et al. (2026) analyzed specific mechanisms and policies for the Hoa Lac High-Tech Park. It can therefore be seen that most studies were conducted before, or do not fully reflect, the new institutional framework following the 2024 Capital Law and the transfer of Hoa Lac to the City. In addition, the existing articles mainly study investment attraction or development conditions without a framework of indicators for monitoring technological outcomes at the project level, and investment projects are rarely considered as a portfolio to be selected, monitored and adjusted throughout the entire life cycle. This study therefore poses research questions and objectives intended to contribute to filling these research gaps.

The objective of the study is to assess the empirical basis regarding the scale, dynamics and resource efficiency of Hanoi's MFG in 2020–2025 from the perspective of the quality of the HTI project portfolio. At the same time, it identifies gaps in the existing indicator system and, on that basis, proposes a framework for governing HTI project portfolios appropriate to the conditions of Hanoi City. The article seeks to answer the following research questions: (1) What do the scale, production dynamics and resource efficiency of Hanoi's MFG in 2020–2025 reveal about the quality of the high-technology project portfolio? (2) Which aspects of project quality does the existing indicator system measure, and which does it not measure? (3) Which governance framework can shift the selection, monitoring and handling of projects from an input basis to a technological-outcome basis, consistent with Hanoi's new institutions?

II. Theoretical Basis

2.1. High-Tech Industry and Project Portfolios

The classification of industries by technological level is commonly based on R&D intensity, measured as the ratio of R&D expenditure to the value added of the industry (Galindo-Rueda & Verger, 2016). Under this classification, the high-technology (HT) group within MFG comprises the manufacture of pharmaceuticals, medicinal chemicals and botanical products (VSIC 21) and the manufacture of electronic products, computers and optical products (26); the medium-high-technology (MHT) group comprises chemicals (20), electrical equipment (27), machinery and equipment not elsewhere classified (28), motor vehicles (29) and other transport equipment (30). UNIDO (2022) combines the two groups into a medium-high and high technology group. This is a statistical classification at the industry level: an industry belonging to the HT group does not mean that every enterprise or every stage within the industry has a high technological level, because an enterprise may only carry out assembly according to designs and technologies supplied by its parent company.

Accordingly, identifying HTI in substance requires considering five groups of criteria simultaneously: R&D intensity, technological content of products, value added, human resources, and innovation capability (Lall, 1992; Kaplinsky & Morris, 2001; Chesbrough, 2003). From a legal perspective, High Technology Law No. 133/2025/QH15, effective from 1 July 2026, defines HTI as the industry that produces high-technology products and provides high-technology services, replacing the 2008 Law (National Assembly, 2025a). This article uses legal concepts to analyze institutions, while quantification is based on the statistical classification of industries.

On that basis, the article defines an HTI project portfolio as a set of production and R&D investment projects in the City that are selected, monitored and adjusted as a unified whole throughout their life cycle in order to maximize technological outcomes and the value created per unit of public resources, especially land and incentives. This definition shifts the unit of analysis from the individual project to the set of projects, and from the time of licensing to the entire implementation process.

2.2. Technological Capability, Value Chains and Innovation Systems

Lall's (1992) approach to technological capability holds that technological capability is not merely the possession of machinery but comprises the ability to select, operate, adapt, improve and independently develop technology. Absorptive capacity, that is, the ability to recognize, assimilate and apply external knowledge, depends on prior knowledge and on the firm's own R&D investment (Cohen & Levinthal, 1990). From this, four levels of technological mastery at the enterprise level can be distinguished: stable operation of imported technology; adaptation and process improvement; independent design of key components, products or processes; and the creation of technology and intellectual property capable of leading the market. A project in a high-technology industry may be only at the first or second level; therefore, monitoring the movement between levels has more governance significance than merely classifying projects by industry.

The global value chain approach shows that the same industry can create very different value depending on the position that the enterprise occupies (Gereffi, Humphrey & Sturgeon, 2005); upgrading is associated with improvements in product, process, function and position in the chain (Kaplinsky & Morris, 2001). The Triple Helix framework (Etzkowitz

& Leydesdorff, 2000) emphasizes the complementary roles of the State (institutions, infrastructure, risk sharing), universities and research institutes (knowledge, human resources) and enterprises (products, markets); when one link operates in isolation, an ecosystem may be rich in resources but poor in commercial outcomes.

The three approaches above lead to an implication for the design of governance criteria: criteria for selecting and evaluating projects must reflect technological capability and position in the value chain, not only industry, registered capital or area. This is the basis for shifting the emphasis from input indicators to outcome indicators.

2.3. Project Portfolio Governance and Incentive Policy Conditional on Outcomes

Project portfolio governance is an approach to managing a set of projects linked to strategic objectives, comprising the activities of selection, prioritization, monitoring and adjustment (Project Management Institute, 2017). In innovation management, the stage-gate model divides the development process into stages, with decision points between stages at which to continue, adjust or stop a project (Cooper, 1990), and new product portfolio management practices have been documented as being associated with firm performance (Cooper, Edgett & Kleinschmidt, 1999).

In industrial policy, Amsden (1989) described the mechanism of reciprocal control in South Korea's industrialization, under which State support was exchanged for performance standards such as exports or productivity improvements. Rodrik (2004) emphasized that industrial policy must be accompanied by clear evaluation criteria, monitoring, and the ability to terminate support when results are not achieved. With respect to FDI, Javorcik (2004) showed that productivity spillovers may arise through backward linkages with domestic suppliers rather than occurring automatically within the same industry, thereby suggesting that supplier linkages are a channel that needs to be monitored.

III. Research Methodology

Secondary data comprise: (i) the Hanoi Statistical Yearbook 2025 (Hanoi Statistical Office, 2026), which provides official figures for 2020–2024 and preliminary figures for 2025 on GRDP, IIP by industry, investment capital, FDI and enterprises; (ii) legal and planning documents, including the 2024 Capital Law, the Capital Planning for the period 2021–2030, with a vision to 2050 (Decision No. 1569/QD-TTg), the High Technology Law and the Law on Science, Technology and Innovation promulgated in 2025; (iii) survey materials of the Management Board of Hanoi High-Tech Parks and Industrial Zones (2026). The 2025 figures are preliminary; enterprise figures have been published only up to 2024 because of the lag in surveys. The survey material published in 2026 is used only as supplementary evidence on the status of R&D and is not used to calculate trends for 2020–2025.

The study uses four methods. First, descriptive statistics and comparison over time and across industries VSIC 20, 21, 26, 27, 28, 29 and 30 relative to MFG as a whole. Second, the Index of Industrial Production (IIP, previous year = 100) is chain-linked to compare dynamics across industries using the following formula:

$$I(t) = I(t-1) \times \mathrm{IIP}(t) \,/\, 100, \text{ with } I(2020) = 100$$

The equivalent average growth rate for 2021–2025 is calculated from the cumulative index:

$$g\ (\%/\text{year}) = [(I(2025) \,/\, I(2020))^{1/5} - 1] \times 100$$

where I(t) is the cumulative output index of year t and g is the equivalent average growth rate.

Third, indicator matrix analysis, that is, comparing the indicators needed for project portfolio governance with the data currently available at the city, industry and project levels. Fourth, policy analysis and qualitative analysis to design the three-stage framework. Position in the value chain is examined qualitatively.

The study adheres to the following interpretive principles. IIP reflects changes in production volume, not value added (VA); therefore, conclusions relate only to production dynamics. The IIPs of individual industries are not aggregated or averaged to create a common index for the HT or MHT group because appropriate weights are lacking. The article does not estimate VA by level-2 industry, domestic value or productivity specific to the high-technology group where the statistical sources do not publish them. Enterprise indicators are averages for the whole of MFG, not separated by HT/MHT group or ownership type, and therefore are not used to compare FDI with domestic enterprises. Finally, apart from aggregate data for the Hoa Lac High-Tech Park and the 2026 sample survey, there are no project-level data; the evidence of this article is therefore indirect, showing scale, dynamics and monitoring gaps, and does not test the effectiveness of individual projects.

Analytical Framework of the Study

The study uses a three-tier analytical framework to read the data and to design the indicator system of the subsequent governance framework:

Tier 1 – Inputs and Conditions: investment capital, FDI, land, infrastructure, human resources, science and technology organizations, and institutions. This is the tier that current statistics reflect most fully.

Tier 2 – Observable Outcomes: scale, growth, structure and financial performance of industries and enterprises, expressed through VA, IIP, revenue, profit and capital turnover.

Tier 3 – Accumulated Technological Quality: R&D conducted, commercialization, intellectual property, supplier linkages, technology spillovers from FDI and the level of technological mastery.

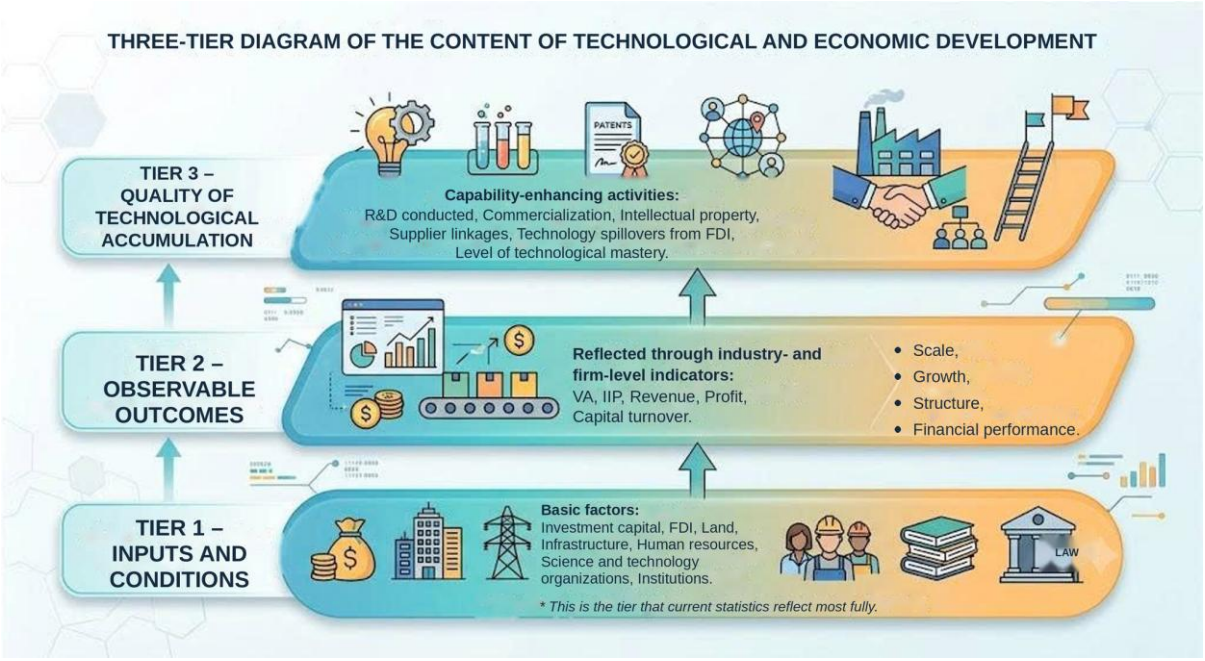


Figure 1. Proposed analytical framework

Source: Proposed by the author

The analytical framework indicates that project portfolios are well governed only when all three tiers are monitored and closely connected with one another: inputs are meaningful only when they are converted into production outcomes, and production outcomes are sustainable only when accompanied by the accumulation of technological capability. The available data are concentrated in the first two tiers, whereas Tier 3, where Lall (1992) and the value chain studies place the focus of technological upgrading, is almost unmeasured at the project level. The study therefore applies an analytical approach in three steps: (1) reading Tiers 1 and 2 with statistical data; (2) examining the extent to which the data cover Tier 3; (3) proposing additional indicators for monitoring Tier 3 throughout the project life cycle.

IV. Research Results

4.1. Production Dynamics of the High-Technology and Medium-High-Technology Industries

In 2020–2025, the VA of Hanoi's MFG rose from VND 136,980 billion to VND 192,213 billion at current prices; at constant 2010 prices, VA rose from VND 86,241 billion to VND 110,494 billion, corresponding to an average real growth rate of about 5.08% per year (Table 1). In 2025, MFG VA grew by 7.18% in real terms, higher than in 2023 and 2024. However, the share of MFG in GRDP fell from 13.46% to 12.11%. This trend does not mean that industry is declining in scale but reflects the faster growth of other sectors, especially services; for a large city, the quality issue is whether the remaining industry shifts toward knowledge-intensive industries and stages. The 2025 Yearbook reports that industry grew by an average of 5.30% per year in 2021–2025 and that MFG accounted for about 86.6% of industry.

Table 1. Selected indicators of Hanoi's processing and manufacturing industry, 2020–2025

Year	MFG VA at current prices (VND billion)	MFG VA at constant 2010 prices (VND billion)	MFG/GRDP (%)	Real VA growth (%)
2020	136,980	86,241	13.46	–
2021	146,179	89,627	13.67	3.93
2022	160,613	94,848	13.49	5.83
2023	167,129	97,835	13.00	3.15
2024	177,656	103,092	12.51	5.37
2025	192,213	110,494	12.11	7.18

Source: Author's calculations from the Hanoi Statistical Yearbook 2025 (Hanoi Statistical Office, 2026). 2025 figures are preliminary.

4.2. Investment Resources, FDI and Enterprise Performance

Realized investment capital of MFG in 2025 reached VND 56,067 billion at current prices, an increase of 19.5% at constant prices compared with 2024. The ratio of realized investment capital to MFG VA fell from 36.3% in 2020 to 25.1% in 2024 and then rose to 29.2% in 2025 (Table 3). Regarding FDI, by the end of 2025 the MFG industry had 1,080 projects with cumulative registered capital of USD 6.593 billion; in 2025 alone there were 10 new projects with registered capital of USD 33 million and realized capital of USD 386 million. It should be noted that the cumulative realized capital published in the Yearbook (USD 7.717 billion) is higher than the current registered capital, which may be related to capital adjustments and differences in statistical coverage; the article therefore does not use the disbursement ratio.

Regarding enterprise performance, the number of MFG enterprises increased from 17,531 in 2020 to 19,649 in 2024, and net revenue rose from VND 751,279 billion to VND 898,278 billion, while the number of employees increased only slightly, from 520,664 to 523,055. Revenue per employee rose from VND 1,443 million to VND 1,717 million per person, and average monthly income rose from about VND 10.0 million to VND 12.4 million. However, financial performance did not improve continuously: pre-tax profit fell from VND 38,328 billion in 2020 to VND 30,201 billion in 2023 and then recovered to VND 38,592 billion in 2024; the pre-tax profit margin fell from 5.10% to 3.78% and then rose to 4.30%, still not returning to the 2020 level; capital turnover fluctuated within the range of 1.02–1.08 times.

Table 3. Investment capital and selected efficiency indicators of Hanoi's processing and manufacturing industry, 2020–2025

Year	Realized investment capital, current prices (VND billion)	Investment capital/ MFG VA (%)	Revenue/ employee (VND million/ person)	Pre-tax profit margin (%)	Capital turnover (times)
2020	49,670	36.3	1,443	5.10	1.02
2021	37,541	25.7	1,456	4.45	1.05
2022	41,602	25.9	1,596	3.98	1.07
2023	43,192	25.8	1,568	3.78	1.02
2024	44,598	25.1	1,717	4.30	1.08
2025	56,067	29.2	not yet published	not yet published	not yet published

Source: Hanoi Statistical Yearbook 2025 (Hanoi Statistical Office, 2026); enterprise ratios were calculated by the author from the original data (revenue/employee = net revenue/number of employees at 31 December; profit margin = pre-tax profit/net revenue × 100; capital turnover = net revenue/average capital for production and business). Enterprise data are published up to 2024.

The above observations are descriptive and do not permit causal conclusions. They show only that the growth in resource scale and revenue is not accompanied by a comparable capacity to accumulate profit; meanwhile, in order to move from contract processing to design, enterprises need cash flow large enough to sustain R&D, train engineers, protect intellectual property and bear the risks of product development cycles. The industry-wide average may also conceal differentiation among groups of enterprises, and the data cannot be separated by HT/MHT group or ownership type. From a portfolio governance perspective, the implication is that if projects are selected mainly by capital and scale, outcomes in enterprise-level technological accumulation do not improve correspondingly.

Two additional observations shed further light on the state of resources. First, at constant 2010 prices, realized investment capital of MFG in 2025 reached VND 36,782 billion, still about 10.5% lower than in 2020 (VND 41,114 billion) (author's calculation); meanwhile, at current prices investment capital fell sharply from VND 49,670 billion in 2020 to VND 37,541 billion in 2021 (a decline of about 24.4%) before gradually recovering. Thus, the 19.5% increase in 2025 reflects a recovery from a low base and has not brought real investment capital above its 2020 level, and the ratio of investment capital to VA, at 29.2%, remains lower than the 36.3% of 2020. Second, the average number of employees per enterprise fell from 29.70 to 26.62 in 2020–2024 (author's calculation from the original data), which means that growth in the number of enterprises has been accompanied by a smaller average workforce size. For small and medium-sized enterprises, the fixed costs of innovation are a major barrier because it is difficult for them to build laboratories, testing centers and teams of experts on their own; this increases the importance of shared infrastructure and of testing, inspection and certification services in the portfolio.

With regard to FDI, the article does not assume that the scale of capital and the number of projects in themselves reflect quality. Technology spillovers from FDI depend on the ability of domestic suppliers to meet standards and on whether parent companies locate design and R&D in the country (Javorcik, 2004). Because the data show only the number

of projects and capital, FDI in the portfolio should be monitored through spillover channels such as supplier development, technical training, R&D cooperation and process transfer, rather than only through investment scale.

4.3. Operational Outcomes at the Hoa Lac High-Tech Park

The Hoa Lac High-Tech Park is the City's largest space for the concentration of high-technology projects. After being transferred to the City for management, the Park has 111 projects with total registered capital of nearly VND 116 trillion, that is, an average of approximately VND 1,000 billion of registered capital per project (author's calculation from data of Hanoi Statistical Office, 2026). The Park already has the National Innovation Center, the Technical Center for Supporting Industrial Development in the Northern Region, a high-tech incubation and training center, and R&D centers. These indicators reflect scale and infrastructure components; they do not yet reveal what technological outcomes the projects produce.

The 2026 survey material of the Management Board of Hanoi High-Tech Parks and Industrial Zones (2026) records that 69.2% of surveyed projects have an in-house R&D unit and 91.7% have assigned personnel to participate in R&D; the Park as a whole has 43 laboratories or testing rooms and 25 clean rooms and pilot workshops. The survey also shows that a gap between policy and practice persists, and that the survey sample recorded no projects transferring technology externally. Because the material was published after the 2020–2025 period and reflects only a survey sample at high-tech parks and industrial zones, the article uses it as supplementary evidence on the status of R&D, not as representative of all Hanoi enterprises nor for comparing FDI with domestic enterprises.

At the citywide level, the input base of the innovation ecosystem is large: in the 2025–2026 academic year, Hanoi has 79 universities with 27.3 thousand lecturers and about 881 thousand students; there are 824 science and technology organizations in the area, of which 312 belong to the group of engineering sciences and technology; and the digital economy accounted for 17.34% of GRDP in 2025. On the enterprise side, as of early 2025, 104 enterprises with 156 products were recognized as producers of key industrial products, of which 7 enterprises are among Vietnam's top 500 enterprises (Hanoi Statistical Office, 2026). This group is not identical to high-tech enterprises under the law, but it shows that the City already has a layer of enterprises with relatively clear products and competitiveness, which can become lead customers in the chain for the ecosystem.

On the other hand, local budget expenditure on R&D was recorded at VND 88.8 billion in 2025. This figure does not reflect total R&D expenditure in the area because there are also central government, enterprise, university and institute, and FDI sources, but it shows the need for caution in inferring R&D investment intensity from the number of research organizations. It can be argued that this is an input–outcome paradox: the supply of knowledge is very large, yet indicators showing whether that flow of knowledge is converted into R&D contracts, commercial products or orders for domestic suppliers are not being monitored. Between the laboratory and the factory there are intermediate links such as testing, inspection, certification, design for manufacturing, intellectual property protection and access to first customers; without these services, enterprises must invest at great cost themselves or move activities outside the locality, reducing agglomeration effects. Therefore, shared infrastructure and intermediary organizations at Hoa Lac are as significant as traditional technical infrastructure and should be monitored as a component of the portfolio.

Thus, input capabilities (R&D units, R&D personnel, laboratories) are present at a considerable level, whereas outcome indicators such as R&D contracts between enterprises and universities or institutes; technologies tested and commercialized; enterprises spun off from research; the value of orders placed with domestic suppliers; and the level of use of shared infrastructure have no periodic monitoring series in the data sources used by this study. Table 4 systematizes this gap by comparing the indicators needed for project portfolio governance with the available data.

Table 4. Matrix of indicators needed for project portfolio governance and available data

Group	Indicators needed for portfolio governance	Data available in the sources used	Level of availability
Scale	Investment capital, number of projects, registered capital	Realized investment capital and FDI of the whole of MFG; aggregate projects and registered capital at Hoa Lac	Available (aggregate level)
Dynamics	Output by level-2 industry	IIP by VSIC 20–30	Available
Dynamics	VA by level-2 industry	Not published at the level of HT/MHT industries	Not available
Financial performance	Profit margin, capital turnover, revenue per employee	Whole-MFG averages up to 2024; not separated by HT/MHT group or ownership type	Partial

Group	Indicators needed for portfolio governance	Data available in the sources used	Level of availability
Technological capability	R&D intensity of enterprises and projects	Local budget expenditure on R&D (VND 88.8 billion in 2025); share of projects with an R&D unit in the sample survey	Partial
Technological capability	Technology transfer, commercialization	Sample survey recorded no external transfer; no monitoring series	–
Technological capability	Intellectual property, revenue from new products	Not available in the sources used	–
Technological capability	Technical and R&D labor	Only aggregate labor data and the share of projects with R&D personnel in the survey sample	Partial
Linkages	Domestic value, localization rate	–	–
Linkages	High-level domestic suppliers, order value	–	–
Linkages	R&D contracts between enterprises and universities/institutes	–	–
Land use, environment	Value created per unit of land	–	–
Land use, environment	Energy use and emissions by project	–	–
Governance	Degree of fulfillment of project commitments (schedule, technology, R&D)	No published information	–

Source: Compiled by the author.

Of the 14 indicators in Table 4, only 2 have data at the aggregate level and both belong to the group measuring scale and output; 3 are partially available; and 9 are not available. In other words, the current system makes it possible to know how many resources the City has attracted and how output has grown, but does not make it possible to assess to what extent a specific project has generated technological capability, domestic value or land-use efficiency.

The data gap is also a governance gap, because a system does not monitor what is not included in its management criteria. The policy analysis of the study identifies four causes linked to governance mechanisms. First, a long-standing extensive-growth mindset has led investment performance to be assessed mainly through capital, area, progress and output rather than technological content, R&D, the ability to develop suppliers or the value added retained. Second, post-investment evaluation is not always tied to changes in technological level, R&D investment, land-use efficiency, labor quality and the degree of fulfillment of technology transfer commitments. Third, policy implementation is fragmented by field: an HTI project simultaneously needs land, infrastructure, energy, human resources, investment procedures, R&D and intellectual property, while State management is organized by specialized sector. Fourth, there is not yet a data system and monitoring tools deep enough on technology spillovers from the FDI sector to domestic enterprises.

V. Proposed Project Portfolio Governance Framework

The framework is built on five principles: (1) From inputs to technological outcomes, in which criteria are linked to R&D, technology transfer, suppliers and technological mastery capability rather than relying mainly on capital and area; (2) Value per unit of land: land is an instrument for selecting industries and projects, not merely a production site; (3) Life-cycle monitoring, in which decisions on projects are reviewed at multiple milestones, not only at the time of licensing; (4) Data-based and transparent, in which criteria, procedures and evaluation results are disclosed to investors, and no quantitative thresholds are set before baseline data exist; (5) Proportionate, with no additional procedures, integrated into existing processes, using shared databases and coordinating focal points, and avoiding duplicate reporting requirements.

5.1. Entry Screening Stage

Stage 1 applies when the City considers accepting, allocating land to, or supporting a new project. The purpose is to ensure that specific public resources are prioritized for projects capable of creating technological capability, not only for projects with large capital. The selection criteria comprise: (i) R&D intensity, expressed through R&D expenditure commitments and R&D units and personnel; (ii) technology transfer plans; (iii) development of domestic suppliers; (iv) training of technical personnel; (v) value added created in Vietnam; (vi) land-use efficiency; and (vii) environmental impact. Considering criteria according to actual operational content, rather than only by industry code, stems from the judgment that a project in an HT industry is not automatically high-tech in substance. On the basis of the degree to which the criteria are met, the study proposes grouping projects to link them with levels of support and accompanying conditions. Group A comprises projects that highly meet the criteria and are given priority access to land, infrastructure and support within the authority of the City. Group B comprises projects that partially meet the criteria and are accepted with additional commitments according to a roadmap. Group C comprises projects mainly engaged in contract processing and assembly, using large areas of land and with low technological commitments, to which only general regulations apply and which are not prioritized for specific public resources. This grouping mechanism is the author's proposal, and its application must remain within the scope of authority and the legal regulations on investment and land. Outcome commitments are recorded in the investment agreement to serve as the basis for the ex-post review.

Table 5. Proposed set of indicators for entry screening

Indicator group	Specific indicator	Unit	Data source	Frequency	Responsible agency
R&D capability	Committed R&D expenditure to revenue; presence of an R&D unit; expected number of R&D personnel	%; yes/no; persons	Investment registration dossier; investment agreement	Once at appraisal	Department of Science and Technology; Management Board of High-Tech Parks and Industrial Zones
Technology transfer and suppliers	Plans for technology transfer, technical training and development of domestic suppliers	Description per template; expected number of suppliers	Project dossier; investor commitments	Once at appraisal	Department of Industry and Trade; Department of Science and Technology
Value added	Expected revenue per employee; expected VA created in Vietnam	VND million/person; VND billion	Feasibility study report	Once at appraisal	Department of Finance; Management Board of High-Tech Parks and Industrial Zones
Land-use efficiency	Expected value of output or VA per unit of land area	VND billion/ha	Land allocation and land lease dossier; feasibility study report	Once at appraisal	City land management agency; Management Board
Environment and energy	Expected energy consumption and emissions	According to the environmental impact assessment dossier	Environmental impact assessment dossier	Once at appraisal	City environmental management agency

Source: Proposed by the author.

5.2. Project Life-Cycle Monitoring Stage

Stage 2 monitors the outcomes of a project after it has been accepted, in order to replace the current situation in which evaluation takes place only at the time of licensing. This stage has four requirements. First, projects report periodically using a unified set of indicators, with standard guidance and definitions to ensure comparability. Second, a project-level database shared among agencies is built covering projects, land fund, technology, R&D, labor, suppliers and

infrastructure, in order to overcome fragmented implementation. Third, a coordinating focal point of the City is established, working with the Management Board of High-Tech Parks and Industrial Zones to collect data, cross-check it against official statistics and aggregate results for the entire portfolio. Fourth, the movement of each project along the four-level technological mastery scale is monitored, because the policy goal is the movement of capability rather than the presence of a project in an industry.

Portfolio-level aggregates (distribution of projects by group, by level of technological mastery and by industry) should be published periodically in aggregate form to increase transparency, but sensitive business information of individual enterprises should not be made public. In the initial stage, the aim of monitoring is to establish baseline data; quantitative thresholds should be set only after a sufficiently reliable data series is available.

Table 6. Proposed set of indicators for the project life-cycle monitoring stage

Indicator group	Specific indicator	Unit	Data source	Frequency	Responsible agency
Realized R&D	Actual R&D expenditure to revenue; number of R&D personnel	%; persons	Periodic project reports; surveys	Annually	Management Board of High-Tech Parks and Industrial Zones; Department of Science and Technology
Commercialization and intellectual property	Number of new products and technologies commercialized; revenue from new products; number of patents and registered intellectual property objects	Number; VND billion	Project reports; intellectual property management agency	Annually	Department of Science and Technology
Supplier linkages	Number of qualified domestic suppliers; value of orders placed with domestic suppliers	Number; VND billion	Reports of chain-leading enterprises; supply contracts	Annually	Department of Industry and Trade
University and institute linkages	Number of R&D contracts with universities and institutes; level of use of shared infrastructure	Number; number of uses	Project reports; shared infrastructure management units	Annually	Department of Science and Technology; Management Board
Technical labor	Share of technical and R&D labor; number of employees trained	%; persons	Project labor reports	Annually	City labor management agency
Level of technological mastery	Movement in level of technological mastery on the four-level scale	Levels 1–4	Assessment by the coordinating focal point together with experts	Annually or at milestones	Coordinating focal point; Department of Science and Technology

Source: Proposed by the author.

5.3. Ex-post Review and Restructuring Stage

Stage 3 uses monitoring results to make decisions at evaluation milestones: the investment completion milestone, the stable production milestone and periodic milestones according to the investment agreement. At each milestone, a project may fall into one of three cases: if it meets its commitments, it continues to receive support and may be moved up a group; if it falls short but there are objective reasons, its commitment roadmap is adjusted and remedial support is

provided, for example through technical services and shared infrastructure; if it fails to fulfill technology commitments or is persistently delayed, its level of support is reviewed and it is handled in accordance with the law.

With respect to land, the City reviews land in industrial zones and industrial clusters, identifies areas that are used inefficiently, are delayed in implementation or are no longer appropriate, and handles them in accordance with the law; reclaimed land is prioritized for R&D, testing, supporting industries and projects capable of technology spillover. It should be emphasized that these are governance instruments within the scope permitted by law: rights and incentives already guaranteed by law to investors must be respected, and ex-post review mainly affects the granting of new support and the use of public resources within the authority of the City. The ex-post review results of the whole portfolio, including the common characteristics of successful projects, are used to calibrate the Stage 1 criteria, completing the feedback loop of the framework.

Table 7. Proposed set of indicators for the ex-post review and restructuring stage

Indicator group	Specific indicator	Unit	Data source	Frequency	Responsible agency
Commitment fulfillment	Degree of fulfillment of commitments on investment, R&D and technology transfer relative to the agreement; project progress	%; level	Investment agreement; project reports	At evaluation milestones	Management Board of High-Tech Parks and Industrial Zones; coordinating focal point
Land-use efficiency	Value created per unit of area; share of area that is delayed or used inefficiently	VND billion/ha; %	Land records; project reports	Annually; periodic review	City land management agency; Management Board
Capability movement	Change in level of technological mastery; change in position in the value chain	Levels 1–4; description	Assessment at milestones	At evaluation milestones	Department of Science and Technology
Spillover	Number of domestic suppliers upgraded; change in value of domestic orders relative to the beginning of the period	Number; %	Project reports; chain-leading enterprises	Annually; at milestones	Department of Industry and Trade
Handling outcomes	Number of projects adjusted, restructured, or with land reclaimed and reallocated in accordance with regulations	–	Handling records	Annually	People's Committee of the City; specialized agencies

Source: Proposed by the author.

5.4. Feasibility

The framework can be implemented in three time phases, consistent with the City's HTI development roadmap. The 2026–2027 phase focuses on standardizing data and criteria, establishing selection and ex-post review procedures, and building a project-level database and baseline data; the study proposes piloting at the Hoa Lac High-Tech Park, which the City already directly manages and for which aggregate project data are available. The 2028–2030 phase expands application to industrial zones, completes the ex-post review, and links with supplier development and R&D cooperation programs. The post-2030 phase completes the self-adjusting mechanism, in which criteria are updated on the basis of accumulated outcome data.

In terms of implementation conditions, the 2024 Capital Law (National Assembly, 2024) and the transfer of the Hoa Lac High-Tech Park to the City for management create room for action, while the Capital Planning for the period 2021–2030, with a vision to 2050 (Prime Minister, 2024), and the laws on high technology and on science, technology and innovation promulgated in 2025 (National Assembly, 2025a, 2025b) provide the general policy framework; however, the

specific mechanisms of the City need to be implemented consistently with sector-specific law, and the central government needs to continue to improve instruments that link incentives to outcomes in R&D, training, supplier development and technology transfer. Organizationally, a coordinating focal point and inter-sectoral coordination are needed among the agencies responsible for science and technology, industry and trade, finance, land, construction and environment, together with the Management Board of High-Tech Parks and Industrial Zones.

The proposed framework entails several risks during piloting and implementation. First, overly strict criteria may reduce investment attractiveness; Group B, with commitments according to a roadmap, helps maintain flexibility. Second, compliance costs for enterprises may increase; existing data, consolidated reporting and the avoidance of procedural duplication should be used. Third, there is a risk of disputes over incentives already committed; therefore, the framework is mainly applied to new projects and to support within the authority of the City, with commitments clearly recorded from the outset. Fourth, indicators may be mismeasured or inaccurately reported; standard definitions, cross-checking against statistical data and sample inspections are needed. Fifth, R&D and commercialization have long cycles, so short-term evaluation may distort long-term investment incentives; evaluation milestones need to match the technology cycle of each field. In addition, the framework is currently a theoretical proposal based on indirect evidence and has not been tested in practice; piloting is a necessary step before broad application.

VI. Conclusion

This article has analyzed the empirical basis and proposed a framework for governing HTI project portfolios in Hanoi. With regard to the first question, the 2020–2025 data show that MFG grew in scale but its share in GRDP fell from 13.46% to 12.11%; the two HT industries increased output but at a rate lower than MFG as a whole (4.91% and 5.57% compared with 5.80% per year), and among the seven HT and MHT industries only the motor vehicle industry exceeded the whole industry; investment resources and FDI are large, but the pre-tax profit margin of enterprises fell from 5.10% to 4.30% in 2020–2024. With regard to the second question, the existing indicator system mainly measures scale and inputs: among the 14 indicators needed for portfolio governance, only 2 have data at the aggregate level, 3 are partially available and 9 are not available in the sources used. With regard to the third question, the article proposes a three-stage framework comprising entry screening, life-cycle monitoring, and ex-post review and restructuring, each stage having a set of outcome-monitoring indicators, together with an assessment of the roadmap, conditions and implementation risks. Based on the results of the study, the author proposes the following policy implications. First, shift the criteria for selecting and supporting projects from capital and area to technological outcomes and value created per unit of land. Second, prioritize building a project-level database and establishing baseline data before setting quantitative thresholds. Third, pilot the framework at the Hoa Lac High-Tech Park before expanding to industrial zones. However, the study has several limitations, namely: the data series covers only five years; IIP reflects production volume rather than value added; enterprise indicators are whole-MFG averages and only up to 2024; there are no project-level data apart from the aggregate data for Hoa Lac and the sample survey; and the proposed framework has not been tested in practice. Future research directions include enterprise surveys and the use of micro-level data, piloting the framework at Hoa Lac, and comparison with localities having similar characteristics.

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APPENDICES

Appendix A. Annual Index of Industrial Production (IIP) of the HT and MHT industries and of MFG as a whole, 2021–2025

Industry (VSIC)	2021	2022	2023	2024	2025
20 – Chemicals	101.5	104.8	100.7	105.2	108.1
21 – Pharmaceuticals	93.9	107.4	111.0	106.0	107.1
26 – Electronics, computers, optical products	101.7	109.3	97.2	107.5	112.9
27 – Electrical equipment	103.2	111.8	102.8	106.5	98.8
28 – Machinery and equipment	107.4	89.6	82.5	127.7	114.2
29 – Motor vehicles	113.1	101.0	100.9	102.3	117.3
30 – Other transport equipment	109.8	109.3	99.1	106.6	104.0
Whole MFG	104.8	109.0	102.5	105.4	107.4

Source: Hanoi Statistical Yearbook 2025 (Hanoi Statistical Office, 2026). Unit: previous year = 100. 2025 figures are preliminary.

Appendix B. Four-level scale of technological mastery at the enterprise and project level

Level	Description	Observable signs (proposed)	Related indicators
1	Stable operation of imported technology	Production according to designs, processes and materials supplied externally; negligible on-site R&D	R&D expenditure; localization rate
2	Adaptation and process improvement	Process improvements, product adjustment to the market; on-site technical personnel	R&D personnel; number of process improvements; domestic suppliers
3	Independent design of key components, products or processes	Has a design and product development unit; co-design with customers	Revenue from new products; R&D contracts; intellectual property registrations
4	Creation of technology and intellectual property capable of leading the market	Owns patents and product architecture; licenses or transfers technology externally	Patents; licensing revenue; external transfers

Source: Proposed by the author based on Lall (1992)

Appendix C. Roadmap for implementing the project portfolio governance framework

Phase	Focus	Main actors	Outputs
2026–2027	Standardize data and the criteria set for project selection and ex-post review; review land and infrastructure; establish baseline data; pilot at Hoa Lac	People's Committee of the City; the departments of science and technology, industry and trade, finance, and construction; Management Board of High-Tech Parks and Industrial Zones; institutes and universities; enterprises	Unified dataset; screening and monitoring procedures; pilot project portfolio
2028–2030	Expand application to industrial zones; operate ex-post review; link with supplier development and R&D programs	The City; chain-leading enterprises; institutes and universities	Outcome data series; consolidated portfolio report; calibration of criteria
After 2030	Data-based self-adjusting mechanism; upgrading of position in the value chain	The enabling State; enterprises and the innovation ecosystem	Periodically updated criteria; projects moving up levels of technological mastery

Source: Proposed by the author on the basis of current policy orientations and planning.