

Fostering Inclusive Entrepreneurship: Integrating Teaching Factory and Business Incubation in Vocational Schools

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ABSTRACT

Objective: Vocational education faces a critical challenge in fostering entrepreneurship and independence, particularly for students with special needs or from vulnerable socio-economic backgrounds. This study aims to develop, validate, and evaluate the effectiveness of an Inclusive Business Incubator (IBI) model in Vocational High Schools (SMK) by integrating the Teaching Factory (TeFa) concept with university-based business incubation practices. **Method:** Employing a Research and Development (R&D) approach based on a modified six-stage Borg and Gall model, the study involved preliminary research, model design, expert validation, and field testing at SMKN 1 Probolinggo, Indonesia. Data were collected through questionnaires, interviews, and documentation from academic experts, industry practitioners, and students. **Results:** Quantitative descriptive analysis revealed that the IBI model is highly viable. The developed model achieved a feasibility score of 89.6% and a practicality score of 86.98%. Furthermore, the model demonstrated high organizational effectiveness (87.6%) in enhancing students' entrepreneurial competencies. **Novelty:** The findings indicate that integrating TeFa with an inclusive incubation framework supported by industry mentorship – successfully provides equal opportunities for all students, including those with disabilities, to develop start-up businesses. This model offers a strategic pathway for vocational institutions to foster inclusive entrepreneurship and reduce youth unemployment.

INTRODUCTION

Education Human capital quality, comprehensively reflected through the Human Development Index (HDI), exhibits a significant negative correlation with unemployment rates, thereby positioning educational investment as a critical macroeconomic strategy [1], [2], [3]. Within this theoretical framework, Vocational High Schools (SMK) in Indonesia occupy a pivotal societal role, structurally designed not only to supply a highly skilled workforce tailored to industrial demands but also to cultivate independent economic agents capable of creating new employment ecosystems through entrepreneurial ventures [4]. Fulfilling this dual mandate requires vocational institutions to move beyond traditional pedagogical boundaries and actively immerse students in real-world economic activities, seamlessly bridging the gap between academic theories and market realities [5], [6], [7], [8], [9].

Educational strategies to manifest these systemic objectives currently rely heavily on the Teaching Factory (TeFa) paradigm, a production-oriented pedagogical concept that meticulously replicates actual industrial operational standards within the academic environment [10]. Institutionalizing this model has demonstrably elevated the aggregate employability of vocational graduates by aligning school-based practices with corporate expectations [11]. The structural limitation of formal job availability in the industrial sector, coupled with dynamic technological disruptions, inevitably leaves a substantial

demographic of competent graduates sub-optimally absorbed. This reality compels vocational institutions to aggressively pivot towards facilitating robust entrepreneurial competencies, transforming students from mere job seekers into resilient start-up initiators [12].

Fostering robust entrepreneurship encounters profound complexities when confronted with the fundamental mandate of inclusive education, which philosophically obligates institutions to fully accommodate the diverse physical, intellectual, and socio-emotional needs of all learners [13], [14], [15], [16], [17], [18]. National labor statistics underscore a persistent marginalization, revealing that individuals with disabilities experience disproportionately low participation rates within the formal workforce compared to the broader population. Existing entrepreneurial infrastructures and pedagogical strategies within vocational schools remain predominantly uniform, frequently failing to provide targeted, empowering interventions necessary for vulnerable and special-needs students to architect their independent career trajectories. Consequently, there is an urgent educational imperative to design adaptive frameworks that democratize access to business development resources.

Strategic interventions to mitigate both the entrepreneurial skill gap and the inclusivity deficit point directly to the establishment of business incubators [19], [20], [21], [22], [23]. Operating as integrated socio - economic ecosystems, business incubators provide qualifying ventures with critical scaffolding - encompassing dedicated workspaces, intensive mentorship, professional networking, and crucial early-stage funding - until the enterprises achieve competitive sustainability [24]. Empirical evidence validates the efficacy of this model, notably reducing early-stage business failure rates from 80% to a mere 20% globally [24]. While this incubation paradigm is extensively institutionalized within higher education and governmental economic agencies to accelerate technology commercialization, its systemic integration into vocational high schools, particularly under a strictly inclusive framework, remains practically non-existent in current empirical literature.

Addressing this critical implementation gap, this study pioneers a structural novelty through the development of the Inclusive Business Incubator (IBI) model tailored specifically for vocational high schools. The proposed architecture systematically synthesizes the existing TeFa production ecosystem with advanced, university-grade incubation management practices, recalibrated to ensure universal accessibility and customized support for diverse learner demographics. The primary objective of this research is to rigorously develop the IBI model and comprehensively evaluate its feasibility, practical applicability, and organizational effectiveness. Ultimately, this framework seeks to establish a sustainable pathway for vocational institutions to cultivate highly competitive young entrepreneurs, ensuring that every student possesses an equal opportunity to thrive in the modern economy.

Literature Review

1.1 The Paradigm of Vocational Education and the Teaching Factory (TeFa) Model

Vocational Education and Training (VET) globally aims to bridge the gap between academic preparation and industrial demands, equipping learners with specific, market-driven competencies. Modern vocational paradigms, however, have transcended the traditional objective of merely producing a skilled workforce; they now fundamentally emphasize the cultivation of independent entrepreneurs capable of navigating dynamic economic landscapes. The Teaching Factory (TeFa) emerges within this context as a robust pedagogical model. Operating as a school-based manufacturing or service entity,

TeFa immerses students in authentic production processes that adhere strictly to industry standards. Empirical observations confirm that learning environments mimicking real-world occupational settings significantly enhance technical mastery and professional work habits. Despite its efficacy in simulating corporate environments, TeFa predominantly focuses on production capacity and technical execution rather than the holistic business life-cycle, thereby necessitating supplementary frameworks to nurture comprehensive entrepreneurial acumen.

1.2. Business Incubation Frameworks in Educational Ecosystems

Entrepreneurial ecosystems rely heavily on business incubators to accelerate the growth of nascent enterprises. Defined conceptually as dedicated environments offering comprehensive support—including mentorship, training, professional networking, and capital access—incubators significantly mitigate the high mortality rates typical of early-stage businesses. Theoretical models of business incubation, such as the framework proposed by Campbell, Kendrick, and Samuelson, categorize the incubation process into four critical dimensions: diagnostic assessment of business needs, rigorous selection and continuous monitoring, capital investment facilitation, and integration into expert networks [25]. Higher education institutions have successfully institutionalized these incubators to commercialize research and foster student-led start-ups. Translating this university-grade incubation model into the vocational high school context requires a strategic recalibration, ensuring the services align with the developmental stages of younger learners while leveraging the existing production capabilities of the TeFa system.

1.3. Inclusive Entrepreneurship and Special Needs Empowerment

Inclusive educational philosophies advocate for the universal accommodation of individual learning needs, transcending physical, intellectual, and socio-economic barriers. Translating this philosophy into vocational entrepreneurship introduces the concept of inclusive entrepreneurship. Educational empowerment for students with special needs must involve the systematic development of entrepreneurial skills tailored to their unique potentials. Unfortunately, standard entrepreneurship curricula are frequently overly abstract, failing to provide the customized mentorship required by vulnerable demographics. Inclusive entrepreneurship theories postulate that providing equal access to business incubation—coupled with specialized facilitation and adaptive training methodologies—can transform marginalized students from economic dependents into self-sufficient business operators.

1.4. Conceptualizing the Inclusive Business Incubator (IBI) Framework

Synthesizing the pedagogical strengths of TeFa, the strategic support mechanisms of business incubators, and the ethical mandate of inclusive education results in the conceptualization of the Inclusive Business Incubator (IBI) model. This integrated framework positions the vocational school not merely as a training ground but as an entrepreneurial hub. The model systematically connects raw student input (including students with diverse needs) with industrial mentorship, university networks, and practical production experience.

To elucidate this theoretical synthesis, the conceptual framework of the IBI model is visualized in Figure 1.

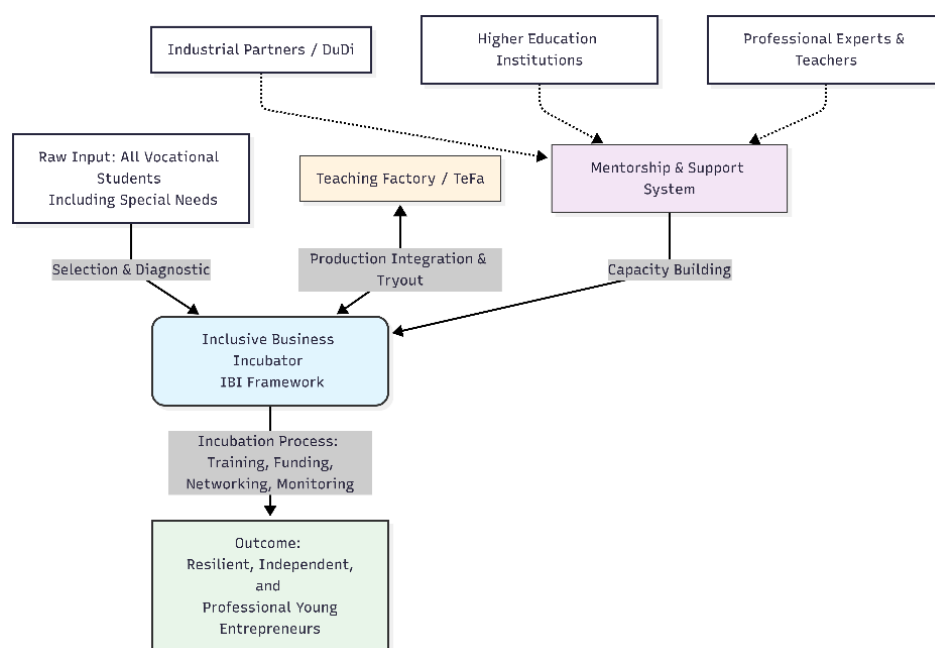


Figure 1. Conceptual framework of the Inclusive Business Incubator (IBI) model.

RESEARCH METHOD

2.1. Research Design and Procedure

This study employed a Research and Development (R&D) design to systematically construct and validate the Inclusive Business Incubator (IBI) model. The methodological framework was anchored in the established R&D model originally proposed by Borg and Gall [26]. To ensure methodological rigor while simultaneously accommodating the practical complexities and time constraints of the vocational education ecosystem, the original ten-step procedural design was strategically modified and streamlined into six essential, context-specific phases.

Phase 1 involved an in-depth literature review and a situational field study evaluating the existing Teaching Factory (TeFa) and industrial class ecosystems at SMKN 1 Probolinggo. Phase 2 focused on strategic planning, orchestrating formal agreements with industrial partners (DUDI) to align TeFa processes with incubation mechanisms, alongside formulating the standard operating procedures (SOP). Phase 3 culminated in the initial design of the IBI framework and its accompanying operational manual. In Phase 4, the prototype was subjected to rigorous preliminary field testing and validation by external academic experts and internal vocational practitioners. Phase 5 accommodated all qualitative critiques and constructive recommendations to refine the conceptual blueprint. Finally, Phase 6 executed the main field testing and empirical implementation of the revised model within the school's ecosystem, culminating in a comprehensive evaluation of its feasibility, practicality, and organizational effectiveness.

2.2. Setting and Participants

Empirical investigations and field testing were conducted at SMK Negeri 1 Probolinggo, East Java, Indonesia, an institution recognized for its active implementation of vocational industrial classes and production units. The validation phase utilized a purposive sampling technique to engage multiple stakeholder cohorts, ensuring a comprehensive evaluation of the model. The expert validation panel comprised three distinguished academic experts specializing in business incubation management, educational management, and vocational education. Subsequently, the practitioner

validation panel included three key institutional figures: the school principal, the incubator coordinator, and representatives from partner industries (DUDI). The final operational field testing involved direct end-users, explicitly encompassing vocational students (including those with special needs), alumni, and incubator tenants.

2.3. Data Collection Instruments

Data acquisition was executed utilizing a mixed-methods instrumentation strategy. Quantitative data were meticulously gathered using structured, expert-validated questionnaires formatted on a 5-point Likert scale (ranging from 1 = "Highly Unfeasible/Impractical" to 5 = "Highly Feasible/Practical"). These instruments were specifically designed to evaluate three core theoretical dimensions: the pedagogical feasibility of the model, operational practicality within the school environment, and overall organizational effectiveness. To substantiate and enrich the quantitative metrics, qualitative data were concurrently collected through semi-structured interviews, direct observations, and extensive documentation analysis. The qualitative inputs primarily captured constructive critiques, functional barriers, and strategic recommendations from both experts and practitioners.

2.4. Data Analysis Procedure

Analytical procedures relied on descriptive quantitative statistics to interpret the validation and trial outcomes. The feasibility and practicality indices were calculated by dividing the aggregate empirical scores by the maximum theoretical scores, subsequently converting the results into percentages. The resulting percentages were categorized using established criteria, where scores falling between 76% and 100% denoted a "Highly Feasible" or "Highly Practical" status. Furthermore, the model's effectiveness was evaluated through a multidimensional organizational effectiveness lens formulated by Steers and Putra [27], [28], measuring indicators across four integrated approaches: goal approach, resource approach, internal process approach, and integrated approach. Effectiveness levels were interpreted against standardized administrative benchmarks, with aggregate scores exceeding 80% indicating robust empirical efficacy and institutional success.

RESULTS AND DISCUSSION

Results

3.1 Feasibility and Validation of the Inclusive Business Incubator (IBI) Model

Quantitative evaluations conducted during the preliminary field testing phase demonstrated a highly positive consensus among academic experts and vocational practitioners regarding the design and structure of the IBI model. Empirical data derived from the validation instruments were categorized into five primary dimensions: program implementation, implementation feasibility, resource adequacy, collaboration viability, and projected impact. The statistical synthesis of these evaluations revealed an aggregate feasibility score of 89.56%, firmly placing the IBI framework within the "Highly Feasible" operational category. Specifically, the program implementation dimension recorded the highest validation score (93.33%), indicating profound theoretical and practical alignment with vocational education objectives. Simultaneously, the evaluation of the accompanying operational manual – which serves as the standardized pedagogical guide for the incubator – yielded a cumulative feasibility index of 86.5%, characterized by strong content validity (88.89%) and visual design adequacy (86.67%).

Table 1. Expert and Practitioner Validation Results for the IBI Model.

No.	Evaluation Dimension	Aggregate Score (%)	Qualification
1	Program Implementation	93.33	Highly Feasible
2	Implementation Feasibility	87.78	Highly Feasible
3	Resource Feasibility	88.89	Highly Feasible
4	Collaboration Feasibility	86.67	Highly Feasible
5	Impact Feasibility	91.11	Highly Feasible
	Average Feasibility Index	89.56	Highly Feasible

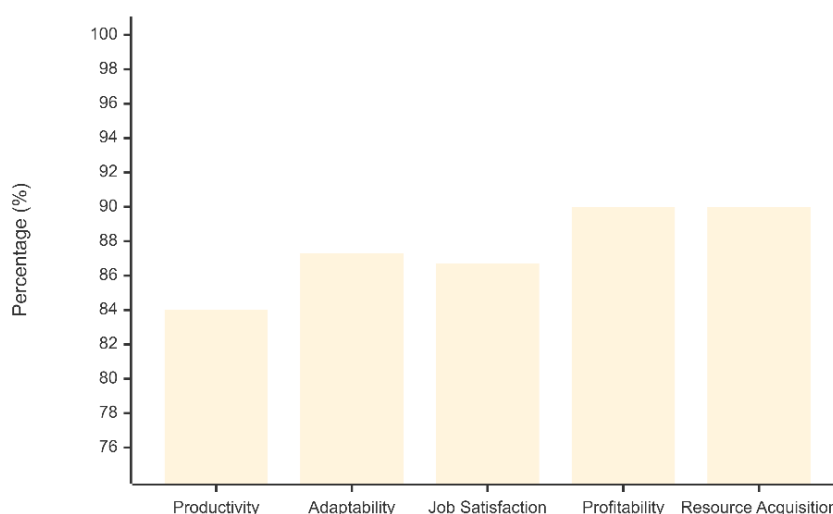
3.2 Practical Applicability of the IBI Framework

Transitioning from theoretical validation to practical execution, the main field testing phase evaluated the operational practicality of the IBI model within the actual ecosystem of SMKN 1 Probolinggo. Assessments gathered from direct end-users, encompassing school administrators, coordinating teachers, and student tenants (including those with special needs), yielded a cumulative practicality score of 86.98%. This robust metric signifies that the integrated incubation mechanisms—ranging from raw input selection to industrial mentorship—can be seamlessly executed without disrupting the core academic schedules of the vocational institution. The provision of accessible infrastructure and tailored industrial partnerships effectively dismantled previous pedagogical barriers, establishing a genuinely inclusive environment for all participating demographics.

3.3 Organizational Effectiveness and Entrepreneurial Impact

Measurements of organizational effectiveness provided the most critical empirical evidence regarding the model's success in cultivating resilient young entrepreneurs. Utilizing an integrated assessment framework, the model's efficacy was evaluated across four distinct methodological lenses: goal approach (89.33%), resource approach (80.67%), internal process approach (84.67%), and integrated approach (84.00%). Evaluating the incubator as an operational organization revealed an overarching effectiveness score of 87.6%, confirming its substantial impact on vocational capacity building.

To visualize these critical findings, the following chart delineates the specific performance across five core organizational effectiveness indicators:

**Figure 2.** Organizational effectiveness performance across five core indicators.

Detailed analysis of the organizational effectiveness metrics underscores the incubator's superior performance in resource acquisition (90.0%) and profitability (90.0%). These specific outcomes empirically validate the efficacy of integrating industrial partners (DUDI) directly into the incubation process, as these collaborations directly facilitated access to initial capital and expanded market networks. Furthermore, the adaptability index (87.3%) illustrates the model's dynamic responsiveness to varying student needs, particularly in customizing mentoring approaches for individuals with disabilities. Consequently, the IBI model operates not merely as an academic simulation, but as a fully functional, highly effective entrepreneurial accelerator capable of generating sustainable start-ups within the vocational education spectrum.

Discussion

The research results show that the developed multi-stakeholder business incubator governance model meets the criteria of feasibility, practicality, and effectiveness in the context of Vocational High Schools (SMK). These findings confirm that business incubators in vocational education cannot be positioned solely as entrepreneurship programs, but rather as institutional management systems that require clear governance and cross-actor collaboration.

4.1 Validation of the Learning Ecosystem: Synergy between TeFa and Business Incubation

Empirical findings demonstrate that the Inclusive Business Incubator (IBI) model possesses a highly robust feasibility rate, aggregating at 89.56%. The peak score in the program implementation dimension (93.33%) verifies that fusing the *Teaching Factory* (TeFa) with business incubation does not disrupt the vocational curriculum but rather constructs a cohesive pedagogical synergy. This phenomenon strongly corroborates Charles Prosser's foundational principle of vocational education in 1950, which asserts that vocational training is only effective when the learning environment accurately replicates real-world occupational conditions. Furthermore, this successful integration elevates the practical application of Kolb's Experiential Learning Theory [29]. In conventional models, TeFa learning frequently halts at the product completion and technical capacity phases. However, through the IBI intervention, learners are compelled to experience the complete, real-world business cycle (*concrete experience*)—from market research and production to commercialization—fundamentally bridging the gap between pure vocational skills and entrepreneurial acumen.

4.2 Operational Practicality and Mechanisms of Inclusivity Success

The central challenge in replicating university-level business incubator practices within vocational high schools lies in their operational practicality and adaptability to a highly heterogeneous student demographic. Field evaluations recorded a practicality score of 86.98%, operationally proving that the IBI guidelines and Standard Operating Procedures (SOP) can be efficiently executed by school management. The most crucial aspect of these findings is the high adaptability index (87.3%) within the organizational effectiveness evaluation. This achievement directly represents the success of inclusive mechanisms in facilitating students with special needs. This resonates profoundly with Tarmansyah's inclusive education philosophy, which mandates schools to flexibly accommodate all student conditions without discrimination [13]. Through modified, individualized mentoring frameworks, vulnerable students and those with disabilities

have proven capable of designing business strategies based on their unique potentials. This model effectively shifts the special education paradigm from mere social rights fulfillment to tangible economic empowerment.

4.3 Extracting Competitive Advantage: Profitability and Resource Acquisition

Organizational effectiveness assessments reveal that Profitability (90.0%) and Resource Acquisition Capacity (90.0%) are the two highest-achieving metrics within the framework. The exponential surge in these two indicators is driven by strategic partnership mechanisms with the Business and Industrial World (DUDI), which are directly involved in technology transfer, mentoring, and the provision of initial capital. These empirical findings validate the Resource-Based View (RBV) Theory initiated by Barney [30]. According to the RBV perspective, competitive advantage is achieved through access to external resources that are both valuable and rare. The IBI ecosystem acts as a catalyst, enabling tenants (students) to leverage industrial networks, technology, and capital as competitive advantages that are impossible to obtain solely through conventional classroom infrastructures.

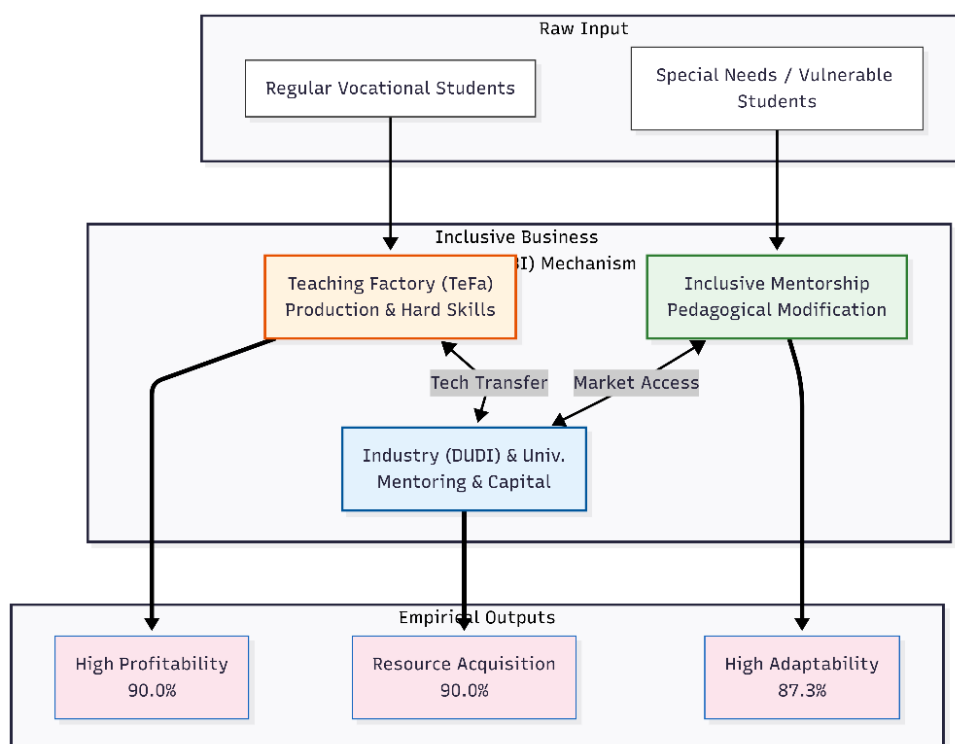


Figure 3. The Operational Mechanism of the IBI Model: Illustrating the synergy between TeFa, Industrial Partnerships (DUDI), and Inclusive Pedagogy driving core effectiveness outcomes.

4.4. Evaluation Gap: Challenges in the Resources Approach Dimension

Although operational effectiveness recorded highly impressive overall figures (87.6%), multidimensional evaluation detected a critical gap warranting academic scrutiny. Effectiveness analysis based on the system approach indicates that the Resources Approach obtained the most conservative score at 80.67%, in contrast to the Goal Approach which reached 89.33%. This discrepancy provides critical insights into the anatomy of public educational institutions. Aligned with Gibson's conception of

organizational effectiveness, long-term stability demands institutional autonomy [31]. The 80.67% score in the resources approach suggests that while DUDI interventions successfully injected massive external resources, the governance of internal school resources—such as independent budget allocations for incubator overhead, workspace maintenance, and incentives for guiding teachers—remains vulnerable and requires optimization. The future managerial challenge for vocational schools is to design robust revenue streams or profit-sharing schemes from the commercial successes of tenants to subsidize internal financing, thereby preventing absolute dependency on external aid instruments.

CONCLUSION

Fundamental Finding : This study successfully developed, validated, and implemented the Inclusive Business Incubator (IBI) model, establishing a robust framework for fostering inclusive entrepreneurship within vocational high schools. By seamlessly integrating the Teaching Factory (TeFa) production ecosystem with university-grade incubation practices and tailored inclusive pedagogy, the model achieved high empirical viability. Quantitative evaluations confirmed the model's exceptional feasibility (89.56%) and operational practicality (86.98%). Furthermore, the organizational effectiveness of the incubator recorded a remarkable 87.6%, driven prominently by its capacity to generate profitability and secure external resources—both peaking at 90.0%—through strategic industrial partnerships (DUDI). Crucially, the model's high adaptability index (87.3%) validates its structural success in empowering marginalized and special-needs students, fundamentally transforming them from passive learners into active, independent economic agents. **Implication :** The theoretical implication of this study enriches the contemporary discourse on vocational education by shifting the paradigm from purely technical labor preparation toward inclusive entrepreneurial acceleration. Practically, the IBI framework offers educational stakeholders, school administrators, and policymakers a verified, replicable blueprint to mitigate youth unemployment by democratizing access to professional business incubation. **Limitation :** Despite these compelling outcomes, the study identified a specific limitation within the Resources Approach dimension, which recorded the most conservative score of 80.67%. This discrepancy highlights the institutional vulnerability of internal school financing mechanisms when compared to massive external industrial injections. **Future Research:** Consequently, future research should focus on longitudinal studies to measure the actual survival rates and market growth of the student start-ups post-graduation. Additionally, subsequent systemic developments must aggressively explore and integrate internal revenue-generating mechanisms within the incubator to ensure the long-term financial autonomy and operational sustainability of vocational institutions.

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