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The Role of the Principal in Optimizing Teaching Factory Services in Vocational High Schools (SMK): A Study at SMK Negeri 3 Tondano

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ABSTRACT

The rapid development of industry and technology demands that vocational education adapt to produce graduates ready to compete in the job market. This study aims to analyze the role of the school principal in optimizing Teaching Factory (TeFa) services in Vocational High Schools (SMK), with a case study at SMK Negeri 3 Tondano. TeFa is a learning model based on real production activities that integrates education with the needs of the business and industrial sectors (DUDI). This research uses a qualitative approach with a case study method. Data were collected through in-depth interviews, participatory observation, and document analysis involving several informants, including the principal, teachers, students, and industry partners. The findings show that the school principal has a strategic role in the planning, organizing, implementation, and evaluation of TeFa services. The principal exhibits visionary and transformational leadership that encourages innovation, collaboration with industry, and the strengthening of a productive work culture and entrepreneurial spirit within the school environment. Adapting the TeFa implementation based on the characteristics of each department is also a key strategy to enhance the relevance and effectiveness of learning. The principal also succeeded in overcoming challenges such as limited facilities, rigid regulations, and a lack of industry-experienced teachers

through collaborative approaches and policy advocacy. Various innovative initiatives, such as digital management systems, the implementation of a multi-stakeholder engagement model, and the integration of curriculum with real project-based learning, demonstrate that school leadership is a determining factor in the successful implementation of TeFa. These findings highlight the essential role of school principals as change agents in creating adaptive, excellent, and competitive vocational education.

Keywords: Industrial Partnership, School Principal, Teaching Factory, Transformational Leadership, Vocational Education, Vocational High School

INTRODUCTION

The rapid development of industry and technology demands that vocational education adapt and improve its services to produce graduates who are ready to compete in the global job market. Vocational High Schools (SMK), as vocational secondary education institutions, play a strategic role in preparing a workforce equipped with technical skills and soft skills according to industry needs. One of the learning innovations implemented to address these challenges is the Teaching Factory (TeFa). Teaching Factory is a learning model that integrates learning activities with the production of real goods or services that align with students' vocational competencies. SMKs have a strategic mandate to prepare skilled and job-ready workers to meet the needs of the business and industrial sectors (DUDI). In the context of globalization and the Fourth Industrial Revolution, which demand high skills and work flexibility, the existence of Teaching Factory (TeFa) is crucial as a learning model that integrates production activities and real services into the student learning process. Teaching Factory offers production-based learning that aligns with industry standards, encourages mastery of hard and soft skills, and fosters entrepreneurial spirit among students.

The implementation of Teaching Factory in various SMKs in Indonesia still faces several challenges, such as limited facilities, weak industry partnerships, and suboptimal school management in managing TeFa services. In this context, the role of the school principal as an educational leader becomes a key factor in orchestrating all resources to optimize the Teaching Factory. The principal is not only responsible for administrative tasks but also must act as a transformational leader, innovator, strategic manager, and change catalyst capable of creating a productive and collaborative learning ecosystem. SMK Negeri 3 Tondano, as one of the leading SMKs in North Sulawesi, has various expertise departments with great potential to optimize Teaching Factory services. These departments include Computer and Network Engineering (TKJ), Electrical Power Installation Engineering (TITL), Light Vehicle Engineering (TKR), Welding Engineering (TP), Construction Business and Property (BKP), Visual Communication Design (DKV), and Creative Wood and Rattan Crafts (KKKR). Each of these departments has different characteristics, facility needs, technology, and production processes, requiring special and integrated approaches to Teaching Factory services.

In this context, the role of the principal is crucial. The principal not only functions as an administrative manager but also as an educational leader who must optimize all resources to create effective, efficient, and industry-relevant Teaching Factory services. Through visionary, innovative, and collaborative leadership, the principal is expected to make Teaching Factory a superior practical learning medium that produces graduates ready to work and with an entrepreneurial spirit.

In practice, the optimization of Teaching Factory services in SMKs is often confronted with various challenges, such as facility limitations, lack of teacher competency, difficulty establishing partnerships with industry, and budget constraints. Therefore, an in-depth study is needed on how the principal's role addresses these challenges and develops a Teaching Factory that aligns with the characteristics of each department at SMK Negeri 3 Tondano. Based on this background, the problem formulation in this study focuses on four main aspects: (1) how the principal's role in optimizing Teaching Factory services at SMK Negeri 3 Tondano; (2) how the implementation of Teaching Factory services is adapted to the characteristics of each department, namely TKJ, TITL, TKR, TP, BKP, DKV, and KKKR; (3) what challenges the principal faces in managing TeFa services at this educational unit; and (4) what strategies the principal applies in facing those challenges and in optimizing Teaching Factory services to align with job market needs and industry developments.

This study aims to describe the principal's role in optimizing Teaching Factory services at SMK Negeri 3 Tondano, elaborate the implementation of Teaching Factory services tailored to each department's needs and characteristics, identify the challenges faced by the principal in managing Teaching Factory, and explain the strategies applied by the principal to overcome those challenges to support the optimization of relevant, quality, and competitive Teaching Factory services. This research is expected to provide both theoretical and practical benefits. Theoretically, the results of this study can enrich academic studies in vocational education management, especially related to the principal's leadership in implementing the Teaching Factory. Practically, this study benefits principals as a reflection and basis for formulating managerial strategies to improve TeFa service effectiveness; teachers and educational staff as a reference in building a collaborative work culture in TeFa implementation; government and policymakers as input for formulating policies to strengthen school-based TeFa management; and future researchers as a reference in developing similar studies in different contexts and regions.

METHOD

This study uses a qualitative approach with a case study method to deeply explore the role of the principal in optimizing Teaching Factory services at SMK Negeri 3 Tondano. The case study approach was chosen because it can provide a deep and comprehensive understanding of real phenomena in a specific context, namely implementing and managing the Teaching Factory in vocational education units (Yin, 2018).

Data was collected through in-depth interviews with the principal and other stakeholders, participatory observation of TeFa activities, and document analysis. The data analysis technique used the interactive model of Miles and Huberman, which includes data reduction, data presentation, and conclusion, to obtain a comprehensive picture of the leadership strategies, challenges, and successes of the principal in effectively managing Teaching Factory services. This study was conducted at SMK Negeri 3 Tondano, Minahasa Regency, North Sulawesi, which is a leading vocational high school with active and integrated Teaching Factory programs across seven departments. The site selection was based on the consideration that the school is representative in terms of comprehensive TeFa service development. The research was conducted over four months, from January to April 2025, providing the opportunity for researchers to directly observe various TeFa learning and management activities, including production practices, supervision, and the evaluation process carried out by the school.

The subjects in this study were the principal of SMK Negeri 3 Tondano, who has the main responsibility for managing the Teaching Factory in the school environment. Key informants included one principal, two vice principals responsible for curriculum and student affairs, seven TeFa coordinators from each department, seven productive teachers directly involved in the TeFa learning and operational process, fourteen students from various departments participating in the program, and five industry partner representatives collaborating with the school in TeFa implementation. A total of 36 informants were selected through purposive sampling to ensure that the data obtained are relevant, in-depth, and able to provide comprehensive insight into the principal's role and the dynamics of TeFa implementation at SMK Negeri 3 Tondano.

Data were collected through three main techniques: participatory observation, in-depth interviews, and documentation. Participatory observation was conducted directly by researchers during TeFa activities across all departments, focusing on practical learning activities, interactions between teachers and students, and the principal's role in supervision and decision-making. Observations were carried out systematically with detailed field notes to gain deep contextual understanding (Creswell, 2014). Semi-structured interviews were conducted with the principal, teachers, students, and industry partners to explore their views, experiences, and perceptions related to TeFa optimization. Interview questions were designed to be open-ended so that informants could freely and deeply convey information (Kvale & Brinkmann, 2009), especially regarding leadership strategies, challenges faced, and TeFa development efforts according to each department's characteristics. Documentation techniques were also used by collecting various relevant school documents, such as TeFa management documents, curriculum, practical schedules, evaluation reports, and evidence of industry collaboration, which served as supporting data to validate field findings.

The collected data were analyzed using thematic analysis based on Braun and Clarke's guidelines (2006), which include several stages: familiarization with the data through reading and in-depth review of observation, interview, and documentation results to gain initial understanding; initial coding by labeling relevant data fragments such as the principal's role, management challenges, and optimization strategies; searching for themes by grouping codes into themes that reflect main patterns in the data; reviewing themes to evaluate and revise them to fit the overall data and research objectives; defining

and naming themes with clear descriptions; and compiling the report that integrates analysis results into a systematic and coherent narrative. Additionally, data triangulation techniques were applied by comparing observation, interview, and documentation results to ensure the validity and credibility of the research findings (Patton, 2015).

To maintain research validity, several strategies were used, including triangulation of data sources by collecting information from various informants and documents to obtain diverse and mutually reinforcing perspectives; member checking by confirming analysis results and data interpretations with informants to ensure accuracy and appropriateness; and an audit trail that systematically documents all data collection and analysis processes so they can be traced by others. Reliability was maintained through consistent procedures in data collection and analysis, as well as researcher reflection notes to minimize potential bias during the research process.

This research was conducted in compliance with research ethics principles, including obtaining written permission from the principal and related parties before research implementation, ensuring confidentiality of informant identities and personal information, clearly informing all participants about the research objectives and benefits, and ensuring voluntary participation with the freedom for informants to withdraw at any time without coercion or pressure.

The limitation of this study is that, as a case study, the research focuses specifically on SMK Negeri 3 Tondano, so the results may not be directly applicable or generalizable to all SMKs. Nevertheless, the in-depth and comprehensive analysis is expected to provide a meaningful and beneficial understanding as a reference for Teaching Factory development in other vocational schools.

RESULTS AND DISCUSSION

Visionary Leadership of the Principal in Teaching Factory Development

The research findings show that the principal of SMK Negeri 3 Tondano plays a central role as a visionary leader in the development of Teaching Factory (TeFa) services. The strategic vision formulated not only focuses on fulfilling national curriculum standards but also emphasizes graduate relevance and readiness for business and industry (DUDI) needs. The principal actively initiated school policy direction that positions Teaching Factory as a flagship program, with a production-based approach that integrates students' technical skills and soft skills. This vision was consistently communicated through internal and external forums, becoming a shared guideline for the entire school community in developing a productive work culture that is adaptive to industrial changes.

In formulating the vision and policies for TeFa development, the principal demonstrated transformational leadership capacity by involving various stakeholders, including productive teachers, department coordinators, and local industry partners. This participatory strategy created a sense of shared ownership and increased commitment to program implementation. The principal also encouraged project-based industrial learning innovation, facilitated teacher training, and initiated

regular evaluations to refine TeFa implementation. This adaptive and collaborative managerial policy shows alignment between visionary leadership and change management practices in vocational education contexts.

The principal's visionary leadership is reflected in initiatives to transform SMK Negeri 3 Tondano into a Government Public Service Agency (BLUD) to support financial autonomy and flexibility in managing the Teaching Factory. The principal acted as a change agent who actively sought new partnership opportunities with strategic industry sectors, expanded partnership networks, and promoted department strengths through student work exhibitions and TeFa production publications. These initiatives prove that visionary leadership is not just conceptual but also actualized in concrete and sustainable actions to position the SMK as an excellent and relevant industry-based learning center.

Managerial Strategies of the Principal in Teaching Factory Implementation

This research reveals that the principal of SMK Negeri 3 Tondano implements comprehensive managerial strategies in Teaching Factory (TeFa) implementation, starting from systematic planning. The principal formulated an annual work plan that integrates TeFa programs into the school's strategic plan, considering business and industry (DUDI) needs as well as each department's potential. This planning was based on internal and external situation analysis and previous year evaluation results. Additionally, the principal facilitated the development of production-based learning programs, allowing students to participate in actual industrial-like production processes.

In terms of organizing, the principal formed a cross-functional Teaching Factory team consisting of department coordinators, productive teachers, technicians, as well as finance and marketing administrative teams. Assignments were made based on each personnel's competence and experience, accompanied by internal training to align understanding of TeFa implementation. The principal also developed an effective coordination system, including regular team meetings, monitoring production activities, and periodic reporting. This mechanism ensured integration between learning activities, production, and financial management, while also promoting accountability and transparency in Teaching Factory management.

At the implementation and evaluation stages, the principal actively supervised TeFa's operational continuity, ensuring the availability of production materials, optimal equipment utilization, and student involvement in practical work. Evaluations were conducted through direct visits to production units, reflective discussions with teachers, and performance report preparation. The principal used evaluation results to design follow-up development programs and continuous improvement strategies. This managerial approach reflects the principal's ability to integrate classical management functions with vocational education innovation principles, creating a productive, collaborative, and responsive school work environment.

Collaboration Between School and Business/Industry (DUDI)

The research findings show that collaboration with business and industry (DUDI) is a strategic pillar in optimizing the Teaching Factory (TeFa) at SMK Negeri 3 Tondano. The principal holds a

central role as the main initiator and facilitator in establishing mutually beneficial partnerships. The strategies used include personal and institutional approaches, such as direct audiences with industry partners, drafting memoranda of understanding (MoUs), and offering cooperation schemes based on industry production needs and the school's departmental potential. The principal also ensured that all TeFa programs were developed relevant to local and regional industry trends and needs.

Partnerships built were not only formal but also operational and sustainable. Industry partners were directly involved in curriculum planning, providing project-based teaching materials, supervising student internships, and teacher training through industrial apprenticeship programs. The principal actively facilitated regular communication forums between teachers and industry partners to align competency targets and learning outcomes. Furthermore, the industry was given space to provide feedback on the TeFa product results, which then served as a basis for program evaluation and development. This approach positioned the school as an integral part of the local production and innovation ecosystem.

Moreover, DUDI partnerships opened marketing opportunities for TeFa products to broader and professional markets. The principal encouraged an education-based business model using the BLUD (Public Service Agency) framework as a legal and managerial scheme to manage TeFa revenues and operational budgets flexibly and accountably. This became an important instrument in realizing the financial autonomy of school production units. Such structured and directed collaboration ultimately improves vocational learning quality and strengthens the competitiveness of SMK Negeri 3 Tondano graduates, as students not only acquire technical skills but also real work experiences aligned with current industry demands.

Adaptation of Teaching Factory to Department Characteristics

This research found that the principal of SMK Negeri 3 Tondano demonstrated adaptive leadership by encouraging the adaptation of Teaching Factory (TeFa) implementation to each department's characteristics. This differentiative approach was manifested through flexible policies that allowed each department to design TeFa services based on their core competencies and specific industry-related work needs. For example, the Light Vehicle Engineering (TKR) department developed an automotive workshop unit serving the public directly, while the Visual Communication Design (DKV) department focused on producing creative content and digital branding for local clients. The principal facilitated each department to have limited autonomy in determining product forms, promotion strategies, and relevant industry collaboration models.

This flexibility did not mean a lack of structure. The principal ensured that each TeFa unit had standard operating procedures (SOPs) aligned with school policies and the national curriculum framework. Through intensive coordination with department coordinators and curriculum development teams, the principal aligned learning objectives with real production targets. This aimed for TeFa to not only focus on production results but also comprehensive student competency development. This differentiation implementation was supported by ongoing coaching, cross-department evaluations, and teacher training tailored to each field of expertise. The principal acted as

a synergy facilitator among departments to ensure TeFa implementation remained adaptive yet systematically integrated.

The impact of this adaptation strategy was seen in the increased relevance and student engagement in production processes. Students found practical learning more meaningful because it matched their expertise and could be directly applied in work contexts. Additionally, industry partners also showed increased participation because they saw that SMK Negeri 3 Tondano's departments could offer products and services aligned with their specific needs. Department-based TeFa adaptation not only strengthened students' technical competencies but also reinforced the school's position as a responsive, adaptive, and relevant vocational education provider.

Challenges and Solutions in Teaching Factory Management

This study revealed that the principal of SMK Negeri 3 Tondano faced significant challenges in managing Teaching Factory (TeFa), primarily related to limited facilities and infrastructure, regulatory constraints, and human resource (HR) quality and quantity. Production facilities in some departments did not fully meet industry standards, both in terms of technology and operational capacity. Rigid educational administration policies that did not fully support flexible production-based learning models also became obstacles in TeFa development. The lack of industry-experienced productive teachers further impacted the gap between practical learning and real work contexts.

To address these challenges, the principal implemented adaptive and collaborative strategies. One was establishing strategic partnerships with business and industry (DUDI) for shared facility utilization, teacher training, and curriculum alignment. The principal also repositioned teachers' roles as facilitators and production coordinators by providing intensive project-based training. In terms of regulations, the principal actively advocated with the education office and local government to promote more flexible and accommodating policies for Teaching Factory models. Additionally, budget optimization based on performance, utilization of School Operational Aid (BOS) funds, and garnering support from alumni and local stakeholders were carried out.

Overall, the principal's strategies in overcoming TeFa management challenges demonstrated responsive and innovative leadership. This managerial approach not only minimized the impact of existing limitations but also strengthened a productive and collaborative work culture within the school environment. As a result, despite limited resources, SMK Negeri 3 Tondano was able to consistently run Teaching Factory services relevant to industry needs. This strategy also created a broad participation space for teachers, students, and industry partners, reinforcing the principal's role as a transformational leader in vocational education.

Strengthening a Productive Work and Entrepreneurial Culture in the School Environment

The research findings show that the principal of SMK Negeri 3 Tondano played a strategic role in fostering a productive work and entrepreneurial culture within the school environment through a transformative leadership approach. Values of discipline, responsibility, timeliness, and result orientation were implemented as part of the learning process, integrated into the Teaching Factory

(TeFa). The principal integrated these principles into internal regulations, TeFa standard operating procedures (SOPs), and daily habitual practices involving teachers, students, and educational staff collectively.

The implementation of these values was not only limited to behavioral aspects but was also applied in the student performance evaluation system during practical activities. For instance, students' technical skills were evaluated along with non-technical indicators such as work attitude, ability to complete tasks independently, and initiative in problem-solving during production processes. The principal also facilitated soft skills training and entrepreneurial workshops involving industry practitioners and local business actors to foster a business mindset and build students' confidence in facing real work and business challenges.

With this approach, the school not only functions as an educational institution but also as a miniature industrial environment where the planting of a work ethic grows from consistent and systemic direct practice. The principal's role as a role model and value driver is crucial in shaping a productive organizational culture. This ethos induction increased student job readiness and strengthened the graduate profile to be adaptive, independent, and entrepreneurial. This shows that entrepreneurship character reinforcement is not merely a formal teaching result but grows from direct practice that is consistent, systemic, and fully supported by visionary, quality-oriented school management.

Innovations and Initiatives of the Principal in Improving TeFa Service Quality

This research found that the principal of SMK Negeri 3 Tondano demonstrated innovative leadership in designing and implementing various breakthroughs to improve Teaching Factory (TeFa) service quality. These innovations included the development of a digital-based TeFa management system, integration of the curriculum with real production projects, and the adoption of problem-based learning (PBL) methods aligned with dynamic work needs. The principal actively created an adaptive learning ecosystem by aligning industry practice schedules, the academic calendar, and production cycles to be synergistic and mutually reinforcing.

One of the flagship initiatives identified in this study is the implementation of a multi-stakeholder engagement model, where the principal involved not only teachers and students but also parents, alumni, and industry partners in the TeFa planning and development process. This inclusive approach resulted in a field-based needs-driven management system that created a broad participation space. The principal also established a special innovation unit tasked with designing sustainable programs, conducting periodic service quality evaluations, and preparing transparent performance reports based on measurable Key Performance Indicators (KPIs).

With a systematic and contextually reflective approach, the principal succeeded in positioning Teaching Factory as the school's center of excellence. The innovations initiated were not merely reactive to external challenges but also proactive in responding to technological changes, industry needs, and national curriculum developments. These findings emphasize that transformative, creative, and collaborative school leadership is the key factor in creating a TeFa management model that is not

only sustainable but also capable of transforming vocational learning culture toward being more relevant and competitive.

CONCLUSION

This study shows that the principal of SMK Negeri 3 Tondano plays a central role as a visionary leader in Teaching Factory (TeFa) development. The principal not only formulates a strategic vision relevant to the industry but also actualizes it through policies and programs focused on improving students' technical skills and soft skills. The principal's role is proven crucial in shaping a productive work and entrepreneurial culture in the school environment. The managerial strategies applied by the principal include systematic planning, organizing, implementing, and evaluating the TeFa programs. The principal integrates TeFa programs into the school's strategic plan by forming cross-functional teams and an effective coordination system. Program evaluations are conducted periodically with a data-driven approach, encouraging continuous improvement and learning relevant to job market needs. Collaboration with business and industry (DUDI) is a key success factor for the Teaching Factory. The principal forges partnerships that are not only formal but also operational and sustainable. Through these partnerships, the school gains access to production facilities, teacher training, joint curriculum development, and TeFa product marketing, which directly impacts graduate quality improvement.

The principal demonstrates adaptive leadership by adjusting the Teaching Factory model to align with each department's characteristics. This flexibility allows SMK departments to develop production models according to their competencies without neglecting quality standards and curriculum integration. This increases student participation and industry partner involvement. Various challenges, such as facility limitations, rigid regulations, and suboptimal HR, were overcome through collaborative strategies, policy advocacy, and resource optimization. The principal also promotes innovations in TeFa services, including digital management and problem-based learning. With transformative and innovative leadership, SMK Negeri 3 Tondano has created a vocational learning ecosystem that is excellent, relevant, and highly competitive.

To support the sustainability and expansion of effective Teaching Factory services in SMKs, it is recommended that regional and central governments accelerate BLUD status legalization for vocational schools, provide leadership and innovative management training for principals, and strengthen regulations that allow flexibility for production-based learning so that all SMKs can develop adaptive, professional, and industry-relevant Teaching Factory.

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