

# Development of the CIPPO Evaluation Model at the Learning Factory of Vocational High Schools in South Sulawesi

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## Abstract

To support structured evaluation of learning factory implementation, this study developed and evaluated a Context, Input, Process, Product, and Outcome (CIPPO) model for vocational high schools in South Sulawesi. A research and development approach based on the Borg and Gall model was employed, involving 80 participants from a population of 793 lecturers and vocational teachers engaged in learning factory implementation. Questionnaire data were analyzed using confirmatory factor analysis with LISREL. The evaluation framework encompassed eight constructs: management, workshop/laboratory, human resources, learning patterns, promotion and marketing, industry relations, products/services, and graduates. Reliability coefficients ranged from 0.812 for management to 0.914 for products/services, indicating acceptable to high internal consistency across the constructs. Expert validation yielded scores of 81.73% for content and 77.94% for media, both classified as feasible with revisions according to the study's criteria. User assessments indicated that the model was rational, useful, and feasible for evaluating learning factory implementation. These findings provide preliminary support for the CIPPO model as a structured evaluation framework integrating institutional context, resources, implementation processes, products, and outcomes. The model offers a basis for evaluating learning factories in vocational education, subject to the revisions identified through expert validation. Further testing across a broader range of vocational schools is recommended to strengthen evidence of its applicability.

**Keywords:** CIPPO Evaluation Model; Learning Factories; Vocational High Schools; Confirmatory Factor Analysis; Model Development

## INTRODUCTION

Learning factories have become an important approach in vocational education, providing practical learning environments that bridge the gap between theoretical knowledge and industrial practices. In vocational high schools, the implementation of learning factories is expected to strengthen students' competencies and improve the relevance of vocational education to industry needs. However, achieving these objectives requires systematic evaluation of the management, resources, learning processes, products or services, and outcomes of learning factory implementation. Therefore, a comprehensive evaluation model is needed to assess the implementation of learning factories and support continuous improvement in vocational high schools. This study focuses on developing a CIPPO (Context, Input, Process, Product, and Outcome) evaluation model for learning factories in South Sulawesi, Indonesia.

The learning factory has emerged as an important instructional approach in vocational education because it provides an authentic learning environment that connects theoretical knowledge with practical activities resembling real industrial processes. This approach enables students to develop technical competencies, problem-solving abilities, teamwork, and entrepreneurial skills while becoming familiar with industrial practices and production standards. Furthermore, the learning factory has been associated with the implementation of Industry 4.0 principles, which require vocational education institutions to prepare graduates who can adapt to technological developments and changing labor market demands.

In vocational high schools (Sekolah Menengah Kejuruan/SMK), the implementation of learning factories requires more than the availability of workshops, laboratories, and production equipment. It also depends on effective management, qualified human resources, appropriate learning patterns, promotion and marketing strategies, collaboration with industry, the quality of products or services, and the competencies of graduates. These components are interrelated and determine whether the learning factory can function effectively as both a learning environment and a production-oriented educational program.

Despite its potential, evaluating the implementation of learning factories remains a significant challenge. An evaluation framework needs to examine not only the resources and processes involved but also the products or services generated and the outcomes achieved by students and graduates. Without a comprehensive evaluation instrument, vocational schools may encounter difficulties in identifying implementation weaknesses, determining program effectiveness, and formulating evidence-based improvement strategies.

In South Sulawesi, the implementation of learning factories in vocational high schools provides a relevant context for developing an evaluation model that accommodates the characteristics and operational requirements of vocational education. Therefore, a systematic evaluation framework is needed to assess learning factory implementation comprehensively, from contextual conditions and available resources to implementation processes, products or services, and graduate outcomes.

The researchers argue that the effectiveness of learning factory implementation in vocational high schools cannot be adequately assessed through a single dimension, such as the availability of facilities or the completion of practical learning activities. Instead, evaluation should consider the relationships among the institutional context, supporting resources, implementation processes, products or services, and outcomes. A comprehensive approach is necessary because weaknesses in one component may influence the performance of other components within the learning factory system.

The researchers further contend that an evaluation model should provide clear and measurable indicators that can be used by schools, teachers, evaluators, and relevant stakeholders. Such indicators are important for identifying the extent to which learning factory implementation meets its intended objectives and for supporting continuous improvement in vocational learning management.

The Context, Input, Process, Product, and Outcome (CIPPO) model provides a relevant conceptual framework for this purpose. The model extends the CIPP evaluation framework by explicitly incorporating outcomes, thereby enabling evaluation to consider not only the conditions and implementation of a program but also its resulting products and broader outcomes. In the context of learning factories, these dimensions can be operationalized through indicators related to management, workshops and laboratories, human resources, learning patterns, promotion and marketing, industrial relations, products or services, and graduates.

Accordingly, the researchers propose that developing and empirically examining a CIPPO-based evaluation model can contribute to a more systematic assessment of learning factory implementation. The model is expected to provide a structured basis for determining the validity and reliability of evaluation indicators and for supporting evidence-based decisions concerning the improvement of learning factories in vocational high schools.

Previous studies have examined the learning factory from various perspectives, including its conceptual development, instructional effectiveness, industrial relevance, and contribution to competency development. Abele et al. discussed the role of learning factories in research, education, and training, emphasizing their relevance as environments for connecting educational activities with industrial applications. Similarly, Cachay et al. examined action-oriented learning through a learning factory approach and highlighted its potential to improve students' application performance and knowledge acquisition. Lamancusa et al. also presented the learning factory as an approach for integrating design, manufacturing, and business realities into engineering education.

Other studies have focused on the relationship between learning factories and technological development. Baena et al. discussed the learning factory as a pathway toward Industry 4.0, while Wagner et al. examined the development of adaptable learning factories. These studies demonstrate the relevance of learning factories for preparing learners to engage with industrial technologies, practical problem-solving, and changing production environments.

In addition to studies on implementation and learning effectiveness, evaluation research has explored frameworks for assessing educational programs. Stufflebeam and Zhang presented the CIPP evaluation model as a framework for supporting program improvement and accountability. Related studies have applied evaluation approaches to educational programs and vocational education contexts. These contributions provide a theoretical and methodological foundation for developing a comprehensive evaluation model for learning factory implementation.

Nevertheless, the manuscript identifies a need for more comprehensive evaluation of learning factories in vocational high schools, particularly concerning the integration of contextual conditions, inputs, processes, products or services, and graduate outcomes within a measurable evaluation framework. Previous studies cited in this research provide important insights into learning factory implementation and educational program evaluation, but the

present study focuses specifically on operationalizing these dimensions into an evaluation model for vocational high schools in South Sulawesi.

The principal research gap addressed by this study is therefore the need for a structured set of learning factory evaluation indicators whose validity and reliability can be examined empirically. The study addresses this gap by developing a CIPPO-based evaluation model and testing its measurement indicators using confirmatory factor analysis (CFA). This focus distinguishes the present research from studies primarily concerned with the conceptual benefits, instructional applications, or industrial functions of learning factories.

The theoretical foundation of this study is the CIPP evaluation model developed by Stufflebeam and subsequently elaborated in the evaluation literature. The framework emphasizes four dimensions: Context, Input, Process, and Product. In this study, the framework is extended to CIPPO by explicitly including Outcome as a separate evaluation dimension, consistent with the conceptual approach described in the original manuscript.

The Context dimension examines the institutional and managerial conditions that support learning factory implementation. The Input dimension addresses the resources and capacities required to operate the program, particularly workshops or laboratories and human resources. The Process dimension evaluates the implementation of learning activities, promotion and marketing, and relationships with industry. The Product dimension focuses on the products or services generated through learning factory activities, while the Outcome dimension concerns graduate competencies and their relevance to employment in industry.

The novelty of this study lies in the operationalization of the CIPPO framework for evaluating learning factory implementation in vocational high schools in South Sulawesi. Rather than treating learning factory evaluation as a general assessment of instructional effectiveness, the study organizes evaluation into eight principal indicators: management, workshop or laboratory, human resources, learning patterns, promotion and marketing, business or industry relationships, products or services, and graduates.

A further contribution is the empirical examination of the proposed indicators through confirmatory factor analysis using LISREL. This procedure enables the researchers to assess whether the observed indicators meet the specified criteria for factor loadings, statistical significance, and reliability. Thus, the study connects the conceptual framework of program evaluation with an empirically tested measurement structure designed for the vocational education context.

The proposed model is intended to provide a systematic evaluation instrument that can assist vocational schools and relevant stakeholders in identifying strengths and weaknesses in learning factory implementation. Its contribution is primarily methodological and practical: it translates the CIPPO framework into context-specific evaluation indicators and examines their measurement properties using empirical data from South Sulawesi.

This study focuses on the development and empirical examination of a CIPPO-based evaluation model for learning factory implementation in vocational high schools in South Sulawesi, Indonesia. The model integrates five evaluation dimensions—Context, Input, Process, Product, and Outcome—into a structured framework consisting of indicators related to management, workshops or laboratories, human resources, learning patterns, promotion and marketing, business or industry relationships, products or services, and graduates.

The specific objective of this study is to develop a comprehensive evaluation model for learning factory implementation and examine the validity and reliability of its measurement indicators using confirmatory factor analysis (CFA). The study also assesses the feasibility of the developed model through expert validation and user assessments, focusing on its rationale, usefulness, and suitability for application in vocational high schools.

Through these objectives, the study seeks to provide an empirically supported evaluation framework that can assist schools, teachers, evaluators, and other stakeholders in assessing learning factory implementation systematically. The resulting model is expected to support evidence-based decisions and continuous improvement in vocational education, particularly in strengthening the alignment between school-based practical learning, industrial requirements, and graduate competencies.

## METHODS

This study employed a research and development approach based on the Borg and Gall model to develop and validate a CIPPO evaluation model for learning factory implementation in vocational high schools in South Sulawesi. Data were collected through questionnaires and expert assessments and analyzed using descriptive statistics and confirmatory factor analysis (CFA).

## **1. Type of Research**

This study employed a research and development (R&D) approach to develop an evaluation model for learning factory implementation in vocational high schools in South Sulawesi, Indonesia. The development process followed the Borg and Gall model, which provides systematic procedures for developing, testing, revising, and disseminating educational products (Borg & Gall, 2003). The product developed in this study was a CIPPO (Context, Input, Process, Product, and Outcome) evaluation model designed to assess learning factory implementation comprehensively. The study focused on developing the evaluation indicators and examining their validity, reliability, and feasibility for use in vocational education settings.

## **2. Research Design**

The research followed the Borg and Gall research and development framework, consisting of ten stages: (1) research and information collecting, (2) planning, (3) developing a preliminary form of the product, (4) preliminary field testing, (5) main product revision, (6) main field testing, (7) operational product revision, (8) operational field testing, (9) final product revision, and (10) dissemination and implementation (Borg & Gall, 2003).

The development process began with a review of the literature and the existing implementation of learning factories in vocational high schools. The findings were used to establish the evaluation indicators within the five CIPPO dimensions. The preliminary model was subsequently assessed by experts and users, revised based on their feedback, and examined through field testing involving users from several districts and cities in South Sulawesi. Confirmatory factor analysis (CFA) was employed to examine the measurement properties of the proposed indicators. The final stage involved preparing the research report and disseminating the findings through scientific publication.

## **3. Participants and Sampling Technique**

The study population consisted of 793 vocational education lecturers and vocational technology education teachers involved in or associated with learning factory implementation in South Sulawesi. The sample comprised 80 participants, determined using the Slovin formula with a 10% margin of error. The study used questionnaires to obtain information relevant to the development and evaluation of the proposed model.

Field testing was conducted in stages. The main field testing involved users in Pinrang Regency and Parepare City, while operational field testing involved users from Barru, Pangkajene and Islands (Pangkep), Gowa, and Makassar. In addition, content experts and vocational education media experts participated in the preliminary assessment of the developed product. These evaluations provided input for revising the model and assessing its suitability for application in vocational high schools.

#### **4. Instruments and Data Collection**

Data were collected using questionnaires developed to assess the indicators and feasibility of the CIPPO evaluation model. The evaluation framework covered five dimensions: Context, Input, Process, Product, and Outcome. These dimensions were operationalized through indicators related to management, workshops or laboratories, human resources, learning patterns, promotion and marketing, business or industry relationships, products or services, and graduates.

The data collection process involved preliminary field testing, main field testing, and operational field testing. During preliminary field testing, content experts and vocational education media experts assessed the developed product. Their evaluations covered aspects such as utility, feasibility, language, presentation, and content. Subsequent field testing collected user assessments to examine the model's rationale, usefulness, and feasibility. Feedback from experts and users was used to inform revisions throughout the development process.

The manuscript reports the use of 140 questionnaire items to collect data on the variables studied. However, the available description does not specify the complete item distribution across the eight indicators or provide detailed information about the questionnaire scale and instrument validation procedures. These details should be reported if they are available in the original research records.

#### **5. Data Analysis Technique**

The data were analyzed using descriptive analysis and confirmatory factor analysis (CFA). CFA was conducted using LISREL software to examine the validity and reliability of the measurement indicators within the proposed CIPPO evaluation model. The assessment criteria included standardized factor loadings greater than 0.50, t-values greater than 1.96, and reliability coefficients greater than 0.70, following the criteria cited in the original manuscript.

The expert validation results were analyzed descriptively by comparing the obtained scores with the ideal scores and expressing the results as percentages. User assessment data were analyzed using average scores to determine the model's rationale, usefulness, and feasibility. These analyses were used to identify indicators that met the specified measurement criteria and to provide evidence supporting the development and refinement of the CIPPO evaluation model for learning factories in vocational high schools.

## RESULTS

The results of this study present the development and evaluation of the CIPPO model for learning factory implementation in vocational high schools in South Sulawesi. The findings cover the validity and reliability of the evaluation indicators based on confirmatory factor analysis (CFA), as well as expert validation and user assessments of the model's rationale, usefulness, and feasibility. These results provide evidence regarding the suitability of the developed model for evaluating learning factory implementation.

The findings indicate that the proposed CIPPO evaluation model comprises eight principal indicators across five evaluation dimensions: Context, Input, Process, Product, and Outcome. The indicators include management, workshop or laboratory, human resources, learning patterns, promotion and marketing, business or industry relationships, products or services, and graduates.

The confirmatory factor analysis (CFA) results reported in the original manuscript indicate that the measurement indicators met the specified acceptance criteria for standardized factor loadings and t-values. The reported reliability coefficients were 0.812 for management, 0.845 for workshop or laboratory, 0.879 for human resources, 0.873 for learning patterns, 0.854 for promotion and marketing, 0.906 for business or industry relationships, 0.914 for products or services, and 0.902 for graduates.

The preliminary expert validation results showed a score of 81.73% from content experts and 77.94% from vocational education media experts. Both results fell within the 70%–85% interval cited in the original manuscript, indicating that the developed product was considered feasible for use with revisions.

Furthermore, user assessments reported an average score of 3.35 for the product's rationale, usefulness, and feasibility. These findings suggest that the developed CIPPO

evaluation model provides a structured framework for assessing learning factory implementation in vocational high schools in South Sulawesi.

**Table 1. Reliability Coefficients of the CIPPO Evaluation Indicators**

| No. | Evaluation indicator            | Reliability coefficient |
|-----|---------------------------------|-------------------------|
| 1   | Management                      | 0.812                   |
| 2   | Workshop/Laboratory             | 0.845                   |
| 3   | Human Resources                 | 0.879                   |
| 4   | Learning Patterns               | 0.873                   |
| 5   | Promotion and Marketing         | 0.854                   |
| 6   | Business/Industry Relationships | 0.906                   |
| 7   | Products/Services               | 0.914                   |
| 8   | Graduates                       | 0.902                   |

Source: Research data, as reported in the original manuscript.

Table 1 presents the reliability coefficients of the eight evaluation indicators. The coefficients range from 0.812 to 0.914. Products/services obtained the highest reported coefficient (0.914), whereas management obtained the lowest (0.812). All reported coefficients exceeded the acceptance threshold of 0.70 used in this study.

**Table 2. Results of Expert Validation**

| Validation aspect                            | Obtained score | Ideal score | Validation percentage |
|----------------------------------------------|----------------|-------------|-----------------------|
| Content expert validation                    | 85             | 104         | 81.73%                |
| Vocational education media expert validation | 106            | 136         | 77.94%                |

Source: Research data, as reported in the original manuscript.

As shown in Table 2, content expert validation achieved 81.73%, while vocational education media expert validation achieved 77.94%. Both percentages were within the 70%–85% interval cited in the original manuscript, indicating that the developed model was feasible for use with revisions.

The figure should illustrate the five dimensions of the CIPPO model and their associated evaluation indicators:

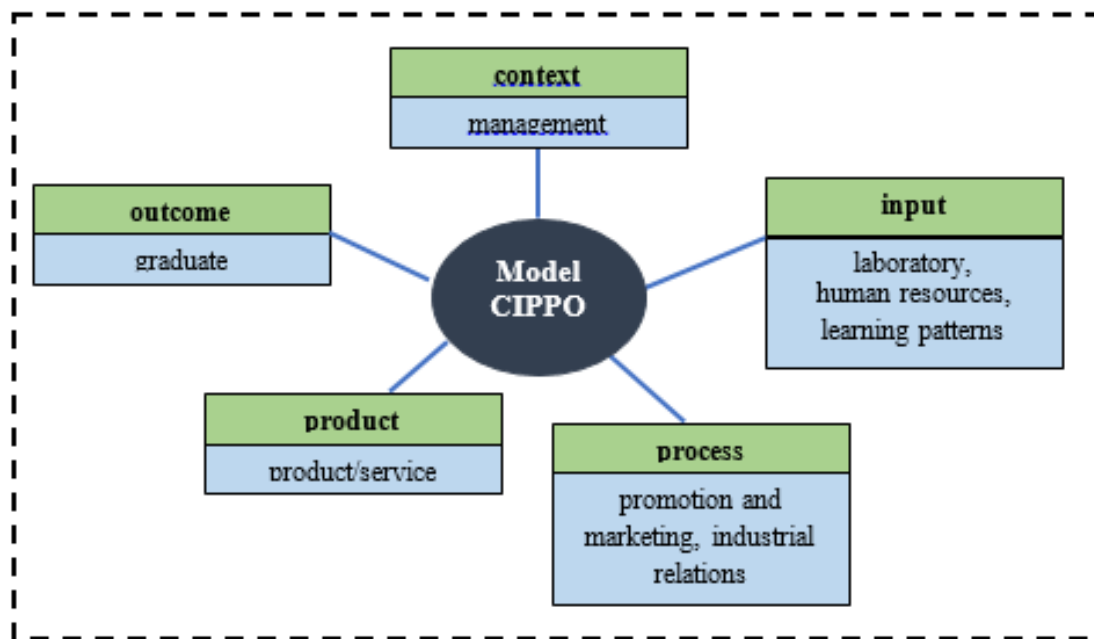


**Figure 1. CIPPO Evaluation Model for Learning Factory Implementation**

The figure provides a conceptual overview of how the eight indicators are organized within the five evaluation dimensions.

The results generally indicated that the proposed evaluation indicators met the measurement criteria specified in this study. However, several issues require clarification to ensure consistency in reporting. First, the reliability coefficient for human resources is reported as 0.879 in the Results section, whereas the abstract states 0.897. This discrepancy should be checked against the original CFA output before the manuscript is finalized.

Second, the expert validation results were 81.73% for content validation and 77.94% for vocational education media validation. Although both scores fell within the 70%–85% interval cited in the manuscript, they indicate that revisions were still required before the model could be considered finalized.

Third, the manuscript reports a sample of 80 participants drawn from a population of 793, using the Slovin method with a 10% margin of error. The reported sample size should be verified against the actual sampling procedure and research records.

These issues are reported to improve transparency and consistency in the presentation of the research findings. They do not, by themselves, establish that the

developed evaluation model is invalid; rather, they identify points that require verification or clarification.

The expert validation percentages were calculated by comparing the obtained scores with the corresponding ideal scores. The calculation can be expressed as follows:

The validation percentage was calculated using the following formula:

$$P = (S_o / S_i) \times 100\% \quad (1)$$

where:

P = validation percentage;

S<sub>o</sub> = obtained score; and

S<sub>i</sub> = ideal score.

For content expert validation, the calculation was as follows:

$$P = (85 / 104) \times 100\% = 81.73\% \quad (2)$$

For vocational education media expert validation, the calculation was as follows:

$$P = (106 / 136) \times 100\% = 77.94\% \quad (3)$$

These calculations reproduce the validation percentages reported in the original manuscript. The equations provide a transparent mathematical representation of the expert validation results.

## DISCUSSION

The discussion interprets the research findings, compares them with relevant theories and previous studies, explains their implications, and identifies research limitations and directions for future research.

### 1. Analysis and Interpretation of Findings

The findings indicate that the proposed CIPPO evaluation model comprises eight indicators: management, workshop and laboratory facilities, human resources, learning patterns, promotion and marketing, business and industry relationships, products and services, and graduates. The reported reliability coefficients range from 0.812 to 0.914, exceeding the study's threshold of 0.70. Products and services demonstrate the highest

coefficient (0.914), while management has the lowest (0.812). These results indicate acceptable measurement consistency for all eight indicators.

Expert validation yielded 81.73% for content and 77.94% for media, both within the feasibility interval applied in the study, indicating that the instrument is feasible with revisions. The average user assessment score of 3.35 also provides descriptive evidence of the instrument's perceived rationality, usefulness, and feasibility. These findings support further development of the model, although reliability and feasibility results alone do not establish the effectiveness of Learning Factory implementation.

## **2. Comparison with Theories and Previous Literature**

The model applies the Context, Input, Process, Product, and Outcome framework to evaluate Learning Factory implementation. Management represents context; workshop and laboratory facilities and human resources represent inputs; learning patterns, promotion and marketing, and business and industry relationships represent processes; products and services represent products; and graduates represent outcomes. This structure enables evaluation of the organizational conditions, resources, implementation processes, and results of vocational learning activities.

The model provides a structured approach to evaluating Learning Factory programs in vocational high schools. However, a direct comparison with previous studies requires verified references addressing CIPPO evaluation, Learning Factory implementation, and vocational education. The model's theoretical contribution should therefore be explained further by comparing its indicators and findings with relevant studies cited in the manuscript.

## **3. Research Implications**

The eight indicators provide a practical framework for vocational high schools to evaluate Learning Factory implementation systematically. School managers can use the model to examine management, facilities, human resources, learning processes, and industry partnerships while identifying areas that require improvement.

The inclusion of products and services and graduates also encourages evaluation beyond resources and activities. Nevertheless, the present findings do not independently demonstrate improvements in graduate employability or institutional performance. Further outcome-based evaluation is needed to determine the model's contribution to improving vocational education practices.

#### **4. Research Limitations and Directions for Future Research**

This study has several limitations. First, the manuscript reports 80 respondents from a population of 793 and states that Slovin's formula was applied with a 10% margin of error. This calculation should be verified because the conventional formula yields approximately 89 respondents. In addition, the reliability coefficients for human resources and promotion and marketing differ between the abstract and results section; these discrepancies must be resolved using the original statistical output.

Future research should test the model with larger and more diverse samples across different vocational schools and regions. Further studies should also report complete confirmatory factor analysis results and relevant model-fit statistics, as well as examine the relationship between evaluation results and measurable outcomes of Learning Factory implementation.

#### **CONCLUSION**

This study developed and evaluated a CIPPO-based evaluation model for Learning Factory implementation in vocational high schools in South Sulawesi. The model comprises eight indicators: management, workshop and laboratory facilities, human resources, learning patterns, promotion and marketing, business and industry relationships, products and services, and graduates. The reported reliability coefficients range from 0.812 to 0.914, while expert validation scores reach 81.73% for content and 77.94% for media, indicating that the instrument is feasible with revisions according to the criteria applied in this study.

This study contributes to vocational education evaluation by organizing eight indicators within a CIPPO-based framework for examining Learning Factory implementation. The model provides a structured basis for assessing management, resources, implementation processes, products and services, and graduate-related outcomes in vocational high schools.

Future research should verify the measurement properties of the model using larger and more diverse samples across different vocational schools and regions. Researchers should also report complete confirmatory factor analysis and model-fit results, resolve inconsistencies in the reported reliability coefficients, and examine the relationship between evaluation findings and measurable outcomes of Learning Factory implementation.

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