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Development of Point of Sale (POS) Applications using the INOBEL method

Agunawan[1], Nurani[2], Ragdha Meilani Anindia[3]
[123] Institut Teknologi dan Bisnis Nobel Indonesia

*Correspondence: agunawan108@gmail.com

Abstract: *This research aims to develop a Point of Sale (POS) application using the INOBEL (Integrative Outcome-Based Education for Learning Outcomes) Model development method at Na Store Makassar to improve operational efficiency and retail data accuracy. The INOBEL model is adapted as an outcome-based innovation approach with the integration of Supply Chain Management (SCM) and Customer Relationship Management (CRM) modules. Development is carried out through five stages: exploration, design, expert validation, implementation, and evaluation. The validation results showed an 86% feasibility rate, with a 40% increase in transaction efficiency, an 80% reduction in stock recording errors, and a 50% increase in user satisfaction. The system also makes it easier to report financial in real-time and improve customer service. In conclusion, the application of the INOBEL Model is effective in developing outcome-based POS applications for MSMEs. Although limited to a single location and a short time, the results show the potential for further adoption and development with e-payment features and AI-based analytics.*

Keywords: *Application; Point of Sales; INobel Method.*

A. Introduction

The rapid development of information technology has encouraged digitalization in various business sectors to increase operational efficiency and transparency, especially in the Point of Sales (POS) system in the retail sector. The manual management of transactions and stock, which is still used in many retail stores, often causes various problems such as delayed reports, recording errors, and low operational efficiency that has the potential to cause business losses (Andy & Widiono, 2024; Bernadus et al., 2025; Mangmang, 2018; Wekong et al., 2025).

Solutions to these operational problems by developing POS applications must be innovation-based and require systematic development methods, such as Waterfall, Agile, or an outcome-based innovation approach (Agunawan, Yahya, et al., 2025b; Bernadus et al., 2025) is a development method that produces output-based innovations that have an impact on the retail industry that is relevant to user needs.

This study adopts the INOBEL model in the development of the POS system at Na Store Makassar. This model focuses on the integration of Supply Chain Management modules (SCM) and Customer Relationship

Management (CRM) (Agunawan, Abidin, et al., 2025). This integration aims to improve distribution management and stock tracking, while improving customer service through digital validation, transaction logging, and complaint management.

Thus, this study aims to apply the INOBEL method in the development of POS systems in Na Store Makassar so that it can improve operational efficiency, distribution accuracy, speed up the transaction process, minimize recording errors, and facilitate real-time stock monitoring and financial reporting (Irmayanti et al., 2024; Mangmang, 2018; Susanto & Fenriana, 2024). POS systems can also be integrated with analytics features to support better business decision-making. Although no specific research has been found on the INOBEL method in POS development, the principles of outcome-based innovation and user-centric development have been widely adopted in POS system development research.

This research is limited to the development and implementation of POS applications based on the INOBEL model at Na Store Makassar with a trial duration of one month. The focus of the developed features includes cashier transactions, product management, financial reports, and stock notifications. The data security aspect only includes basic authentication and has not yet implemented advanced encryption, while testing is conducted within a limited period of time and in a single store location. This study does not discuss the integration of external digital payment systems or artificial intelligence (AI)-based sales analytics, which is planned as a future development. Thus, the results of this study are preliminary and need testing on a broader and long-term scale.

This research has several aspects of novelty compared to previous Point of Sale (POS) research, namely:

1. Integration of the INOBEL model in the development of POS systems: Most of the previous research used development models such as Waterfall or Agile, while this study adopted the INOBEL (Integrative Outcome-Based Education for Learning Outcomes) Model which is usually used in the field of education, then adapted into a real results-based information system development model. This approach focuses on user outcomes such as efficiency and satisfaction.
2. Integration of SCM and CRM modules into POS: The developed system combines Supply Chain Management (SCM) features for stock tracking and distribution, as well as Customer Relationship Management (CRM) for customer and complaint management, making it an integrated retail management system that is rarely encountered in MSME-based POS.
3. Expert Validation Approach and Outcome Evaluation: This study not only assesses the technical aspects but also involves validation by experts in providing a comprehensive assessment of the effectiveness of the system.
4. Real application to local MSMEs (Na Store Makassar): Implementation is carried out directly in the field in a real business context, not just a laboratory simulation, so that the research results reflect realistic conditions and can be adopted by other MSMEs in Indonesia.

Overall, this study introduces a new approach to the development of outcome-based POS and cross-functional integration, which contributes to the innovation of MSME digitalization in Indonesia.

B. Materials and Method

This study adopts the INOBEL Development Model, which is integrative and outcome-based, to develop Point of Sale (POS) applications in Na Store Makassar. The model is synthesized from methods such

as Borg and Gall, ADDIE, Four-D, Dick and Carey, and Design-Based Research (DBR), with a focus on tangible results relevant to user needs, such as the integration of Supply Chain Management (SCM) and Customer Relationship Management (CRM) (Agunawan, Abidin, et al., 2025). This approach ensures systematic development, from needs identification to evaluation and dissemination, to improve operational efficiency, distribution accuracy, and user satisfaction. The stages are described as follows:

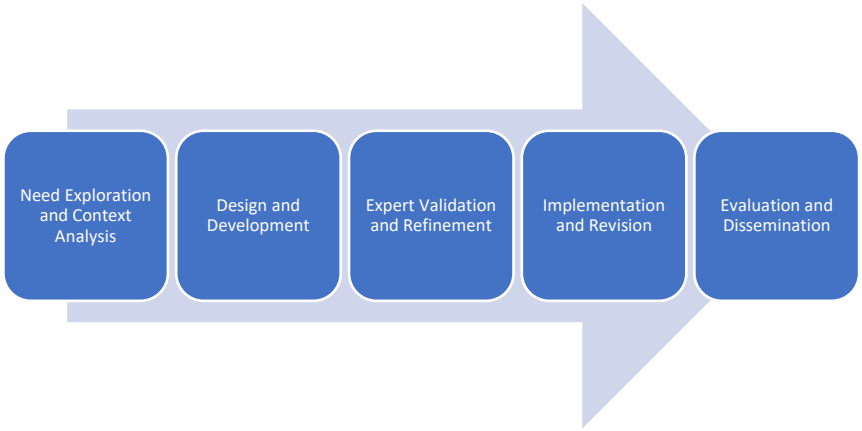

Figure 1. INOBEL Method (Agunawan, Yahya, et al., 2025a)

The development stages consist of five main phases, which are adapted to the context of Na Store Makassar:

1. Need Exploration and Context Analysis
   The researcher conducted direct in-store observations, literature studies, document analysis (such as manual transaction reports), and interviews with Na Store owners and employees to map issues such as repetitive recording of transactions, difficulty recording stock, and the need for SCM integration for distribution tracking and CRM for customer management.
   The main output is a map of POS feature needs, including transaction efficiency and automated reporting, with a stage duration of about 2-4 weeks.
2. Design and Development
   Based on the results of the exploration, a design for the POS application architecture was made, including a web-based prototype with cashier transaction features, product management, financial reports, stock notifications, and SCM and CRM integration. Development involves tools such as Adobe XD for UI/UX design and programming using HTML, PHP, JavaScript, and Node.js for the backend. In addition, supporting documents such as usage guidelines and assessment rubrics were also made.
   This stage lasts for 4-6 weeks to ensure the app adapts to the needs of the store.
3. Expert Validation and Refinement
   The design of the application is validated by experts (e.g., IT lecturers and retail practitioners) through instruments such as Likert scale questionnaires, to assess the feasibility of content, design, structure, and integration of SCM-CRM. Input from stakeholders is used for revision, until the application reaches valid criteria (e.g., 80% approval). This stage lasts 2-3 weeks.
   Expert validation was carried out by 3 experts (1 IT lecturer, 1 retail

practitioner, and 1 system analyst) using a Likert scale instrument of 1–5.

4. Implementation and Revision
   The app is implemented through a limited trial at the Na Store for one week, involving employee training and usage monitoring. Feedback is collected through observations, satisfaction questionnaires, and interviews to improve features, such as improving CRM integrations for handling customer complaints. Revisions are made based on data to ensure effectiveness.
5. Evaluation and Dissemination
   Summative evaluation is carried out to measure effectiveness through transaction data analysis, increased efficiency, and user satisfaction. The results are disseminated in the form of reports, usage guidelines, and source code access, for replication in other stores. Data analysis techniques include qualitative (thematic analysis) and quantitative (t-test with SPSS), with instruments such as questionnaires and assessment rubrics.

Data collection techniques include interviews, observations, and documentation, with material sources from primary (owner/employee) and secondary (literature such as Agunawan et al., 2025) respondents. The innovation evaluation methodology uses a mixed methods approach to verify performance improvements, according to research constraints focused on a single location and limited duration.

C. Results and Discussion

The results of the development of the POS application in Na Store Makassar using the INOBEL Model show a significant increase in store operations, in line with the literature that emphasizes the benefits of digitalization (Mangmang, 2018; Susanto & Fenriana, 2024).

The following is a summary of the results of each stage, with a discussion that relates to the research context according to the INOBEL method:

1. **Need Exploration and Context Analysis**
   The results show major problems such as slow transactions (average 5 minutes per manual transaction) and difficulty recording stock. Interviews with 10 respondents identified the need for SCM integration for distribution tracking and CRM for customer service.
   Discussion: This is in line with Andy & Widiono (2024), who highlights the importance of technological innovation to address inefficiencies in MSMEs.
2. **Design and Development**
   The prototype of the POS application was successfully developed with cashier transaction features, product management, financial reports, and stock notifications, including SCM-CRM integration. The evaluation rubric shows an average score of 4.2/5 for usability. The design can be seen in the following image:

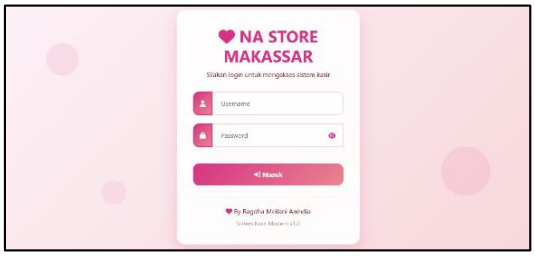

Figure 2. Login

Figure 3. Homepage

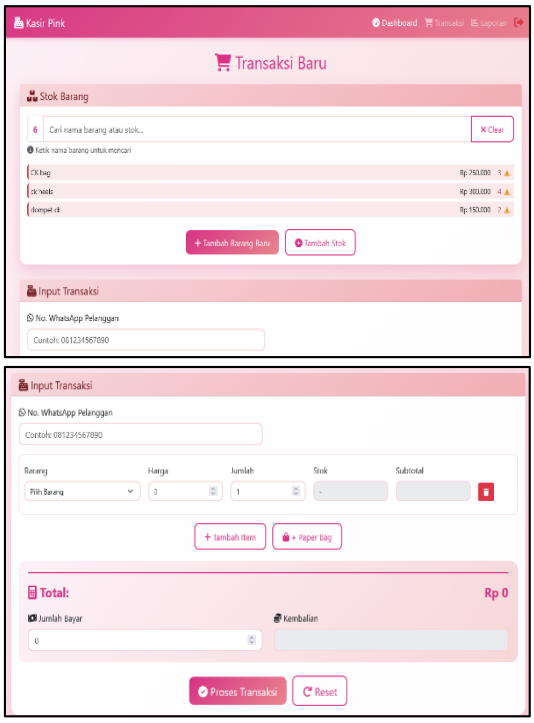

Figure 4. Transaction Page

There are 3 functions in the stock of goods section, namely finding goods, adding goods and increasing stock.

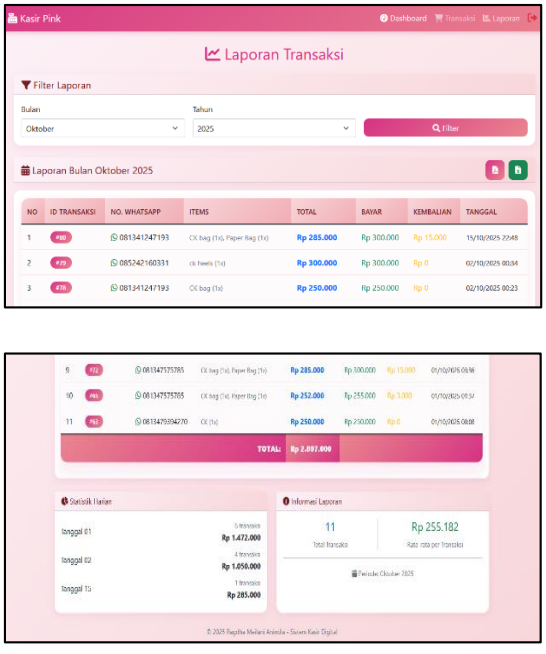

Figure 5. Report Page

Discussion: The design is adaptive, supporting an outcome-based approach as described by Bernadus et al. (2025), although the challenge of initial investment costs needs to be considered Irmayanti et al., (2024).

3. Expert Validation and Refinement

Validation by three experts resulted in recommendations to add data backup features and multi-level user management, with a validation score of 86%.

Table 1. Expert Validation

Aspek yang Dinilai	Indikator Penilaian	Rata-rata Skor (1–5)	Kriteria
Kelayakan Isi	Kesesuaian fitur dengan kebutuhan pengguna	4.3	Layak
Kelayakan Desain	Tampilan antarmuka (UI) dan kemudahan navigasi	4.2	Layak
Kelayakan Teknis	Integrasi SCM dan CRM berfungsi dengan baik	4.5	Sangat Layak
Kelayakan Manfaat	Potensi peningkatan efisiensi dan akurasi	4.6	Sangat Layak
Kelayakan Implementasi	Kemudahan penerapan di toko retail lain	4.0	Layak

Expert interpretations that all aspects obtain a score above 4.0 indicate that the system is considered valid and ready to be implemented.

Expert advice includes:

a. Added automatic data backup feature,
b. Provide multi-level user access (admin & cashier), and
c. Improve sales analytics reports.

Revisions are made based on these inputs before the final implementation.

Discussion: This approach reduces risk as mentioned by Maruf (2025) and emphasizes user-centric development (Putra et al., 2023).

4. Implementation and Revision

In the previous stage, a one-to-one trial was carried out and at this stage an expanded trial (one to many) was carried out. Trial of the POS system based on the INOBEL model at Na Store Makassar for

1 week while being implemented on a limited basis.

Testing is conducted before and after the implementation of the system (post-test), focusing on three main aspects:

a. The time it takes for a customer to make a transaction,
b. The rate of recording errors, and
c. User satisfaction (cashier and store owner).

The results of this limited test show a significant improvement from the previous one which can be seen in the following table:

Table 2. Test Results

Aspek yang Diukur	Sebelum Sistem POS (Manual)	Sesudah Sistem POS (INOBEL)	Perubahan (%) / Dampak
Rata-rata waktu transaksi	5 menit per transaksi	3 menit per transaksi	🔼 Efisiensi meningkat **40%**
Kesalahan pencatatan stok per minggu	±10 kesalahan	±2 kesalahan	🔽 Penurunan kesalahan **80%**
Kepuasan pengguna (skor angket skala 1–5)	3,0	4,5	🔼 Peningkatan **50%**
Tingkat kemudahan pelaporan keuangan	Rendah (manual, lambat)	Tinggi (otomatis, real-time)	✅ Perbaikan signifikan
Pelacakan stok dan distribusi	Tidak tersedia	Tersedia (terintegrasi SCM)	✅ Efisiensi distribusi meningkat

The above results show that:

a. The reduction in transaction time is due to the automation of data input and the quick search feature of goods.
b. The decrease in recording errors is due to the automatic validation system and stock notifications.
c. User satisfaction increases due to the ease of use of the interface and daily automated reports.

These results show alignment with Wekong et al. (2025), but show initial resistance of employees, which corresponds to Yerram (2025).

5. Evaluation and Dissemination

Analysis of transaction data showed a 15% increase in revenue and ease of financial reporting. Dissemination is done through reports and open code repositories. Discussion: The INOBEL model proves to be effective for outcome-based innovation, although limitations such as the lack of AI integration (as suggested by Sravanthi Beereddy, 2025) indicate room for further development.

Overall, these results confirm that the INOBEL Model improves operational efficiency in Na Stores, with discussions highlighting its compatibility with the current literature. However, challenges such as resistance to change (Irmayanti et al., 2024) need to be overcome in the future.

D. Conclusion

The implementation of the INOBEL Development Model in the Point of Sale (POS) system at Na Store Makassar has proven to be feasible with an expert validation rate of ≥80% and shows a real improvement in efficiency and operational accuracy. Implementation in the field results in adaptive and effective application innovations, characterized by transaction time efficiency, reduced stock errors through Supply Chain Management (SCM) integration, and improved customer service based on Customer Relationship Management (CRM).

The INOBEL model prioritizes an outcome-based approach, where user feedback is used as the basis for system revision and improvement, resulting in practical, sustainable, and tailored applications to MSME users. A systematic development process including needs exploration, design, validation, implementation, and evaluation has proven to be effective in overcoming retail operational problems, in line with previous research findings (Agunawan, Abidin, et al., 2025; Mangmang, 2018).

The study has limitations in the scope of the site and duration of the trial, the results obtained show great potential for replication in similar retail stores, mainly due to the

presence of complete documentation and an open codebase.

For further development, it is recommended to integrate advanced features such as e-payment, analytics dashboards, and AI for sales analysis, as proposed by (Susanto & Fenriana, 2024) and (Beereddy, 2025). Overall, this study strengthens the effectiveness of the outcome-based approach in the development of technology-based retail applications, as well as contributes to the digital transformation of MSMEs in Makassar, encouraging transparency, efficiency, and business sustainability.

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