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Original Article

Minimization of Operational Costs for Non-Capitation Claims Verification at BPJS Kesehatan Using a Business Process Reengineering Approach

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Abstract

Indonesia's national health insurance (BPJS Kesehatan) faces rising costs, growing 3.14% yearly from 2017 to 2023. While advanced health facilities use the automated VEDIKA system, primary health centers still verify claims manually, causing delays and high costs. This inefficiency needs urgent improvement to ensure sustainable healthcare services. This study aims to reduce operational costs in the FKTP claim verification business process by using a business process reengineering and the Time-Driven Activity-Based Costing (TDABC) approach and determine the resulting savings. In this study, the data collection method was carried out through participatory observation. The data analysis method in this study uses the TDABC approach and business process simulation with iGrafx. The results of this study show that the implementation of Business Process Reengineering (BPR) in the verification process of non-capitation claims significantly improves cost efficiency and operational time. BPR was able to reduce operational costs by 33.1% and cut verification time by 32.9%, through process simplification, elimination of non-value-added activities, and the use of technology such as Optical Character Recognition (OCR). In addition to efficiency, BPR also improves overall organizational accountability and performance, enabling more appropriate resource allocation, reducing the potential for human error, and creating a more transparent, responsive, and sustainable work system. These findings show that BPR is not only a technical tool, but also an organizational transformation strategy that strengthens governance and service quality in the health insurance system.

Keywords: Business Process Reengineering, Time-Driven Activity-Based Costing, Verification of Non-Capitation Claims, Operational Efficiency, Optical Character Recognition.

1. Introduction

BPJS Kesehatan has several duties, one of which is to pay benefits and/or finance health services in accordance with the provisions of the health insurance programme. This payment is made to two health care facilities in Indonesia, namely the Advanced Referral Health Facility (FKRTL) and the First Level Health Facility (FKTP). FKTP is a health facility that provides non-specialised individual health services, while FKRTL is a health facility that provides specialised or subspecialised individual health services (Kementrian Keuangan, 2018).

In this case, there are differences in the benefit payment schemes to each type of health facility. Benefit payments to FKRTL are made using the Indonesian Case Based Groups (INA-CBG) scheme and the addition of drugs, ambulances, and medical aids, while benefit payments to FKTP are divided into two schemes, namely capitation and non-capitation. In the capitation scheme, claim payments are made based on the number of participants registered at the FKTP.

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Then, in the non-capitation scheme, payments are made according to the health services provided such as ambulances, screening, midwifery, and others (BPJS Kesehatan, 2018).

Claims submitted by health facilities need to be verified by BPJS Kesehatan. Verification of claims submitted by FKRTL has been implementing the Claims Digital Verification (VEDIKA) system since 2017. VEDIKA is a digital verification system that aims to reduce manual operations at hospitals, reduce BPJS Kesehatan's operational burden, and speed up the claims verification process. On the other hand, the claim verification process at FKTP is still carried out manually by BPJS Health verifier officers. This can cause obstacles such as the length of time and the amount of resources spent on the verification process of non-capitation claims and the disbursement of claims submitted by FKTP.

In accordance with the BPJS Kesehatan Program and Financial Management Report, in the 2017-2023 period, the operational costs of implementing the health insurance programme continued to increase with an average increase of 3.14%. The process of verifying non-capitation claims is one of the activities of implementing the health insurance programme so that the costs incurred for this process contribute to the increasing operational burden of implementing the health insurance programme. Therefore, an action is needed to engineer the verification process of non-capitation claims so that the process becomes faster and the operational costs incurred are cheaper (Ulfasari & Husin, 2022).

In the last five years, there have been several studies that discuss the application of business process engineering in various sectors. Based on research conducted on credit companies, organisational adaptability and institutional leadership are the main determinants of the success of business processes (Nkurunziza et al., 2019). Then, with the implementation of business process engineering, government agencies in Sri Lanka could potentially reduce inputs by 5% without reducing service levels (Elapatha & Jehan, 2020). In addition, business process engineering was also carried out to find out the alternative development of the stock-taking process, to find out which alternative provides higher accuracy (Polim & Lestari, 2023). Then, a study conducted on international business organisations in the Middle East provided recommendations for business process engineering to improve performance and reduce operational costs (Alhawamdeh, 2021). TELCO, an information technology company implemented business process transformation by implementing IoT and product development for smart cities using Soft System Methodology (SSM) (Saragih et al., 2021). Business process engineering was also applied to the World Book Fair which resulted in the optimisation of processes and resources with the implementation of online ordering and reduced advertising costs (Sikandar et al., 2023).

Furthermore, a study was conducted at a health facility to perform management on outpatients. This research uses the Time-Driven Activity-Based Costing (TDABC) method to improve the accuracy of operational cost calculations (Etges et al., 2020). In addition, TDABC can also be used to find the bottlenecks of a process (Gervais et al., 2010). For example, a logistics company uses the TDABC method to find out which activities in the goods receiving business process have the most expensive operational costs and find out alternative improvements that can be made (Ding et al., 2022).

In line with the above description, this paper aims to conduct business process engineering on the verification process of non-capitation claims. Then, the TDABC method is used to measure the amount of operational costs in the process before and after the business process engineering is carried out so that it can be seen how much savings are generated from business process engineering.

Based on previous research, the results of observations were obtained, namely the positive impact resulting from the application of business process engineering to reduce the

input required from an activity. This study aims to reduce operational costs in the FKTP claim verification business process using a business process reengineering approach and TDABC and determine the resulting savings.

2. Methods

2.1. Data Collection Methods

In this study, the data collection method was carried out through participatory observation, in which the author was directly involved in the activities at the workplace agency. Observations were conducted systematically by recording various relevant aspects, such as communication patterns, work procedures, policies implemented, and individual and group responses to these policies. Field notes were made regularly to document significant findings, which were then analysed to obtain more objective conclusions.

2.2. Data Analysis Method

The data analysis method in this research uses the Time-Driven Activity-Based Costing (TDABC) approach and business process simulation with iGrafx to evaluate cost efficiency and operational performance in the analysed business processes. In addition, this research also applies business process simulation using iGrafx to model workflows, analyse system performance, and optimise operational processes. Simulations were conducted by visualising various scenarios, analysing performance indicators such as cycle time and capacity, and testing changes in resources or operational policies to improve efficiency.

1. Time-Driven Activity-Based Costing (TDABC)

The Time-Driven Activity-Based Costing (TDABC) model in Kaplan and Anderson's book calculates costs per activity based on two main parameters:

1) Unit Cost of Capacity Provided
   a. Calculated by dividing the total resource cost by the available practical capacity.
   b. For example, if the total operational cost of customer service is $560,000 per quarter and the practical capacity is 700,000 minutes, then the cost per minute is $0.80.
2) Time Required for Each Activity
   a. Estimate the average time required to complete an activity.
   b. For example, if handling a customer order takes 40 minutes, the cost per transaction is 40 × $0.80 = $32.

After specifying these two parameters, TDABC enables the calculation of activity costs more flexibly and accurately than traditional ABC.

1) Implementation in Business Process
   a. Identify the Key Activities in the business process to be costed.
   b. Determine the Capacity Unit Cost of the resources used in the activity.
   c. Estimate the Time Required to complete each transaction or activity.
2) Use Equation of Time to handle complexity variations in transactions.
3) Calculate the Total Activity Cost by multiplying the time per transaction by the unit capacity cost.
4) Evaluate and Optimise the process based on the information of capacity used and unused capacity.

2. Business process simulation with iGrafx

iGrafx is a process visualisation tool that allows users to easily create workflow diagrams. To get started, users can create a new document via the File > New > Process menu, which automatically includes a department ('Dept. 1') and an initial shape ('Start'). Additional departments can be added via the Department icon in the Toolbox, naming them after their role in the process such as 'Client,' 'Support,' or 'Credit.' Once the departments are ready, users can add shapes such as Activities (for actions) and Decisions (for decisions) to the diagram by dragging and dropping them from the Toolbox to the appropriate swimlane, then connecting them using the Selector tool to logically illustrate the process flow.

In addition to building the main diagram, iGrafx allows the addition of advanced features such as external document links, additional notes, and auto-numbering of shapes to clarify process information. Users can also create subprocesses to detail specific parts of the flow by simply changing the activity type to 'Subprocess' and drawing an advanced diagram. Navigation between the main diagram and subprocesses can be done by right-clicking or through the document component panel. With this intuitive visual approach, iGrafx is ideal for documenting and analysing complex business processes.

2.3. Research Design

This research design uses a descriptive qualitative approach with a participatory observation method. Researchers directly observed and recorded the verification process of non-capitation claims carried out at the BPJS Kesehatan Branch Office. The descriptive qualitative approach was chosen because the purpose of this study was to understand and describe in depth the mechanisms, challenges, and effectiveness of the non-capitation claim verification system. This research does not only rely on quantitative data, but also explores aspects of the process that cannot be measured with numbers, such as interactions between parties, administrative barriers, and best practices in claims verification.

2.4. Place, Time, Unit of Analysis, Subject, and Object of Research

This research uses data from the BPJS Health Branch Office, focusing on the non-capitation claim verification business process. The research time was determined based on the schedule prepared by the researcher to ensure the smooth process of data collection and analysis.

The unit of analysis in this study is the non-capitation claim verification process, which includes the stages, policies, and mechanisms applied by BPJS Kesehatan in assessing health service claims from health facilities.

The research subjects involved individuals who directly played a role in the verification process of non-capitation claims, such as claims verifier officers, administrative staff, and other related parties within BPJS Kesehatan.

The research object is the process, system, and factors that influence the effectiveness and efficiency of non-capitation claim verification conducted at the BPJS Kesehatan Head Office.

2.5. Data Collection Procedure

Data collection in this study was conducted through direct observation during work (participatory observation) at the BPJS Kesehatan Branch Office. This observation aims to understand more deeply how verification of non-capitation claims is carried out in daily practice. The steps in the data collection procedure are as follows:

1) Identify the work environment - Identify the organisational structure and workflow in the non-capitation claims verification section.

2) Observation of the verification process - Directly observe how officers check claim documents, use information systems, and coordinate with hospitals or other health facilities.
3) Recording field findings - Record any findings related to procedures, constraints, and best practices applied in claims verification.
4) Interaction with research subjects - Informal interactions with staff to explore their understanding of procedures and challenges in claims verification.
5) Documentation and data analysis - Collecting and analysing observational data to draw conclusions relevant to the research objectives.

3. Results and Discussion

3.1. Research Results

3.1.1. As-Is Result Analysis

The cost analysis of claim verification services in Table 1 as a whole involves a total personnel work time of 5,290 minutes with a personnel cost of IDR593,597. The stage with the highest personnel costs is the process of checking the completeness and suitability of the file, which reaches IDR258,192. This is due to the long processing time (an average of 1,440 minutes) and the high probability of activity (25%). In addition, other activities such as rechecking by the finance department and recording claims in the books also contributed considerable costs, at IDR129,096 and IDR43,032 respectively, indicating that the technical and administrative stages have a significant cost burden.

In terms of room usage, the total utilisation time reached 4,230 minutes with a total cost of IDR2,072,608. The staff room is the most frequently used room, especially for checking and recording activities that take a long time and have a high level of involvement. In addition, there are indirect costs of IDR166,905 that are also included in the calculation. If all components are summed up, the total unit cost of claims verification services is IDR2,833,110, with a total cost requirement of IDR3,399,732,288. This finding indicates that efficiency in long-duration and high-cost stages is the key to controlling the operational costs of claims verification services.

Table 1. Calculation of Stages, Costs, and Resources for Claims Verification Services (As-Is)

Tahapan Pelayanan		Personnel							
Step #	aktivitas pelayanan	Personnel	No. involved	Biaya Staff per menit	Probabilitas pelayanan (jobdesc di aktivitas ini/total jobdesc)	Hari	Jumlah waktu rata-rata (menit)	Probabilitas rata-rata tertimbang waktu (menit)	Total biaya (menit)
1	Berkas diterima	Staf Verifikator	1	717	13%	0	10	1,25	897
2	Cek Kelengkapan & Kesesuaian berkas	Staf Verifikator	1	717	25%	3	1440	360	258.192
4	Pengecekan ulang berkas oleh bidang keuangan	Staf Keuangan	1	717	13%	3	1440	180	129.096
5	Pembuatan SPM	Staf Keuangan	1	717	13%	2	960	120	86.064
6	Persetujuan SPM oleh kepala bidang	Kepala Bidang	2	1.298	5%	1	480	24	31.159
7	Persetujuan SPM oleh Kepala Cabang	Kepala Cabang	2	2.164	4%	1	480	20,87	45.158
8	Klaim dicatat dalam pembukuan	Staf Keuangan	2	717	13%	1	480	60	43.032
SUB TOTALS						11	5290	766,12	593.597

Tahapan Pelayanan		Ruangan						Indirect	
Step #	aktivitas pelayanan	Nama Ruangan	Biaya ruangan (Rp/menit)	Jumlah Waktu rata-rata	Probabilitas pemakaian ruangan	Probability-weighted time (min)	Total Biaya Ruangan	Name	Cost/u
1	Berkas diterima	Ruang Pegawai	590	10	60%	6	3.537	LAYANAN Verifikasi Klaim	166.905
2	Cek kelengkapan dan verifikasi dengan OCR	Ruang Pegawai	590	1.440	80%	1.152	679.188		
4	Pengecekan ulang berkas oleh bidang keuangan	Ruang Pegawai	590	1.440	80%	1.152	679.188		
5	Pembuatan SPM	Ruang Pegawai	590	960	80%	768	452.792		
6	Persetujuan SPM oleh kepala bidang	Ruang Kepala Bidang	33	480	80%	384	12.669		
7	Persetujuan SPM oleh Kepala Cabang	Ruang Kepala Cabang	49	480	80%	384	18.839		
8	Klaim dicatat dalam pembukuan	Ruang Pegawai	590	480	80%	384	226.396		
SUBTOTALS						4230	2.072.608		166.905
TOTAL UNIT COST LAYANAN			2.833.110						
TOTAL KEBUTUHAN BIAYA			3.399.732.288						

Based on the results of the Time-Driven Activity-Based Costing (TDABC) analysis presented in Table 2, it is known that the process that takes the most time and the highest cost is the Check Completeness & Suitability of Files stage with a time duration of 1,440 minutes and a unit cost of IDR958,243. This shows that this process requires special attention because it accounts for the largest cost burden in the administrative flow.

Table 2. TDABC Results (As-Is)

Process	Time (minutes)	Unit Cost (IDR)
File received	10	25.297
Check completeness & suitability of files	1440	958.243
File rechecking by the finance department	1440	829.147
SPM making	960	559.719
SPM approval by field head	480	64.691
Approval of SPM by Branch Head	480	84.860
Claim is recorded in the bookkeeping	480	290.291

Source: Data processed, 2025

Furthermore, the rechecking of files by the finance department also has the same duration of 1,440 minutes, but with a lower cost of IDR829,147, which is still significant. The 'SPM Preparation' process ranks third in terms of cost with 960 minutes and a unit cost of IDR559,719. Meanwhile, the approval stages, both by the field head and branch head, took 480 minutes each, but at a much lower cost of IDR64,691 and IDR84,860. The process of claims being recorded in the books also took 480 minutes with a unit cost of IDR290,291. The Receiving File process is the shortest stage, taking only 10 minutes and costing IDR25,297. From this analysis it can be concluded that most of the cost and time burden lies in the file verification process, so it is necessary to evaluate the efficiency of the process to reduce the overall operational cost burden.

Based on the process flow diagram and TDABC results, an analysis can be carried out to support process simulation using iGrafx. The process starts from receiving the claim file by the Primary Benefit Guarantee Verifier, then proceeds with checking the completeness and suitability of the file. If the file is not suitable, it is returned to the health facility, but if it is suitable, the process continues to the financial staff for rechecking. This checking stage is one of the activities with high time and cost allocations according to TDABC (1,440 minutes and IDR829,147), indicating a potential bottleneck that needs to be optimised.

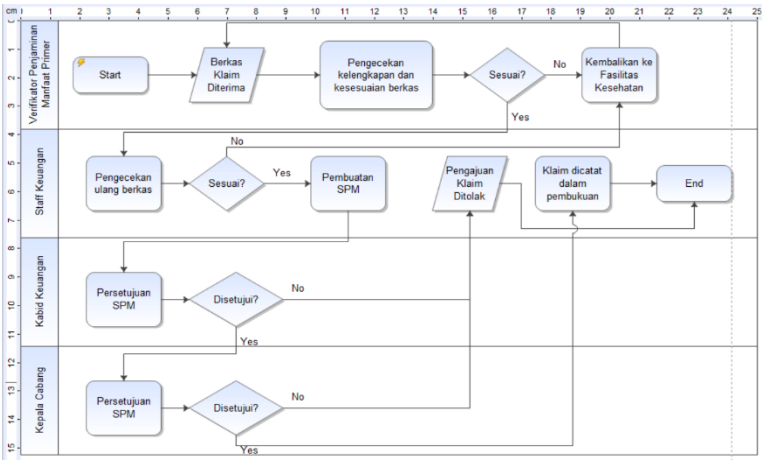

Figure 1. Tools Process Simulation (As-Is)
Source: Data processed, 2025

Based on the results of the claim process simulation using iGrafx in table 3, an analysis can be made of the time efficiency and cost burden of each activity in the As-Is process.

Table 3. Simulation Results of As-IS Process using iGrafx

As-Is Process	Time (day)	Cost
Primary Benefit Guarantee Verifier - Start	0	0
Primary Benefit Guarantee Verifier - Checking the completeness and suitability of files	3	958243
Primary Benefit Guarantee Verifier - Compliant?	0	0
Primary Benefit Guarantee Verifier - Claim File Accepted	0,01	25297
Finance Staff - File rechecking	5	829147
Finance Staff - Appropriate?	0	0
Finance Staff - Preparation of SPM	2	559719
Finance Staff - End	0	0
Finance Staff - Claims are recorded in the books	1	290291
Head of Finance - Approval of SPM	1	64691
Head of Finance - Approved?	0	0
Branch Head - Approval of SPM	3	84860
Branch Manager - Approved?	0	0
Primary Benefit Guarantee Verifier - Return to Health Facility	0	0
Finance Staff - Rejected Claim Submission	0	0

Source: Data processed, 2025

The earliest process starts with the receipt of the claim file by the Primary Benefit Guarantee Verifier which only takes 0.01 days and costs IDR 25,297, indicating that this stage is very short and efficient. However, the next process, namely checking the completeness and suitability of the file, takes 3 days with the highest cost burden of IDR958,243. This shows that the initial verification stage is the first significant bottleneck in the process.

The next stage is held by the Finance Staff, where the process of rechecking the files takes the longest time, 5 days with a cost of IDR829,147, which makes it the longest process and one of the most costly. SPM generation took 2 days and cost IDR559,719, still high but faster than the previous process. After SPM generation, the claim was recorded in the books, taking only 1 day and costing IDR290,291, relatively efficient compared to the previous stage.

On the authorisation side, the SPM approval process by the Head of Finance took 1 day at a cost of IDR 64,691, while SPM approval by the Branch Head took 3 days, but at a lower cost of IDR 84,860. This indicates that despite the long duration, this activity is not financially burdensome.

There are some decision-making activities such as 'Conform?' and 'Approved?' that are recorded as having zero time and cost, because in iGrafx simulations, decision-making usually does not consume significant time or cost directly, but rather reflects the logic path of the process.

Overall, the iGrafx simulation results reinforce TDABC's previous findings that the initial verification and checking process is a critical point that requires special attention. With a total process time of more than 15 days, there is a great opportunity for efficiency improvements, especially by shortening the file checking process by both verifiers and finance staff. Optimisation at these points is expected to speed up the overall claims process and significantly reduce total operational costs.

3.1.2. Analysis of To-Be Results

Based on the results of the tabulation of service activity data in the claims verification process, shown in Table 4, it was found that the file rechecking activity by the finance department was the stage that absorbed the highest costs, both in terms of personnel costs of IDR129,096, as well as room usage costs of IDR679,188. The average duration of this stage was also the longest, at 1,440 minutes, reflecting the complexity of the work and the involvement of intensive administrative analysis.

Table 4. Calculation of Stages, Costs, and Resources for Claims Verification Services (To-Be)

Tahapan Pelayanan		Personnel							
Step #	Aktivitas Pelayanan	Personnel	No. involved	Biaya Staff per menit	Probabilitas pelayanan	Hari	Jumlah waktu rata-rata (menit)	Probabilitas rata-rata tertimbang waktu (menit)	Total biaya (menit)
1	Berkas diterima	Staf Verifikator	1	717	13%	0	10	1,25	897
2	Cek kelengkapan dan verifikasi dengan OCR	Staf Verifikator	1	717	25%	0	86	21,5	15.420
4	Pengecekan ulang berkas oleh bidang keuangan	Staf Keuangan	1	717	13%	3	1440	180	129.096
5	Pembuatan SPM	Staf Keuangan	1	717	13%	2	960	120	86.064
6	Persetujuan SPM oleh kepala bidang	Kepala Bidang	2	1.298	5%	1	480	24	31.159
7	Persetujuan SPM oleh Kepala Cabang	Kepala Cabang	2	2.164	4%	1	480	20,87	45.158
8	Klaim dicatat dalam pembukuan	Staf Keuangan	2	717	13%	1	480	60	43.032
SUB TOTALS						*8*	*3936*	**427,62**	**350.825**

Tahapan Pelayanan		Ruangan						Indirect	
Step #	Aktivitas Pelayanan	Nama Ruangan	Biaya ruangan (Rp/menit)	Jumlah Waktu rata-rata	Probabilitas pemakaian ruangan	Probability-weighted time (min)	Total Biaya Ruangan	Name	Cost/u
1	Berkas diterima	Ruang Pegawai	590	10	60%	6	3.537	LAYANAN Verifikasi Klaim	346.905
2	Cek kelengkapan dan verifikasi dengan OCR	Ruang Pegawai	590	86	80%	69	40.563		
4	Pengecekan ulang berkas oleh bidang keuangan	Ruang Pegawai	590	1.440	80%	1.152	679.188		
5	Pembuatan SPM	Ruang Pegawai	590	960	80%	768	452.792		
6	Persetujuan SPM oleh kepala bidang	Ruang Kepala Bidang	33	480	80%	384	12.669		
7	Persetujuan SPM oleh Kepala Cabang	Ruang Kepala Cabang	49	480	80%	384	18.839		
8	Klaim dicatat dalam pembukuan	Ruang Pegawai	590	480	80%	384	226.396		
SUBTOTALS						**3147**	**1.433.983**		**346.905**
TOTAL UNIT COST LAYANAN			**2.131.713**						
TOTAL KEBUTUHAN BIAYA			**2.558.055.241**						

Cumulatively, the total service time recorded was 3,936 minutes, with a total labour cost of IDR350,825 and a total room cost of IDR1,433,983. There is an additional cost in the form of subscription fees for one of the OCR applications, Amazon Textract with the Analyze Document API-Query package of IDR 270 million. This cost was calculated together with the indirect cost component and obtained a total unit cost of claim verification services of IDR

2,131,713. If multiplied by the volume of services or claims processed, the total cost requirement to support the entire service process reaches IDR 2,558,055,214. The results of this analysis show that the cost of claims verification services is not only influenced by the length of service time, but also by the type of personnel involved and the efficiency of space usage.

The application of Optical Character Recognition (OCR) technology has shown a significant impact in improving the efficiency and accuracy of information processing from physical documents to digital formats. One example of effective implementation can be seen in the healthcare sector, particularly in the cashless health insurance claims process. Through the digitisation of documents such as hospital bills, identity cards (Aadhar and PAN), an intelligent document management system (IDMS) that uses a combination of OCR, Natural Language Processing (NLP), and cloud services such as Amazon Textract, is able to automatically extract important information. Test results show that the highest accuracy rate reaches 94.55% for hospital bills using AWS Textract services, while for identity cards such as PAN and Aadhar, the best accuracy is achieved with NLP and computer vision-based heuristic approaches, at 70.32% and 85.13%, respectively (Arora et al., 2024).

The application of OCR has also proven effective in accelerating the process of extracting information from Indonesian digital posters, as done in a study by Rosidy et al. (2020). This study combines the OCR method with Named Entity Recognition (NER) to identify important information such as speaker's name, location, city, and event date from poster images. The use of this method was able to drastically reduce the duration of information retrieval from an average of 149.18 seconds/poster (manual method) to only 8.3 seconds/poster, recording a time efficiency of 94% without sacrificing the accuracy rate, which was in the range of 82% to 92% (Rosidy et al., 2020).

In implementing OCR, it is necessary to consider several things so that OCR can be implemented properly. Kapral and Stockton (2023) describe the best practices in implementing OCR, namely:

1. OCR Project Planning: determine the purpose of OCR development, legalities, outputs, and required resources.
2. Document Quality Assessment: review the condition and quality of documents to adjust the OCR process.
3. Document Digitisation: digitise documents with good resolution, exposure, and positioning to improve the accuracy of OCR results.
4. Scanning the Text Contained in the Document: use appropriate OCR software and adjust its settings for maximum text recognition.
5. Verification and Correction of OCR Results: Thoroughly check the OCR reading results and document the correction process to ensure accuracy.

The efficiency resulting from the implementation of OCR is clearly reflected in the redesign of business processes, especially in the to-be model. In this study, in the to-be model, the business process underwent significant changes, especially in the file rechecking stage by the finance department, which previously took up to 1440 minutes with a unit cost of IDR958,243. Based on the literature and system development, this process can be automated or simplified, so that the implementation time can be cut by 94%. This means that the duration of this process can drop dramatically to only about 86 minutes, comparable to the verification process using OCR. This efficiency has a huge overall impact, not only reducing waiting time and processing costs, but also increasing productivity and accuracy. Whereas previously, checking the completeness and suitability of files was the longest and most expensive process, in the to-be scenario, the process is much shorter and more cost-effective.

Table 5. TDABC (To-Be) Results

Processes	Time (minutes)	Unit Cost (IDR)
File received	10	47.797
Verification with OCR	86	99.346
File rechecking by finance	1440	851.647
SPM making	960	582.219
SPM approval by field head	480	87.191
Approval of SPM by Branch Head	480	107.360
Claim recorded in the bookkeeping	480	312.791

Source: Data processed, 2025

The use of OCR at the verification stage has shown quite efficient results with 86 minutes of time and low cost (IDR 99,346). This proves that the implementation of technology in business processes can significantly reduce manual workload.

With the to-be approach, subsequent processes such as file rechecking by finance, SPM generation, SPM approval by field heads and branch heads, and claim recording in the books. File rechecking (1440 minutes; IDR 851,647), SPM generation (960 minutes; IDR 582,219), approval by field heads and branch heads (480 minutes; IDR 87,191 and IDR 107,360 respectively), and recording claims in the books (480 minutes; IDR 312,791), showed considerable duration and cost, indicating that there is still room for improvement, especially with digitalisation and system integration between work units, can still be identified as areas for further improvement. Digitisation of workflows, use of e-approval systems, and data integration between units can be the focus of future development.

Based on the simulation results of the to-be process using iGrafx, it can be seen that the total process time required to complete the entire flow is around 10.07 days with a total cost of IDR 2,088,351. This shows an increase in efficiency compared to the as-is process, especially in terms of a significant reduction in time and cost.

Table 6. Simulation Results of To-Be Process using iGrafx

To-Be Process	Count	Time (day)	Cost
Primary Benefit Guarantee Verifier - Start	1	0	0
Primary Benefit Guarantee Verifier - Compliant?	1	0	0
Primary Benefit Guarantee Verifier - Claim File Received	1	0,007083333	47797
Primary Benefit Guarantee Verifier - Verify with OCR	1	0,059583333	99346
Finance Staff - File rechecking	1	3	851647
Finance Staff - Compliant?	1	0	0
Finance Staff - Preparation of SPM	1	4	582219
Finance Staff - End	1	0	0
Finance Staff - Claims are recorded in the books	1	1	312791
Head of Finance - Approval of SPM	1	1	87191
Head of Finance - Approved?	1	0	0
Branch Head - Approval of SPM	1	1	107360
Branch Manager - Approved?	1	0	0
Primary Benefit Guarantee Verifier - Return to Health Facility	0	0	0
Finance Staff - Rejected Claim Submission	0	0	0
Total		10,06666667	IDR 2.088.351

Source: Data processed, 2025

The process starts at the Primary Benefit Assurance Verifier stage, with several sub-processes such as checking for completeness and suitability, which lasts very short (0 to 0.007 days), indicating an efficient initial process and minimal bottlenecks. The next process, verification by OCR, lasts around 86 minutes at a cost of only IDR 99,346. This shows the effectiveness of applying technology to speed up document validation.

The most time-consuming and costly stage is still the process of rechecking files by finance staff, which takes 3 days at a cost of IDR829,147. Although still a critical point, this is the result of optimisation from the previous condition which took up to 1440 minutes (24 hours non-stop), indicating a significant time improvement although not ideal.

Furthermore, the process of making SPM also still takes 4 days at a high cost (IDR559,719), and recording claims in the bookkeeping for 1 day at a cost of IDR290,291. The approval process at the head of field and branch head level was carried out in 1 day at a cost of IDR64,691 and IDR84,860, respectively. However, decision point processes such as 'Approved?' or 'Conformed?' are automated in a way that takes no time or cost.

It can be concluded that this to-be simulation illustrates significant process improvements compared to the previous model, especially in the initial and verification processes. However, there are several stages such as rechecking and SPM generation that can still be further optimised, especially through information system integration and internal workflow automation. This simulation provides a strong basis for decision-making in business process improvement and system development oriented towards cost and time efficiency.

Based on the recapitulation of the comparison between the as-is and to-be conditions in the verification process of non-capitation claims shown in Table 7, it can be seen that the application of business process engineering can have a significant impact on operational efficiency.

Table 7. Recapitulation of Comparison Results between As-Is and To-Be Conditions

	Time (day)	Unit Cost
As-Is	15,01	IDR2.812.248
To-Be	10,06666667	IDR2.088.351
Total Savings	32,9%	25,7%

Source: Data processed, 2025

In the as-is condition, the total process completion time took 15.01 days with a total operational cost of IDR2,812,248. However, after process engineering (to-be), the turnaround time was reduced to 10.07 days, and the cost dropped to IDR2,088,351. In percentage terms, there was a time saving of 32.9% and a cost saving of 25.7%. This shows that the application of automation, technology such as OCR, and simplification of workflows have improved efficiency in terms of both time and cost.

3.2. Discussion

3.2.1. Implementation of business process engineering can reduce operational costs in the verification process of non-capitation claims

Based on the recapitulation results shown in Table 7, it can be seen that the implementation of Business Process Reengineering (BPR) in the non-capitation claim verification process has a significant impact on improving operational efficiency, both in terms of time and cost. In the As-Is condition (before BPR), the average claim settlement time reached 15.01 days. After process improvement to the To-Be condition, this duration was reduced to 10.07 days, or a time saving of 32.9%. This decrease shows that the post-

engineering work process has become faster, more effective, and efficient. This time efficiency is very likely due to the simplification of workflows, the elimination of unnecessary activities, and the application of information technology-based systems that accelerate the process of inputting, validating, and reporting claims.

Apart from the time aspect, the implementation of BPR also has a real impact on cost efficiency. Operating costs per claim unit decreased from IDR 2,812,248 to IDR 2,088,351, or a savings of 25.7%. This cost reduction reflects the optimisation of resources, both in terms of the use of manpower, working time, and the reduction of repetitive activities that previously added to the cost burden. Non-value added activities such as duplicate document checks, manual filing, or non-integrated communication have been eliminated in the new streamlined and standardised process. This also demonstrates that BPR is able to address the structural inefficiencies that have been inherent in the claims verification process at BPJS Kesehatan.

The main reason for the success of this cost reduction lies in the identification and elimination of non-value added activities that previously hindered efficiency. In the as-is condition, there were many repetitive processes, overlapping authorities, and a predominance of manual work, which resulted in high cycle times and resource utilisation. After process re-engineering, several steps were simplified, including the use of technology such as OCR that replaced manual document validation. The use of this technology accelerated the process and directly cut the labour burden and work time required, resulting in cost efficiency.

This finding is in line with research by (Prawasari et al., 2024) which states that BPR can optimise time and cost efficiency in hospitals by completely reorganising service processes, removing bottlenecks, and utilising information technology as a catalyst for change. On the other hand, (Handriani & Mahendrawathi, 2024) in their systematic review, they also emphasise that the effectiveness of BPRs in reducing costs is highly dependent on the integration of business process management strategies with the appropriate application of digital technology.

The positive impact of this cost efficiency is not only felt on the administrative side, but also has a systemic impact on the quality of public services. With a faster and cheaper claims verification process, agencies can allocate resources to other more strategic areas, such as direct services to patients or improving information systems. In addition, this process improvement can increase the satisfaction of health facility partners, as claims payments can be processed more quickly and transparently. This also has an impact on the institution's image and stakeholder trust, especially in the context of public services that demand high accountability.

Furthermore, in the context of health policy, operational efficiency is highly relevant to the principle of sustainable health insurance management. As stated by (Yuliva et al., 2019) in a study conducted at a Puskesmas in Padang City, the management of non-capitation claims often faced obstacles in procedures and delays in payment. BPR is a strategic solution to simplify procedures, streamline verification flows, and speed up the overall administrative service process.

Thus, it can be concluded that the successful implementation of BPR in this study is not only limited to reducing costs, but reflects the success of the institution in building a more modern, efficient, and accountable work system. This proves that BPR is a relevant strategic approach to be applied in a complex and dynamic healthcare environment, especially in the face of demands for budget efficiency and high service quality.

Overall, the results of this analysis indicate that business process engineering has a strategic role in creating a more responsive, structured, and cost-effective work system. In the context of healthcare management, the successful implementation of BPR not only provides

financial benefits, but also improves service speed and the quality of claims administration governance. This process transformation also contributes to increased stakeholder satisfaction, ranging from hospital management, health workers, to insuring institutions such as BPJS Kesehatan. Therefore, business process engineering can be used as a relevant and applicable managerial approach in supporting the sustainable improvement of operational performance of health care institutions.

3.2.2. Savings generated from business process engineering on the verification process of non-capitation claims

The implementation of business process engineering at the verification stage of non-capitation claims has proven to have a significant impact on improving operational efficiency. Based on the data listed in Table 7, there is a decrease in process completion time from the As-Is condition for 15.01 days to 10.07 days in the To-Be condition. This means that there is a time saving of 32.9%. This reduction not only indicates the acceleration of administrative processes, but also reflects the increased effectiveness of cross-unit coordination and simplification of verification stages. In the context of business process management, this shows that proper process analysis and redesign can eliminate non-value added activities, improve bottlenecks, and increase throughput time.

From the cost aspect, there was a significant decrease in unit cost, from IDR 2,812,248 to IDR 2,088,351, or equivalent to a savings of 25.7%. This cost reduction indicates the efficiency of resource allocation in the implementation of the process, both in the form of administrative labour savings, reduction in physical documentation costs, and optimisation of digital-based support systems. This finding is in line with operational efficiency theory, which states that the use of technology and simplification of procedures can reduce process costs without reducing service quality.

Within the larger framework of non-capitation claims management, time and cost efficiency are important indicators of system success. Time savings can increase facility satisfaction with BPJS Kesehatan as the insurer, as claims are processed faster and payments are received earlier. On the other hand, cost savings provide space for institutions to allocate funds to other more strategic areas, such as improving service quality, training human resources, or strengthening information technology systems. These two indicators, when consolidated in a sustainable manner, will contribute to improving organisational performance and creating a more adaptive, responsive and sustainable healthcare system.

In addition, these results indicate that the business process engineering approach can be an alternative managerial strategy that is applicable in the context of public health institutions, which have often been considered rigid in conducting administrative innovations. With such data-driven changes, policy makers at the managerial level have a strong basis for standardising processes nationally, especially in the context of implementing the National Health Insurance (JKN). This is important considering that one of the main challenges in managing JKN is the inefficiency of bureaucratic processes, which has an impact on delays and fiscal burden.

Thus, the time and cost savings obtained from business process engineering in the verification stage of non-capitation claims show that process-based interventions can add substantial value. More than just numerical savings, these changes lead to performance transformation that impacts on system sustainability, public trust, and optimisation of services in the national health insurance system.

The results of this study are in line with previous findings on the effectiveness of BPR in reducing public sector operational costs through comprehensive process transformation. Prior to BPR, administrative processes were manual with multiple parties involved and repeated

double-checking. This was not only time-consuming, but also posed a high risk of human error and workload accumulation, leading to wasted resources. This reinforces the view that (Masih, 2015) that inefficient processes can be a major source of waste and ineffectiveness in organisations. Following process re-engineering through a BPR approach, workflows became more linear and efficient, supported by the integration of digital technologies such as OCR, which significantly reduced the need for manual re-verification. This transformation proves that by radically redesigning processes and integrating technology, public organisations can achieve automation as well as real cost savings, as also expressed by (Namirah et al., 2024) and (Brüggemeier et al., 2006). This implementation reflects the success of BPR's core principles in simplifying processes, reducing redundancies, and improving the overall efficiency and accuracy of public services.

The impact of these savings does not stop at nominal figures. Cost efficiencies have direct implications for improving the agency's capacity to deliver services. For example, time previously spent on manual verification can now be allocated to improving the quality of user services or developing better supervisory policies. In addition, budget savings allow for re-investment in the form of strengthening technological infrastructure, training human resources, and increasing managerial transparency.

With time efficiency of up to 32.9%, the claims verification process has become faster and more responsive. This has a positive impact on the satisfaction of external parties, such as health facilities and service providers, as claims are processed faster without being protracted. On the other hand, from an internal organisational perspective, these efficiencies help reduce workload and stress on employees, which in the long run can improve productivity and the quality of administrative decisions.

Overall, the savings generated by the implementation of this business process engineering show that the strategy of process innovation based on operational efficiency is a real and measurable step in supporting the optimisation of public services. This transformation is also an important foundation for institutions that want to build good governance, transparency, and accountability, especially in the health sector which is directly related to the basic rights of the community.

The results of this study have important implications both theoretically and practically in the development of public service process management, particularly in the context of non-capitation claims verification in the health sector. Theoretically, the findings reinforce the concept that BPR is an effective approach to create significant efficiency, as proposed by Hammer and Champy. The implementation of BPR is proven to cut processing time by 32.9% and reduce operational costs by 25.7%, suggesting that workflow reorganisation and the application of information technology can be a solution to the complexity and inefficiency of administrative processes.

From a practical perspective, these results provide a strong basis for health service management agencies to evaluate and simplify work processes that are still manual and redundant, by integrating technologies such as OCR and other digital systems. In addition, the success of this efficiency can be a foothold in the formulation of new policies, both in the form of preparing more adaptive SOPs and broader public service digital transformation policies. The social implications are equally important, as process efficiency has the potential to improve service speed, health facility partner satisfaction, and strengthen overall organisational accountability and transparency. Thus, this research not only contributes to academic understanding, but also provides concrete directions for health service governance reform in Indonesia.

4. Conclusion

This research focuses on the implementation of Business Process Reengineering (BPR) in the non-capitation claims verification process, which is an integral part of the health insurance system. The results showed that BPR had a significant impact on the cost and time efficiency of the process. Specifically, the implementation of BPR reduced operational costs by 25.7%, from IDR 2,812,248 to IDR 2,088,351. This cost reduction was due to process simplification, elimination of non-value-added steps, and integration of technology such as Optical Character Recognition (OCR) that simplifies and speeds up claims processing. The use of this technology is proven to not only increase efficiency but also reduce the potential for human error in claims verification. In addition to cost efficiency, operational time savings are also a significant result. Before the implementation of BPR, the verification process of non-capitation claims took 15.01 days, which was successfully cut to 10.07 days after the implementation of BPR, or a 32.9% reduction in time.

This reduction in time greatly affects the responsiveness of services and the satisfaction of health facility partners who depend on the speed of the claims process. Speed in claims verification accelerates the flow of information and payments, which in turn improves the relationship between BPJS Kesehatan and health facilities. Therefore, the improvements in time and cost generated by BPR not only impact administrative efficiency, but also have the potential to improve the overall quality of health services.

Another impact of implementing BPR is improved organisational accountability and performance. More streamlined and automated processes allow for more efficient and targeted resource allocation. This has the potential to reduce resource wastage and increase transparency in operational systems. When administrative processes run more efficiently, organisations can focus more on strategic tasks, ultimately improving service quality and reducing the risk of errors in other critical processes. The implementation of BPR in non-capitation claims verification brings about structural changes that strengthen organisational effectiveness, increase transparency, and create a more sustainable system.

Based on the results of the study, it is recommended that the implementation of BPR is not only limited to verification of non-capitation claims, but is extended to other types of claims such as FKRTL to improve overall system efficiency. In addition, continuous investment in information technology such as OCR and cloud systems needs to be improved, accompanied by training of human resources to be adaptive to new systems. Regular process evaluation is important to maintain the relevance and efficiency of the system, and collaboration with various stakeholders such as BPJS Kesehatan and technology developers needs to be strengthened so that digital transformation can run optimally and sustainably. This study has several limitations, including the scope that is limited to the verification process of non-capitation claims so that the results cannot be generalised to other types of claims such as capitation or FKRTL.

The qualitative method used also limits generalisability as the sample was limited and focused on only one type of process. In addition, the study has not examined in depth the challenges of technology implementation, such as infrastructure readiness and HR competencies, and did not highlight psychological and social aspects such as resistance to change. Therefore, future research is recommended to expand the object of study to other types of claims, use quantitative methods with larger samples, and explore the technological challenges and psychosocial impacts of BPR implementation more thoroughly.

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