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Risk Analysis in Manual Financial Processes at PT XYZ Using the Fmea (Failure Mode Effect Analysis) Method

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ABSTRACT

Manual financial processes in an organization often pose various operational risks, such as delays in recording, duplication of data, and input errors, especially in administrative systems that have not been digitized. This study aims to analyze potential failures and prioritize risks in the financial recording and collection process at PT XYZ using the Failure Mode and Effect Analysis (FMEA) method. The research is carried out by identifying the main activities, formulating potential failures, and providing an assessment of the severity, occurrence, and detection capabilities of each potential failure. The Risk Priority Number (RPN) value is calculated to determine the risk priority. The results showed that out of the eight main activities, 32 potential failures were found with RPN values varying between 72 to 315. Some activities, such as data transfer between sheets, manual financial record-keeping, and monthly arrears checks, have the highest risk. These findings confirm the need for digitization and system improvement as a risk mitigation strategy in manual financial processes.

KEYWORDS *FMEA, RPN, financial processes, administrative risk, digitalization*

INTRODUCTION

The process of recording and collecting finances is a crucial part of an organization's operations, including in the education sector (Sebidi et al., 2023). This activity is the foundation in maintaining smooth cash flow and ensuring compliance with financial obligations (Barnabas & Oloyede, 2024; Nasimiyu, 2023). However, there are still many institutions that rely on manual processes in their financial recording and reporting, which poses potential high risks such as recording delays, data duplication, and input errors (Andansari et al., 2022; Syamsul, 2022; Yusnidhar et al., 2022).

In Indonesia, based on a survey conducted by the Central Statistics Agency (BPS) in 2022, it was recorded that more than 45% of private educational institutions still use manual financial recording methods without an integrated information system. Reliance on manual systems risks slowing down payment validation and increasing the potential for loss of transaction data (Ojeh et al., 2025; Roy & Tinny, 2024). This is exacerbated by the low understanding of administrative risk management in the education sector, which generally focuses more on academic aspects than financial operations. Table 1 below shows an overview of the problems faced in manual financial processes.

Table 1. Common problems with manual financial processes

Yes	Problems	Impact
1	Incomplete payment confirmation	Input errors, double logging
2	Manual delinquency check	Invoice delivery delays, increased workload
3	Dependency on a single admin	Risk of individual errors, no system backup
4	No databae integration	Difficult to audit, data is scattered across many files
5	Payment reminders aren't automatic	High payment delay rate

One of the case studies that represent this problem in private educational institutions is at PT XYZ, where the process of recording and collecting finances is still carried out manually with tools such as Google Sheets and informal communication through instant messaging applications. Systems like these tend to be prone to data irregularities and a lack of validation controls, which ultimately leads to backlogs and increased financial admin workloads (Danilova, 2024; Spatafora, 2023). The following are some errors in financial and billing records consisting of the type of error, frequency of error, impact and additional information of each error, at PT. XYZ in May-September 2024, which can be seen in the following table 2.

Table 2. Errors in recording and billing at PT. XYZ

Yes	Error Types	Error Frequency	Impact	Information
1	Transaction Recording Error	20%	Financial statement inaccuracies	Many transactions are not recorded correctly
2	Billing Delays	50%	Cash flow is hampered	Billing is done after maturity
3	Data duplication	5%	Financial losses	The same transaction is recorded more than once
4	Data mismatch	10%	Problems in audits	The recorded money data does not match the company's account
5	Unclear Proof of Transaction	15%	Problems in audits	Incomplete or unclear proof of transaction
6	Incompleteness of financial records	30%	Cash flow is hampered	A lot of recording, checking transactions/arrears that are not optimal

Based on the data in Table 2, there are various errors in the recording of financial collections in the company. This has a negative impact on the smooth operation and decision-making in the company (Monga et al., 2020; Ahmad & Salleh, 2018). Poorly organized financial administration processes also cause major problems related to late payments from students or customers (Polinar et al., 2022; Shi et al., 2025; Uhakula, 2023). Late or even unpaid payment arrears disrupt a company's cash flow and damage the company's financial stability (Buckland et al., 2015).

In this context, it is important to adopt a risk analysis method that can identify critical points in the process and prioritize improvements. One method that has proven to be effective

is Failure Mode and Effect Analysis (FMEA). This method has been widely applied in various industries, not only manufacturing but also the service and administrative sectors, due to its ability to identify potential failures and assess the priority level of risk quantitatively.

The FMEA works by assessing three main parameters: the severity of the impact, the likelihood of occurrence, and the system's ability to detect failures (Fabis-Domagala et al., 2021; Salah et al., 2023). Each parameter is rated on a scale of 1–10, and the result of its multiplication results in a Risk Priority Number (RPN) that is used to determine the level of urgency of improvement (Karek et al., 2025; Wu & Wu, 2021). This approach provides an objective basis in risk mitigation decision-making (Yusuf & Ramdani, 2020).

Previous studies have highlighted the persistent weaknesses of manual financial management in educational and service institutions. For instance, Monga et al. (2020) revealed that errors in financial data recording significantly increase the risk of operational inefficiencies and disrupt organizational decision-making processes. Similarly, Ahmad and Salleh (2018) emphasized that poor integration of financial administration systems in educational institutions leads to delays in payment validation and higher risks of data mismatches, which in turn affect financial sustainability. However, both studies focus more on describing the problems and impacts of manual financial administration without offering a structured risk-based method for prioritizing improvements. This study seeks to fill that gap by applying the Failure Mode and Effect Analysis (FMEA) approach, which quantitatively identifies potential failures and prioritizes them based on their severity, occurrence, and detectability.

This study aims to identify potential failures in the financial administration process at PT XYZ, measure the level of risk, and provide recommendations for improvement based on the results of risk mapping. It is hoped that the results of this research can be the basis for strategic decision-making in designing a safer and more efficient financial system.

RESEARCH METHOD

This study uses a descriptive quantitative approach with the Failure Mode and Effect Analysis (FMEA) method. The focus of the research is to analyze potential failures in the financial recording and collection process at PT XYZ, as well as determine the level of risk priority based on the Risk Priority Number (RPN) value. The first step in the FMEA is the identification of eight key activities in the financial process (record-keeping and billing processes) that have high risk potential based on observations and studies of internal documentation. Each activity is analyzed so that there are 32 failure modes that are the object of risk assessment. Eight main activities are the flow of the financial records and collection processes at PT XYZ which consist of:

1. Student Payment Reminder
2. Responding to student payment confirmation
3. Check student payment data
4. Manual receipt creation
5. Input transaction data into cashflow
6. Moving data from cashflow to student payments
7. Manual checking of student arrears
8. Send student delinquent invoices.

The assessment was conducted based on three main parameters: Severity (S), Occurrence (O), and Detection (D), each using a scale of 1–10. To improve validity, the assessment was conducted by three evaluators consisting of financial administration staff, the head of the finance section, and an internal auditor. The final score for each parameter was calculated using the average score of the three evaluators. The Risk Priority Number (RPN) calculation formula used is:

$$RPN = S \times O \times D \quad (1)$$

In addition, according to Wijaya Sari, & Gunawan (2021) the criteria for classification of risk levels, which are as follows:

RPN 1–100 = Low Risk
RPN 101–200 = Medium Risk
RPN >200 = High Risk

Classification of risk assessment scales based on the entire data processing process is carried out using the help of Excel software to recapitullate the score and compile a risk rating from highest to lowest. Furthermore, those values are analyzed to identify failure priorities that require immediate fix. This method was chosen because it has proven to be effective in providing systematic risk mapping, even in the environment of non-manufacturing organizations such as educational institutions (Zaini & Marlina, 2022).

RESULT AND DISCUSSION

In the initial stages of implementing the Failure Mode and Effect Analysis (FMEA) method, the first step was to identify critical processes in the financial recording and billing system at PT Hikari Bridge Indonesia. Critical processes in this context are defined as activities that have a high potential for failure, delay, inaccuracy of information, and a significant impact on the smooth flow of work if not executed correctly. The identification of critical processes is carried out by referring to the flow of the stages of the financial recording and collection process at PT XYZ. In this flow, there are eight main activities that are analyzed for potential failure (failure mode). There are 32 potential failures identified based on historical data from the finance department at PT. XYZ as in the following 3 tables.

Table 3. Potential failure of the recording and billing process at PT XYZ

No	Activity	Potential for Failure	Causes of Failure	Impact of failure
1	Input Data Into Cashflow	Nominal Input Error	Human error, multitasking	Financial statement errors, inaccurate balances
2		Data not stored	Network disconnected, files not saved	Data loss, incomplete data
3		Data duplication occurs	Unfiltered reinput	Duplicate reports, confusing
4		Data is late input	Work delays, not priority	Reports are not real time
5		Inconsistent writing format	No input SOP	Hard audit, hard validation
6	Moving data to a student payment file	Copying data between files	Copy paste manual	Incompatibility between cashflow and student files

No	Activity	Potential for Failure	Causes of Failure	Impact of failure
7		Destination files are not updated	No synchronization	Students are considered unpaid
8		Student name changed	Similar names, manual data	Invalid report, incorrect billing
9		Sheets are closed on move	Files not fully open	Process failed, needs to be redone
10		Incomplete copy	Rushing at work	Partially missing payment information
11	Month-end arrears check	Students missed being checked	Too many files, manual process	Undelivered bills, lost revenue
12		Incorrect calculation	Forgetting filters, wrong formulas	Unidentified arrears
13		Files are out of sync	Data is stored in different locations	Can't validate payment status
14		Student data has not been updated	No recent recording has been done	Inaccurate system, wrong invoice sent
15		Complex and hard-to-read tables	Non-standard format	Admin is slow to process, prone to wrong checks
16	Checking student data	Misidentification of names	Similar names, manual checking	Payments recorded to other students
17		No proof of payment	Students forget to confirm	Cannot input data, considered unpaid
18		Admin forgot to record	Too many notifications	Data lost, students protest
19		Students use nicknames	Data doesn't match the name in the file	There is confusion in recording
20		Dual student data	No student ID merge	The system stores two different student data
21	Send payment reminders	Reminder not sent	Wrong schedule, human error	Students don't know the payment deadline
22		Wrong group of students	Unclear chat grouping	Misplaced bills, confusion
23		Reminders sent late	Unscheduled routine	Late payment, disrupted cash flow
24		The language of the reminder is unclear	No standard templates	Students ignore messages
25		Sending too often	Students are distracted, messages are ignored	Reminder effectiveness decreases
26	Delivery of delinquent invoices	Invoice not delivered	Forgot email input/student not responding	Unpaid arrears
27		Incorrect nominal	Copy paste from another file	Mispayment, additional correction needed
28		Invoice ganda	Send more than once	Students are confused, don't trust the system
29		Invoice sent to the wrong parent	Contact data not updated	Communication failure, late payment

No	Activity	Potential for Failure	Causes of Failure	Impact of failure
30		Invoice doesn't match the billing period	Ambiguous in the file	Student confusion, system is considered unprofessional
31	Confirmation of Student Payment	Unconfirmed payment	High volume of messages in groups	Data not recorded and Complaints from students/parents
32	Manual receipt creation	Incorrect nominal or wrong name on the receipt	Processes are done manually without validation system, High admin workload, No double-check	Incompatibility of payment documents and user distrust of the internal financial system

After the identification of failures is carried out, the next stage is to conduct a risk assessment. This stage aims to conduct a quantitative assessment of the risks that have been identified in each failure mode in each critical activity. Risk assessment in the Failure Mode and Effect Analysis (FMEA) method uses three main parameters, namely Severity (S), Occurrence (O), and Detection (D), which are then combined to obtain a Risk Priority Number (RPN) value.

Severity (S) is a measurement of the severity of the impact of failure on the process or output. A high value indicates a significant impact such as service interruption or financial loss, as shown in table 4. Occurrence (O) is an assessment of how often the failure is expected to occur. A high value indicates that failures occur regularly or frequently as in table 5. *Detection* (D) is a measurement of the current system's ability to detect failures before they have an impact. A high value indicates a failure that is difficult to detect as shown in table 6.

Table 4. Saverty Assessment Criteria (Severity) (Carlson)

Saverty Rate	Criterion	Value
Dangerous without warning	Failure to cause substantial financial loss, loss of trust, or external audit; Record Failure	10
Dangerous with warnings	Failure causes significant errors in monthly/annual financial statements.	9
Very high	Failure leads to large billing delays or monthly cash recap errors.	8
Tall	Direct influence on report delays and mismatches between sheets.	7
Keep	Financial data is out of sync between files, requiring repetitive manual revisions.	6
Low	Minor errors that affect daily decision-making.	5
Very Low	Disrupts the work efficiency of the finance staff, but does not change the key data.	4
Minor	It has no impact on the final result, only adds to the workload	3
Very Minor	It only causes communication disruptions between finance teams.	2
None	It does not have a significant impact, it is still within the tolerance limit.	1

Table 5. Occurrence Assessment Criteria (Carlson)

Tingkat Occurance	Criterion	Value
Almost certainly	Failures occur almost every day, without system intervention.	10
Very high	Failure occurs 3–5 times a week, consistently.	9
High	It occurs at least 2 times a week.	8
Quite High	It happens every week.	7
Medium	It occurs every 2 weeks.	6
Low	Once a month, but it's quite annoying.	5
A little smal	It occurs 1–2 times every 3 months.	4
Very small	It occurs 1 time per semester.	3
Infrequently	It happened once a year.	2
Almost never	It's almost unprecedented, or unprecedented.	1

Table 6. Detection Assessment Criteria (Carlson)

Tingkat Detection	Criterion	Value
Almost impossible	There is no control system. Failures are only known after a major impact.	10
Very rare	It is very difficult to detect. There are no SOPs, and there are no re-checks.	9
Infrequently	Weak controls. Detection only from user complaints or during audits.	8
Very low	The check is only carried out at the end of the month and is not comprehensive.	7
Low	There is a check form, but it is not consistent.	6
Medium	Detection is done manually by a single staff without system backup.	5
Rather high	Regular detection is performed, but not yet automated.	4
High	There are periodic SOPs and control schedules, manual but disciplined.	3
Very high	The monitoring process is semi-automated and can detect 80% of errors.	2
Almost certainly	Automated integrated system, errors are immediately detected before impact.	1

After the assessment scale is carried out, the next stage is the risk assessment. The risk assessment was carried out using a google form assessed by three people who were responsible and directly involved in the financial recording and billing process at PT XYZ. The results of the risk assessment can be seen in table 7.

Table 7. Risk Assessment of the Financial Recording and Collection Process.

No	Activity	Potential for Failure	S	Or	D	RPN
1	Input Data Into Cashflow	Nominal Input Error	7	6	3	126
2		Data not stored	9	4	2	72
3		Data duplication occurs	8	5	5	200
4		Data is late input	7	7	3	189
5		Inconsistent writing format	6	6	6	216
6	Moving data to a student payment file	Copying data between files	7	6	7	294
7		Destination files are not updated	7	4	6	168
8		Student name changed	6	7	6	252
9		Sheets are closed on move	7	6	6	273
10		Incomplete copy	6	8	4	192
11	Month-end arrears check	Students missed being checked	9	7	5	315
12		Incorrect calculation	6	6	5	180
13		Files are out of sync	7	6	5	210

No	Activity	Potential for Failure	S	Or	D	RPN
14		Student data has not been updated	9	6	4	234
15		Complex and hard-to-read tables	9	5	5	225
16	Checking student data	Misidentification of names	6	5	6	198
17		No proof of payment	7	5	3	105
18		Admin forgot to record	6	4	5	132
19		Students use nicknames	6	4	6	144
20		Dual student data	6	5	5	156
21	Send payment reminders	Reminder not sent	6	6	4	162
22		Wrong group of students	6	5	4	135
23		Reminders sent late	6	5	4	174
24		The language of the reminder is unclear	6	5	4	120
25		Sending too often	6	5	5	150
26	Delivery of delinquent invoices	Invoice not delivered	6	4	6	138
27		Incorrect nominal	6	4	5	114
28		Invoice ganda	6	3	7	123
29		Invoice sent to the wrong parent	7	3	7	147
30		Invoice doesn't match the billing period	6	5	3	90
31	Confirmation of student payment	Confirmation message not read by admin	5	3	3	45
32	Manual Receipt Creation	Contents of incorrect receipts	6	5	4	120

The results of the RPN calculation show a significant variation in the level of risk. The lowest RPN recorded is 45 and the highest is 315. Based on the literature, RPN values that exceed the threshold of 150 are usually used as a top priority in risk mitigation measures. From the results of the analysis, it was found that some failure modes with high RPN are dominated by manual activities involving data input, file transfer, and repeated verification without an automation system. Two examples include the activity "Transferring data to student payment file" and "Checking the month-end arrears" shows consistently high RPN values because both are carried out with manual processes, minimal control, and are prone to delays and errors.

In addition, as part of the follow-up analysis after the calculation of the Risk Priority Number (RPN), eight main activities were classified based on the average RPN value from 8 risky activities. This classification is divided into three levels of risk, namely high, medium, and low. This level of risk determination aims to prioritize activities that need immediate remedial intervention. The following table 8 presents a summary of the average RPN score for each activity, its risk level, and suggestions for improvement based on the results of interpretation and relevant academic references.

Table 8. Suggestions for activity improvement based on risk levels

No	Activity Name	Average RPN	Risk Level	Suggestions for Improvement
1	Month-end arrears check	233	High	Implementation of automated digital systems for delinquency detection; Periodic checking SOPs
2	Moving data to a student payment file	236	High	Separation of duties and SOPs for data transfer; The use of accounting software (Sugesti & Nilawati, 2022)
3	Delivery of delinquent invoices	122	Medium	Use an automated invoice template; Scheduled digital reminder system

No	Activity Name	Average RPN	Risk Level	Suggestions for Improvement
4	Checking student data	147	Stuttgart	Student data validation training; data filter and grouping of student ID (Denisa & Nurlaila, 2022)
5	Send payment reminders	148	Medium	Automatic reminder scheduling; Monitoring Delivery Through System (Ghozali, 2018)
6	Data input to cashflow files	161	Medium	Preparation of SOPs for data input; administrative training and periodic audits
7	Confirmation of Student Payment	45	Low	The implementation of a transaction-based automatic notification system and payment identification with a student's unique ID to improve recording accuracy (Denisa & Nurlaila, 2022)
8	Manual Receipt Creation	120	Medium	Automate using digital invoicing systems and standard templates based on accounting software to reduce the risk of input errors and speed up the process (Sugesti & Nilawati, 2022).

Based on this classification, it can be seen that two main activities are at a high risk level, while the others are moderate, and only one activity is classified as low. So the main priority that is recommended to be carried out immediately is the implementation of digital systems or accounting software. According to Ghozali (2018), the implementation of digital financial applications in educational institutions can reduce late payments by up to 40% and increase operational efficiency by up to 60%.

These findings are in line with prior research emphasizing the importance of digital transformation in financial administration. For example, Putri and Ismail (2023) showed that the adoption of integrated accounting information systems in educational institutions significantly reduces data duplication and delays in payment validation. Similarly, Novitasari et al. (2023) found that digital-based financial recording improves transparency and accuracy, thereby minimizing audit risks and ensuring smoother cash flow. Furthermore, Yusuf and Ramdani (2020) highlighted that combining risk analysis methods such as FMEA with digital accounting systems can provide a more structured approach to identifying critical points in financial processes while ensuring sustainable improvements. By aligning with these studies, the results of this research reinforce that the adoption of digital financial applications is not only urgent but also a strategic solution to mitigate high-risk failures in manual systems.

CONCLUSION

This study demonstrates that applying the Failure Mode and Effect Analysis (FMEA) method effectively identifies and prioritizes potential failures in PT XYZ's manual financial recording and billing process, revealing medium to High Risk Priority Numbers (RPN) in most activities, which indicates significant risks requiring urgent corrective actions. Key vulnerable activities include data transfer between sheets, cash flow recording, and monthly arrears checks, primarily due to the absence of automated controls and detection systems. As a strategic solution, digitizing financial processes through integrated information systems and

automating recording and payment validation can reduce the occurrence of errors and improve detection. Additionally, implementing standard operating procedures (SOPs), regular training, and internal audits is recommended to strengthen risk mitigation over time. Future research could explore the impact of digital transformation on risk reduction and the effectiveness of automated controls in manual financial systems across various industries.

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