

Enhancing B2B Direct Purchasing through MSMEs E-commerce: Prioritizing Quality Attributes and Reengineering Processes in an Oil and Gas Company

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Abstract. Efficient procurement processes are crucial for oil and gas companies to meet their business needs. This study focuses on improving the direct purchasing process of an Indonesian oil and gas company through its MSMEs E-commerce platform. The research employs a two-step approach: first, Multi Criteria Decision Making (MCDM) with Fuzzy Analytical Hierarchy Process (FAHP) is used to prioritize critical quality attributes based on expert opinions; second, Business Process Reengineering (BPR) is applied to redesign the process based on the prioritized attributes. The FAHP analysis reveals that Financial Flow, Commercial Flow, and Information Flow are the top priority categories, with payment accuracy, order fulfillment, and system integration being the most critical attributes. The redesigned process, which eliminates redundant steps and improves payment and order handling, achieves an 18% reduction in processing time. The findings provide practical insights for procurement practitioners in structuring direct purchasing processes via e-commerce platforms and highlight the value of combining MCDM and BPR for process improvement.

Keywords: Procurement, Direct Purchase, B2B E-commerce, Quality Attributes, Business Process Reengineering, Fuzzy AHP

1. Introduction

Oil and Gas Company is a holding company that runs an integrated energy business from upstream to downstream through its subholdings, namely Upstream Subholding, Gas Subholding, Power & NRE Subholding, Commercial and Trading Subholding, Refining & Petrochemical Subholding, and Integrated Marine Logistics Subholding. In running its business, each sub-holding plans its purchasing needs independently through the goods/services procurement process. Oil and Gas Company has a high frequency of procurement of goods/services. Therefore, companies need to carry out goods/services procurement activities quickly, flexibly, efficiently, and effectively.

One method of procuring goods/services is direct purchasing. Direct purchasing is a method of procuring goods/services without going through a tender process. Because it does not go through a tender, direct purchases are limited to goods/services transactions with a certain nominal value, namely 300 million per transaction.

Oil and Gas Company is trying to increase direct purchases from Micro, Small and Medium Enterprises (MSMEs) through MSMEs E-commerce. MSMEs E-commerce is a B2B e-commerce platform built for direct purchases by companies to MSMEs.

The Oil and Gas Company has used MSMEs' e-commerce to purchase goods/services directly for three years to meet its business needs. However, direct purchasing through MSMEs' e-commerce has not been completely successful. This is proven by only 16.27% of the direct purchase transactions made through MSMEs E-commerce and only 12% of Purchase Orders (POs) issued for direct purchases through MSMEs E-commerce. Based on the results of the buyer group survey at Oil and Gas Company, the problem is that Oil and Gas Company's internal business processes related to direct purchases via MSMEs E-commerce are complicated such as redundant processes, bottlenecks, and communication breakdowns.

In the future, a procurement process that are flexible, transparent, sustainable, digitalized, and good integration of stakeholder management along the supply chain is needed so that it will have an impact on improving the quality of goods/services procurement (Beske-Janssen et al., 2023). The process of procuring goods/services cannot be separated from the capabilities of human resources who are experts in their fields. New competencies that must be possessed by goods/services procurement experts include digitalization capabilities (e-Procurement technology, automation), innovation and sustainability (Bals et al., 2019).

Therefore, the author plans to evaluate the current direct purchasing business process flow through MSMEs' e-commerce. To increase transactions through MSMEs' e-commerce, improving the quality of the business process flow for procuring goods/services by purchasing directly through MSMEs' e-commerce is necessary.

The formulation of this research problem is the inefficiency of oil and gas companies' internal business processes related to direct purchases of goods/services through MSME E-commerce, resulting in the long process of direct purchase transactions through MSMEs e-commerce. Therefore, an improvement strategy is needed to improve the quality of the business process of purchasing goods/services electronically through MSMEs' e-commerce.

Despite the company's efforts to increase direct purchases through the MSMEs E-commerce platform, the adoption rate remains low due to complicated internal business processes. This study aims to address this issue by prioritizing critical quality attributes and redesigning the direct purchasing process using BPR to improve its efficiency and effectiveness.

2. Literature Review

There are several methods to improve business performance in the industry. Based on previous research studies, the most widely used and proven effective methods are Lean and Business Process Reengineering (BPR). When applied in the construction procurement industry, Lean can effectively overcome process delays in procurement (Ottou et al., 2021). In the phosphate rock exploration industry,

Lean can produce significant average annual company savings (Adlane & Aouane, 2020). In research on improving the customer purchase journey (CPJ) in the e-commerce industry, the use of Lean can result in time reduction by eliminating non-value-added activities, increasing approximately 15% of the established index for customer satisfaction, and avoiding losses worth US \$ 50 (Guimarães et al., 2023).

Besides, using BPR to improve business process performance has been proven in various fields. In the insurance services industry, improving business processes with BPR has reduced processing time by 35-76% compared to the original process (Masayu & Dachyar, 2018). BPR also improving cashback process up to 71,67% in banking industry (Abednego & Dachyar, 2020). Other research conducted in the oil and gas industry resulted in time savings at the planning stage of up to 55% and the procurement stage with efficiencies of up to 35% (Dachyar & Sanjiwo, 2018). Furthermore, other research shows that improving business processes for procuring goods and services through digitalization can help companies save time, reduce uncertainty, increase trust, enable proactive user responses, and increase automation (Tripathi & Gupta, 2020). Apart from that, the use of digitalization technology, such as Artificial Intelligence (AI) and Business Intelligence (BI), can successfully increase agility in the procurement process (Rane et al., 2020) (Karttunen et al., 2023).

Although the use of Lean and BPR approaches has been proven effective for improving the performance of procurement business processes, each approach has its characteristics. The Lean approach is used to improve business processes by streamlining business processes, one of which is by eliminating activities that do not provide added value. Meanwhile, BPR has the characteristic of radically improving business performance by changing almost all business process flows and using the latest technologies to improve the quality of business processes.

Based on previous research studies and research gap analysis, the author will use the BPR method in the internal process of direct purchasing via the MSMEs E-commerce platform. The best scenario is based on expert opinion analysis using the Multiple-Criteria Decision-Making (MCDM) method, especially the Fuzzy Analytical Hierarchy Process (FAHP) for weighting critical attributes.

This research also addresses previous limitations on prioritizing critical attributes for B2B cross-border electronic commerce platforms. This research scope was limited to company respondents in Taiwan and purchased only through Alibaba e-commerce (Ho & Chuang, 2023). The author determined priority attributes for B2B electronic commerce platforms in Indonesia and through MSME's E-commerce platforms in this research. This research prioritizes the purchasing quality attributes and creates a design to improve the direct purchasing business process to improve its performance using a BPR approach.

While previous studies have demonstrated the effectiveness of Lean and BPR in improving procurement processes, there is limited research on the application of these methods in the context of B2B e-commerce platforms, particularly in the oil and gas industry. This study addresses this gap by combining MCDM and BPR to prioritize quality attributes and redesign the direct purchasing process in an oil and gas company.

3. Research Methods

This research methodology is divided into six stages: determining the research topic, deepening the theoretical basis, data collection and analysis process, the as-is model design stage, prioritizing the quality attributes stage, and the to-be model design stage, and ending with the analysis and conclusion drawing stage.

The first stage is determining the research topic. The steps taken before determining the research topic will be described at this stage. Starting from identifying the problem of the research object, conducting literature studies from previous research, formulating the problem, and ending with determining the research objectives.

The second stage is deepening the theoretical basis. At this stage, the author will deepen the theories related to the research topic.

The third stage is the design of the as-is model. At this stage, the author will collect in-depth data on as-is business process documentation, interviews with stakeholders, and data validation. If the data is validated, proceed with preparing the as-is model design. After that, the design is validated, and improvements are made until it is valid.

The fourth stage is prioritizing the quality attributes. At this stage, the author will prepare a questionnaire to identify problems and prioritization, distribute the questionnaire to experts, and weigh the criteria with FAHP.

The fifth stage is the design of the model to be. At this stage, the author will prepare recommendations for improvements to become a to-be design, design a to-be design, validate the model, and improve it until it is validated.

The final stage is the analysis and conclusion. At this stage, the author will analyze the results of the to-be model and draw conclusions.

4. Results and Discussion

Study 1: As Is Process Analysis

BPR discusses how a company operates, how to re-engineer the process by eliminating the potential for processes that do not add value or repetitive processes to increase the efficiency of business processes, and how to apply these new processes to increase the company's competitive advantage. The results of BPR are not only to achieve company goals, but also to increase customer satisfaction. Therefore, the value of the BPR business process is customer-centric (Chen, 2001). BPR is the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical performance measures, such as cost, quality, service, and speed (Caeldries, 1994). BPR involves a complete overhaul of existing processes to achieve substantial improvements in performance, efficiency, and value delivery, often leveraging technological innovation and obtaining best practices (Ball, 1995).

To ensure that BPR can be implemented well, there are several things that must be considered in order to increase the success factors of BPR, including (Sturdy, 2010):

1. Factors related to changes in management systems and culture
2. Strong commitment and leadership
3. Factors related to organizational structure
4. Factors related to BPR program management
5. Factors related to IT infrastructure

Failure in implementing BPR may occur. There are several failure factors that must be avoided when implementing BPR, including (Sturdy, 2010):

1. Lack of organizational readiness for change
2. Problems associated with creating a culture for change
3. Lack of training and education
4. Factors related to management support
5. Ineffective BPR team
6. Factors related to organizational structure
7. Issues related to goals and measures
8. Insufficient focus and goals
9. Redesign ineffective processes
10. Problems related to BPR resources
11. Unrealistic expectations

The data collected to compile the as-is process consists of the direct purchasing business process flow through E-commerce MSMEs and the time required for each activity carried out along the business process flow. This data was obtained through interviews with experts involved in this business process. Then, the as-is process is simulated using the Business Process Modelling Notion (BPMN) diagram in iGrafx software. The business process is divided into five sub-sections: sourcing, registering MSMEs

in the company's SAP, preparing procurement documents in SAP, order fulfilment, and payment as in Figure 1. Based on the simulation results on Table 1, it is known that the minimum time required to complete one order in the direct purchasing process via MSMEs E-commerce is 22 weeks. According to research conducted by the Aberdeen Group, the average duration of a B2B purchasing cycle can range from several weeks to several months. This study emphasizes the importance of streamlining procurement processes to reduce cycle times and improve efficiency. Forrester Research has found that B2B purchasing cycles are often longer and more complex than B2C (business-to-consumer) transactions. Their studies suggest that the average B2B purchasing process involves multiple stakeholders and decision-makers, which can extend the duration of the cycle. However, direct purchasing process via MSMEs E-commerce can be minimized by recognizing the problems along the process and create improvement planning.

The as-is diagram that has been prepared shows potential problems that cause a lack of efficiency in the direct purchasing business process at this oil and gas company. Analysis of potential problems that need to be fixed is obtained from business process analysis and interviews conducted with experts and system users.

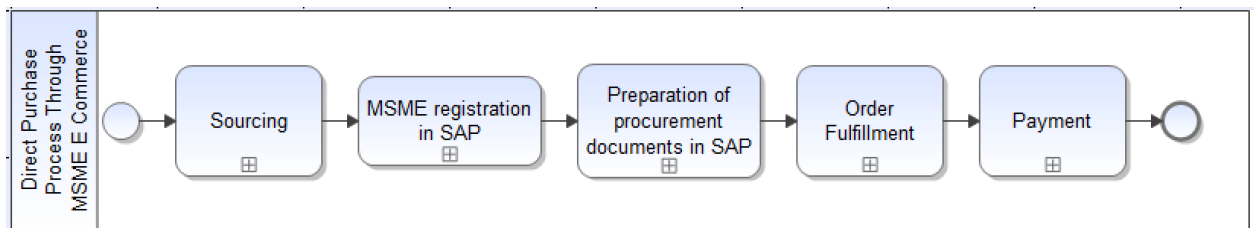


Fig 1. As Is Process

Table 1. As Is Simulation Result

Transaction Statistics (Weeks)

Count	Avg Cycle	Avg Work	Avg Wait	Avg Res Wait	Avg Block	Avg Inact	Avg Serv
1	22.00	5.33	16.68	0.00	0.00	16.68	5.33

Study 2: Data Analysis of the Quality Attributes with Fuzzy AHP

The problems collected through business process analysis and interviews conducted with experts and system users, 15 quality attributes have been formulated and grouped into five categories formulated in Table 2: Commercial Flow, Financial Flow, Information Flow, Design Flow, and Logistics Flow. Commercial Flow refers to transaction planning and transition of commodity ownership between sellers and buyers. Financial Flow refers to transferring money or bills between institutions in direct purchase transactions through MSME's E-commerce. Information Flow refers to exchanging information in the direct purchasing procurement process through MSME's E-commerce. Design Flow refers to the design flow for buyers and sellers on the MSMEs E-commerce platform. Logistics Flow refers to logistics services that send commodities from trading activities. The attributes were selected based on the complications found in the simulation of the as-is process and grouped into relevant categories based on literature review.

Then, expert opinions were collected through a questionnaire to prioritize the categories and attributes that had been prepared. Prioritization is carried out using the Fuzzy AHP algorithm. Fuzzy AHP is used to minimize bias resulting from pairwise comparisons. The ranking results for categories and attributes are formulated in Table 3 and Table 4. Data processing shows that based on category, the priorities for improving the direct purchasing business process at the Oil and Gas Company are sequentially, namely Financial Flow, Commercial Flow, Information Flow, Logistics Flow, and Design Flow. The priority attributes in the Financial Flow category are payment accuracy, payment process, and payment revision process. The priority attributes in the Commercial Flow category are order fulfilment, dispute policy, transaction documentation, and transaction process. The priority attributes in the Information Flow category are information system integration, information security, and user communication. The priority attributes in the Logistics Flow category are balanced between delivery status and reliability. The priority attributes in the Design Flow category are product search, product comparison, and system usability.

Table 2. Research Categories and Attributes

Categories	Attributes	Studies
Commercial Flow	Transaction process	(Ahmad et al., 2023; Ho et al., 2023; Marei, 2022)
	Transaction documentation	(Ahmad et al., 2023; Hashim et al., 2022; Ho et al., 2023)
	Order fulfilment	(Hashim et al., 2022; Ho & Chuang, 2023; Karttunen et al., 2023)
	Dispute policy	(Ho & Chuang, 2023; Kostecka & Kopczewska, 2023; Picoto et al., 2023)
Financial Flow	Payment process	(Ahmad et al., 2023; Ho et al., 2023; Marei, 2022)
	Payment accuracy	(Ahmad et al., 2023; Ho et al., 2023; Marei, 2022)
	Payment revision process	(Ahmad et al., 2023; Ho et al., 2023; Marei, 2022)
Information Flow	Information security	(Ahmad et al., 2023; Hashim et al., 2022; Ho et al., 2023)

Design Flow	Information systems integration	(Ahmad et al., 2023; Hashim et al., 2022; Ho et al., 2023)
	Communication between users	(Ho & Chuang, 2023; Kostecka & Kopczewska, 2023; Picoto et al., 2023)
	Product search	(Brandon-Jones et al., 2011; Hashim et al., 2022; Ho et al., 2023)
	System usability	(Brandon-Jones et al., 2011; Hashim et al., 2022; Ho et al., 2023)
	Product comparison	(Brandon-Jones et al., 2011; Hashim et al., 2022; Ho et al., 2023)
Logistics Flow	Delivery status	(Ho & Chuang, 2023; Karttunen et al., 2023; Murmura et al., 2021)
	Delivery reliability	(Ho & Chuang, 2023; Karttunen et al., 2023; Murmura et al., 2021)

Table 3. Categories Priority Rank

Categories		Importance FN			Norm FN			RS	Rank
		L	M	U	L	M	U		
Commercial Flow	A	1,313	1,652	2,055	0,183	0,290	0,464	0,307	2
Financial Flow	B	1,436	1,797	2,102	0,200	0,316	0,474	0,326	1
Information Flow	C	0,822	1,139	1,474	0,115	0,200	0,333	0,212	3
Design Flow	D	0,345	0,452	0,618	0,048	0,079	0,140	0,087	5
Logistics Flow	E	0,515	0,655	0,923	0,072	0,115	0,208	0,128	4

Table 4. Attributes Priority Rank

Categories	Attributes		Importance FN			Norm FN			RS	Rank
			L	M	U	L	M	U		
Commercial Flow	Transaction process	A1	0,75	0,89	1,05	0,16	0,22	0,31	0,23	4
	Transaction documentation	A2	0,75	0,89	1,05	0,16	0,22	0,31	0,23	3
	Order fulfilment	A3	0,95	1,13	1,33	0,20	0,28	0,39	0,29	1
	Dispute policy	A4	0,95	1,13	1,33	0,20	0,28	0,39	0,29	2
Financial Flow	Payment process	B1	0,89	1,06	1,22	0,21	0,31	0,41	0,31	2
	Payment accuracy	B2	1,60	1,86	2,42	0,37	0,54	0,82	0,57	1
	Payment revision process	B3	0,45	0,51	0,68	0,10	0,15	0,23	0,16	3
Information Flow	Information security	C1	0,89	1,06	1,22	0,23	0,33	0,45	0,34	2
	Information systems integration	C2	1,25	1,50	1,79	0,33	0,47	0,67	0,49	1

	Communication between users	C3	0,54	0,63	0,77	0,14	0,20	0,29	0,21	3
Design Flow	Product search	D1	1,22	1,54	2,16	0,29	0,49	0,86	0,53	1
	System usability	D2	0,57	0,70	0,89	0,14	0,22	0,35	0,23	3
	Product comparison	D3	0,73	0,93	1,15	0,17	0,29	0,46	0,30	2
Logistics Flow	Delivery status	E1	0,33	0,38	0,59	0,28	0,50	0,88	0,54	1
	Delivery reliability	E2	0,33	0,38	0,59	0,28	0,50	0,88	0,54	1

Study 3: To Be Process Analysis

Prioritization of categories and attributes is the basis for improving business processes structured in the to-be process. The ideal procurement process must pay attention to (Tripathi & Gupta, 2020):

1. Cost,
2. Cycle time,
3. Human effort,
4. Degree of automation,
5. Traceability,
6. Information availability and uncertainty.

Important components that need to be considered to increase the level of success in implementing various types of strategies when making strategic purchases are strategic planning, maturity, status and report level (Patrucco et al., 2023).

The to-be business process is divided into four sub-sections: sourcing, preparation of procurement documents in SAP, order fulfilment, and payment as in Figure 2. The elimination of subsections from 5 to 4 was carried out because of the integration process between the company's internal procurement system and e-commerce MSMEs to increase information flow efficiency. Improvements are also made by increasing payment accuracy to improve Financial Flow. Improvements are made by increasing payment accuracy to improve Financial Flow by eliminating processes:

- Verification of procurement documents by SSC
- SSC sends a dispute email to the buyer for revision or sends a revision email to PaDi regarding VA revision
- Revise documents and send them back to SSC (if needed) by the buyer
- Revise VA (if needed)
- Verify the documents and if they are appropriate then send them to the Finance Function

Apart from that, to maintain good order fulfilment in Commercial Flow, payment is made after the user receives the product so that the user can make payment after ensuring the product is of good quality. Based on the results of the to-be process simulation on Table 5, it is known that the minimum time required to complete one order in the direct purchasing process via MSMEs E-commerce is 18.01 weeks.

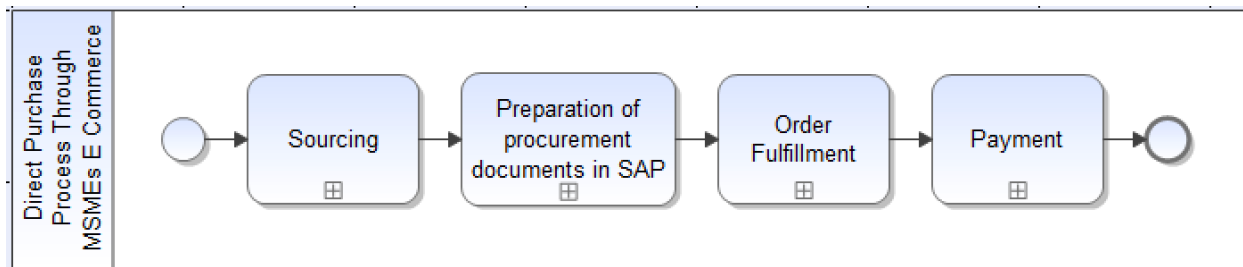


Fig 2. To Be Process

Table 5. To Be Simulation Result

Transaction Statistics (Weeks)

Count	Avg Cycle	Avg Work	Avg Wait	Avg Res Wait	Avg Block	Avg Inact	Avg Serv
1	18.01	4.29	13.71	0.00	0.00	13.71	4.29

The FAHP analysis reveals that Financial Flow, Commercial Flow, and Information Flow are the top priority categories for improving the direct purchasing process. This suggests that addressing issues related to payment accuracy, order fulfillment, and system integration should be the focus of the redesign efforts. The BPR approach, which eliminates the MSME registration subsection and improves payment accuracy and order fulfillment, aligns with these priorities and results in an 18% reduction in processing time.

5. Conclusions

This study addresses the challenges faced by an Indonesian oil and gas company in adopting an MSMEs E-commerce platform for direct purchases. By combining MCDM and BPR, the research provides a structured approach to identifying and prioritizing critical quality attributes and redesigning the procurement process accordingly. The FAHP analysis reveals that Financial Flow, Commercial Flow, and Information Flow are the top priority categories, with payment accuracy, order fulfillment, and system integration being the most critical attributes. The redesigned process, which eliminates the MSME registration subsection and improves payment accuracy and order fulfillment, aligns with these priorities and results in an 18% reduction in processing time.

The study contributes to the literature on e-commerce procurement by demonstrating the value of integrating attribute prioritization and process redesign. It extends previous research by applying these methods in the context of a large oil and gas company and focusing on the specific challenges of B2B transactions with MSMEs. The findings have practical implications for procurement practitioners, providing a roadmap for improving direct purchasing processes and increasing adoption of e-commerce platforms.

However, the study has some limitations that future research could address. First, the findings are based on a single case study, and the generalizability of the results to other companies or industries may be limited. Future studies could investigate the applicability of the approach in different contexts and explore potential variations in priority attributes and redesign strategies. Second, the study focuses on the short-term impact of the redesigned process on processing time. Future research could examine the long-term effects on adoption rates, cost savings, and supplier relationships.

In conclusion, this study offers a valuable contribution to the understanding and improvement of e-commerce procurement processes in the oil and gas industry. By prioritizing critical quality attributes and

applying BPR, companies can streamline their direct purchasing processes and increase the efficiency and effectiveness of their transactions with MSMEs. The approach presented in this research provides a foundation for future studies and practical applications in this area.

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