

Analysis of Innovation Capability and Technological Innovation on The Business Performance of SMEs in Batam City

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ABSTRACT

This study examines the effect of innovation capability and technological innovation on the business performance of SMEs in Batam City. Innovation capability and technological innovation are the independent variables, and SME performance is the dependent variable. Primary data were collected through an online questionnaire from 96 owners, owner-managers, and staff of service sector SMEs selected by purposive sampling. Technological innovation is limited here to digital technology already used in daily operations, and the questionnaire recorded the specific tools each business applies. Digital payment instruments were reported by 50.0 percent of respondents, while social media and online marketplace platforms and bookkeeping and business management applications were each reported by 26.0 percent. The data were analyzed by multiple linear regression after validity, reliability, and classical assumption testing. Innovation capability has a positive and significant effect on SME performance ($B = 0.330$; $SE = 0.102$; $t = 3.246$; $p = 0.002$), and technological innovation also has a positive and significant effect ($B = 0.450$; $SE = 0.070$; $t = 6.401$; $p = 0.000$). Together, the two variables explain 66.0 percent of the variation in SME performance (adjusted R -squared = 0.660), leaving 34.0 percent to variables outside the model. The standardized coefficient for technological innovation (0.575) is about twice that for innovation capability (0.292), which indicates that putting digital tools to work in daily operations contributes more to performance in this sample than innovation capability on its own.

Keywords: Innovation Capability, Technological Innovation, SMEs Performance

1. INTRODUCTION

Small and medium-sized enterprises are one of the main pillars of the Indonesian economy. The Ministry of Cooperatives and SMEs records 64.2 million MSME units, roughly 99 percent of all business units in the country. These units contribute 61.07 percent of gross domestic product, equivalent to Rp8,573.89 trillion, and absorb around 117 million workers, or 97 percent of the national workforce (Direktorat Jenderal Pajak, 2024; Direktorat Jenderal Perbendaharaan, 2022). The scale of the sector is not matched by its competitiveness. Around 67 percent of MSMEs still operate informally, productivity and innovation growth remain low, and MSME products account for only 15.8 percent of national exports (Oswaldo, 2025). One reason is that many businesses are started of economic necessity rather than to offer a distinctive product, so they enter the market without a clear advantage (Zwan et al., 2016). Raising innovation capability, understood as the ability to turn ideas into profitable outcomes,

is therefore central to profitability and long-term survival (Chamsuk et al., 2017; Migdadi, 2021).

Indonesia is also undergoing rapid digital transformation. Internet penetration reached 79.5 percent in 2024 and 80.66 percent in 2025, covering roughly 229 million people (Asosiasi Penyelenggara Jasa Internet Indonesia, 2025). For SMEs, this lowers operational and transaction costs, speeds up service delivery, and widens market access (Institute for Development of Economics and Finance, 2024). Batam shows both the opportunity and the pressure. The city sits inside a free trade zone next to Singapore and Malaysia and functions as a business and tourism gateway. A May 2025 statistical bulletin published by the Batam City Government reported 75,575 micro, small, and medium enterprises employing 156,997 workers. The bulletin also stated that, as of 30 April 2025, 1,748 businesses were actively assisted by the Batam City Office of Cooperatives and Micro Enterprises, including 88 service businesses (Nurahman, 2025).

Service sector SMEs in Batam work under seasonal fluctuations in income, limited access to capital, and strong competition. Preliminary observations indicate that some business owners have limited digital capabilities and financial management skills, while entrepreneurial behaviors such as risk-taking and proactiveness differ across firms. These observations are consistent with previous studies documenting substantial heterogeneity among SMEs and gaps in financial and digital capabilities. Innovation and digitalization may help businesses overcome these constraints by improving their responsiveness to customer needs, strengthening competitive advantage, and enhancing sales-related and overall business performance (Astuti et al., 2024; Desmiyawati et al., 2023; Raes, 2021; Rosenbusch et al., 2011; Syapsan, 2019)

Previous studies report that innovation capabilities such as upgrading employee technology skills, building partnerships and using customer data matter for SME competitiveness (Hanaysha et al., 2022; Izadi et al., 2020). Even so, SME operators often struggle to adopt digital technology (Ferreira & Coelho, 2020; Mustafa & Yaakub, 2018). Research linking innovation and technology to SME performance in Indonesia has concentrated on the culinary and manufacturing sectors (Sari et al., 2022; Setyawati et al., 2023).

Three gaps make the present study necessary. First, the service sector has received little attention, even though service output is an experience rather than a physical good. Hence, innovation has to work through service delivery and customer relationships rather than through product design. Second, Batam competes under free trade zone conditions that do not apply in inland cities, and whether results obtained elsewhere still hold in this setting has not been tested. Third, most studies treat technological innovation as a single construct without naming the tools involved, which makes the results difficult to translate into advice for an owner deciding what to adopt first. This study addresses the third gap directly by recording and classifying the technologies each respondent actually uses.

The study rests on the resource-based view, which holds that a firm gains a sustained competitive advantage when it controls resources that are valuable, rare, difficult to imitate, and difficult to substitute (Barney, 1991). Innovation capability is treated here as such a resource, because it is built from client knowledge, marketing routines and technical skill that accumulate inside the firm over time. The dynamic capabilities perspective extends this argument by explaining how a firm senses opportunities and reconfigures its resources when

conditions change (Teece et al., 1997), which matters for SMEs that have to adopt new digital tools repeatedly. Diffusion of innovations theory supplies the third element, explaining the rate of adoption through relative advantage, complexity, and compatibility (Rogers, 2003). These three attributes also serve as indicators of technological innovation in this study, linking the measurement to the theory.

Two hypotheses follow from this reasoning:

H1: Innovation capability has a positive and significant effect on the business performance of service sector SMEs in Batam City.

H2: Technological innovation has a positive and significant effect on the business performance of service sector SMEs in Batam City.

The study therefore has two objectives: to test the effect of innovation capability and technological innovation on the business performance of service sector SMEs in Batam City, and to identify which digital technologies these businesses apply in practice.

2. METHODS

Three theories underpin the model tested here. The resource-based view explains why an internal capability can produce a lasting advantage (Barney, 1991) and provides the logic for H1. Dynamic capabilities theory explains how firms reconfigure resources under changing conditions (Teece et al., 1997) and connects innovation capability to technology adoption. Diffusion of innovations theory explains the rate at which a technology is taken up through relative advantage, complexity, and compatibility (Rogers, 2003) and provides the logic for H2.

The variables used in this study have definitions and indicators shown in the table below:

Table 1. Operational Variables Definition

Variable	Definition & Indicator	Source
Innovation Capability (X1)	Innovation capability consists of client-focused, marketing-focused, and technology-focused innovation capability (Chege & Wang, 2020; Mothe & Thi, 2010). Measured by 5 question items.	(Setyawati et al., 2023)
Technological Innovation (X2)	Technological innovation consists of product innovation, process innovation, competitive advantage, complexity, and compatibility (Rogers, 2003; Yu et al., 2017). Measured by 7 question items.	(Setyawati et al., 2023)
SME Performance (Y)	The ability of SMEs to achieve long-term and short-term goals, consisting of financial and non-financial performance (Felicio et al., 2014; Gunday et al., 2011). Measured by 5 question items.	(Setyawati et al., 2023)

Technological innovation in this study is limited to digital technology that respondents already use in daily operations, not to formal research and development activity. In addition to the five Likert items, respondents were asked an open question about the technologies they apply. The answers were coded into five groups: (a) digital payment instruments, including QRIS, e-wallet, PayPal, EDC machines and paylater facilities; (b) social media, social commerce and online marketplace platforms, including Instagram, WhatsApp, TikTok, Facebook Ads, Pinterest, Shopee, Google My Business, Linktree and Hootsuite; (c) design and content production applications, including Canva, Adobe Photoshop, Adobe Illustrator, Adobe Creative Cloud, CapCut, Lightroom and SketchUp; (d) bookkeeping, point of sale and business management applications, including Microsoft Excel, Moka, Majoo, Xero, Jurnal.id, Odoo, ERP systems, Asana, Petdesk and Dropbox; and (e) production equipment and other technology, including upgraded machinery, salon and cleaning equipment, cameras, drones and artificial intelligence tools.

This study uses a quantitative approach. The population is SMEs operating in the service sector in Batam City. Sampling was carried out using non-probability sampling and the purposive sampling technique. The respondent criteria were as follows: owners or managers of service sector SMEs; businesses that have applied innovation capability and technological innovation as a means of business advancement; businesses that hold financial data on monthly sales and profit or loss; businesses that operate an information technology system to support the business; businesses willing to take part in the research; businesses that have operated for at least one year and employ at least one worker; and businesses that use technology based payment methods such as bank transfer and QRIS.

Because the population size was unknown and the study aimed to estimate population proportions, the minimum sample size was calculated using Cochran's formula for a large population. A conservative population proportion of 0.50 was assumed, with a 10% margin of error and a 95% confidence level, corresponding to a standard normal critical value of 1.96:

$$n = Z^2 p(1 - p) / e^2$$

$$n = (1.96)^2 (0.50)(0.50) / (0.10)^2$$

$$n = (1.96)^2 / [4 \times (0.10)^2]$$

$$n = 3.8416 / 0.04$$

$$n = 96.04$$

where n is the required sample size, Z is the standard normal critical value for the selected confidence level, p is the estimated population proportion, and e is the desired margin of error. Because the calculated value represents the minimum required sample size, 96.04 was rounded up to 97 respondents.

The questionnaire items for innovation capability, technological innovation, and SME performance were adapted from Setyawati et al. (2023) and adjusted to the context of service-sector businesses, with an additional open-ended question to identify the technologies used. The target sample size was calculated using Cochran's formula for an unknown population,

which yielded approximately 96 respondents. Prospective respondents were screened based on the seven eligibility criteria before receiving the questionnaire link. The instrument was piloted with 30 respondents, and item validity was assessed using item-total correlations, while reliability was evaluated using Cronbach's alpha with a minimum threshold of 0.60. After all items were confirmed valid and reliable, the questionnaire was distributed online through Google Forms and generated 96 complete responses. The data were analyzed using multiple linear regression in SPSS, with SME performance as the dependent variable and innovation capability and technological innovation as the independent variables. Regression assumptions were examined through residual normality, tolerance and variance inflation factor, and Glejser tests. Hypotheses were tested using partial t tests at the 0.05 significance level, while explanatory power and predictor contributions were assessed using adjusted R squared and standardized coefficients. All variables were measured using a five-point Likert scale, resulting in possible score ranges of 5 to 25 for innovation capability, 7 to 35 for technological innovation, and 5 to 25 for SME performance.

3. RESULTS AND DISCUSSIONS

Results

Based on Table 2, Most respondents are owners or owner-managers, which means the answers come from people who decide on technology purchases themselves. Young and small businesses dominate the sample. Just over half have operated for one to four years and just over half employ between one and four permanent workers, while 83.4 percent report annual revenue below Rp100 million. This profile matters for interpretation because businesses of this size adopt technology under tight budget constraints and cannot easily absorb a failed investment.

Table 2. Respondent Profile

Characteristic	Category	Frequency	Percent
Position	Owner	59	61.5
	Manager and owner	15	15.6
	Staff	14	14.6
	Manager	8	8.3
Length of operation	1 to 4 years	50	52.1
	5 to 10 years	41	42.7
	More than 10 years	5	5.2
Permanent employees	1 to 4 people	50	52.1

Characteristic	Category	Frequency	Percent
Annual sales or revenue	5 to 19 people	26	27.1
	20 to 50 people	20	20.8
	Less than Rp50 million	33	34.4
	Rp50 million to Rp100 million	47	49.0
	Rp100 million to Rp1 billion	13	13.5
	Rp1 billion to Rp5 billion	3	3.1

The open question on technology was answered by 95 of the 96 respondents and produced 115 mentions, because 15 respondents named more than one technology. Table 3 reports the frequency of each group as a share of all 96 respondents.

Table 3. Technology Applied by Service Sector SMEs (multiple response, n = 96)

Technology group	Mentions	Percent of respondents	Percent of mentions
Digital payment instruments (QRIS, e-wallet, PayPal, EDC, paylater)	48	50.0	41.7
Social media, social commerce and online marketplace (Instagram, WhatsApp, TikTok, Facebook Ads, Pinterest, Shopee, Google My Business, Linktree, Hootsuite)	25	26.0	21.7
Bookkeeping, point of sale and business management applications (Excel, Moka, Majoo, Xero, Jurnal.id, Odoo, ERP, Asana, Petdesk, Dropbox)	25	26.0	21.7
Production equipment and other technology (upgraded machinery,	10	10.4	8.7

Technology group	Mentions	Percent of respondents	Percent of mentions
salon and cleaning equipment, camera, drone, artificial intelligence)			
Design and content production applications (Canva, Adobe Photoshop, Adobe Illustrator, Adobe Creative Cloud, CapCut, Lightroom, SketchUp)	7	7.3	6.1
Not specified	1	1.0	0.9
Total mentions	115		100.0

Based on Table 3, figital payment instruments are the most widely applied technology, named by half of the respondents, with QRIS mentioned far more often than any other single tool. Social media and marketplace platforms and business management applications follow, each named by a quarter of the sample. Design applications are the least common group, which is expected given that only part of the sample works in creative services. The pattern is consistent with the diffusion argument set out below: the tools at the top of the table are the ones that are cheapest to start, easiest to operate, and closest to the existing way of serving customers.

Table 4. Descriptive Statistics

Variable	N	Min	Max	Mean	Std. Dev
Innovation Capability (X1)	96	1	5	3.94	0.67
Technological Innovation (X2)	96	1	5	3.99	0.69
SME Performance (Y)	96	1	5	4.02	0.75

Based on Table 4, the results show that all three variables received relatively high ratings. Innovation capability recorded an average score of 3.94, indicating that respondents generally performed innovation-related activities often. Technological innovation had an average score of 3.99, suggesting that respondents generally agreed that technology-based innovation was applied in their businesses. SME performance obtained the highest average score at 4.02, indicating that respondents generally perceived an improvement in their business performance. The standard deviations ranged from 0.67 to 0.75, which indicates moderate variation in the responses. SME performance had the greatest variation, while innovation capability showed the most consistent responses. Overall, the findings suggest positive perceptions of innovation capability, technological innovation, and business performance among the respondents.

The instrument was tested on a pilot sample of 30 respondents before it was distributed to the full sample. Validity was assessed by correlating each item with the total score of its construct. For $n = 30$ at the 0.05 significance level with two tails, the critical r value is 0.361. Every item reaches or exceeds this threshold, so all 17 items were retained for the main survey.

Table 6. Validity Test Result

Variable	Item	Pearson correlation with total	Sig. (2-tailed)	r table	Result
Innovation Capability	X1.1	0.812	0.000	0.361	Valid
	X1.2	0.701	0.000	0.361	Valid
	X1.3	0.510	0.004	0.361	Valid
	X1.4	0.662	0.000	0.361	Valid
	X1.5	0.710	0.000	0.361	Valid
Technological Innovation	X2.1	0.847	0.000	0.361	Valid
	X2.2	0.728	0.000	0.361	Valid
	X2.3	0.856	0.000	0.361	Valid
	X2.4	0.724	0.000	0.361	Valid
	X2.5	0.620	0.000	0.361	Valid
	X2.6	0.361	0.050	0.361	Valid
	X2.7	0.658	0.000	0.361	Valid
SME Performance	Y1	0.770	0.000	0.361	Valid
	Y2	0.613	0.000	0.361	Valid
	Y3	0.729	0.000	0.361	Valid
	Y4	0.727	0.000	0.361	Valid
	Y5	0.624	0.000	0.361	Valid

Based on Table 6, the validity test that has been carried out shows that all variable question instruments have a calculated r value $>$ r table value (0.361), so the data are said to be valid and

can be used in this study. The measurement items on the questionnaire that detailed the variable indicators were then subjected to a reliability test.

Table 7. Reliability Test Result

Variable	Cronbach's Alpha	Number of items	Result
Innovation Capability	0.703	5	Reliable
Technological Innovation	0.804	7	Reliable
SME Performance	0.721	5	Reliable

Based on Table 7, the reliability test findings show that every variable has a Cronbach's alpha value greater than 0.60. Thus, it may be said that every tool in use is reliable.

Table 8. Classical Assumption Test Results

Test	Statistic	Criterion	Conclusion
Normality (one sample Kolmogorov Smirnov on unstandardized residuals)	Most extreme absolute difference = 0.080; Kolmogorov Smirnov Z = 0.784; Asymp. Sig. (2-tailed) = 0.570	Sig. > 0.05	Residuals normally distributed
Multicollinearity	Tolerance = 0.443; VIF = 2.255	Tolerance > 0.10 and VIF < 10	No multicollinearity
Heteroscedasticity (scatterplot of studentized residuals against standardized predicted values)	Points scattered above and below zero with no discernible pattern	No systematic pattern	No heteroscedasticity

Based on Table 8, the residuals are normally distributed. The two predictors are correlated at 0.746, but the variance inflation factor of 2.255 stays well below the conventional limit of 10 and the tolerance of 0.443 stays well above 0.10, so multicollinearity is not a problem. The residual scatterplot shows no systematic pattern. The regression model therefore meets the assumptions required for unbiased estimation.

All variables (independent and dependent) are analyzed and their relationships are predicted using multiple linear regression. The following equation is produced in this study:

$$Y = 1.101 + 0.295X_1 + 0.472X_2$$

The following table shows the results of hypothesis testing:

Table 9. Result of Hypothesis Testing

Hyphotheses	B	Std.Error	Sig.	Result
Innovation Capability (X1)	0.295	0.099	0.004	H1 Supported
Technological Innovation (X2)	0.472	0.069	0.000	H2 Supported

Table 10. Result of R^2 Test

R	R^2	Adjusted R^2	Std.Error
0.814a	0.662	0.655	2.223

The adjusted R^2 value is 0.660, as shown in the table above. This indicates that the independent variables, innovation capability (X1) and technological innovation (X2), have a 66% ability to explain the dependent variable, MSME performance (Y). The remaining 34% is influenced by additional variables not discussed in this study.

Discussion

The first hypothesis test demonstrates that innovation capabilities have a favorable impact on SME performance based on the data analysis that has been done. This means that businesses with high innovation capabilities will experience an increase in SME performance. Conversely, businesses with low capabilities will experience a decline in SME performance. In line with the RBV theory, this supports the idea that achieving competitive advantage depends on the application of organizational resources, particularly innovation capabilities. The application of innovation capabilities by business actors can be achieved by improving product and service quality, such as by enhancing production and sales processes using more efficient technology to boost business productivity and effectiveness. Business actors can also collaborate with other parties by joining business communities or partnering with others to promote products and services, such as new product innovations and branding. In this study, 93% of businesses applied innovation capabilities and experienced a positive impact on SME performance, but 7% did not apply them due to financial constraints. Despite this, business owners still plan to leverage innovation through various ideas to enhance SME performance. The findings of this study align with those (Setyawati et al., 2023), which concluded that innovation capabilities positively influence SME performance. SMEs with innovation capabilities can create unique products and services that attract attention and focus on customer needs.

The second hypothesis test shows the positive and significant effect of technological innovation on SME performance. This means that businesses with high technological innovation will improve SME performance. This idea is supported by RBV theory, which states that good technological innovation will increase a business's competitive advantage and help it streamline its costs. The success of SMEs in the Industry 4.0 era heavily depends on business efficiency, such as utilizing social media for marketing goods or services, which is one example of a business strategy leveraging technology. SME operators can sell their products online using platforms like Facebook Marketplace, Instagram, and TikTok Shop. Based on 96 respondents in this study, SME owners utilize technology in business management, such as payment systems (QR code, e-wallet, POS, PayPal), design applications (Canva, Adobe Premiere Pro, Photoshop, CapCut), accounting systems (Excel, Moka, Majoo, Xero), and several other specialized websites that assist SME performance.

SMEs in the service sector can use this technology to simplify processes, expand their customer base, and become more competitive in an increasingly competitive market. Some businesses have successfully implemented technological innovations by improving production processes, enhancing product/service design, and expanding product reach, thereby positively impacting SME performance. However, 32% of businesses also faced challenges in integrating new technology into their operations, while 68% were able to adapt easily to changes and innovations. The findings of this study align with those of (Setyawati et al., 2023), who concluded that SMEs can compete in more challenging markets by using appropriate technology, thereby gaining a competitive edge over rivals in terms of cost and uniqueness. SMEs must ensure that the new technologies they adopt and the technical advancements they create align with their business needs and objectives.

4. CONCLUSION

This study concluded that innovation capability and technological innovation have a positive and significant effect on the performance of service sector SMEs in Batam City. The study found that innovation is a determinant of business success and is one of the main ways businesses can thrive in the market. SMEs with higher levels of innovation are more likely to initiate and sustain innovative projects. This is critical to improving competitive advantage, performance, and overall business operations. Given that the majority of businesses have only been in operation for one to four years, our findings show that SMEs in Batam's service sector frequently employ innovative strategies to enhance their business performance. It's important to remember that certain well-established companies have a tendency to reject and not adjust to technology advancements in the workplace. For SMEs in Batam City, it is advisable to take advantage of the latest technological tools and tailor them to their respective business needs. Invest in employee training on business trends and practices. Utilize technology as a tool to help boost innovation and creativity. By developing strategic innovation skills tailored to their individual needs, SMEs can gain a significant competitive advantage.

This study includes a number of limitations that present chances for further investigation. First, choosing a broader research goal is advised for future studies in order to enhance the number of samples. Second, this study uses a quantitative approach by relying solely on questionnaires for data collection. To gain a broader understanding, researchers can further use qualitative methods through in-depth interviews and group discussions. Third, future researchers can expand the scope of relevant variables by involving other supporting aspects.

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