The Role of Customer Sentiment Analysis in Enhancing Service Efficiency through Digital Transformation: Evidence from Coffee Shops in Manado

Abraham Patayoan[1], Samuel Rantung[2], Benny Lule[3]
[1]Universitas Klabat, Sulawesi Utara, Indonesia, 52410024@student.unklab.ac.id
[2]Universitas Klabat, Sulawesi Utara, Indonesia, 62220001@student.unklab.ac.id
[3]Universitas Klabat, Sulawesi Utara, Indonesia, benlu@unklab.ac.id

Corresponding Author: 52410024@student.unklab.ac.id[1]

Abstract: *This study examines the role of Customer Sentiment Analysis (CSA) in improving service efficiency in coffee shops in Manado, with a particular emphasis on the mediating function of digital transformation. Using a quantitative explanatory research design, data were collected from 180–200 coffee shop customers who actively engage with digital platforms such as online ordering systems, cashless payments, and social media interactions. Structural Equation Modeling (SEM) using SmartPLS was employed to test direct and indirect relationships among variables. The results show that CSA has a positive and significant effect on both digital transformation and service efficiency. Digital transformation also demonstrates a strong positive effect on service efficiency. The mediation analysis confirms that digital transformation significantly mediates the relationship between CSA and service efficiency, indicating that sentiment-driven insights enhance operational effectiveness when supported by digital technologies. This study contributes empirical evidence from the local coffee shop context, expanding prior research that has primarily focused on large companies and global service sectors. Practical implications suggest that small and medium-sized coffee shops can optimize service processes by leveraging sentiment data and digital tools to enhance customer experience and operational responsiveness.*

Keyword: *Customer Sentiment Analysis, Service Efficiency, Digital Transformation, Coffee Shops, Manado*

INTRODUCTION

In recent years, coffee shops have become more than just places to enjoy a drink; they have evolved into social hubs that reflect urban lifestyles and consumer behavior. In cities like Manado, the rapid growth of the coffee shop business is accompanied by increasing competition, making service efficiency an important determinant of customer satisfaction and loyalty. Customers not only expect quality products but also demand fast, accurate, and personalized service (Setiawan et al., 2022).

The advent of digital transformation has brought significant changes in the way businesses operate and interact with customers. Digital tools such as mobile apps, online ordering systems, cashless payment methods, and customer relationship management (CRM) platforms are now widely adopted by coffee shops to streamline operations and improve service delivery. However, the effectiveness of these tools is highly dependent on the manager's ability to interpret and respond to customer needs in real time (Fauzi et al., 2022).

Customer sentiment analysis (CSA) has emerged as an essential approach to capturing customer perceptions and feedback from a variety of digital channels, including online reviews, social media posts, and rating platforms. By systematically analyzing this sentiment data, coffee shops can identify service gaps, monitor customer expectations, and adjust their strategies. Previous studies in the service industry have highlighted that CSA can significantly improve decision-making by providing actionable insights into customer preferences and dissatisfaction (Mishrif & Khan, 2023).

Despite the growing interest in CSA and digital transformation, limited research has focused on its integration within the coffee shop industry in regional contexts such as Manado. Most of the existing research emphasizes large industries or metropolitan areas, leaving a gap in understanding how small and medium-sized coffee shops can leverage digital transformation through CSA to improve service efficiency. Addressing this gap is important, as local coffee shops not only contribute to the city's economy but also represent the cultural and social identities that shape the consumer experience.

METHOD

This study uses a quantitative approach with an explanatory design that aims to test the causal relationship between Customer Sentiment Analysis (CSA), Digital Transformation (DT), and Service Efficiency (SE) and identify the mediating role of DT. Data were collected through a survey using a structured questionnaire that was distributed to coffee shop customers in Manado who actively use digital services. The study population included users of online ordering services, digital payments, and social media interactions, while the sample was selected using purposive sampling techniques based on the criteria of age 18–45 years, visits to coffee shops in the last three months, and use of at least one digital service. The sample size was determined using the recommendation of Hair et al. (2014), namely five respondents per indicator, so that the minimum number reached 125–150 people, with a target of collecting 180–200 respondents to improve reliability. The research variables consist of CSA as an independent variable, DT as a mediating variable, and SE as a dependent variable, which are operationalized into measurable indicators as presented in Table 1 of Variables and Research Indicators.

Table 1. esearch Vari Rables and Indicators

Variable	Dimension / Indicator	Source
Customer Sentiment Analysis (CSA) (Independent Variable)	1. Positive sentiment from online reviews 2. Negative sentiment detection and feedback 3. Frequency of customer reviews and ratings 4. Sentiment trends on social media platforms 5. Influence of sentiment on brand perception	Liu (2020); Cambria et al. (2017); Feldman (2021)
Digital Transformation (DT) (Mediating Variable)	1. Adoption of online ordering systems 2. Use of cashless payment methods 3. Integration of CRM and loyalty programs 4. Application of data analytics for decision-making 5. Utilization of	Vial (2019); Verhoef et al. (2021); Hess et al. (2016)

	social media and digital platforms for customer engagement	
Service Efficiency (SE) (Dependent Variable)	1. Speed of service (waiting time reduction) 2. Accuracy of order processing 3. Optimal use of digital and human resources 4. Reduced service errors and complaints 5. Customer satisfaction with service process	Parasuraman et al. (1988); Grönroos (2015); Fitzsimmons & Fitzsimmons (2019)

The research instrument is a five-point Likert scale questionnaire that has been tested through a pilot test to ensure clarity and initial validity. The data collection procedure was carried out online and offline to reach respondents more widely. Data were analyzed through three stages, namely descriptive analysis to describe respondent profiles, measurement model testing through validity and reliability tests using SmartPLS, and structural model testing through bootstrapping to assess direct and indirect influences between variables, including CSA–DT–SE mediated effect testing.

RESULTS AND DISCUSSION
Respondent Characteristics

Based on the characteristics of 103 research respondents regarding the role of customer sentiment analysis in improving service efficiency through digital transformation in coffee shops in Manado, it can be concluded that the majority of respondents are male (56.3%), showing that coffee shop customers in Manado in the context of digital engagement and the use of digital platforms are dominated by male groups. The largest age group was 20–25 years old (38.8%), followed by 26–30 years old (19.4%). This indicates that young and early adults are the main users of coffee shop services and are most actively interacting digitally, including providing reviews, comments, and sentiments on online platforms. Most of the respondents work as private employees (35.9%) and civil servants (35%), which reflects that coffee shops in Manado are visited by many working people. This group generally has a high intensity of technology use so that it is a significant source of digital sentiment data. In terms of visit behavior, respondents visited the most 1–2 times per month (36.9%) and ≥ 6 times per month (34%). This shows that there is a variation in the intensity of visits that can affect digital perception and sentiment of coffee shop services.

Table 2. Respondent Characteristics

Characteristics	Category	Quantity (n)	Percentage (%)
Gender	Man	58	56.3
	Woman	45	43.7
Total		103	100.0
Age (Years)	< 20 Years	3	2.9
	20–25 Years	40	38.8
	26–30 Years	20	19.4
	31–35 Years	19	18.4
	≥ 36 years old	20	19.4
Total		103	100.0
Work	ASN	2	1.9
	Bartender	1	1.0

	Housekeeping	1	1.0
	Employee	1	1.0
	Private Employees	1	1.0
	Student	13	12.6
	Civil Servant	36	35.0
	Private Employees	37	35.9
	Unemployment	1	1.0
	PPPK	1	1.0
	HP Technician	1	1.0
	Entrepreneurial	8	7.8
Total		103	100.0
Frequency of Visits to Coffee Shops / Month	1–2 Times	38	36.9
	3–5 times	29	28.2
	≥ 6 times	35	34.0
	(invalid input) 4–6 years	1	1.0
Total		103	100.0

Statistics Descriptive

The descriptive statistics in Table 3 show that all indicators have a mean value in the range of 3.51 to 4.40, which indicates that respondents tend to give positive assessments of all Customer Sentiment Analysis (CSA), Digital Transformation (DIG), and Service Efficiency (EFI) items.

Table 3. Descriptive Statistical Results

Name	Mean	Standard deviation	Excess kurtosis
CSA1	3.843	1.064	-0.183
CSA2	4.147	0.984	1.412
CSA3	3.510	1.235	-0.649
CSA4	4.010	1.071	0.969
CSA5	3.892	1.009	0.711
CSA6	3.853	1.070	0.246
CSA7	3.863	1.029	0.899
CSA8	3.980	0.918	1.710
CSA9	3.716	1.079	-0.067
CSA10	4.225	0.979	2.760

Dig1	4.324	0.920	1.767
Dig2	4.324	0.909	1.951
Dig3	4.314	0.863	1.271
Dig4	4.225	0.917	1.050
Dig5	4.402	0.808	2.281
Dig6	4.353	0.788	2.356
Dig7	4.333	0.820	2.097
Dig8	3.922	1.064	-0.728
Dig9	4.255	0.882	2.060
Dig10	4.294	0.924	1.800
Efi1	4.088	0.853	0.491
Efi2	4.118	0.796	0.739
Efi3	4.118	0.889	0.389
Efi4	4.098	0.902	1.207
Efi5	4.098	0.869	0.577
Efi6	4.127	0.825	0.709
Efi7	4.137	0.897	1.713
Efi8	4.255	0.813	1.815
Efi9	4.284	0.759	1.995
Efi10	4.275	0.782	2.046

Measurement Model

Based on the results of the outer loading analysis, it was found that the CSA3 indicator had a loading value of 0.656, which was below the minimum criterion of 0.70 to maintain convergent validity. Therefore, the CSA3 indicator was declared to be did not meet the convergent validity criterion and was dropped from the model at the next stage of analysis.
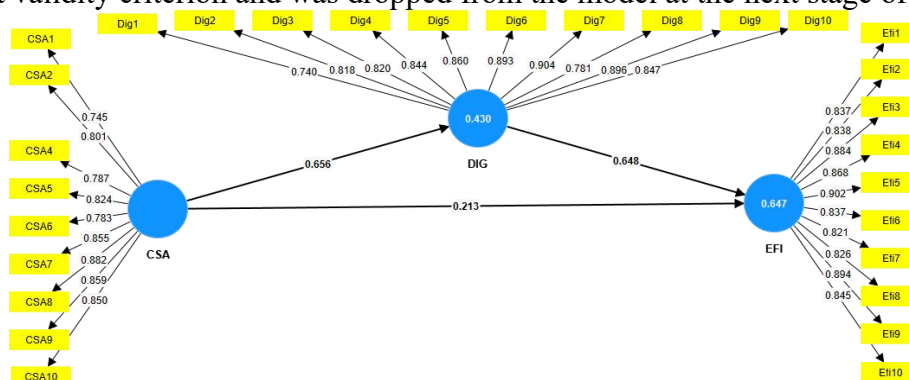

Figure 2. Measurement Model

Convergent Validity

In the *outer loading* test, it was found that the CSA3 indicator had a loading value below the minimum threshold of 0.70 so that it did not meet the criteria for convergent

validity. Therefore, the indicator is removed from the model (*drop indicator*). After the outlier removal process, all remaining indicators in the CSA, DIG, and EFI constructs show a *loading factor* value above 0.70 as presented in Table 4, so that it can be declared valid and suitable for use in the analysis of the measurement model.

Table 4. Hasil Uji Factor Loading

Construct	Indicator	Factor Loading
CSA (Customer Sentiment Analysis)	CSA1	0.745
	CSA2	0.801
	CSA4	0.787
	CSA5	0.824
	CSA6	0.783
	CSA7	0.855
	CSA8	0.882
	CSA9	0.859
	CSA10	0.850
DIG (Digital Transformation)	Dig1	0.740
	Dig2	0.818
	Dig3	0.820
	Dig4	0.844
	Dig5	0.860
	Dig6	0.893
	Dig7	0.904
	Dig8	0.781
	Dig9	0.896
	Dig10	0.847
EFI (Service Efficiency)	Efi1	0.837
	Efi2	0.838
	Efi3	0.884
	Efi4	0.868
	Efi5	0.902
	Efi6	0.837
	Efi7	0.821
	Efi8	0.826
	Efi9	0.894
	Efi10	0.845

Discriminant Validity

The Fornell-Larcker results in Table 5 show that the square root value of AVE is greater than the correlation with other constructs, so that the discriminant validity is met.

Table 5. Fornell-Lacker Criterion

	CSA	DIG	EFI
CSA	0,822		
DIG	0,656	0,842	
EFI	0,638	0,788	0,856

The results of cross loading in Table 6 also show that each indicator has the highest loading on the constructed measured.

Table 6. Cross Loading Test Results

	CSA	DIG	EFI
CSA1	0,745	0,421	0,490
CSA10	0,850	0,651	0,557
CSA2	0,801	0,542	0,470
CSA4	0,787	0,451	0,514
CSA5	0,824	0,510	0,525
CSA6	0,783	0,449	0,382
CSA7	0,855	0,599	0,545
CSA8	0,882	0,625	0,611
CSA9	0,859	0,545	0,584
Dig1	0,539	0,740	0,543
Dig10	0,488	0,847	0,717
Dig2	0,587	0,818	0,618
Dig3	0,478	0,820	0,611
Dig4	0,601	0,844	0,635
Dig5	0,559	0,860	0,750
Dig6	0,589	0,893	0,718
Dig7	0,560	0,904	0,735
Dig8	0,541	0,781	0,579
Dig9	0,576	0,896	0,694
Efi1	0,534	0,731	0,837
Efi10	0,587	0,701	0,845
Efi2	0,558	0,645	0,838
Efi3	0,529	0,678	0,884
Efi4	0,544	0,648	0,868

Efi5	0,575	0,679	0,902
Efi6	0,533	0,622	0,837
Efi7	0,526	0,576	0,821
Efi8	0,543	0,779	0,826
Efi9	0,523	0,644	0,894

Reliability

The reliability test in Table 7 shows that the entire construct has Cronbach's Alpha, rho_A, and Composite Reliability values that exceed 0.70, as well as AVE values that exceed 0.50. The findings confirm that the entire construct has a strong internal consistency and is reliable for further analysis.

Table 7. Reliability Test Results

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
CSA	0,940	0,946	0,949	0,675
DIG	0,954	0,956	0,960	0,708
EFI	0,959	0,960	0,965	0,732

Goodness of fit

The goodness of fit results showed an SRMR value of 0.061 in both saturated and estimated models, which were below the maximum limit of 0.08. This shows that the model used has a good level of compatibility.

Table 8. Results of Suitability Model Results

	Saturated model	Estimated model
SRMR	0,061	0,061
d_ULS	1,597	1,597
d_G	1,561	1,561
Chi-square	726,939	726,939
NFI	0,780	0,780

Structural Model

In the structural model testing, the results showed that most of the relationships between variables in this model were significant.
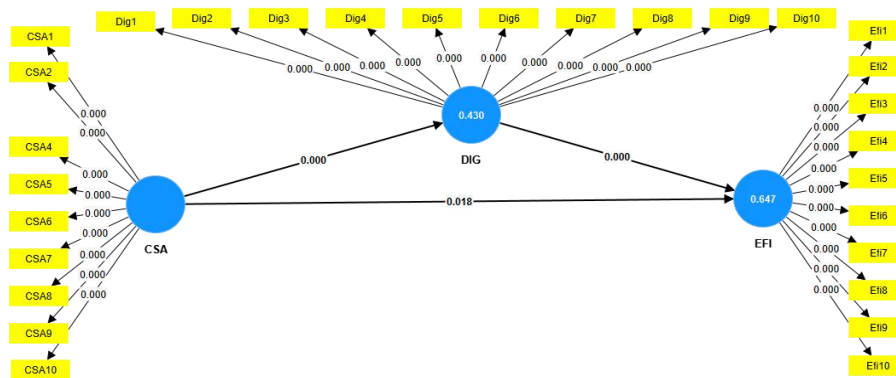
Figure 3. PLS Bootstrapping Structural Model Test Results

Based on the results of the hypothesis test in Table 9, Customer Sentiment Analysis is proven to have a positive and significant effect on Digital Transformation with a T-statistic value of 9.277 and a p-value of 0.000. In addition, CSA also has a significant effect on Service Efficiency with a T-statistic value of 2.369 and a p-value of 0.018. Digital Transformation was found to have a positive and significant influence on Service Efficiency, which was shown by a T-statistic value of 7.925 and a p-value of 0.000. These findings support the H1, H2, and H3 hypotheses.

Table 9. Hypothesis Testing Results (Direct Influence)

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
CSA -> DIG	0,656	0,656	0,071	9,277	0,000
CSA -> EFI	0,213	0,217	0,090	2,369	0,018
DIG -> EFI	0,648	0,642	0,082	7,925	0,000

Based on the results of the mediation analysis in Table 10, it was found that This can be seen from the low T-statistical value and insignificant P-value in all mediated pathways tested. This means that the improvement of operational performance in the Indonesian manufacturing industry does not occur through the mechanism of increasing process efficiency when influenced by Lean Manufacturing or Digital Supply Chain. In other words, Process Efficiency does not have an intermediary role in transmitting the influence of these two variables on Operational Performance.

Table 10. Mediation Analysis Results (Indirect)

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
CSA -> DIG -> EFI	0,425	0,422	0,076	5,623	0,000

CONCLUSION

The results of the study show that Lean Manufacturing, Digital Supply Chain, and Process Efficiency do not have a significant influence on Operational Performance. These findings differ from many previous studies, such as the Shah & Ward, Pradana & Suhendra, Christopher & Holweg, and Wijaya & Darmawan studies, which showed a positive relationship between lean, digitalization, efficiency, and improved operational performance. The insignificance of this influence indicates that in the context of Indonesia's manufacturing industry in 2025, the improvement of operational performance is not solely determined by the implementation of lean, digital supply chain, or process efficiency. Other factors such as

labor quality, technology maturity, organizational readiness, or market conditions are likely to still play a dominant role.

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