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An evaluation of suppliers' perception of the effectiveness of procurement system in the steel sector

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Abstract The procurement process plays a significant role in the materials management system of an organisation. It entails the planning and implementation of supply chains to satisfy the needs of an organisation so that required actions can be adopted for boosting the productivity of the materials team thereby increasing production. The steel sector faces challenges in adhering to procurement criteria, including tendering, evaluation, holding auctions among technically and commercially qualified bidders, and completing plant needs on time. The present study analyses the efficacy of the procurement system. The results indicate that the dimensions transparency, adaptability, ease of use, and grievance redressal are significantly associated while the timely payment is not significantly associated with the procurement system of the organisation. The findings of the study can enable the steel organisations to develop the necessary strategies for improving the procuring system.

Keywords: adaptability, ease of use, grievance redressal, timely payment, transparency

1. Introduction

The steel sector plays a pivotal role in the sectors such as defence, automobile, infrastructure, engineering and construction. The global economy and infrastructure are highly influenced by steel production. China and India have elevated their production levels while advanced countries such as Russia and the United States have reduced their domestic production (Weforum, 2020). Over time, the steel industry in India has experienced significant expansion, making the nation a dominating presence in global steel manufacturing and the 2nd largest manufacturer of crude steel worldwide (PIB, 2023). As per the world steel association (WSA, 2022) report, crude steel production saw an increase of 3.8 per cent in 2021 in comparison to the year 2020with 1032.8 million tonnes. According to the IBEF (2022) report, in the year 2022, the total crude steel production of the Indian steel industry stood at 124.5 million tonnes and manufacturing of finished steel was at 117.6 million tonnes. Throughout the year 2022, there were exports of 5.33 million tonnes of finished steel, while the imports stood at 5 million tonnes. During 2020, the per capita Indian steel consumption was 70 kg, which is just one-third of the global average of 228 kg (VSP, 2021).

During the Covid-19 pandemic, lockdowns around the world indirectly affected the import of metallurgical coal and transportation from ports, leading to lower raw material stocks in many steel plants, including the Visakhapatnam steel plant (Rath & Ram, 2021). The various challenges encountered in achieving procurement objectives include executing e-procurement, reasons for adopting e-procurement, information technology (IT) solutions for order processing, procurement-related IT tools, electronic document exchange with suppliers, methods of e-business document exchange with vendors, the extent of IT tools leveraged in e-procurement, and the need for continued promotion of IT to enhance the procurement process (Hasmukhbhai, 2016). For improved competitiveness and responsiveness, industries require stable top management with a digital transformation vision and upgraded technology to automate manual processes. Agile operations are crucial for PPM to be effective in the value chain (Rane et al., 2020).

The core challenge witnessed by the steel sector is the less availability of coal in India, necessitating coal imports. The main sources of coal for India are Australia and Indonesia, and the increased cost of coal in Australia has a significant effect on the pricing of Indian iron and steel. Due to large inventories and sluggish demand globally, particularly in Japan and Europe, prices for Australian coking coal has remained range-bound. The steel industry does, however, suffer a number of significant obstacles, including a lack of funding, outdated equipment, low productivity, low potential utilization, a lack of

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mettallurgical coal, and subpar product quality. The need for steel is growing daily, even at a low rate of per capita consumption, and significant amounts of steel are being imported to meet the demand. Thus, in order to save foreign currency and support the development of our nation's infrastructure, production must be raised. (VoltaGreen, 2018). Digital disruption is a possible concern that the Indian steel industry may eventually have to deal with on a major scale, but it also presents a chance to maintain global competitiveness. Companies can successfully overcome these obstacles by implementing cutting-edge technology through agile pilot testing, such as data lakes, IOT, and predictive analytics. (ISA, 2019). To confront the diverse obstacles experienced by the steel industry in India, the Government of India has enshrined the National Steel Policy (NSP) 2017. The policy outlines the Government's strategic plan to boost the steel industry in the long run. It aims to increase the production of high-grade steel and promote local consumption of the material. The policy also guarantees the establishment of a cutting-edge and highly competitive steel industry on a global scale (NSP, 2017).

The steel industry has the potential to help regain its positive trade balance as well as to drive the country's export capabilities. Nonetheless, increasing the competitiveness of the nation's steel sector is imperative. Reducing expenses throughout the supply chain, creating effective logistics, and lowering finance costs are a few of the steps needed to accomplish this. The development of several innovative technologies, such as robotics, drones, and the Internet of Things, which provide businesses useful solutions, is causing the steel industry to undergo an exciting transition. These technologies not only automate processes but also link every unit in a plant, enabling real-time interaction and increasing system efficiency. Upskilling the current workforce and creating a new labor pool with the necessary abilities will be necessary when new technologies are introduced. Stronger credit markets, improved investment climates, and increased infrastructure development will all contribute to the industry's growth. (ISA, 2019).

The procurement system for materials management is a fundamental aspect of an organisation's supply chain management. The materials management department is responsible for ensuring the procurement that the material is delivered right time to the company by using the correct carrier, receipt, custody and releasing the materials to the shop floor (VSP, 2022). Therefore, the study focuses on identifying the factors affecting the procurement system and its impact on the performance of materials management in the steel sector.

2. Review of the Literature

The study analyses the literature related to the effectiveness of procurement systems in material management among companies. Changalima et al. (2022) stated that procurement planning has a positive and significant correlation with procurement regulatory compliance, which in turn has a positive and significant correlation with value for money (VfM) in procurement. Additionally, procurement planning is a significant predictor of VfM. Adinyira et al. (2021) identified that both significant and minor deviations decreased over the years, while the number of contracts without deviation increased through the procurement process of public-private partnerships (PPPs) and infrastructure development. Olojede et al. (2021) discovered that PSOs do not regularly fulfil responsibilities in the management of variance, allocation of fines and abatements, selection of preferred bidders, and establishment of management systems for PPP risks. According to Agarchand and Laishram (2017); Maddi et al. (2020), the main issues that hinder progress towards sustainable development include the absence of comprehensive environmental and social impact assessments, a lack of stakeholder and local participation, high bid and transaction costs, high user fees, improper risk allocation, a lack of transparency and accountability, conflicts of interest between the public and private sectors, and a lack of sustainability expertise and knowledge. Windapo et al. (2020) stated that traditional and management-oriented procurement procedures are the only ways for medium-sized construction firms in South Africa to accomplish social growth through community empowerment, managerial skills, and advancement on the register of contractors.

According to Kulkarni et al. (2017), major businesses use standard procedures and software for material management, therefore, they experience the minimum issues. However, due to the absence of software or lack of knowledge of material management procedures, medium and small businesses lag in terms of material management. Ultimately, poor material management causes work delays, project cost overruns, a decline in labour productivity, and material waste. Daniel (2019) articulated that the organisation's material management activity handles storage facilities, among other things, and entails constant procurement for uninterrupted production processes. This activity contributes to the organisation's profitability. It is found that there is a strong correlation between issues with materials management and frequent plant breakdowns, wherein prompt decision-making occurs at the moment of failure. Hallikas et al. (2021) showed a significant and favourable correlation between supply chain effectiveness overall, digital procurement capabilities, and data analytics capabilities. Additionally, the relationship between supply chain effectiveness and the capacity for external data analytics is mediated through digital procurement skills. Saroha et al. (2020) identified that financial demands have been highlighted as the main pressure, while a lack of top management support, a failure to apply laws and policies, and a lack of a clear vision for circular supply chain management (CSCM) are the main sub-pressures for CSCM implementation.

Ambekar et al. (2020) stated that the utilisation of information technology in materials management has an impact on both supplier relationships and purchasing practices. Although businesses want to use better technology, doing so will only have a positive impact on their performance. Panigrahi et al. (2021) articulated that inventory management has a significant

effect on the operational efficiencies of steel manufacturing organisations in India. Therefore, management teams in the manufacturing industry should prioritise inventory management practices to improve firm efficiencies, particularly in volatile environments. Hong et al. (2018) highlighted that effective management of procurement risks requires not only mitigation of price and lead time risks but also the use of advanced analysis techniques to address supply and demand uncertainties. Additionally, the four key factors impacting the adoption of e-procurement are management support, user acceptance of the system, finance and integration of e-procurement, and reliability of information technology and supplier performance (Kunnapapdeelert & Thepmongkorn, 2017).

Sani (2020) indicated that purchasing procedures from the bid stage to storing the materials, budget preparations, and effective inventory management have a significant association with the material management of construction projects. Addo (2019) identified the challenges involved in the acceptance of e-procurement systems in the public sector. These encompass deficiency of employee skillset, insufficient legislative structure, inadequate technological infrastructure for merging e-commerce with other systems, and apprehensions about safeguarding the data and information of e-procurement business transactions. Furthermore, operational, cultural, economic, infrastructure, supplier-related, and forecasting risks are among the many common supply chain hazards in India (Rogers et al., 2018). Likewise, Hungund and Mani (2019) identified that various factors such as firm size, firm age, work experience, education and culture, as well as external elements like competition, customers, ecosystem, and technological advancements, have an impact on the implementation of open innovation compared to closed innovation in SMEs. Altayyar and Beaumont-Kerridge (2016) found that the factors such as government support, reliable postal and delivery services, secure payment choice, affordable and high-speed internet connection, IT-related supplier engagement, educational programs, policy and regulations, competitive pressure and national culture were significant barriers to the implementation of e-procurement SMEs. The function of e-procurement in SMEs is significantly influenced by skills, supplier compatibility, and infrastructure costs (Nasidai, 2016). Alvarez-Rodríguez et al. (2015) stated that emerging technologies can decrease costs, provide more intelligent decision-making environments, and enhance the overall efficiency of business processes.

3. Significance of the Study

The study established the impact of supplier compatibility on the adoption of an effective procurement system as well as the impact of skills on these adoptions. The purchasing process has undergone a significant transformation towards e-procurement. Organisations in the public and private sectors have come to appreciate the benefits of e-procurement techniques. Despite the potential advantages of e-procurement, the majority of county governments have not properly and efficiently embraced the practices. Studies have assessed how likely bidders are to use public e-procurement to lessen corruption in the delivery of products and services to the government.

Studies dealing with the procurement system and its impact on materials management performance are scarce and limited empirical studies within the area have been found in the Indian context. Most of the existing studies have considered these capabilities as laid down procedures regarding the public sector procurement process. A more comprehensive model with the factors affecting the procurement system and its impact on the performance of materials management in the steel sector is essential. However, the perception of the suppliers on the procurement system and its impact on the performance of materials management is essential for performance improvement.

4. Research Objectives and Hypotheses

The study's specific goal is to identify and examine suppliers' perceptions of the dimensions of the procurement system's efficacy in the steel sector. Examine the providers' general information as well.

The following hypotheses are formed based on the literature:

There is a significant relationship between the type of organisation, procurement experience sector, age of the organisation, number of branch offices, and annual turnover range and the procurement system determinants, namely, transparency (H1), adaptability (H2), ease of use (H3), timely payment (H4), and grievance redressal (H5).

5. Research Methodology

The research employs both secondary and primary data sources. The secondary data is gathered from steel plant records, steel sector and annual reports of enterprises, the Ministry of Steel, trade association publications, journals, magazines, websites, and so on. The primary data was collected using a self-administered questionnaire from the suppliers of steel industries in India. A sample of 15 per cent is considered for the study from the total 3,000 suppliers across India. The study used a representative sample of 450 suppliers using a basic random sampling technique. The sample size is determined based on Krejcie and Morgan (1970) formula. The information was gathered from the suppliers by sending the questionnaire through online mode. To get the responses were collected during March to May 2023. To gain further qualitative insights into the procurement system, focused group discussions and interviews with target respondents were conducted. The questionnaire is carefully structured based on the specified qualities related to input procurement system in the steel

industry. The survey instrument's validity and reliability are rigorously verified. Before gathering full-scale data from the intended respondents, pilot research is done. After getting the responses from the suppliers, the data were entered into the database to assess and analyse the sample respondents' perceptions on the procurement system in the steel sector. SPSS (Statistical Package for Social Sciences) version 22 was used for tabulations and statistical measurements, while Microsoft Excel 2016 was used for results interpretation.

6. General Information of the Suppliers

The general information related to the supplier viz., type of organisation, sector of procurement experience, age of the organisation, number of branch officers, and range of annual turnover is analysed and presented in Table 1.

Table 1 General Information of the Suppliers.

Parameters		Frequency	Per cent
Type of Organisation	Local	335	74.4
	Non-Local	115	25.6
Sector of Procurement Experience	Micro	98	21.8
	Small	103	22.9
	Medium	131	29.1
	Large	118	26.2
Age of Organisation	Below 10 years	47	10.4
	11 to 20 years	141	31.3
	21 to 30 years	103	22.9
	31 to 40 years	58	12.9
	41 to 50 years	38	8.4
	Above 50 years	63	14
Number of Branch Offices	None	93	20.7
	Less than 5	272	60.4
	5 - 10	29	6.4
	11 - 15	29	6.4
	16 - 20	4	0.9
	More than 20	23	5.1
Range of Annual Turnover	Below 25 crores	155	34.4
	26 - 50 crores	61	13.6
	51 - 75 crores	31	6.9
	76 - 100 crores	27	6.0
	Above 100 crores	176	39.1

Source: Primary Data.

The type of organisation operated by the respondents reveals that 74.4% are operators of local organisations whereas, 25.6% are non-local organisational operators. The sector of procurement experience of the respondents reveals that 29.1% are medium-sized enterprises. Of the respondents representing 26.2% are operating in the large sector, 22.9% are related to small enterprises and 21.8% are operating in micro-level enterprises. The age of the organisations operated by the respondents reveals that out of the total, 31.3% are operating between 11 to 20 years. There are 22.9% of the organisations operating for 21 to 30 years. The organisations representing 14% are operating for above 50 years, 12.9% are operating for 31 to 40 years, 10.4% are operating for below 10 years, and 8.4% are operating between 41 to 50 years.

The number of branch offices operated by the suppliers reveals that 60.4% have less than 5 branch offices. There are 6.4% of the respondents having 5 to 10 branch offices, 6.3% of the respondents operate 11 to 15 branch offices, 5.1% of the respondents maintained more than 20 branch offices, and only 1% of the respondents have 16 to 20 branch offices. However, 20.7% of the respondents do not have any branch offices. The range of annual turnover generated by the respondents reveals that 39.1% of the organisation’s annual turnover is above 100 crores. It is found that 34.4% of the organisations earn an annual turnover of below 25 crores. The organisations representing 13.6% are generating an annual turnover of 26 to 50 crores, 6.9% are earning 51 to 75 crores and only 6% of the organisation's annual turnover is in the range of 76 to 100 crores.

7. Results and Discussions

In Table 2, a descriptive statistical analysis of the respondent's perceptions of the identified five procurement system determinants—transparency, flexibility, usability, prompt payment, and grievance redressal—is shown. Transparency is the most highly regarded variable among the five determinants, with a mean score of 4.14, followed by timely payment (4.11), adaptability (4.10), ease of use (4.07) and grievance redressal (4.05). The Cronbach’s alpha value of the stated five

dimensions is above 0.90, indicating an internal consistency among the variables. The factor loadings of all the parameters are above 0.50 stating that all variables have significant association.

Table 2 Determinants of Procurement System.

Sl. No.	Dimensions and Parameters	Mean	Factor Loadings	Cronbach alpha
Transparency		*4.14*		*0.934*
1	Information security and privacy are well-protected	4.51	0.755	
2	The terms for packing and delivery are precise and fair	4.26	0.787	
3	Specification parameters are clearly established	4.21	0.718	
4	The auto-start bid price is clearer in the e-reverse auction	4.16	0.750	
5	Effective procedures are in place to weed out non-serious suppliers with punitive actions	3.93	0.703	
Adaptability		*4.10*		*0.960*
1	Necessary infrastructure with hardware and software support is available	4.21	0.784	
2	Guidelines issued by various authorities are compiled and made available	4.16	0.757	
3	The expertise and skills of a purchase manager are sufficient	4.14	0.732	
4	Suitable training has been imparted for participating in the e-procurement system	4.08	0.810	
5	Guarantee performance clauses are to be incorporated by internal technical analysis and involve customer discussions	3.94	0.694	
Ease of Use		*4.07*		*0.972*
1	Frequent interaction between buyers and suppliers is desirable to avoid unwarranted disputes	4.19	0.795	
2	Consolidated procurement data shall be necessary on trends and performance of various agencies	4.11	0.648	
3	The procurement system manual must be simpler and easier to understand	4.08	0.719	
4	It is vital to have a comprehensive list of items available for external buying	4.01	0.613	
5	The search engine for accessing the system is complex and users are finding difficulty to get the required information	3.94	0.772	
Timely Payment		*4.11*		*0.984*
1	Payment via banking channels is an excellent instrument	4.27	0.846	
2	For late payments, the payment must be released with interest	4.25	0.832	
3	Payments must be made on time to ensure the continued operation of the MSEs	4.12	0.822	
4	Integrated Financial Management Information System is contributing to effective timely payment to the suppliers	3.80	0.619	
Grievance Redressal		*4.05*		*0.938*
1	Periodic review with the suppliers will help in taking corrective actions	4.28	0.674	
2	Respond to bidders' questions within the timeframes specified	4.18	0.788	
3	Delay in resolving the queries is detrimental to the subsequent supplies	4.02	0.827	
4	The purchase decisions for trial consignments will be subject to financial audit.	3.73	0.715	

Source: Primary Data.

In the case of transparency, ‘information security and privacy are well protected’ is the highly-rated parameter with a mean score of 4.51 followed by the parameters ‘the terms for packing and delivery are precise and fair (4.26)’, ‘specification parameters are clearly established (4.21)’, ‘the auto start bid price is clearer in the e-reverse auction (4.16)’ and ‘effective procedures are in place to weed out non-serious suppliers with punitive actions (3.93)’. Referring to the determinant adaptability, ‘necessary infrastructure with hardware and software support is available’ is the highly-rated parameter with a mean score of 4.21, followed by the parameters ‘guidelines issued by various authorities are compiled and made available (4.16)’, ‘the expertise and skills of a purchase manager are sufficient (4.14)’, ‘suitable training has been imparted for participating in the e-procurement system (4.08)’ and ‘guarantee performance clauses are to be incorporated by internal technical analysis and involve customer discussions (3.94)’.

The respondent’s perception on the ease-of-use dimension reveals that the parameter ‘frequent interaction between buyers and suppliers is desirable to avoid unwarranted disputes’ is highly rated with a mean score of 4.19 followed by the parameters ‘consolidated procurement data shall be necessary on trends (4.11)’, ‘the procurement system manual must be simpler and easier to understand (4.08)’, ‘it is vital to have a comprehensive list of items available for external buying (4.01)’ and ‘the search engine for accessing the system is complex and users are finding difficulty to get the required information (3.94). Regarding timely payment, the parameter ‘payment via banking channels is an excellent instrument’ is highly rated with a mean value of 4.27 followed by the parameters ‘for late payments, the payment must be released with interest (4.25)’, ‘payments must be made on time to ensure the continued operation of the MSEs (4.12)’, and ‘integrated financial management information system is contributing to effective timely payment to the suppliers (3.80)’. In the case of grievance redressal, the parameter ‘periodic review with the suppliers will help in taking corrective steps’ is highly rated with a mean score of 4.28 followed by the parameters ‘respond to bidders' questions within the timeframes specified (4.18)’, ‘delay in

resolving the queries is detrimental to the subsequent supplies (4.02)', and the procurement decisions on trial consignments shall be brought into the ambit of the financial audit (3.73)'. Thus, it can be inferred that the stated five dimensions has significant positive perception by the respondents on the procurement system in steel sector.

The results of the ANOVA test related to the respondent's perception on dimensions for the effectiveness of the procurement system in the organisations are shown in Table 3. The statistics indicate that the dependent variables transparency ($F=5.757$, $p=0.000< 0.05$), adaptability ($F=3.292$, $p=0.040< 0.05$) and ease of use ($F=6.661$, $p=0.000< 0.05$) shows a significant association with the independent variables range of annual turnover, type of organisation, number of branch offices, age of the organisation, and sector of procurement experience. However, the dimensions timely payment ($F=2.123$, $p=0.062> 0.05$) and grievance redressal ($F=3.068$, $p=0.110 < 0.05$) do not show a significant association with the independent variables range of annual turnover, type of organisation, number of branch offices, age of the organisation, and sector of procurement experience.

Table 3 ANOVA

Dimensions		Sum of Squares	df	Mean Square	F	Sig.[b]
Transparency	Regression	9.492	5	1.898	5.737	.000[b]
	Residual	146.918	444	0.331		
	Total	156.41	449			
Adaptability	Regression	0.861	5	0.778	3.292	.040[b]
	Residual	107.921	444	0.236		
	Total	108.781	449			
Ease of Use	Regression	0.847	5	1.723	6.661	.000[b]
	Residual	122.602	444	0.259		
	Total	123.449	449			
Timely Payment	Regression	0.083	5	0.644	2.123	.062[b]
	Residual	137.898	444	0.304		
	Total	137.981	449			
Grievance Redressal	Regression	0.183	5	0.819	3.068	.110[b]
	Residual	122.463	444	0.267		
	Total	122.646	449			

[b.] Predictors: (Constant), Range of annual turnover, Type of Organisation, Number of branch Offices, Age of Organisation, Sector of Procurement.

Thus, the regression analysis results provide strong support for the acceptance of the hypothesis relating to the association between independent type of organisation, age of the organisation, and sector of procurement experience with the dependent variables transparency (H1), adaptability (H2) and ease of use (H3). The hypothesis relating to the association between independent type of organisation, age of the organisation, and sector of procurement experience with the dependent variable timely payment (H4) and grievance redressal (H5) is not supported. The findings of the study will enable the steel sector to overcome certain challenges related to transparency of the information, ease of use in operating the online websites, and redress the grievance of the suppliers from time to time. Major raw materials used in the steel industry, such as iron ore, metallurgical coal, and imported lime stone, are typically acquired via letter of credit (LC) mechanisms. As the global mining policies are developing, open tender or global tender procurement method can be used by providing the suppliers with credit facility and making timely payments to them. This will improve the performance of the steel industry and maintain positive relationship with the suppliers.

8. Conclusions

The study precisely examined the characteristics of the procurement system's effectiveness. It has been discovered that the procurement system aspects of transparency, flexibility, and ease of use have a substantial relationship with the supplier's demographics, namely, yearly revenue range, type of organisation, number of branch offices, age of the organisation, and sector of procurement experience. However, the dimensions of prompt payment and grievance redressal have no significant relationship with the supplier's demographics. The study will enable the the materials management department of the steel companies to focus on developing an effective input procurement system while incorporating provisions to support ancillary industries. Further, the companies can focus on adoption of recent Government of India policy by giving preference to Make in India suppliers and procurement through Government E-Market (GeM) portals. As a result of the findings, specific recommendations are made to improve the performance of the steel sector's procurement system.

The suppliers can be provided with easy access to participate in the e-tendering process without much difficulty in the procurement system. More effective policies and procedures can be adopted on non-responding/non-serious suppliers with further action to see that they are participating in future tenders. Necessary policies and procedures need to be framed in purchase sections of materials management regarding budgetary quotations whenever the registered suppliers are not participating in the procurement bidding process. The supplier should be provided with an effective IFMIS, to enable it to get

the present status of payment and bill information. The material management should focus on resolving the pending queries/grievances of suppliers so that the supplier is not dissatisfied and would participate in future tenders regularly. It would be beneficial to locate and gather all vendors involved in the public sector units' procurement process and establish a single platform for their ease of use.

9. Limitations and Further Research

There are inherent limitations in this study. However, the researcher has made every effort to minimize their impact on the quality of the research. The study was conducted in the steel sector and so it may not apply to other organisations across the country. The responses were specifically collected from the suppliers across India, therefore, the results cannot be generalised with steel companies across the globe. The study may not apply to other sectors or industries. Due to the confidentiality of the information, some suppliers hesitated to give their fair perception.

This study adds to the literature by expanding on previous theoretical and empirical investigations conducted in close collaboration with industrial enterprises and the public sector. The study's components can be used to perform research studies in other steel factories across the country and around the world. The study can also be applied to other public sector enterprises as well across the country. Future research can be undertaken on analysing the importance of e-procurement systems and government e-marketplaces in other sectors.

Ethical considerations

I confirm that I have obtained all consent required by the applicable law to publish any personal details or images of patients, research subjects, or other individuals used. I agree to provide Multidisciplinary Science Journal with copies of the consent or evidence that such consent has been obtained if requested.

Conflict of Interest

The authors declare no conflicts of interest.

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