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Analyzing the Role of Artificial Intelligence (AI) in Enhancing the Efficiency of India's Goods and Service Tax Network (GSTN)

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Abstract

Artificial intelligence is a technology that enables to solve the real time problem into minutes. The Artificial Intelligence has emerged as a transformative force in ensuring operational efficiency, reducing compliance burden and improving the services across India. The Goods and Services Tax Network (GSTN) serves as a backbone of GST regime in India as it ensures return filing, tax payment, new registrations and monitoring of the GST laws. The complexity of GST portal, frequent changes in GST laws has created bigger challenges for all the stakeholders and professionals. This study examines the role of Artificial Intelligence (AI) in enhancing the efficiency of India's Goods and Services Tax Network (GSTN). The research adopts a primary survey of 110 respondents including goods traders, service providers, tax consultants, accountants, and government officials. The purposive sampling and random sampling method would be adopted to collect the data from respondents. The period of the study was between 1st August, 2025 to 25th August, 2025. The questionnaire employed demographic questions, Likert scale questions, open-ended questions and qualitative feedback to capture the respondent's awareness of artificial intelligence in Goods and Service Tax Network. The research study adopts the descriptive and analytical research design. The research question that is identified for the study is – the level of awareness among the professional about AI applications in GSTN and how much ready are the professionals to adopt the AI driven technology in GSTN. The key area of focus is awareness and current usage of artificial intelligence in goods and services tax network, training needs, social implications and future Outlook. The collected data would be analyzed using IBM SPSS Statistics software and Microsoft Excel data analysis tool. The modes of central tendency as mean, median, mode, validity test and reliability test (Cronbach's Alpha) and Annova test analysis would be used for the detailed analysis of primary data. The Awareness of the artificial intelligence has significantly increased in the past several years and its application with the Goods and Services Tax Network can ensure substantial benefits for various professionals. The Artificial Intelligence driven technology can serve the professionals with the various aspects of GST as input tax credit, new registrations, compliance with several GST forms, filing Returns, tax payment, data validation, predictive analytics for tax forecasting, fraud detection,24x7 query solving, intelligent document processing etc. The integration of Artificial Intelligence and Goods and Services Tax Network would also encourage the policy makers to implement the AI tools and ensure tax payers education and robust data protection framework.

Keywords: Artificial Intelligence, Goods and Service Tax Network, Online tax Compliance, Technology, Tax Professionals.

Introduction

Artificial intelligence is the Computer Based Technology that can perform the task in a no time which typically require human intelligence. In the simple terms, if we say it's about making machines smart. Artificial intelligence uses such a transformative technology which ensure automation and efficiency, enhance decision making, simulation of human intelligence, data driven learning. The artificial intelligence Technology follow a process of learning in an initial stage from various sources and collects data, then the artificial intelligence draws the conclusions and make decisions from the available data. Artificial intelligence then focusses on finding the

creative solutions to the complex issues. The artificial intelligence has the capability of understanding the natural language and has a perception towards various aspects of the society.

The Goods and Services Tax (GST) was introduced in the year July 2017, this was a milestone in the Indian indirect taxation system as the old tax regime of Value Added Tax System (VAT), Central Sales Tax System (CST) and Service Tax System on goods/services was replaced with a unified taxation system. With the launch of GST regime, the of India's Goods and Service Tax Network (GSTN) portal was also launched. The GSTN is a portal which serves as a unified platform for registration of goods traders and service providers, filing GST Returns, tax payment, filing GST forms and compliance monitoring of GST laws. GSTN is a technological backbone for GST in India. All the transactions of The Central Goods and Services Tax (CGST), The State Goods and Services Tax (SGST) and The Integrated Goods and Services Tax (IGST) are performed through GSTN Portal.

The Indian Taxation ecosystem is rapidly digitalizing, all the stakeholders who are involved with GST have a desire that the artificial intelligence tools should be used in goods and services tax network. The artificial intelligence Technology would ensure that various benefits can be obtained such as reduction of technical glitches, less system downtime, real time data reconciliation and analysis, enhanced fraud detection, prevention of tax evasion, reduce audit risk assessment, automatic dispute resolution and personalized tax payer services. The volume of tax data and its compliance requirement is increasing day by day so there is a need for the advanced solutions so that Goods and Service Tax Network (GSTN) portal can ensure accuracy efficiency and a good user experience.

This research seeks to analyze the role of Artificial Intelligence in improving the efficiency of India's GSTN, with an emphasis on perception of various stakeholders of GST. The research study is relied upon the primary data collected through a systematic and approved questionnaire which focus on the demographic details of a stakeholder, there awareness and current usage of artificial intelligence in Goods and Service Tax Network (GSTN), training needs in artificial intelligence, social implication of artificial intelligence and future outlook.

Review of Literature

A Remarkable step in unifying the indirect taxation system of the country and improving the transparency was the implementation of the GST in the year of July 2017. The Finance ministry has already started the initiative to reduce the manual errors and improved tax payer participation through digitalization in GST. *(Singh & Singh, 2023)*

However, with the integration of Artificial Intelligence in the GST framework would ensure real time governance and reduction in the compliance burden on tax payers of India. The most necessary requirement would be a good digital infrastructure which would ensure the challenges are addressed in future. *(Agrawal & Soni, 2025)*

The involvement of Artificial Intelligence into the taxation system of the country would ensure a Revolutionary change in the financial management and managing public funds. Artificial intelligence tools like Natural Language Processing Technique (NLP), Machine Learning Technique (ML)and Robotic Process Automation Technique (RPA) are used to automate the entire process, ensure timely compliance and detect and prevent fraud (Mannan, Farhana, & Chowdhury, 2025). The GSTN is the spine of GST system, as it handles the vast database of Indian tax payers. The adoption of Artificial Intelligence could potential serve to enhance the efficiency, accuracy and user experience of Goods and Services Tax Network *(Sharma & Garg, 2025).*

The Ministry of Finance should also ensure that a good policy framework must be framed so that easy integration of Artificial Intelligence be made in Goods and Services Tax Network, so that it can ensure ethics and accountability in the financial system of country. Indian government has framed National strategy for Artificial Intelligence and DPDP act, 2023 for use of Artificial Intelligence into government services but due to lack of public trust, no robust data governance and lack of information datasets its practical implementation has lagged behind up to a great extent *Raisinghani (2025).*

The perception of the stakeholders and professionals play a very crucial role in adoption of Artificial Intelligence in Indian Taxation System. Rather than the replacing of human expertise in taxation system the Artificial Intelligence should be perceived as a compliment, as such will ensure of Upscaling of stakeholders and professionals (Chouhan, Shakdwipee, Vasita, & Chand, 2020). AI driven tax solutions would also improve accessibility and awareness of lower income group and consumers towards the taxation system (Sai & Sundar, 2025). Robust policy framework to remove data security concerns, digital literacy gaps, and reducing a high integration cost must be framed *(Agrawal & Soni, 2025).*

Malpractices such as misuse of the Input Tax Credit (ITC), fake invoicing and tax evasion are biggest challenges in GST framework of India. A pilot study between 2018 and 2023 demonstrated that AI based monitoring would reduce the above reported fraud. Artificial intelligence can easily identify the suspicious transactions and escalate them before happening. The similar Artificial Intelligence models have been adopted in United Kingdom as 'Connect System' and even in Australia as 'Anomaly Detection Model' which has prevented many such frauds in the indirect taxation system. *(Sharma & Garg, 2025).*

Predictive and Prescriptive analytics, are the two tools of Data Analytics and such can help to improve fraud detection, streamline tax management, monitor compliance, detect inconsistencies real time invoice reconciliation and forecast risk in Goods and Service tax Network (GSTN). The AI driven tax governance ensures proactive risk assessment and improved financial governance in the country. *(Mannan et al., 2025)*

The GST Interactive Technical Assistant (GITA) was held in 2022- 2023 in which more than 535000 queries were handled and the conclusion was drawn that chatbots using Artificial Intelligence have resolved more than 92% of the queries with accuracy and real time assistance to users. These chatbots have reduced tax official's manual workload and employment of conversational agents. Ministry of Finance should shift to AI based application chatbots from basic FAQs (frequently asked questions) as it would help to improve tax payer satisfaction *(Mohan, 2024).*

Research Gap

The Review of Literature demonstrates the potential use of AI in administration of tax in India as well as global, it also clearly identifies that the application of Artificial Intelligence within Goods and Services Tax Network (GSTN) is limited. Research need is raised to study the aspect of Artificial Intelligence and digitalization in taxation with a view point of primary data driven from GSTN users. This research gap focuses on stakeholder centric studies on AI integration in India's indirect taxation ecosystem.

Research Question

1. How much the incorporation of AI can enhance the operational efficiency of India's GSTN, from the view point of stakeholders of GST?
2. How much the stakeholders of India's GSTN are aware towards the tools of Artificial Intelligence?
3. How much training is required for stakeholders of India's GSTN?

Research Objective

To analyze the stakeholder's perception towards the integration of Artificial Intelligence technology in India's Goods and Service tax Network (GSTN).

Research Hypothesis

- *Null Hypothesis (H_0):* The integration of Artificial Intelligence (AI) does not have a significant impact on the operational efficiency of India's Goods and Service tax Network (GSTN).
- *Alternative Hypothesis (H_1):* The integration of Artificial Intelligence (AI) does have a significant impact on the operational efficiency of India's Goods and Service tax Network (GSTN).

Variables Of Research Study

Objective	Independent Variable	Dependent Variable
To analyze the stakeholder's perception towards regarding the integration of Artificial Intelligence technology in India's Goods and Service tax Network (GSTN).	Artificial Intelligence(AI)	India's Goods and Service tax Network (GSTN).

Research Design

This research study adopts the analytical and statistical research to understand the role of Artificial Intelligence (AI) in enhancing the efficiency of India's Goods and Service tax Network (GSTN)

Sampling Method

The Random Sampling and Purposive Sampling method has been adopted to collect the data from the question respondents who possesses the experience in the field of Goods and Service tax (GST).

Sample Size And Data Collection

The primary data of the research paper has been collected from the 110 respondents using the systematic and approved questionnaire. The questionnaire contains demographic questions, Likert's-Scale questions, Multiple choice questions (MCQs) and open-ended questions.

Data Analysis Tool

The collected data would be examined using IBM-SPSS Statistics software and Microsoft Excel data analysis tool. The modes of Central Tendency as Mean, Median, Mode, validity and reliability test as well as Annova Test would be used to identify the relationship between the variables.

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Data Analysis And Findings

Validity Test and Reliability Test

- Validity Test – Validity test ensures that all the primary data collected through questionnaire is accurate, meaningful and when such data would be analyzed the results will be accurate and would not produce any misleading results. Here the validity test is conducted for all the 110 responses collected through the questionnaire.

Primary Data Processing Summary

		N	%
Cases	Valid	110	100.0
	Excluded	0	.0
	Total	110	100.0

The Validity test clearly indicates that all the 110 responses collected using the questionnaire are valid and the data is reliable and accurate for the further statistical analysis of the data.

- Reliability Test (Cronbach's Alpha) – Cronbach alpha will be used to check the reliability test; the reliability test helps to measures the internal consistency of the data collected using the questionnaire of survey and it indicates how the set of different items are closely related to each other as a group. Here the Reliability test is conducted for all the questions which are based on the Likert's Scale so as to check the reliability of data.

Cronbach's Alpha	No. of Items
.9359	8

Cronbach's Alpha Interpretation:

- **≥ 0.9** → Value is Excellent
- **0.8–0.9** → Value is Good
- **0.7–0.8** → Value is Acceptable
- **0.6–0.7** → Value is Questionable
- **0.5–0.6** → Value is Poor
- **< 0.5** → Value is Unacceptable

The r value in the Cronbach Alpha test is 0.9356 which is greater than 0.90, hence it clearly highlights that the r value is excellent. The total number of items used for the computation of r value are 8.

Annova Test

The Annova test is also known as the Analysis of Variance test, this statistical test is used to compare means of three or more groups of the primary data to determine if they are statistically different among each other, rather than the difference due to random chances. Annova test works by comparing the variance between the groups to variance within the groups using F-Test analysis, it is also the generalization of the T-Test. The Annova Test was developed by famous statistician Roland Aylmer Fisher in 1920s.

Here the Annova test is been performed to identify that whether the primary data so collected is statistically different among each other and to compare the means of the different groups. This test is also used to check which hypothesis which is been accepted null hypothesis or alternative hypothesis.Stand for –

- ss – sum of the squares
- df – degree of the freedom
- MS – Mean Square
- F – F Statistics value
- P value
- F crit – F Critical value

	A	B	C	D	E	F	G
1	Anova: Single Factor						
2							
3	SUMMARY						
4	*Groups*	*Count*	*Sum*	*Average*	*Variance*		
5	Are you aware with the	110	425	3.863636364	0.522518766		
6	Technology has improv	110	416	3.781818182	0.557464554		
7	Integrating AI in GSTN	110	422	3.836363636	0.596830692		
8	AI would improve tran	110	418	3.8	0.510091743		
9	AI technology in GSTN	110	396	3.6	0.590825688		
10	AI could lead to biasne	110	414	3.763636364	0.475729775		
11	AI in GSTN be regulate	110	435	3.954545455	0.630942452		
12	Investment in AI softw	110	399	3.627272727	0.566221852		
13							
14							
15	ANOVA						
16	*Source of Variation*	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
17	Between Groups	10.67159091	7	1.524512987	2.740312308	0.008099	2.020063
18	Within Groups	485.1181818	872	0.55632819			
19							
20	Total	495.7897727	879				

If F Statistics value of the data is greater than F Critical value of the data then the test is significant or vice-versa, hence in this case the value of F Statistics is 2.74031230841925 and the value of F Critical is 2.02006294448799, which clearly indicate that the Annova Test is Significant.

The alpha level in calculation of Annova Test was taken as 0.05

If P Value of the data is less than or equal to 0.05 then alternative hypothesis as stated is accepted and null hypothesis as stated is rejected, on the contrary if the P-Value is greater than 0.05 then the null hypothesis as stated would be accepted and the alternative hypothesis as stated would be rejected.

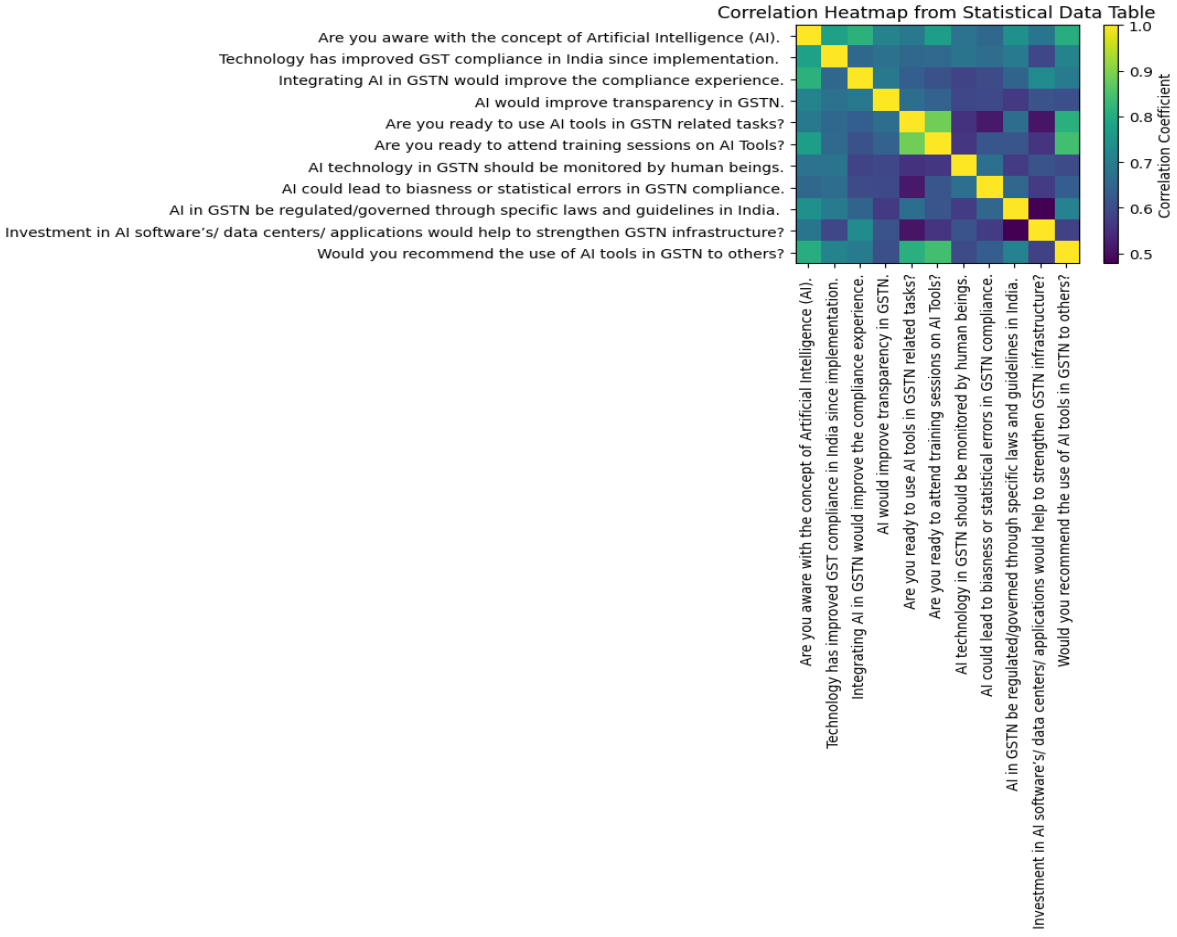
As in this case on performing the Annova Test, the P value is 0.0080985308829942, that is less than 0.05, hence it clearly indicates that the alternative hypothesis as stated is accepted and the null hypothesis as stated is rejected.

The Annova test is been performed in Microsoft Excel Data Analysis Tool.

Correlation Analysis

Correlation is the statistical measure that define the direction and strength of a linear relationship between different quantitative variables. The values ranging from 0.01 to 0.99 is a positive correlation, -0.01 to -0.99 is a negative correlation, 1 is a perfect positive correlation, -1 is a perfect negative correlation and 0 indicates no linear relationship.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1		Are you aw	Technolo	Integratir	AI would	Are you re	Are you re	AI techno	AI could l	AI in GSTI	Investme	Would you recomm	
2	Are you aware with the concept of Artificial Intelligence (AI).	1											
3	Technology has improved GST compliance in India since implementation.	0.777	1										
4	Integrating AI in GSTN would improve the compliance experience.	0.814	0.653	1									
5	AI would improve transparency in GSTN.	0.711	0.674	0.688	1								
6	Are you ready to use AI tools in GSTN related tasks?	0.690	0.654	0.633	0.667	1							
7	Are you ready to attend training sessions on AI Tools?	0.770	0.657	0.608	0.641	0.887	1						
8	AI technology in GSTN should be monitored by human beings.	0.677	0.678	0.584	0.588	0.554	0.560	1					
9	AI could lead to biasness or statistical errors in GSTN compliance.	0.652	0.665	0.598	0.592	0.515	0.618	0.668	1				
10	AI in GSTN be regulated/governed through specific laws and guidelines in India.	0.740	0.695	0.646	0.566	0.667	0.616	0.571	0.650	1			
11	Investment in AI software's/ data centers/ applications would help to strengthen GSTN infrastructure?	0.682	0.589	0.731	0.611	0.506	0.559	0.612	0.571	0.478	1		
12	Would you recommend the use of AI tools in GSTN to others?	0.804	0.712	0.693	0.606	0.810	0.841	0.600	0.633	0.709	0.580	1	
13													
14													



Pearson's correlation analysis was conducted to determine the relationship between the 11 items included in the research study, the result indicated that all the coefficients of correlation were ranging from 0 to +1 which clearly state that there is a positive relationship among the items. The variables are positively related with one another which define that an increase in one correspondent item results an increase in the other item. The correlation values exhibited the moderate to strong positive correlation ($r>0.50$) which reflects substantial level of consistency and variance among all the 11 items of the study.

Therefore, correlation analysis clearly confirm that all the 11 items of the research study are positively correlated and statistically aligned which provide evidence of construct validity and consistency among the 11 variables.

Summary & Conclusion

The primary data so collected from the respondents has provided the valuable information about the research objective and it is authentic and contextually relevant. The results clearly indicate that people are aware with the concept of Artificial Intelligence and integrating the AI in GSTN would improve the compliance experience of the users and would improve the effectiveness of the GST system. The adoption of AI in GSTN though will create some obstacles but such would also help to improve transparency in the system.

The stakeholders are also ready to use AI related tools in the GSTN, and even if they are not trained about such tools they are willing to learn and adopt using seminars, online tutorials, workshops, webinars, classrooms teaching modes and helpdesks. The reliance on AI can only be maintained when AI is been monitored by human beings and government should frame specific laws and guidelines for its implementation. AI can also reduce the biasness and statistical errors in GSTN compliance.

It is a need of the time that the investment must be made in AI tools, software's, data centers, applications and technology through this AI would become integral part of India's GSTN system. The stakeholders also agreed that they themselves would use the AI tools and would recommend those to other stakeholders, so as make GST system an AI enabled system.

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