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Fixing the GST Process: Five Years of Iterative Problem Solving



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Sanjeev Sanyal and Pankaj Dikshit

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Sanjeev Sanyal is Member, Economic Advisory Council to the Prime Minister (EAC-PM) and Dr Pankaj Dikshit was Senior Vice President, Goods and Services Tax Network (GSTN) and currently is the Chief Technology Officer (CTO) at Government e-Marketplace (GeM). The contents of the paper including facts and opinions expressed are sole responsibility of the authors. EAC-PM or the Government of India does not endorse the accuracy of the facts, figures or opinions expressed therein. The authors would like to thank Dr Bibek Debroy, Chairman, EAC-PM for his support and comments. The authors would also like to acknowledge the help of Naveen Sharma and Surbhi Madan of GSTN and Jayasimha K R of EAC-PM.

Fixing the GST Process: Five Years of Iterative Problem Solving

ABSTRACT

After years of debate, India rolled out the Goods and Service Tax (GST) in July 2017. Much has been written about the administrative architecture of the framework, the trends in tax collections, the impact on internal trade and so on. This paper, however, examines the topic from the perspective of process efficiency and the ability of the system to correct by responding to feedback loops. Thus, it delves into areas such as customer complaint rates, responsiveness of the Goods and Services Tax Network (GSTN), time taken for redressal, and the technological tools being used to improve interactions with taxpayers. It is hoped that the paper will add to the understanding of process reform and the impact of iterative feedback-based adjustments, an area that is rarely discussed in economics literature. This is the administrative equivalent of the “*agile*” framework.

As is now widely appreciated, the country’s indirect tax collections witnessed a significant boost after the introduction of GST and have been rising steadily. The unified digitized system for taxpayers as well as for tax administrators has enabled a single point of aggregation with more efficiency and transparency. However, there were also a lot of complaints and requests for clarification at the time of transition, and during the disruptions caused by the Covid-19 pandemic. Even in “normal” times, there is always a flow of queries, complaints and system bugs. This paper looks at how policy makers and system administrators constantly monitored the rollout of the GST regime and have since tried to improve it using feedback loops.

A helpdesk established for taxpayers had 550 call centre agents in the initial months of the launch in order to handle queries on not only the new tax regime but also the new IT system that no one had used before. Users could simply call on telephone lines or even report their issues on a web portal created to allow sharing of documents / screenshots of the errors, and the practical challenges they faced. In the first quarter more than 20 lakh calls/queries were received! But it has since dropped to less than 2 lakh. Note that this decline happened even as more users were brought in. While the GST regime began with ~38 lakh taxpayers on 01st July 2017, it saw a steady increase and had climbed to 1.12 crore taxpayers by June 2018. At the time of publication, there were 1.37 crore taxpayers, with a peak count of nearly 1.42 crore in the last quarter of 2022 (note that some fluctuation is normal).

The complaint rate can be used as another useful metric to judge the taxpayers’ understanding and comfort with the system. The complaint rate has declined from 2.36 lakh complaints (in early 2018) to ~17,000 in the last quarter of 2022. The ratio of complaints to the usage of the system (i.e. number of returns filed), which was as high as 83 problems reported for every 10,000 returns, have

now reduced drastically to less than 4 reported problems, demonstrating the sharp reduction in the complaint ratio.

After every interaction with the helpdesk – whether by calls or by tickets – feedback on their satisfaction is sought and recorded to measure how satisfied taxpayers are with the services offered. This metric now stands at ~93 %, which is quite high, though is yet to achieve the pre-COVID level of 96%.

The usage of the GST regime and the IT platform can also be gauged from the on-time filing of returns (i.e. by the due dates). Having recovered from pandemic related disruptions, compliance to tax return filing by taxpayers is now at its highest ever i.e. 76%. How good is this when evaluated against global benchmarks? An OECD Report of 2021 shows that the average VAT/GST compliance rate (on-time filing) is 86% in developed economies. It seems India has done well but needs to work harder to achieve the 86 % compliance rate mark. This is possible as India's IT platform is technically comparable to that of developed countries although more effort will be needed to educate taxpayers as well as further smoothen the process and remove bugs.

Of course, technology related issues like bugs and defects still exist. Although bugs have sharply declined as GSTN has stabilized and evolved, the system still needed 473 bugs/defects to be fixed in 2022. Although there is a need to reduce the number of bugs, the time taken to resolve specific technical issues, including complex ones, is now steady in the 3-4 day range. This is acceptable and it appears to have developed a good process routine.

The time taken to resolve taxpayer issues at the call centre is usually 22-24 hours (the issues are usually simpler and more routine than the above technical issues) This is perhaps an acceptable range but we found that it was prone to spikes. There is no pattern in the factors that cause the spikes; they include everything from call-centre staff attrition rates to changes in registration requirements or features introduced anew for taxpayer facilitation. We recommend that, given the likelihood that unforeseen issues will keep coming up, some redundancy and slack be built into the system so that the spikes can be smoothened.

GSTN introduced a chatbot, called GITA, for taxpayers, to add another channel of interaction as well as to introduce automated responses to frequent and simpler queries of users. The paper provides a sample of how GITA works. While GITA's accuracy has stabilised at 92%, we were curious to evaluate how new language capable chatbots like ChatGPT (AI and LLM trained chat engine) can help take the GST chat engine to new levels. We interacted with ChatGPT and have given examples of the responses that were actually received as well as the kind that are desirable. The tool still has some way to go, but its evolving language abilities will certainly make the automated responses more user friendly (especially when this can be done for Indian languages).

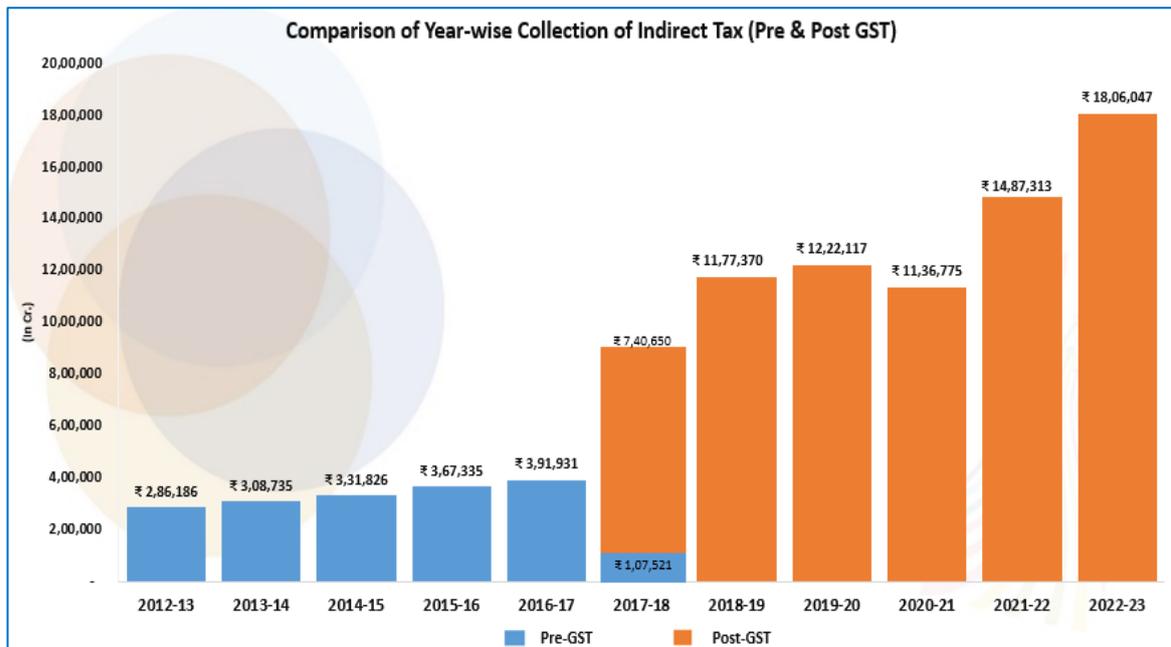
Fixing the GST Process: Five Years of Iterative Problem Solving

I. Introduction

India's indirect tax system was transformed in July 2017, when the central government, in partnership with the state governments, introduced the Goods and Services Tax (GST). It replaced a complex system of 17 indirect taxes previously levied by the central and state governments in order to create a unified taxation system that applied to the whole country. Effectively, this was a free trade agreement that India signed with itself, thereby creating a single national market. The GST is governed by the GST Council¹, which has representatives from the central and state governments.

GST regime has brought about greater efficiency, transparency, and cost savings across the supply chain for businesses. One of the primary objectives of GST was to boost the tax revenues. Data shows that the new system has increased tax collections. Figure 1 provides the annual indirect taxes recorded between 2012-13 to 2022-23. As shown in the figure, there has been a level shift in collections. Revenues of the last full year of the old indirect tax system (prior to GST) was Rs 3.91 lakh crores in 2016-17 (combining collections from all 17 legacy taxes). The GST system now collects more revenue in a quarter; and the annual collections for 2022-23 is a record 18.06 lakh crore. Even allowing for inflation, this is a major shift.

Figure 1: Annual collection of sales-type indirect taxes – pre-GST and post GST



Source: GST Council website: <https://gstcouncil.gov.in/gst-revenue>

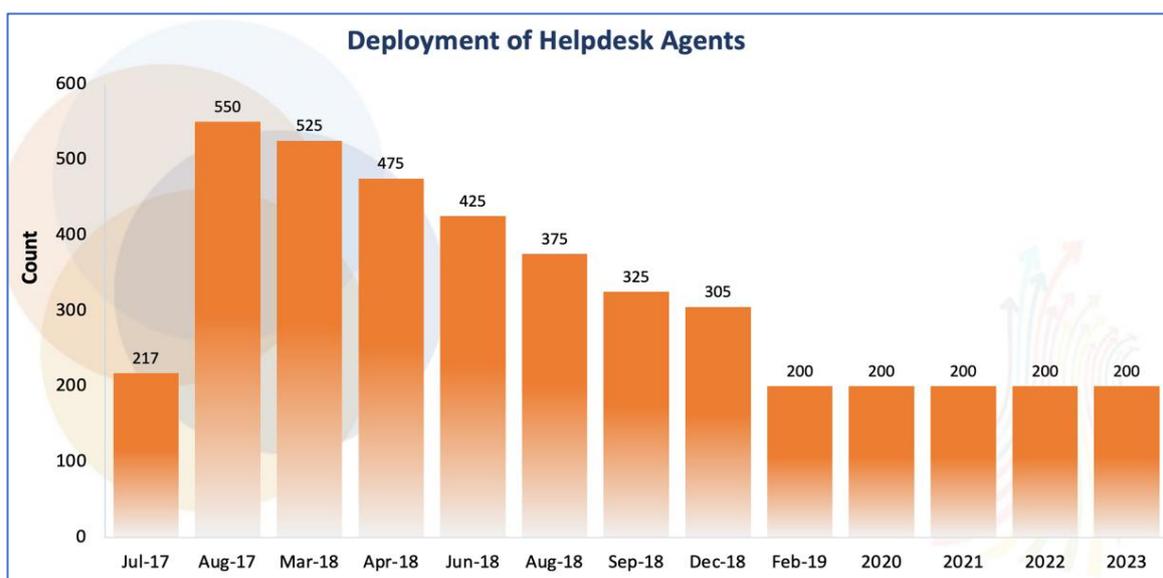
¹ Goods and Services Tax Council: <https://gstcouncil.gov.in/>

Much is being written about the fiscal and supply-chain implications of GST. This paper focuses on a different issue – the process-efficiency of the system and its ability to correct itself. Introduction of such a large-scale system naturally entailed large number of teething issues. This paper looks at how error and complaint redressal was tackled by the GST system over the last six years using constant monitoring and feedback loops. The paper, therefore, looks at data on the speed of grievance redressal and error correction, the application of technology and possible use of artificial intelligence to improve the system. This iterative process of improvement is the administrative version of the “Agile” framework commonly used in software development.

II. Grievance Redressal

It is now widely accepted that GST works well and has managed to fix most of the early glitches. What were the mechanics that allowed the system to improve itself over time? The idea of iterative improvement was part of the design of the system and therefore helpdesk was established right from the implementation to address grievances of the taxpayers. The helpdesk, located in Noida, at its peak had more than 550 agents to attend grievances and other system issues and now has around 200 agents (see figure 2). Users could call and sort out technical or process related issues and register complaints by providing supporting documents. One of the objectives of the administration has been to seek feedback from people doing business and taxpayers and respond to it constructively to carry out improvements. Taxpayers were also regularly asked for feedback in order to rate the services that were offered. Feedback was used to measure ‘customer satisfaction’. In this section we examine the mechanism provided to taxpayers to voice their challenges, the process of fixing these errors and complaints, and the evolving level of user satisfaction.

Figure 2: Agent deployment trend at the helpdesk

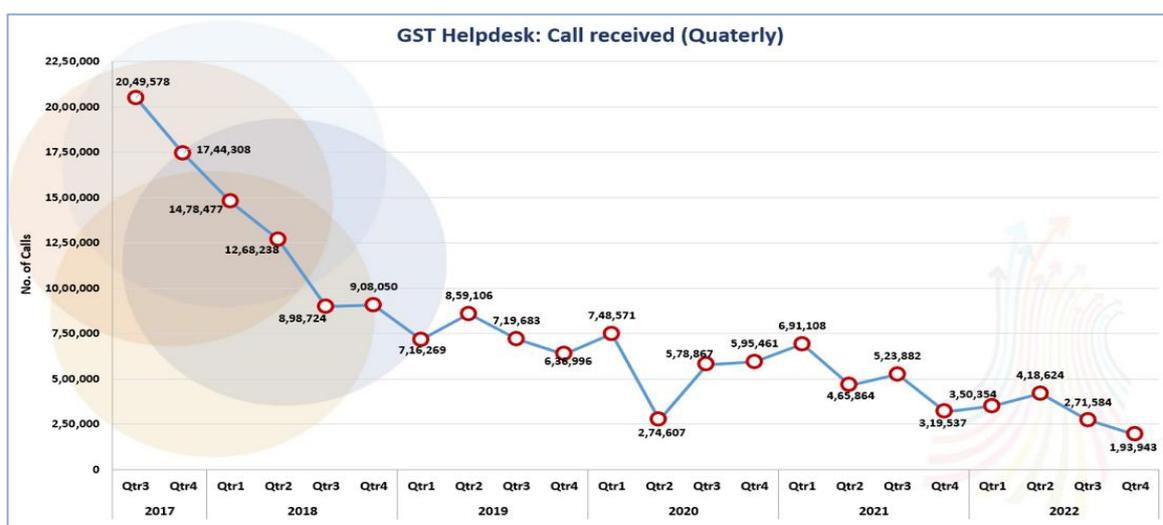


Source: Goods and Services Tax Network (GSTN)

II (A) Call volumes at GST call centre

An important parameter to gauge the customer's comfort level is number of calls that are received at the GST helpdesk for issues and challenges that are being faced by the taxpayers. Figure 3 shows the trend in the number of calls received by the helpdesk. In the initial months, it was not unusual to see call volumes of ~60,000 per day. Figure 3 shows the steady decrease in the volume of calls over time. Today, the number of calls has reduced to less than 10 % of what it was in 2017 (quarterly count of calls).

Figure 3: The quarterly count of calls received at the call-centre helpdesk



Source: Goods and Services Tax Network (GSTN)

On the day of launch – 01st of July 2017 – GST System had just 38.51 lakh users. This low count on the first day can be understood, as the taxpayers were still acquainting themselves with the new GST regime, the method of enrolling in it, the new IT system, etc, not to mention the associated technical difficulties. By August 2017, there were 66.52 lakh taxpayers on the GST system, 87.74 lakh by September, 93.12 lakh by October, 96.12 lakh by November. By June 2018 there were 1.12 crore taxpayers on the system. Calls in early days from users ranged from queries on how to use the new system, process of filing returns to how to calculate and where to populate the components of GST (CGST, SGST, IGST, cess, etc), B2B supplies, B2C supplies, tax-wise reporting etc. Today, the count of registered taxpayers stands at 1.37 crore on the system. This number of registered taxpayers also changes, marginally, with the business/economic cycle.

In order to handle such high number of taxpayers, additional helpdesk agents were introduced at the call centers (see figure 2). The training frequency of the call center agents was increased so that they could better comprehend the challenges being faced by the users and provide solutions in lesser times. As the new tax regime progressed, along with additional measures and efforts at stabilization of the GST information system the call volumes decreased steadily.

It was also endeavored to listen to the constructive feedback from the taxpayers and implement the changes in the IT system as well as the rules/regulations, as felt necessary. The introduction of technology aids e.g. the chatbot called GITA (acronym for GST Interactive Assistant) to assist and help tax payers also led to reduction in calls at the helpdesk (see Chapter III for discussion on GITA). Common queries were easily answered by GITA and obviated the need for calls. An additional facilitation was to add the support in 12 regional languages in order to cater to taxpayers calling from different regions of the country.

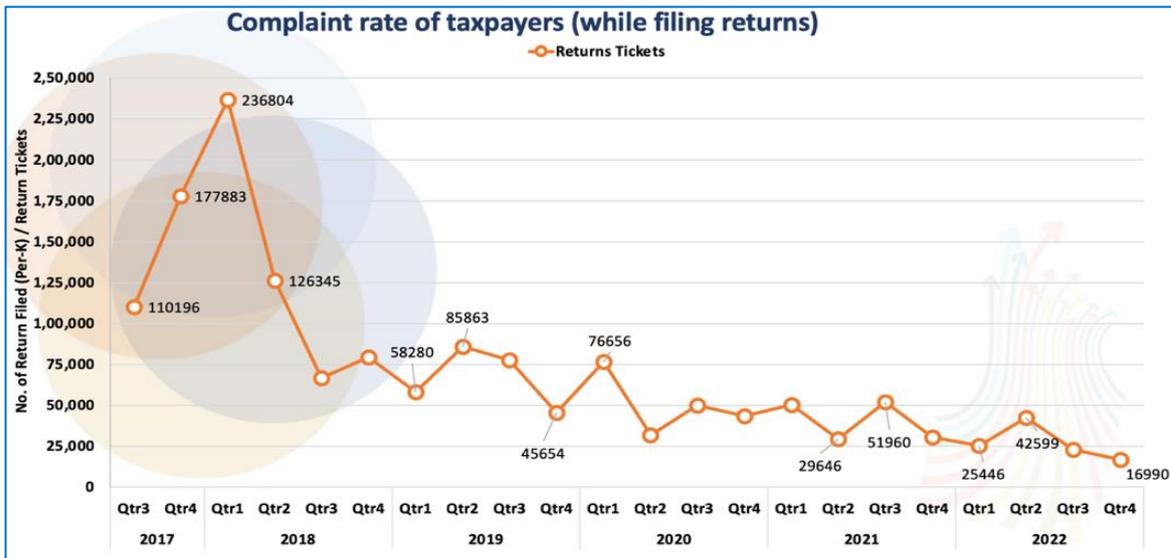
II (B) Complaint rate

Second key metric that can be used is the number of technical problems taxpayers reported to the helpdesk (via tickets), especially during filing returns. Filing of returns is a key compliance activity that is mandated by law. Figure 4 shows the number of problem tickets reported due to issues faced by taxpayers during filing of returns. At its peak, the number of technical reports of problems reported exceeded 2.36 lakh in a quarter. That was the time the GST system was in the initial months and there were issues with knowledge of the GST regime, the GST portal, the forms, the stability, volumes of users, etc.

As can be seen in figure 4, the complaint rate peaked in early 2018 and since then has declined to less than half the peak level. Nonetheless, there remains some variability and complaint rates go up from time to time. For example, after the steep fall in complaints in the second and third quarters of 2018, the rise in the last quarter was due to a system error where users were unable to file the tax return. The specific problem was fixed, but complaints rose again in 2019 due to ‘error in submission’ and mismatch in the calculation of the tax liabilities. The system then improved, but in early 2020 the annual returns were opened for submission for the first time and again the tax payers faced challenges in understanding its format and the submission process.

A new functionality of payment for the small taxpayers (composition taxpayers) via form CMP-08 was rolled out in 2021 and in August there were technical issues resulting in a rise in complaints in the third quarter of 2021. Another new functionality to ease tax calculation for taxpayers was made available viz. GSTR2B. This was very popular but due to some system slowness in April/May 2022 can be seen to have led to another peak of reported problems. Readers will appreciate how an evolving system has to be constantly monitored and actively managed.

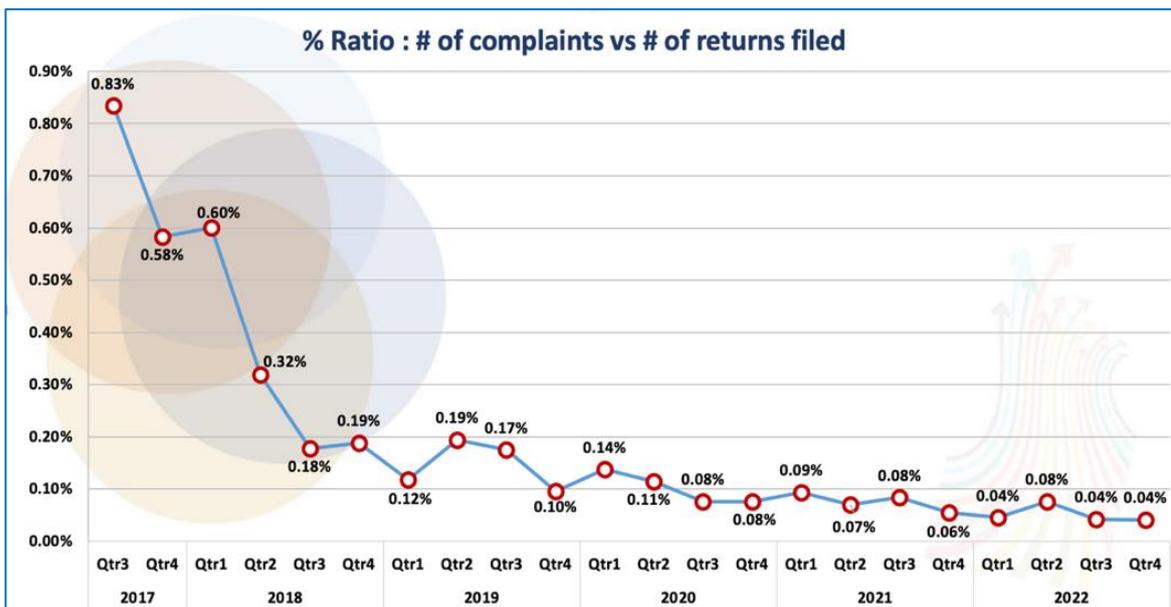
Figure 4: Quarterly count of complaints reported by taxpayers (while filing their returns)



Source: Goods and Services Tax Network (GSTN)

A useful metric that provides valuable insight is the number of the complaints as a proportion of the number of returns filed. This ratio provides a feel of the efficiency of the system as it has evolved over the years. This ratio was 0.83% in September 2017 which means that there were 83 problem tickets that were reported for every 10,000 returns filed by taxpayers. This ratio has now reduced to less than 0.04 % which means only 4 problem tickets are reported by taxpayers for every 10,000 returns filed. Figure 5 shows that the complaint ratio has stabilized at this level.

Figure 5: Number of complaints reported by tax payers as percentage of the number returns filed

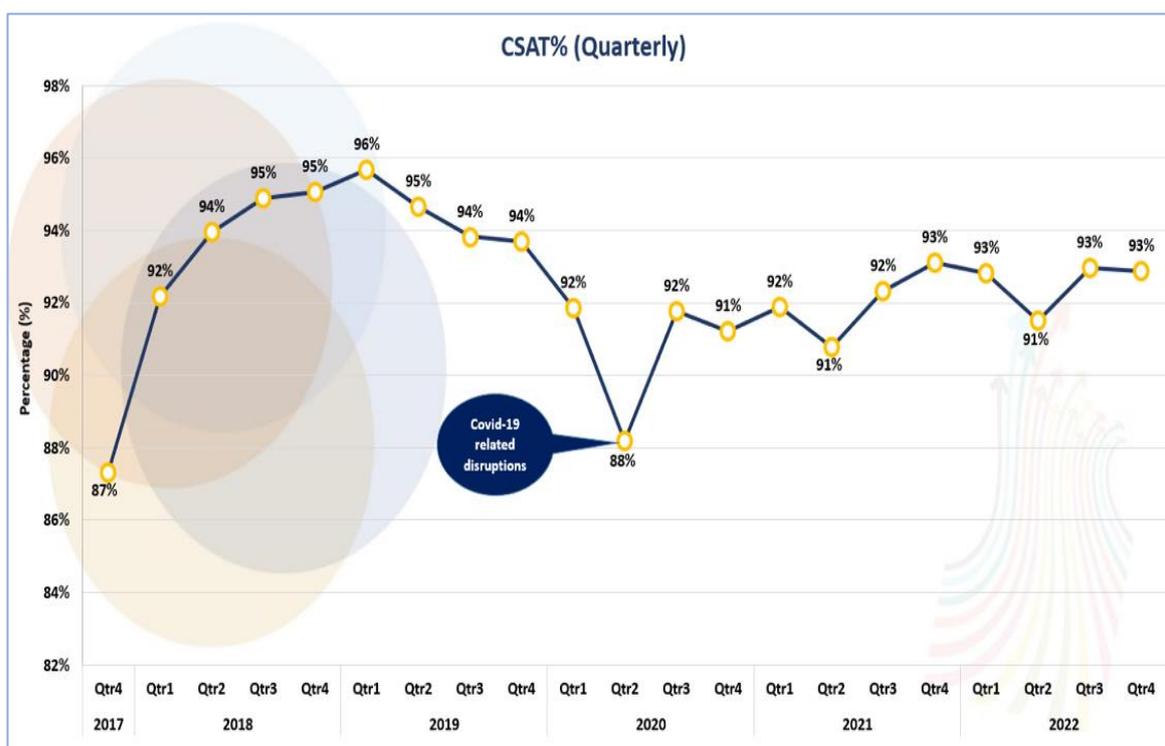


Source: Goods and Services Tax Network (GSTN)

II (C) Customer satisfaction report

Another useful parameter is that of customer satisfaction. Customer feedback is a constant input that is taken from taxpayers when they report a complaint. When a call is received at the help center and is resolved, the customer is asked to rate the quality of the interaction with the agent. Another method of feedback is through the email which is sent to the taxpayer when the issue is resolved. The taxpayer may rate his satisfaction on a scale of 1 to 5 (lowest to highest) which is recorded and documented. Over a period of last 6+ years, the customer satisfaction has been tracked and can be seen to be showing (see figure 6) a stabilization well above 90 % (except the dip during the COVID-19 pandemic presumably caused by lockdown and related disruptions). The addition of support in 12 languages for taxpayers at the helpdesk was also a factor that led to higher satisfaction rate amongst customers. Nonetheless, it is worth noting that it has levelled off at a rate that is below the pre-pandemic peak of 96%.

Figure 6: Customer satisfaction ratings

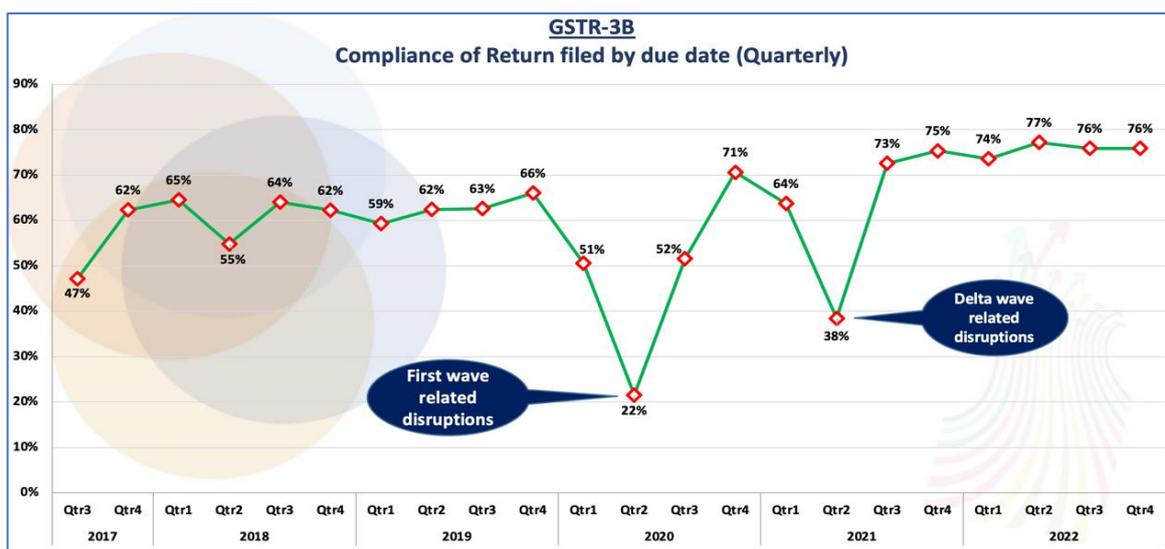


Source: Goods and Services Tax Network (GSTN)

II (D) Timely compliance behavior of taxpayers

In our assessment of systemic efficiency of the GST framework, it is also important to assess how compliance by taxpayers has trended i.e. whether they adhere to the timelines prescribed by the tax regime. In order to study this behavior of taxpayers, it is possible to assess it from the viewpoint of the on-time filing percentage i.e. taxpayers that adhere to the dates of filing of their returns for payments (the 3B return).

Figure 7: The trend of on-time filing compliance of tax payment returns (3B)



Source: GST portal: <https://www.gst.gov.in/download/gststatistics>

As can be seen in figure 7, timely compliance of tax payers shows a consistently upward trend, closing at nearly 76 % in December, demonstrating that over the years, the taxpayers too have become more compliant and adhere to the prescribed dates to file their returns and pay their taxes (the two dips correlate with the two waves of COVID-19 and the subsequent disruption it had on business and economy). Still, one in four taxpayer is still behind the cycle, and there needs to be some research into why this is the case. Is it the case that system would benefit from some specific simplification in the process or a “nudge”? Interestingly, a 2021 Report on tax administration by OECD² says that the average VAT/GST compliance rate in advanced economies (44 jurisdictions that provided the data) is ~86 %. It indicates that these on-time filing figures relate to better tax administration and better enforcement of compliance. It also suggests that other factors that influence compliance are the overall tax burden on businesses, level of trust in governments and its institutions as well as the availability of redressal mechanisms such as robust legal and administrative tools. However, it is important to note that compliance is also dependent on complexity of the tax law/regulations, incentives for compliance (vs penalties) and level of development of the economy.

Taking into considering these factors, the GST regime already shows an on-time filing compliance rate with a consistently rising trend. That also encourages us to aspire for the ~86 % score of the developed countries, showing a great scope for improvement. While we observe it stabilizing at 76%, given the systemic and institutionalized efforts at taking feedback, the responsiveness, we have potential to reach ~86%.

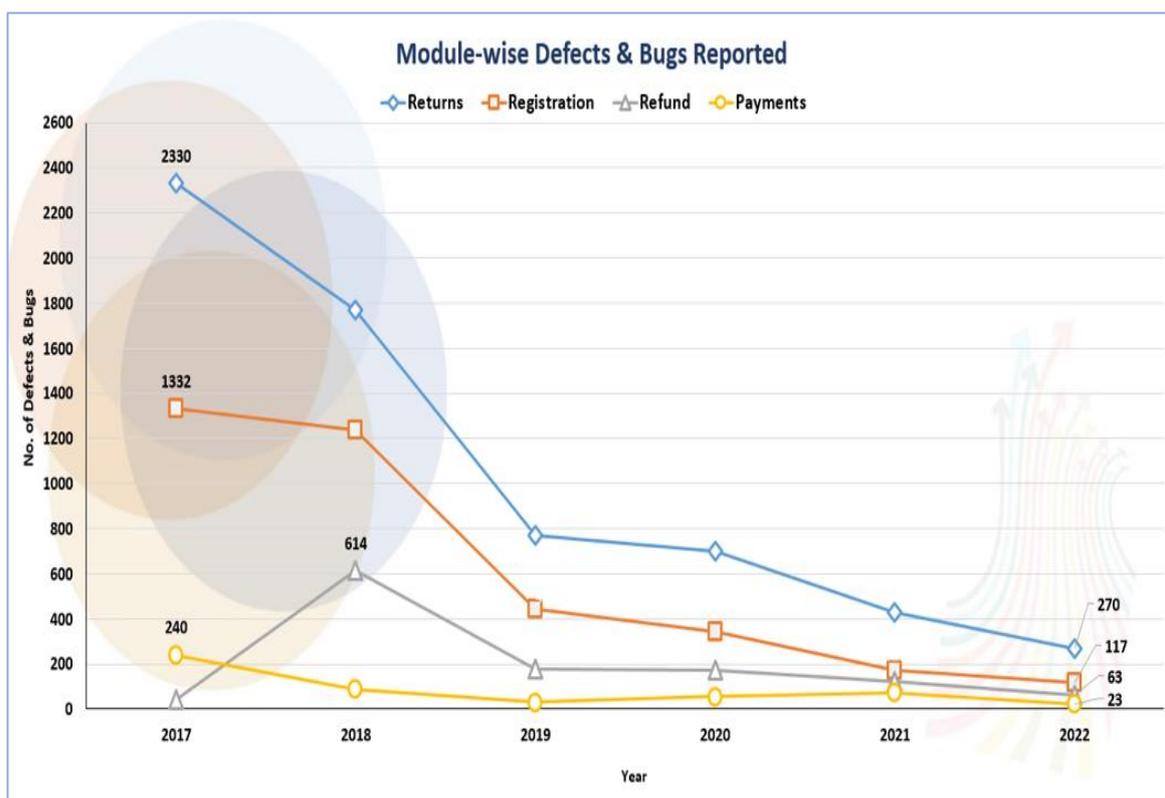
² Tax Administration 2021: Comparative Information on OECD and Other Advanced and Emerging Economies. OECD Publishing, Paris. The Report can be accessed here: https://www.oecd-ilibrary.org/taxation/tax-administration-2021_cef472b9-en.

III. Trends in the Application of Information Technology

III (A) Fixing technology bugs and defects

One way to measure the quality of the IT system can be the number of defects / bugs that find their way into the software code. We have considered the four most used and prominent modules, namely ‘returns’, ‘payment’, ‘registration’ and ‘refund’. As shown in figure 8, we have witnessed a significant decline in reported bugs and defects since 2017. Interestingly, the largest number of bugs were in the returns and registrations section, and these have sharply reduced. Nonetheless, given that the system has now been in use for several years, the overall system still threw up almost five hundred bugs in 2022. This is high and must be brought down.

Figure 8: The number of defects/bugs that were detected in the code of the GST software system



Source: Goods and Services Tax Network (GSTN)

III (B) Resolving complex technical issues

When issues are reported by the users, then the team at GSTN endeavors to rectify the problems at the earliest. The time that it takes to find a solution and provide that to the users could be in hours or days or weeks, as the case may be, depending on the complexity of the issue/problem. Figure 9 tracks the issues reported through direct calls to the helpdesk – these issues are typically solved in hours. Although there are spikes, the time usually runs in the 20-24 hours range.

Figure 9: Time taken (in hours) to resolve issues reported over tele-call by the call-center agents at the helpdesk

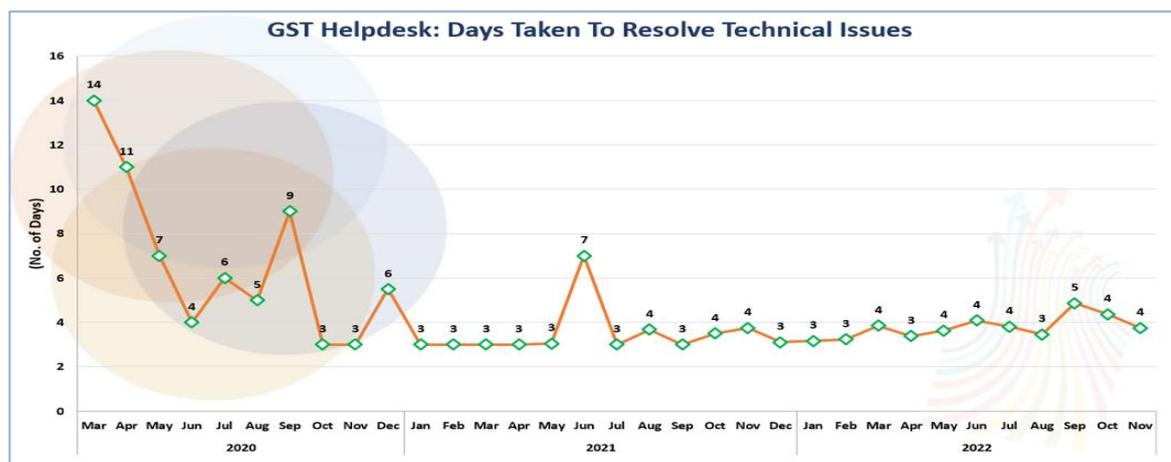


Source: Goods and Services Tax Network (GSTN)

The timings, whenever they spiked, were studied as to why it took longer than usual. It was found that these were due to various unique causes for each spike e.g. sudden volume spikes due to roll out of new features/functionality, or due to technical problems on the portal. Experience and attrition rates of call center agents also mattered (2021 being the ‘year of attrition’ globally). Some redundancy may need to be built into the system to buffer for the spikes.

The graph in figure 10 shows the time taken in days to resolve more technical issues by the development teams, since it would have needed some code to be re-written or to be fixed. The timings for technical fixing show a consistent trend of 3 to 5 days for resolution. It appears that a stable process cycle has evolved for software-fix dependent issues here.

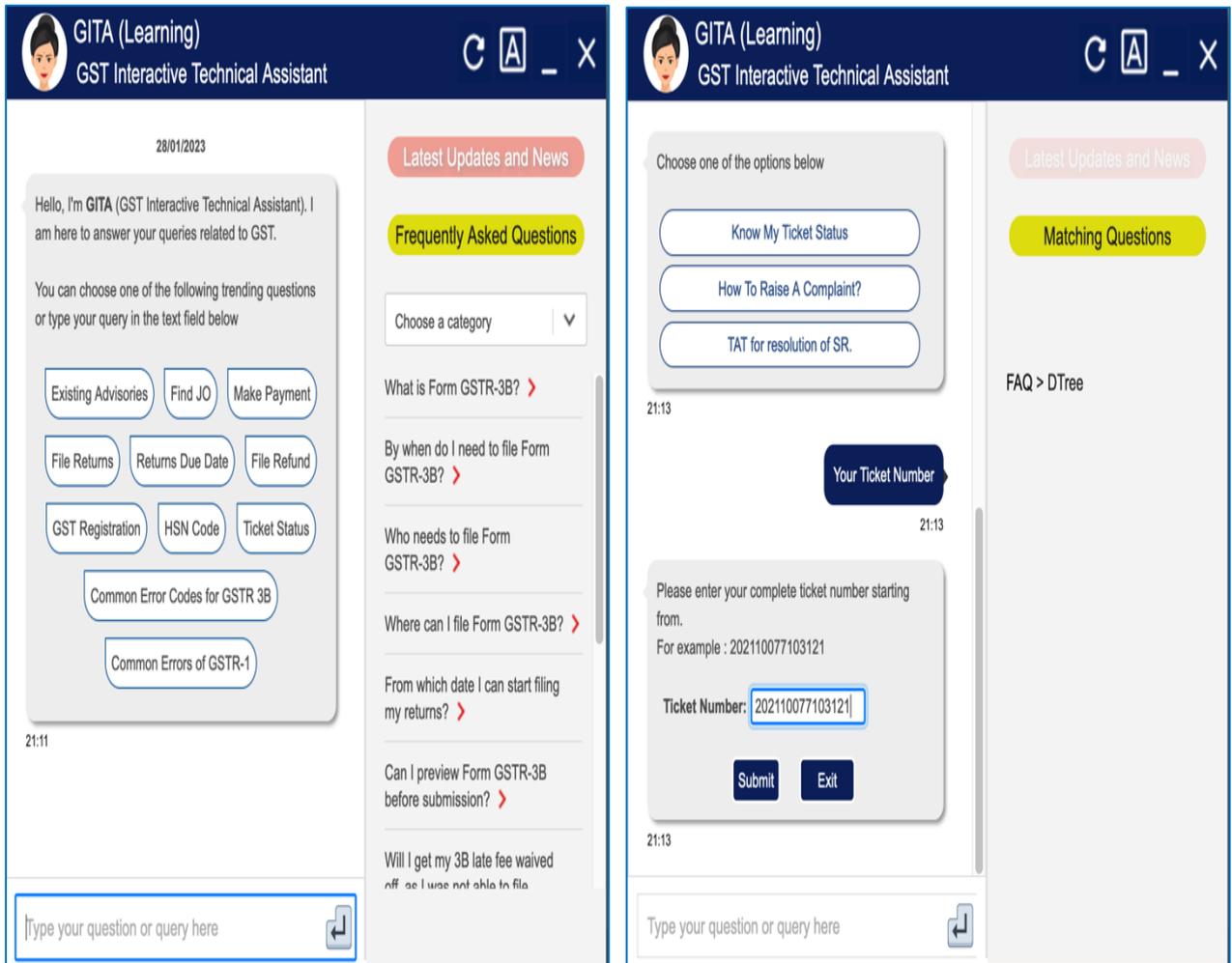
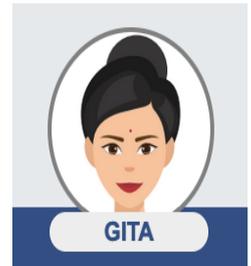
Figure 10: Number of days taken to resolve complex technical issues of taxpayers that needed development code writing/fixing



Source: Goods and Services Tax Network (GSTN)

III (C) GITA – the first generation chatbot

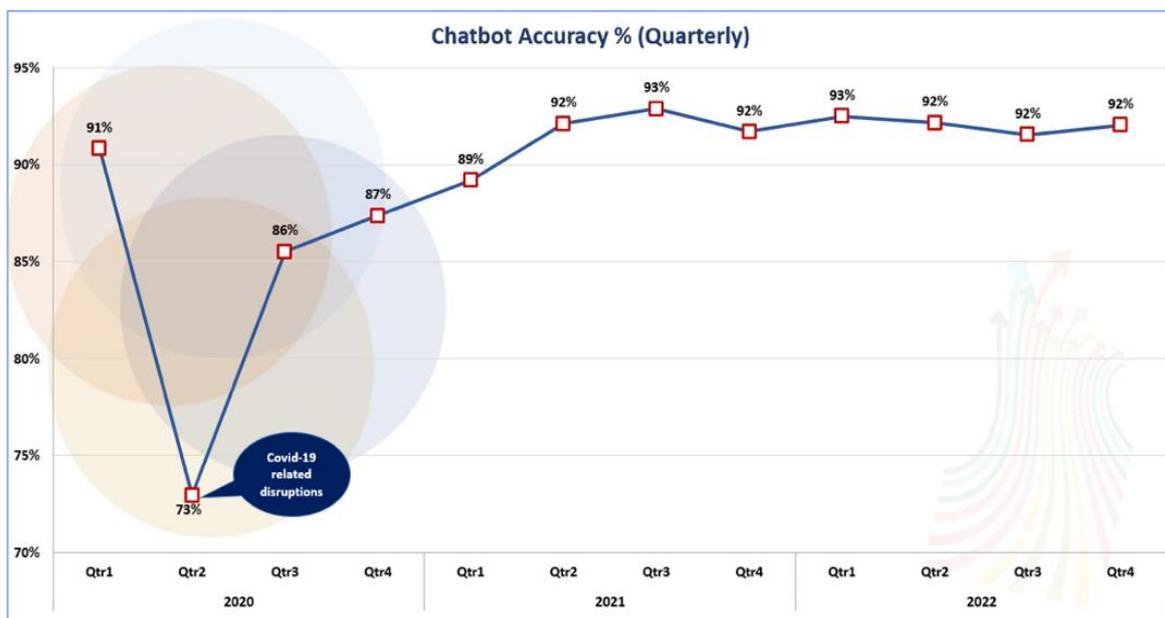
For providing technology-based assistance, a robotic automated ‘chatbot’ was provided on the GST helpdesk portal (Grievance Redressal Portal or GRP). It provides taxpayers with automated answers to common queries, status updates and even answers to FAQs. The chatbot also highlights top queries that are trending at that particular time.



A few examples of GITA chatting with taxpayers are shown below.

The GITA chatbot gained attention of the users immediately after introduction. Its accuracy improved over time, with usage – the more it was used, the more it improves. Figure 11 shows the usage trend of the chatbot by the taxpayers as well as the accuracy that has consistently improved over time, since inception. On the one hand the use of a chatbot resulted in better customer satisfaction and on the other hand it took away some of the pressures of common queries away from the call center. The chatbot did face problems during the first wave of COVID-19 as it was not designed to deal with an unpredictable, evolving situation. Nonetheless, it has improved as normalcy has been restored but it still finds it difficult to deal with around 8% of queries.

Figure 11: Chatbot accuracy, (from the inception of chatbot in Feb 2020) till Dec 2022



Source: Goods and Services Tax Network (GSTN)

Common questions answered by GITA

GITA was found to be most comfortable and successful in answering the following kinds of questions:

- Providing status of registration applications
- I have opted “Yes” for Aadhaar authentication while registering on the GST Portal and Aadhaar authentication is unsuccessful for e-KYC. From where can I resend the authentication link?
- New Registration - Till when is my GST number be active?
- What is the effect of blocking/unblocking on the transporters?

Questions un-answered by GITA

However, GITA failed to answer complex queries when the questions were not fully formed by the taxpayer e.g.:

- How to delete a draft
- Can I get a temporary GST number
- DRC 03 Pending for Verification with RSP
- Buyer not releasing the payment
- Who can furnish security in Form INS 04 BOND FOR RELEASE OF GOODS SEIZED on the GST Portal?

III (D) Upgrading GITA with language-capable artificial intelligence

GSTN introduced a ‘chatbot’ named GITA three years back which was an evolving technology at the time, and it has been a great success. With artificial intelligence (AI) having evolved, there is a new ‘generative pre-trained transformer’ – the disruptive avatar of chatbots with an AI engine under its bonnet, called *ChatGPT* (chat generative pre-trained transformer). Embedding this ‘*ChatGPT*’-type language capable software with the GST system can take our response quality and the spectrum of response to businesses to a new dimension. The *ChatGPT*-type softwares are built on top of language models and are trained on very large language datasets using AI and have been fine-tuned with NLP (natural language processing) based learning techniques.

ChatGPT has been available for trial by the public at large and will soon be available for integrating public systems through APIs (application program interfaces). If the GITA chatbot of GST is integrated with the language-capable *ChatGPT* through APIs it can potentially provide realistic and human-like responses to taxpayers. The datasets related to the issues and solutions of the GST system would be needed to enhance the learning of *ChatGPT* and in turn provide more accurate and human-like responses to queries of users.

In order to test the capability of *ChatGPT*’s increased language capability with customer support, we carried out a small training, followed by output for GST queries. In order to train it and bring it around to the subject of GST, a few initial queries were put to it, related to indirect tax system followed by VAT and GST. We then homed onto GST regime implementation in India and asked about how it has performed, followed by perception amongst taxpayers and businesses. This line of questioning was followed in order to ‘*prompt*’ a particular chain of thought (similar to how humans do as well) and provide it the opportunity to store these responses in its cache and also prepare it for finer responses to further queries. After building on this conversation, so to say, we then put two common questions related to the GST information system that are simple but very common at the helpdesk. The responses to the questions are placed below in two forms, viz. the first is the desired response from a taxpayer’s perspective and second is the actual response that we got from *ChatGPT*. It can be seen from these examples that the *ChatGPT* response, once integrated with the GST system (through APIs), has the potential to provide human-like responses, just akin to the desired response.

a. **Example 1:**

Taxpayer’s input: *“I am unable to file my GST payment return”.*

Ideal desired response by taxpayer: *“The payment return is GSTR 3B. The date of filing is 20th Feb for you. As of this moment, you may experience slowness due to high*

volumes at the GST system. The slowness is also since one of the modules has had a new release. You may retry after 9 minutes when the volumes shall reduce by 46 % and your return shall take just 95 seconds to file successfully.”

Actual ChatGPT response (as obtained from ChatGPT on 27 Feb 2023): “If the Ask GSTN chatbot of GSTN is integrated with ChatGPT APIs, the possible answer to the query "I am unable to file my GST payment return" could be:

"Sorry to hear that you are facing difficulties in filing your GST payment return. Can you please provide me with more information about the issue you are facing? Have you encountered any error messages or technical glitches while trying to file your return? Also, have you checked your GST payment history and verified that the payment has been successfully processed?"

Based on the information you provide, I can help you troubleshoot the issue and guide you through the process of filing your GST payment return. In the meantime, I would recommend that you check the GST portal for any updates or notifications related to the issue you are facing.”

The Ask GSTN chatbot could then follow up with more specific questions or prompts to gather additional information and provide a more customized solution to the user's query. By using ChatGPT's advanced NLP capabilities, the chatbot could potentially understand the user's query more accurately and provide more relevant and useful guidance.

b. Example 2.

Taxpayer's input: *“My tax calculation is showing Rs 3000/-. But I am unable to file as the system is showing an error.”*

Ideal desired response by taxpayer: *“You are attempting to file your tax return for the month of Feb 2023. Your tax due for this month is Rs 2785/- only and not Rs 3000/-. For the previous month of January 2023, you had an input tax credit, which has now been taken into consideration and hence your correct tax payment due is Rs 2785/- only. You may proceed with filing it successfully now.”*

Actual ChatGPT response (as obtained from ChatGPT on 27 Feb 2023): If the Ask GSTN chatbot of GSTN is integrated with ChatGPT APIs, the possible answer to the query "My tax calculation is showing Rupees 3000/-. But I am unable to file my return as the system is showing an error" could be:

"I'm sorry to hear that you're facing difficulties filing your return. It sounds like there might be an issue with the system preventing you from filing, and we want to help you get it resolved as soon as possible.

To assist you better, could you please provide me with more information about the error you are seeing? Specifically, what is the error message displayed on your screen? Knowing the specific error message will help us better understand the issue you are facing.

Once we have more information, we can help you troubleshoot the issue and provide you with guidance on how to file your return successfully. In the meantime, please ensure that all of your tax calculations are correct and that you have made the necessary payments. You can also check the GST portal for any updates or notifications related to the issue you are facing.

Please let us know the specific error message so that we can provide you with further assistance."

The Ask GSTN chatbot could then follow up with more specific questions or prompts to gather additional information and provide a more customized solution to the user's query. By using ChatGPT's advanced NLP capabilities, the chatbot could potentially understand the user's query more accurately and provide more relevant and useful guidance.

IV. Conclusion

Most of the research about India's GST system relates to revenue collections and the impact it has on internal trade. This paper, however, looked at the responsiveness of the GST system to feedback relating to technical errors, bugs and other problems. Research on process efficiency and reforms, as opposed to structural reforms, is sadly scarce in India and this paper hopes to provide an example of this line of enquiry.

We found that the performance of the GSTN system has improved steadily over time. It is felt that feedback loops have responded well with the readiness of the government and tax administration to pay attention to the inputs and suggestions of trade, industry and business, with a satisfaction score that is steady at 92-93% and a complaint ratio at 0.04%. Despite the disruptions caused by COVID-19 pandemic, the on-time filing rate of returns has stabilized at ~76 %, which may be good so far. Nonetheless, an effort is needed to achieve the 86% or higher, as seen in developed economies.

Technology related issues like bugs and defects still exist. Although bugs have sharply declined as GST System has stabilized and evolved, the system still needed 473 bugs/defects to be fixed in 2022. Although there is a need to reduce the number of bugs, the time taken to resolve specific technical issues, including complex ones, is now steady in the 3-4 day range. This is acceptable and it appears to have developed a good process routine.

The time taken to resolve taxpayer issues at the call centre is usually 22-24 hours as these issues are usually simpler and more routine than the above technical

issues). This is perhaps an acceptable range but we found that it was prone to spikes. There is no pattern in the factors that cause the spikes - they include everything from call-centre staff attrition rates to changes in registration requirements. We recommend that, given the likelihood that unforeseen issues will keep coming up, some redundancy and slack be built into the system so that the spikes can be smoothed.

While the accuracy of the GITA chatbot stands at a good 92 %, the paper has also looked at the application of language capable artificial intelligence that could sharply increase the accuracy of automated responses. We tested GITA as well as *ChatGPT*. The examples shown from *ChatGPT* and the discussions with the tech teams of chatbot suggest that the GITA can be given capabilities like *ChatGPT* through deep learning with advanced generative based conversational AI that does not use any predefined repository of responses. The model will need NLP (natural language processing), NLU (NL understanding), NLG (NL generation) and dialogue management (DM) which are the building blocks of conversational AI based chatbot engines. Once a conversational AI based chatbot is deployed, voice recognition can be added as a new channel of interaction for users, first in English and subsequently in Indian languages, once the language-capable tools are available.