TARK TANSAKU

ISSN : 3139-7700

VOLUME 1, ISSUE 2,
JUNE 2026

INTERNATIONAL
MULTIDISCIPLINARY
RESEARCH JOURNAL

ESTD. 2026



INTERNATIONAL JOURNAL

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ISSN : 3139-7700

TARK TANSAKU
ISSN: 3139-7700
Volume 1, Issue 2, June 2026

Impact Bonds: An Innovative Financing Mechanism for Social Development

Dilip Suthar
Assistant Professor
Department of Business Intelligence
BK School of Professional and Management Studies
Gujarat University

Abstract: Artificial Intelligence (AI) has emerged as one of the most transformative and rapidly expanding Even though SIB's usefulness, Social Impact Bond's adoption is still modest. The mismatch between widespread interest and actual application raises interesting questions as to whether we are still in the early adoption stage of SIBs and massive diffusion is yet to come, or we are observing a marginal phenomenon. To throw some light on this issue, the paper provides a review of the cases in which the SIB model has been already applied, exploring the specific configuration employed, with the purpose to identify regular configuration patterns and their deviation from a prototypical structure.

Keywords: Impact Bond, Finance, Social Cause, Development, Organization, Investors.

1. Introduction:

Impact Bonds are an innovative financial Investment approach. It utilizes private capital to fund government projects and public welfare projects. It is a new investment approach towards social problems. There are two types of Impact bonds i.e., social impact bonds and development impact bonds, both the impact bonds are result-based financings for public welfare which results in economic growth and helps transfer risk to investors. Both the impact bonds are similar, just difference comes from who ultimately pays for the outcome. In a social impact bond, the outcome funder/payer is the government, while in a development impact bond the outcome payer is a donor. Social impact bonds are also known as "Pay-for-Success" financing, Payment for Performance, Payment for Result regarding the delivery of public services. Pay for Success initiatives are different from the traditional approach because they are focused not simply on creating additional financial incentives for contractors to produce better outcomes, but more broadly on overcoming the wide set of barriers that are hindering the pace of social innovation. For sure, these obstacles include a lack of performance focus and outcome measurement, but they also include political constraints that prevent the government from investing in prevention, the inability of nonprofits to trail the capital needed to expand operations, and insufficient capacity to develop rapid and rigorous evidence about what works. In some of these new models, the amount of performance risk shifted from taxpayers to those on the hook for producing the outcomes is much greater than under traditional performance contracts, requiring the participation of socially-minded investors to make the projects feasible. Result-based SIBs are

focused on short-term goals and try to solve the social problems fully or partially. For that, every time different evaluation model is prepared. Certain parameters are prepared regarding social impact success to give the return to the investor, If those parameters are fulfilled then return is given otherwise not. e.g.If an impact bond is issued about drop-out of students, then Impact can be assessed through the decrease in drop-out ratio.

Background: First of all, the Impact bond was introduced in the world by the United Kingdom in the year 2010. The purpose of the Impact bond program in the United Kingdom was to reduce the rate of recidivism at Peterborough Prison in Cambridge. Then many impact bonds were issued in the world to fund the welfare projects. In India also some impact bonds were issued over a while. Impact bond in India was introduced in the year 2015 i.e. Educate girls development impact bonds. The purpose behind launching the development impact bond was to improve education for girls in Rajasthan, after that other development bonds were also issued in India and some are in process.

2. What is a Social Impact Bond?

SIBs are funding mechanisms that invest in social outcomes. They have three elements:

- Monetary investment (for example, £x million from local authorities, commercial investors, philanthropists, or foundations)
- A program of actions to improve the prospects of a group (for example support and mentoring service to those leaving prison with the aim to reduce re-offending)
- Commitments by national or local Government, or foundations, to make payments linked to improved social outcomes achieved by the group (for example, re-payment of the $x million original investment and an extra percentage agreed to return, sustained by reduced costs for the Ministry of Justice through reducing re-offending and numbers in prison).

Parties Involved: -

In the Impact bond agreement, there are five parties involved i.e. External Organization (Intermediary), Investors, Service Providers, Independent Assessor/Evaluator, Outcome Funder.

Role of The Parties: -

Service provider	Provide social service in the project e.g., NPO's or NGO's, Public sector service provider
Investors	Provide funds to service providers upfront or throughout the contract e.g., Individual, Trust, Foundation, Public sector entity, etc.
Intermediaries	Raise capital, manage the deal, receive outcome payments and pay investors e.g., government agency, Impact investment firm, etc.
Outcome Funder	Pay for outcomes, determine outcome metrics and repayment Parameters or conditions. e.g., Government agency, foundation, development agency
Evaluators	Assess outcomes of program e.g., independent evaluation firm, Research institution, university, government institution

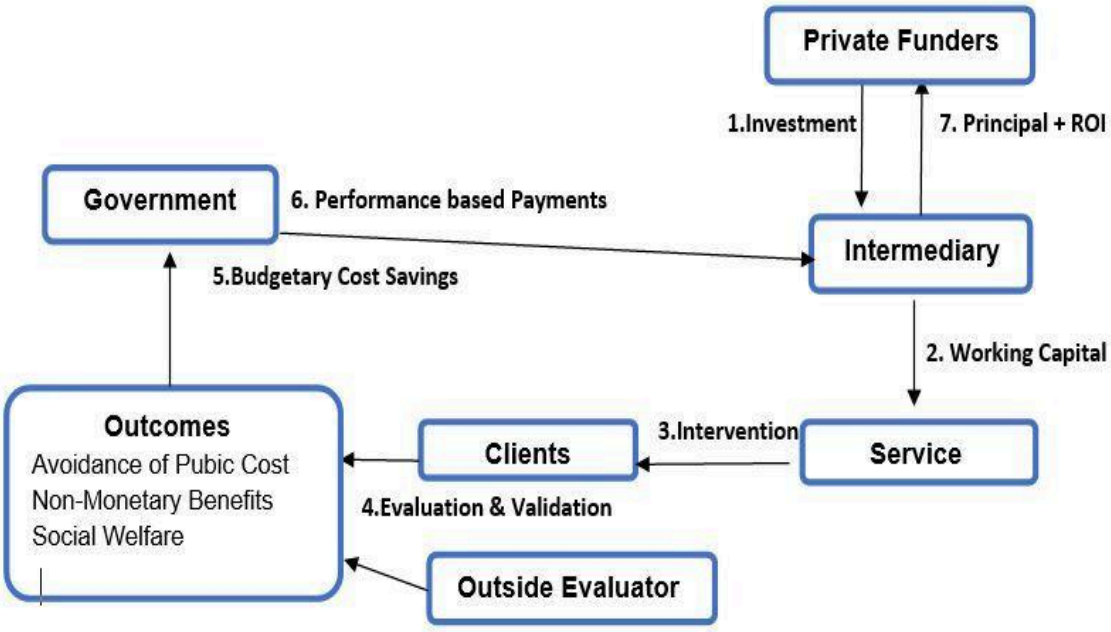
Motivation for Investors

- To test a new and innovative financial model for social services
- Ideal social image and publicity
- Both social and financial return
- Personal morals that focus on positive societal changes

Comparison with Traditional Approach

In traditional social projects, it includes a government agency collaborating or bonding with private NPO's or NGOs to perform the project on the focused group. The objective behind the project was to achieve the benefits, such as avoidance of public cost and other social benefits. If the project is successful, it results in the public-welfare. The modern Social Impact bonds, It is based on the payment for performance or outcome. In this kind of project, Private Investors are also made available by for-profit or social welfare interest and return is depends on the decided parameters achieved or not.

Procedure:



Advantages:

1. They are very prominent in cost-saving and transferring the risk to private investors.
2. It provides evidence-based service.
3. It is useful to transfer costs from the public to the private sector.
4. Impact bonds shift focus to results or performances
5. Impact bond foster novation in the delivery of social services
6. It leads to Performance management which results in the achievement
7. Support Experimental Interventions

3. Case Study: India Educate Girls Development Impact Bonds (2015-2018)

This presents the case analysis of the impact bond Project in India by identifying the parties involved and the benefits, hazards, and safeguards for each party.

Target Population	Children in 166 public schools in 140 villages in Bhilwara District
The target number of beneficiaries	15,000 children (9,000 of them girls)
Service provider	Educate Girls
Investors	The UBS Optimus Foundation (UBSOF)
Intermediaries	Instiglio (project manager, impact bond designer, performance management provider)
Outcome Funder	The Children's Investment Fund Foundation (CIFF)
Evaluators	IDinsight

3.1 Outcome Metrics:

- Enrollment outcomes (20% of outcome payment): number of girls on school rosters in grades 2-8 in the treatment group over 3 years;
- Learning outcomes (80% of outcome payment): Annual Status of Education Report (ASER) measures basic literacy in Hindi, basic literacy in English, and basic numeracy

3.2 Evaluation Method:

- **Enrollment:** A baseline of out-of-school girls was created through household surveys before the implementation of the program; IDinsight independently verifies the accuracy of the enrollment list by sampling a portion of the lists and conducting school and household visits to measure the percentage of out-of-school girls who are enrolled in school rosters after three years.
- **Learning:** IDinsight evaluates learning outcomes through a clustered randomized control trial. The students' learning progress was measured using the ASER assessment. A baseline test was administered at the start of the trial 3 periods to students in Grades 1-5 (the students that will receive the learning intervention in any given year during the lifetime of the project) randomly sampled from schools receiving the intervention and control schools. It measured students' starting grades on a scale of A to E for English and Math, and A+ to E for Hindi. The students are tested again at the end of every school year for three years. The evaluator will then calculate the aggregate learning gains in terms of the number of levels gained on the ASER scale by children in schools receiving Educate Girls' intervention as compared to children in control schools

3.3 Payment Schedule and Amounts:

- UBSOF disburses 50% of investment principal to Educate Girls in 2015 and 50% in 2016; CIFF will disburse one outcome payment of $0–$412,000 to UBSOF in 2018

3.4 Maximum Return:

- Target IRR = 10%, max IRR = 15%; UBSOF pays incentive to Educate Girls equal to 32% of its payment above principal.

3.5 Result:

- More than seven thousand students who studied in the Educate Girls programs gained 8,940 ASER learning levels — the annual survey that aims to provide reliable estimates of children's enrollment and basic learning levels for each district and state in India — more than those in the control village and 160 % of the target.
- The learning gains for students in the Educate Girls schools were 28 percent higher than the learning gains for students in the control schools. Year three gains accounted for more than 6,000 of the overall learning level gains, while years one and two hovered at about 1,400. That translates to students on average gaining 1.08 ASER (Annual Status of Education Report) levels more than those in the control group — a jump linked to, for example, moving from words to paragraphs.

4. Case Study: India (Rajasthan) Maternal and Newborn Health Dib

This presents the case analysis of the impact bond Project in India by identifying the parties involved and the benefits, hazards, and safeguards for each party.

The India (Rajasthan) Maternal and Newborn Health DIB aim to improve the quality of maternal and newborn health services provided through private facilities throughout Rajasthan. The impact bond structure is used to drive efficiencies and harness the novel commercial perspective of investors to improve performance in service delivery. The ultimate aim is to reach a tipping point so that all private facilities across Rajasthan will be incentivized to increase the quality of service delivery. Improved service delivery in private facilities, in tandem with the new Matritva certification process, will enable the government to confidently contract out services to the private sector and facilitate demand-side financing initiatives, leading to a raise in maternal and early newborn survival.

Target Population	Mothers and newborns across the state of Rajasthan
The target number of beneficiaries	At least 300,000 TARGET
Service provider	Hindustan Latex Family Planning Promotion Trust (HLFPPT) Population Services International (PSI)
Investors	80% UBS Optimus Foundation with 20% of the total investment capital being provided by the Implementation Partnership of Palladium, PSI and HLFPPT

Intermediaries	Palladium (Intermediary, design agency, performance manager)
Outcome Funder	USAID, Merck for Mothers, Government of Rajasthan planning to commission outcomes in Year 4 and 5
Evaluators	RFP for independent verification agency currently being evaluated
Technical assistance provider	Instiglio (Performance Management System design inputs), Skotkonung (Information System Development), Social Finance (Deal Advisory and Structuring inputs), Reed Smith (International Legal Counsel), Phoenix (Indian Legal Counsel), Rabin Martin (Strategic Advisory Services to Merck for Mothers).

4.1 Outcome Metrix

Full payment is readiness for JQS - > = 50% of the total points available in each NABH chapter (10 in total) AND 100% of at least 70% (11) of the applicable FOGSI standards (16 in total). Progressive metric (25% of full outcome payment ie $4,500) is >=30% of the total points available in each NABH chapter (10 in total) AND 100% of at least 40% (6) of any of the applicable FOGSI standards (16 in total)

4.2 Evaluation Method: Independent audit

4.3 Payment Threshold: $18,000 per facility that reaches agreed JQS level

4.4 Payment Schedule and Amounts: Six-monthly with $4,500 for each the facility at the progressive stage and the remainder of $13,500 for facilities that reach JQS during that period.

4.5 Maximum Potential Loss of Investment For Investors: No guarantee – payments are per facility ready for accreditation hence full loss is not possible but anything other than reaching the minimum target of 360 facilities at JQS level according to the agreed forecast during the three-year duration will result in losses for the investors.

4.6 Maximum Return: 8% annualized for UBSOF component with 15% return possible for the implementation partnership investment piece.

5. Case Study: Quality Education, India (2018-2022)

This presents the case analysis of the impact bond Project in India by identifying the parties involved and the benefits, hazards, and safeguards for each party.

Given low levels of learning in public primary schools in India, and not enough scalable models to deliver a good quality of learning, this DIB seeks to impact 200,000 marginalized children from 3 states in India. The DIB will finance the implementation of 4 different models in the field: (a) whole school management (b) remedial teaching for children who are behind their

grade level of learning (c) teacher training and (d) school leadership or principal training. Each of these has a diverse level of impact on student learning at a different cost per beneficiary. The end goals are broadly threefold: to improve the learning levels of these 200,000 children, to identify models which work in the field, learn lessons and promote their scale-up, and finally, look to bring the private sector and philanthropic money into development programs that focus on outcomes.

Target Population	Primary school students
The target number of beneficiaries	200,000
Service provider	Kaivalya Education Foundation; Educate Girls; Gyan Shala; Society for All Round Development (subject to final due diligence)
Investors	The UBS Optimus Foundation (UBSOF)
Intermediaries	TBC
Outcome Funder	British Asian Trust, Michael, and Susan Dell Foundation INVESTOR: UBS Optimus Foundation TECHNICAL ASSISTANCE PROVIDER: TBC
Evaluators	TBC

5.1 Outcome Metrix :

- Improvement in literacy and numeracy outcomes over four years.
- Enable primary school students to catch up between [1-2.5] grades over the four years to allow sustained learning outcomes at their grade-appropriate learning level.
- Set-based operational models and global benchmarking targets on effective education initiatives.

5.2 Evaluation Method: Validated administrative data

5.3 Payment Threshold: TBC

5.4 Payment Schedule and Amounts: Approx. 8% per annum on investment amount not to exceed $740,000 if outcome targets are met. Performance reviewed annually. Investors deploy an estimated $1.8 million in year 0, $400,000 in year 1, and $200,000 in year 2, for a total of $2.4 million over 4 years (capped at $3 million) if 100% outcome targets are achieved every year.

5.5 Maximum Potential Loss of Investment For Investors: Subject to Capital Protection sought by UBS Optimus Foundation

5.6 Maximum Return: Returns capped at $740,000 (7% IRR)

Evaluation Methods:

The methods of evaluation have fallen into different categories:

- Validated administrative data,
- Historical comparison,
- Quasi-experimental,
- Randomized controlled trials
- Quantitative benefit-cost analysis to map out transaction costs

6. Challenges, Suggestions, and Conclusion

6.1 Challenges:

1. The payment structure is complex
2. Financial costs of the projected deal and the hours required to make the deal together
3. Availability of measurable and monetizable results are a big challenge
4. Random evaluation method

6.2 Suggestions:

Impact Bonds as a form of CSR: Evaluators opened up to the opportunity that CSR funds are allowed to generate profit, then SIBs can build a bridge between the companies' business and their (sometimes burdensome) CSR activities. The isolation of CSR has equally been subject to criticism by the public just like no CSR activities at all. SIBs can detain the drifting apart of these two spheres by changing the mindset about the role of CSR within the firm. Pilot Project The Haryana Early Literacy DIB is piloting a new method of utilizing CSR funds for outcomes payment in India. The project enables CSR entities to pay for outcomes, instead of inputs and activities.

To achieve Sustainable Development Goals: Impact bonds are a notable way of bringing private capital to accelerate our journey towards SDGs.

6.3 Conclusion:

Nonprofit organizations and governments are often criticized for their lack of innovative efforts and preventative approaches in targeting social problems. Resource and capability constraints are partly to be blamed for the reluctance to invest public money in risky interventions for complicated and contentious social issues. As discussed earlier, social impact bonds enable nonprofit organizations and governments to attract alternative resource providers and to shift the financial risk in social intervention programs. However, the potential winners in social impact bond program initiatives include several parties as well. By conducting a case analysis of the SIF Project, this study highlighted the multiple parties involved, their potential benefits, costs, hazards, and safeguards. Our study suggests that Impact bonds can change the funding scenario in health welfare and Poverty issue-related projects.

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TARK TANSAKU
ISSN: 3139-7700
Volume 1, Issue 2, June 2026

Cyber Crime and Cyber Security: Challenges, Threats, and Preventive Measures with Case Studies

Bhavesh A. Prabhakar
Assistant Professor
Shree Parekh Science, Arts and Commerce College, Mahuva

Abstract: In the digital era, the rapid advancement of technology has transformed human life by enabling seamless communication, online transactions, and global connectivity. However, this transformation has also led to the emergence of cyber crime, posing serious threats to individuals, organizations, and governments. This research paper explores the concept, types, and impact of cyber crime, along with the significance of cyber security measures. It further examines real-world cyber attack case studies such as WannaCry, Equifax, SolarWinds, Yahoo, Colonial Pipeline, and Target breaches. The study highlights the need for robust security frameworks, proactive monitoring, and awareness to mitigate cyber threats effectively.

Keywords: Cyber Crime, Cyber Security, Data Breach, Malware, Phishing, Ransomware, Information Security

1. Introduction

The rapid advancement of information and communication technologies has fundamentally transformed the way individuals, businesses, governments, and institutions communicate, transact, store information, and deliver services. The widespread adoption of the Internet, smartphones, cloud computing, digital banking, electronic commerce, social media, artificial intelligence, Internet of Things (IoT) devices, and other digital technologies has created an increasingly interconnected digital ecosystem. Digitalization has enhanced operational efficiency, reduced transaction costs, expanded access to information, and enabled organizations to provide services across geographical boundaries. However, the growing dependence on digital infrastructure has simultaneously increased exposure to cyber threats. As more personal, financial, commercial, and governmental activities move into cyberspace, digital systems have become attractive targets for individuals, organized criminal groups, hacktivists, and state-sponsored actors.

Cyber crime has consequently emerged as a significant challenge accompanying the expansion of the digital economy. Unlike conventional crimes, cyber crimes can be committed remotely,

rapidly, anonymously, and across national boundaries. An attacker located in one country may compromise a system situated in another country, obtain information belonging to individuals in several jurisdictions, and use infrastructure distributed across multiple locations. This borderless nature makes cyber crime particularly complex from the perspectives of detection, investigation, attribution, evidence collection, prosecution, and international cooperation. Moreover, the increasing availability of sophisticated tools and cyber-criminal services has lowered some of the technical barriers to conducting attacks, allowing relatively less-skilled offenders to participate in activities such as phishing, credential theft, malware distribution, ransomware, and online financial fraud.

The nature of cyber crime has also changed considerably over time. Earlier forms of cyber offences were often associated with unauthorized access, computer viruses, website defacement, or relatively isolated attacks. Contemporary cyber threats, however, are increasingly organized, automated, targeted, and financially motivated. Ransomware can simultaneously disrupt organizational operations and threaten to publish stolen information; phishing can be combined with credential theft and account takeover; and software supply-chain attacks can exploit trusted relationships to compromise multiple organizations simultaneously. The European Union Agency for Cybersecurity (ENISA, 2025) identifies ransomware, information theft, vulnerability exploitation, supply-chain compromise, cyber espionage, and other forms of malicious activity as important components of the contemporary cyber-threat environment. The growing use of artificial intelligence further adds complexity because the technology can potentially strengthen defensive capabilities while also enabling attackers to automate reconnaissance, personalize social-engineering campaigns, and produce increasingly convincing deceptive content.

The consequences of cyber crime extend far beyond the immediate loss of data or disruption of a computer system. At the individual level, cyber attacks may result in identity theft, financial losses, privacy violations, account compromise, online harassment, and psychological distress. At the organizational level, cyber incidents can interrupt business operations, expose confidential information, compromise intellectual property, generate legal and regulatory liabilities, and damage corporate reputation. At the national level, attacks against critical infrastructure, government systems, financial institutions, healthcare organizations, telecommunications networks, and energy systems may create broader economic and social consequences. The WannaCry ransomware attack, for example, demonstrated how exploitation of a software vulnerability could cause widespread disruption, including significant operational consequences for healthcare services. Similarly, the Colonial Pipeline incident demonstrated how a cyber attack against digital infrastructure can have consequences for physical supply chains and essential services. These cases illustrate that cybersecurity has become closely connected with business continuity, economic security, public safety, and national resilience.

The increasing scale and complexity of cyber threats have consequently made cyber security an essential component of modern organizational and national risk management. Cyber security

broadly refers to the policies, processes, technologies, controls, and practices adopted to protect information systems, networks, applications, devices, and data against unauthorized access, disruption, alteration, destruction, and misuse. Traditionally, information security has emphasized the protection of confidentiality, integrity, and availability of information. However, contemporary cybersecurity requires a broader perspective incorporating identity and access management, privacy, threat intelligence, vulnerability management, supply-chain security, incident response, business continuity, and organizational governance. The National Institute of Standards and Technology (NIST, 2024), through the Cybersecurity Framework (CSF) 2.0, conceptualizes cybersecurity through six interconnected functions: Govern, Identify, Protect, Detect, Respond, and Recover. This approach emphasizes that cybersecurity is not simply a technical activity but an ongoing process of identifying and managing risks across the organization.

An important characteristic of the contemporary cybersecurity environment is that organizations cannot assume that preventive controls will completely eliminate the possibility of successful cyber attacks. Even organizations with significant financial resources, advanced technological infrastructure, and dedicated cybersecurity teams have experienced major breaches. The Equifax breach, for instance, demonstrated the consequences of inadequate vulnerability and patch management, while the SolarWinds incident highlighted the risks associated with software supply chains and trusted technology providers. The Target breach demonstrated how third-party relationships and compromised credentials can provide attackers with access to an organization's internal environment. These incidents indicate that cybersecurity failures are frequently the result of interactions between technological vulnerabilities, human behaviour, organizational processes, governance weaknesses, and interconnected digital dependencies.

Human behaviour represents another critical dimension of cyber security. Employees and individual users may unintentionally become entry points for attackers by using weak or reused passwords, clicking malicious links, downloading unsafe files, sharing confidential information, or failing to verify unusual requests. Social engineering attacks are particularly significant because they exploit human psychology rather than relying exclusively on technical vulnerabilities. Therefore, cybersecurity awareness, employee education, secure authentication practices, and organizational security culture are increasingly important components of cyber-risk management. Technical controls such as firewalls, antivirus software, encryption, intrusion detection systems, and endpoint security must consequently be complemented by appropriate administrative and behavioural controls.

The problem is further complicated by the growing interdependence among organizations. Contemporary businesses rarely operate in isolation. They depend on cloud-service providers, software vendors, payment processors, logistics partners, consultants, managed service providers, application developers, and other third parties. Consequently, an organization's cybersecurity posture may be influenced by vulnerabilities outside its direct administrative

control. The SolarWinds incident illustrates the systemic implications of such relationships, where compromise of a software provider's development or distribution process created an avenue through which malicious code could reach downstream customers. This highlights the need to extend cybersecurity risk assessment beyond organizational boundaries and incorporate supply-chain and third-party risk management.

In this context, cyber security should increasingly be understood in terms of cyber resilience rather than prevention alone. Cyber resilience refers to an organization's ability to anticipate, withstand, detect, respond to, recover from, and adapt to cyber-related disruptions. A resilient organization recognizes that cyber threats cannot be eliminated entirely and therefore develops layered controls capable of limiting the probability and impact of successful attacks. Such an approach requires continuous monitoring, timely vulnerability remediation, multi-factor authentication, data encryption, network segmentation, secure backups, employee awareness, incident-response planning, threat intelligence, vendor-risk management, and periodic security assessment. The objective is not merely to prevent an attack but also to minimize damage and restore critical operations as rapidly as possible when an incident occurs.

Against this background, the present research article examines cyber crime and cyber security with particular emphasis on contemporary challenges, emerging threats, preventive measures, and lessons derived from major real-world cyber attacks. The study considers cyber crime as a multidimensional phenomenon involving technological, human, organizational, financial, and regulatory dimensions. It examines major forms of cyber crime, identifies important vulnerabilities and cybersecurity challenges, and discusses preventive measures applicable at individual, organizational, and institutional levels. In addition, selected case studies—including WannaCry, Equifax, SolarWinds, Yahoo, Colonial Pipeline, and Target—are examined to understand how cyber attacks originate, how vulnerabilities are exploited, what consequences emerge, and what lessons can be derived for improving cybersecurity practices.

The significance of the study lies in its attempt to connect the conceptual understanding of cyber crime with practical evidence from major cyber incidents. Rather than considering cyber security solely as a technical issue, the study approaches it as an integrated risk-management and governance challenge. The findings from the case studies are expected to demonstrate the importance of timely patch management, strong authentication, employee awareness, network segmentation, third-party risk management, continuous monitoring, incident-response preparedness, secure backups, and organizational accountability. The study ultimately argues that building a secure digital environment requires a coordinated approach involving individuals, businesses, technology providers, governments, law-enforcement agencies, and international institutions. In an increasingly digital economy, effective cybersecurity is not merely a mechanism for protecting computers and data; it is an essential foundation for protecting privacy, financial stability, organizational continuity, public trust, critical infrastructure, and the broader digital economy.

2. Literature Review

The literature on cyber crime and cyber security demonstrates that the rapid expansion of digital technologies has created significant opportunities for economic and social development while simultaneously generating new forms of criminal activity and security vulnerabilities. Cyber crime has gradually evolved from relatively simple forms of unauthorized computer access into a complex phenomenon involving hacking, malware, identity theft, financial fraud, ransomware, cyberstalking, data breaches, social engineering, cyber espionage, attacks on critical infrastructure, and technologically facilitated organized crime. Brenner and Clarke (2004) examined cybercrime prevention from the perspective of distributed security and argued that preventing cybercrime requires security responsibilities to be distributed across different actors rather than relying exclusively on post-crime investigation. Hartel et al. (2010) further conceptualized cyber-crime science as an intersection between crime science and information security, highlighting that technological vulnerabilities and criminological factors need to be considered together. Choo (2011) subsequently examined the changing cyber-threat landscape and emphasized that cybercrime continuously evolves alongside technological development, thereby requiring continuous adaptation of preventive and security mechanisms. Oreku and Mtenzi (2016) similarly identified cybercrime as a growing concern associated with the increasing use of information and communication technologies and emphasized the challenges involved in controlling criminal activities within increasingly interconnected digital environments. These early contributions established the foundation for understanding cybercrime not merely as a technical problem but as a multidimensional social, organizational, economic, and security issue.

As digital technologies became increasingly integrated into organizational and individual activities, researchers began to focus more extensively on emerging cybersecurity vulnerabilities and the changing nature of cyber attacks. Reddy and Reddy (2014) examined cybersecurity challenges associated with emerging technologies and highlighted the increasing vulnerability of modern digital environments. Neghina and Scarlat (2013) similarly emphasized that changing cybercrime trends create difficulties for traditional information-technology security practices and require organizations to continuously adapt their security mechanisms. Goyal and Goyal (2017) examined cybercrime from a societal perspective and discussed security issues, prevention, challenges, and social consequences, thereby demonstrating that cybercrime extends beyond technological systems and affects individuals and society more broadly. Verma and Misra (2017) also examined cybercrime threats, issues, challenges, and control measures, emphasizing the need for appropriate preventive and corrective mechanisms. Veresha (2018) focused specifically on preventive measures against computer-related crimes from an individual perspective, demonstrating that individual users constitute an important component of cybersecurity because unsafe digital behaviour can create opportunities for cybercriminals.

The literature further demonstrates that the effectiveness of cybersecurity is strongly influenced by the human factor. Mamade and Dabala (2021) investigated the relationship between cybersecurity awareness, protective measures, and victimization among academic staff and highlighted the importance of cybersecurity awareness in reducing exposure to cyber threats. Al-Alawi et al. (2020) examined cybercrime prevention in higher-learning institutions and emphasized the importance of security technologies and awareness in protecting educational institutions. Tarrad et al. (2022) similarly examined cybercrime challenges in academia and emphasized the importance of digital awareness in preventing cybercrime. Karagiannopoulos et al. (2021), through a study of cybercrime awareness and victimization among older individuals, demonstrated that different population groups may possess different levels of awareness and vulnerability. These studies collectively indicate that technological security mechanisms alone cannot provide complete protection because human behaviour, awareness, digital literacy, and individual security practices significantly influence cyber risk. More recently, Masmoudi (2025) examined the human factor in cybercrime and cybersecurity by considering motivations, behaviours, vulnerabilities, mitigation strategies, and research methods, reinforcing the growing recognition that human behaviour represents both a potential vulnerability and an important component of cybersecurity prevention.

The increasing digitization of financial services has made the banking and financial sector a particularly important area of cybersecurity research. Lagazio et al. (2014) examined the impact of cybercrime on the financial sector using a multilevel perspective and demonstrated that the consequences of cybercrime extend beyond direct financial losses to include operational, reputational, and institutional consequences. Akinbowale et al. (2020) examined the effects of cybercrime on the banking sector through a balanced-scorecard perspective and emphasized the importance of precautionary measures in online banking. Amer and Al-Omar (2023) further examined cybersecurity in the Jordanian banking sector and emphasized its role in preventing and mitigating electronic crimes. Al-Surkhi and Maqableh (2024) investigated the relationship between cybercrime and Internet-banking adoption and demonstrated that cybercrime can influence users' perceptions of security and their willingness to adopt digital banking services. These studies suggest that cybersecurity is not only a technological requirement for financial institutions but also an important determinant of customer confidence, digital adoption, institutional reputation, and financial-sector stability.

Similar concerns have emerged in the field of e-commerce and digital business. Fianyi (2016) examined cybercrime prevention and e-commerce security from the perspective of digital forensics and highlighted the importance of protecting online commercial activities from cyber threats. Smith et al. (2011) examined case studies of cybercrime and its effects on marketing activity and shareholder value, demonstrating that the consequences of cybercrime may extend beyond immediate technical or financial losses to influence organizational reputation, market performance, and stakeholder confidence. Mostafa (2022) examined cybercrime in business and emphasized the growing importance of cybersecurity as an organizational concern. The literature

therefore indicates that organizations operating in digital environments must consider cybersecurity as part of broader business-risk management rather than treating it as a narrowly technical responsibility.

The expansion of mobile technologies has further broadened the cybersecurity landscape. Srivastava et al. (2019) examined smartphone-triggered security challenges and identified various threats, cases, and prevention mechanisms. The increasing dependence on smartphones for communication, banking, authentication, shopping, and information sharing has created additional opportunities for cybercriminals. Consequently, cybersecurity has expanded from protecting organizational networks and computers to protecting mobile devices and individual digital identities. This development reinforces the earlier argument that cybercrime prevention requires a combination of technological safeguards and responsible user behaviour.

The literature also demonstrates that cybersecurity risks can increase substantially during periods of rapid technological or social transformation. Lallie et al. (2021) examined cybercrime and cyber attacks during the COVID-19 pandemic and demonstrated how rapid digital transformation and increased dependence on online systems created additional cybersecurity vulnerabilities. The shift toward remote working, digital communication, online transactions, and internet-based services expanded the attack surface available to cybercriminals. This finding is important because it demonstrates that cybersecurity risk is not constant; rather, it can increase during periods in which organizations and individuals rapidly adopt new technologies without sufficient time to develop corresponding security practices.

Beyond individuals and businesses, cybercrime has increasingly been recognized as an issue of national security and critical infrastructure protection. White (2016) examined cyber threats from the perspective of national security, policy, and strategy and demonstrated the transition of cybersecurity from an organizational IT concern to a broader national-security issue. Kshetri and Alcantara (2015) examined cyber threats from a cross-cultural perspective and highlighted the importance of considering cultural and institutional differences when understanding cybersecurity challenges. Jayakumar (2020) examined cyber attacks by terrorists and other malicious actors using cases from Estonia, Singapore, and the United States, emphasizing the importance of national preparedness and prevention. Yeboah-ofori et al. (2018) examined cybercrime risks associated with cyber-physical systems and highlighted the challenges created when digital systems become connected with physical infrastructure. Adisa (2023) similarly examined the relationship between cybercrime, cybersecurity, and national security, reinforcing the argument that cyber threats can have consequences extending beyond individual victims and organizations.

Another important dimension of the literature concerns the legal and institutional challenges associated with cybercrime. Porcedda (2012) examined data protection and cybercrime prevention and highlighted the tension between cybersecurity requirements and privacy

protection. The issue is particularly significant because effective cybersecurity may require monitoring, information sharing, and surveillance, while excessive monitoring can create concerns regarding individual privacy and data protection. Anwary (2023) examined legal frameworks for cybercrime in Indonesian public administration and demonstrated the importance of interdisciplinary approaches to cybercrime regulation. Erikha and Saptomo (2024) similarly examined the dilemma of legal policy in addressing cybercrime in the digital era, highlighting the difficulty of ensuring that legal frameworks keep pace with technological developments. Gupta and Lunia (2024) emphasized the challenges associated with cybercrime prosecution and prevention and identified public awareness, business awareness, and training of law-enforcement agencies and judicial institutions as important requirements for effective cybercrime control.

The increasing sophistication of cyber attacks has also increased the importance of cyber intelligence, incident response, and digital forensics. Tsakalidis et al. (2019) proposed a cybercrime incident architecture incorporating adaptive response policies, emphasizing that cybersecurity responses must be capable of adapting to different types of cyber incidents. Skopik (2017) emphasized collaborative cyber-threat intelligence as a mechanism for detecting and responding to advanced cyber attacks, particularly at the national level. Matsaung and Masiloane (2025) examined the role of cyber intelligence in policing cybercrime and highlighted the challenges faced by law-enforcement personnel. Shami et al. (2025) examined cybercrime and digital evidence and emphasized the challenges associated with investigating cybercrime and handling digital evidence. Surakanti et al. (2025) further examined anti-forensic tactics used in cybercrime investigations and demonstrated how offenders may attempt to conceal, manipulate, or destroy digital evidence. These studies indicate that cybersecurity must be understood as a complete cycle involving prevention, detection, response, investigation, evidence preservation, and recovery rather than simply the prevention of unauthorized access.

Recent literature indicates that the cybercrime ecosystem itself is becoming increasingly organized and technologically sophisticated. Ganguli (2024) examined the emergence of Cybercrime-as-a-Service and demonstrated how specialized cybercriminal services can reduce the technical barriers to participation in cybercrime. Abdullah et al. (2025) examined the historical evolution of cybercrime and identified continuing changes in cybersecurity threats and mitigation strategies. These studies suggest that cybercrime is increasingly moving from isolated individual activities toward organized ecosystems involving specialized tools, services, infrastructure, and expertise. Such developments create significant challenges for traditional cybersecurity approaches because attackers can acquire sophisticated capabilities without necessarily possessing advanced technical expertise themselves.

Artificial intelligence represents another emerging dimension of the cybersecurity environment. Volodymyr et al. (2025) examined artificial intelligence and cybercrime and highlighted new challenges and prospects for legal regulation. The increasing use of AI creates a dual situation in which the same technology can be employed to improve cybersecurity through threat detection,

anomaly identification, and automated response while also being exploited by cybercriminals to automate malicious activities and increase the sophistication and scale of attacks. Consequently, emerging technologies require cybersecurity research to continuously examine both their defensive potential and their capacity to generate new forms of cyber risk.

Social media has similarly created new opportunities for cyber victimization. Kaur et al. (2024) reviewed social media in the digital age and identified cybercrime-related challenges including identity theft, cyberstalking, and malicious online activity. Vrabie and Soesilo (2023) examined government cybercrime-prevention campaigns on Twitter and demonstrated the importance of public communication and awareness in cybercrime prevention. These studies reinforce the significance of cybersecurity education because many social-media-based attacks depend upon manipulating users rather than directly compromising sophisticated technological systems.

The consequences of cybercrime are also increasingly being examined beyond financial and technological damage. Gautam and Yadav (2026) examined the psychological impact of cybercrime on victims and highlighted the need to consider victim wellbeing and protective measures. This represents an important development in the literature because cybercrime can generate psychological consequences such as fear, anxiety, loss of confidence, reputational concerns, and emotional distress. Cybersecurity therefore increasingly needs to be understood as a mechanism for protecting not only information systems and financial resources but also individuals and social trust.

The literature also demonstrates that cybersecurity challenges are particularly significant for developing economies and smaller organizations. Donalds et al. (2022) examined cybercrime and cybersecurity in the Global South and emphasized the need for context-specific strategies and frameworks for greater cyber resilience. Imran (2023) examined cybercrime prevention in Indonesia and highlighted the importance of cybersecurity standards alongside challenges such as cyberbullying. Shabbir and Adnan (2025) examined cybersecurity challenges in Pakistan and highlighted their implications for national security. Ajuzie (2019) examined cybersecurity challenges faced by small businesses and identified difficulties associated with identifying threats and implementing effective prevention policies. Omrani et al. (2026) further examined cybersecurity strategies in European SMEs and emphasized digital risks and cyber resilience. Collectively, these studies suggest that cybersecurity capacity is influenced not only by the nature of cyber threats but also by organizational resources, institutional capabilities, awareness, technological infrastructure, and regulatory environments.

Overall, the reviewed literature demonstrates that cybercrime and cybersecurity constitute a continuously evolving and multidimensional field. Earlier studies primarily emphasized computer-related crime, network vulnerabilities, and preventive security, whereas subsequent research has expanded toward human behaviour, organizational risk, financial consequences, legal frameworks, cyber intelligence, digital forensics, national security, social media,

cyber-physical systems, artificial intelligence, Cybercrime-as-a-Service, and cyber resilience (Brenner & Clarke, 2004; Choo, 2011; Li & Liu, 2021; Aslan et al., 2023). The literature consistently suggests that no single technological or regulatory mechanism can completely eliminate cybercrime. Effective cybersecurity requires an integrated approach combining technological safeguards, cybersecurity awareness, organizational policies, preventive controls, intelligence sharing, incident response, digital forensics, appropriate legislation, law-enforcement capacity, and continuous adaptation to emerging threats. At the same time, the increasing sophistication of cybercrime and the rapid emergence of technologies such as artificial intelligence, cloud computing, IoT, and cyber-physical systems create a continuing need for empirical research and context-specific preventive strategies. Although existing studies provide substantial knowledge regarding individual cyber threats, sectors, technologies, and preventive mechanisms, the literature remains relatively fragmented across these dimensions. There is therefore a need for an integrated examination that connects the nature of cyber threats with cybersecurity challenges, preventive measures, organizational preparedness, and lessons derived from real-world cybercrime cases. Such an approach can provide a more comprehensive understanding of how individuals, organizations, financial institutions, governments, and law-enforcement agencies can strengthen their capacity to prevent, detect, respond to, and recover from cybercrime.

3. Types of Cyber Crimes

Hacking: Hacking refers to unauthorized access to computer systems, networks, or digital accounts. Hackers may exploit vulnerabilities to access, steal, modify, destroy, or misuse sensitive information for personal, financial, political, or other malicious purposes.

Phishing: Phishing is a form of cyber fraud in which attackers impersonate legitimate individuals, organizations, banks, or service providers to deceive users into disclosing confidential information such as passwords, banking credentials, OTPs, or credit-card details, often through fraudulent emails, messages, or websites.

Malware Attacks: Malware refers to malicious software such as viruses, worms, trojans, spyware, and ransomware that is designed to damage systems, obtain unauthorized access, steal information, monitor users, or disrupt operations. Ransomware may additionally encrypt files or systems and demand payment for their restoration.

Identity Theft: Identity theft occurs when an individual's personal or identifying information is obtained and misused without authorization for fraudulent purposes, such as opening accounts, conducting unauthorized transactions, obtaining services, or impersonating the victim.

Cyber Stalking and Harassment: Cyber stalking and harassment involve the repeated misuse of digital platforms, social media, messaging applications, or other online technologies to threaten, intimidate, monitor, abuse, or harass individuals, potentially causing emotional, psychological, and reputational harm.

Online Financial Fraud: Online financial fraud involves the use of digital platforms and technologies to deceive individuals or organizations for financial gain. It includes credit-card fraud, online scams, fraudulent investment schemes, unauthorized banking transactions, and other deceptive activities that can result in substantial monetary losses.

4. Cyber Security: Concept and Importance

Concept of Cyber Security: Cyber security refers to the systematic protection of digital devices, computer systems, networks, applications, and information from unauthorized access, misuse, disruption, alteration, theft, or destruction. Its fundamental purpose is to maintain the **confidentiality, integrity, and availability** of information while ensuring the secure and reliable functioning of digital systems.

Importance of Cyber Security: Cyber security is essential for protecting sensitive personal, financial, business, and governmental information from unauthorized access and cyber attacks. It helps prevent financial losses, ensures the continuity and smooth functioning of organizational operations, strengthens trust and confidence among customers and users, protects privacy and digital assets, and contributes to safeguarding critical infrastructure and national security.

5. Cyber Crime and Cybersecurity Cases

Table 1: Cyber Crime Type and Analysis of Selected Cases

Real-life case / Year	Type of cyber crime / incident	Major threat / attack vector	Key cybersecurity challenge / vulnerability	Major impact	Preventive measures / lessons
Target Data Breach (2013)	Data breach / POS malware	Compromised third-party vendor credentials	Weak third-party access controls and inadequate network segmentation	Theft of approximately 40 million payment-card records	Vendor-risk assessment, least-privilege access, network segmentation, POS monitoring, MFA

Yahoo Data Breach (2013–2014)	Account compromise / data theft	Theft of account information and authentication data	Weak protection of account credentials and security questions	Information associated with billions of accounts was compromised	Strong password hashing, MFA, credential monitoring, secure account recovery, timely disclosure
JPMorgan Chase Breach (2014)	Unauthorized access / data breach	Compromised employee credentials	Inadequate authentication and access controls	Data associated with tens of millions of households and businesses was exposed	MFA, privileged-access management, network monitoring, credential protection
Sony Pictures Attack (2014)	Destructive malware / data theft	Malware and unauthorized network access	Weak internal security and insufficient protection of sensitive corporate systems	Confidential employee information, emails and corporate data were exposed; systems were disrupted	Endpoint security, segmentation, privileged-access controls, backups, incident-response planning

Ashley Madison Breach (2015)	Data breach / identity and privacy exposure	Unauthorized network intrusion	Lack of adequate information-security policies, access controls, employee training and monitoring	Data of more than 36 million users was exposed	Security policies, access controls, employee training, encryption, continuous monitoring and vendor oversight. (Federal Trade Commission)
Bangladesh Bank SWIFT Heist (2016)	Financial cyber fraud	Compromise of banking/payment infrastructure	Weak authentication, inadequate monitoring and controls around payment messaging	Attackers attempted fraudulent transfers of approximately $1 billion; about $81 million was successfully transferred	MFA, transaction monitoring, segregation of duties, SWIFT security controls, anomaly detection
WannaCry Ransomware (2017)	Ransomware / worm	Exploitation of Windows SMB vulnerability	Failure to apply available security patches; vulnerable legacy systems	Worldwide disruption; major disruption to UK healthcare services	Timely patching, vulnerability management, segmentation, offline backups, endpoint protection

Equifax Breach (2017)	Data breach / identity theft risk	Exploitation of an unpatched Apache Struts vulnerability	Failure to patch, poor segmentation, weak monitoring and insecure credentials	Approximately 147 million people affected	Automated patch management, network segmentation, intrusion detection, credential protection. (Federal Trade Commission)
NotPetya Attack (2017)	Destructive malware / ransomware-like attack	Compromised software/update mechanism	Supply-chain vulnerability and inadequate segmentation	Global disruption to businesses, logistics, manufacturing and other services	Software supply-chain security, application control, segmentation, offline backups, incident response
Marriott/Starwood Breach (2014–2020)	Long-term data breach	Compromised hotel-network systems and credentials	Weak password/access controls, outdated systems, inadequate MFA, logging and segmentation	More than 344 million customer records affected across multiple breaches	MFA, strong access controls, patching, segmentation, continuous logging, data minimization. (Federal Trade Commission)

Capital One Breach (2019)	Cloud data breach	Exploitation of misconfigured web application firewall	Cloud configuration and access-control weaknesses	Personal information of more than 100 million people was stolen	Secure cloud configuration, least privilege, WAF monitoring, access reviews, continuous cloud security monitoring. (Department of Justice)
SolarWinds Attack (2020)	Supply-chain cyber espionage	Malicious code inserted into trusted software updates	Software supply-chain compromise and inadequate detection	Government agencies and private organizations were compromised	Secure software development, code integrity, zero trust, vendor monitoring, threat intelligence
Colonial Pipeline Attack (2021)	Ransomware	Compromised credentials / remote access	Weak authentication and inadequate resilience of critical infrastructure	Fuel-supply disruption across the eastern United States	MFA, privileged-access management, network segmentation, offline backups, critical-infrastructure resilience

Log4Shell Vulnerability (2021)	Remote code execution vulnerability	Exploitation of Log4j software library	Extremely widespread dependency on vulnerable open-source software	Potential compromise of thousands of applications and systems worldwide	Software inventory, vulnerability scanning, rapid patching, dependency management, virtual patching
Lapsus$ Attacks (2022)	Social engineering / credential theft	SIM swapping, social engineering and stolen credentials	Overreliance on passwords and weak identity verification	Compromise of major technology and telecommunications organizations	Phishing-resistant MFA, identity verification, privileged-access controls, employee awareness
MOVEit Transfer Exploitation (2023)	Mass data theft / vulnerability exploitation	Zero-day vulnerability in file-transfer software	Third-party software dependency and delayed vulnerability remediation	Data of numerous organizations and individuals was exfiltrated	Rapid vulnerability response, software inventory, segmentation, data encryption, third-party risk management

MGM Resorts Cyberattack (2023)	Social engineering / ransomware-related disruption	Social engineering and identity compromise	Weak identity verification and dependence on interconnected systems	Major disruption to hotel, casino, booking and digital systems; MGM estimated approximately $100 million negative impact on adjusted property EBITDAR for September 2023. (SEC)	Strong identity verification, MFA, help-desk security, segmentation, incident response, offline operational procedures
ICBC Financial Services Attack (2023)	Ransomware / financial-sector disruption	Ransomware intrusion	Interconnected financial systems and operational dependencies	Disruption to financial-market operations and settlement activities	Segmentation, ransomware resilience, business continuity, rapid incident response, backup systems
Change Healthcare Attack (2024)	Ransomware / healthcare disruption	Credential compromise and ransomware	Critical dependence on centralized healthcare-payment infrastructure	Major disruption to healthcare payments and claims processing	MFA, privileged-access management, segmentation, tested backups, critical-service continuity planning

Snowflake Customer Data Breaches (2024)	Cloud account compromise / data theft	Stolen credentials and lack of MFA on some accounts	Identity and cloud-access management	Multiple organizations experienced data theft through compromised cloud accounts	Mandatory MFA, credential rotation, conditional access, cloud monitoring, least privilege
CrowdStrike Global Outage (2024)	Cybersecurity/technology failure—not cyber crime	Faulty security-software update	Insufficient update testing and concentration risk	Large-scale disruption to airlines, banks, healthcare, businesses and public services	Staged deployment, update testing, rollback mechanisms, redundancy, business-continuity planning
Ticketmaster/Live Nation Breach (2024)	Data breach / cloud compromise	Unauthorized access to cloud-hosted data	Third-party/cloud access and credential security	Customer information was reportedly exposed	MFA, cloud access controls, encryption, monitoring, vendor risk management
Change Healthcare / UnitedHealth Group (2024)	Ransomware / critical healthcare disruption	Stolen credentials and network compromise	Identity security and concentration of critical services	Major disruption to healthcare billing and payment ecosystem	MFA, zero trust, segmentation, offline backups, operational resilience

23andMe Credential-Stuffing Attack (2023)	Account takeover / data exposure	Reused passwords / credential stuffing	Password reuse and inadequate account protection	Personal and genetic-profile information of affected accounts was exposed	MFA, password managers, breached-password detection, rate limiting, anomaly detection
Okta Customer Support System Breach (2023)	Identity-system compromise	Stolen session/authentication information	Session management and privileged identity exposure	Customer support data and session information were accessed	Strong session controls, MFA, privileged-access management, logging, identity monitoring

The overall analysis of the selected cyber crime and cybersecurity cases reveals that cyber threats have become increasingly **div**erse, sophisticated, interconnected, and capable of producing large-scale consequences. The cases range from traditional data breaches and hacking to ransomware, phishing, credential theft, social engineering, supply-chain attacks, cloud compromises, financial fraud, and attacks on critical infrastructure. Despite differences in attack methods and sectors, a common pattern is visible: successful cyber incidents are frequently associated with weaknesses such as unpatched software, weak authentication, compromised credentials, inadequate network segmentation, poor monitoring, insecure third-party connections, cloud misconfigurations, and insufficient employee awareness. The cases involving Target, Equifax, WannaCry, SolarWinds, Colonial Pipeline, MGM, MOVEit, and Snowflake particularly demonstrate that even organizations with substantial technological resources can remain vulnerable when basic cybersecurity controls are inadequate.

The cases also demonstrate that the impact of cyber crime extends far beyond direct data or financial loss. Cyber incidents can interrupt business operations, affect healthcare and financial services, damage organizational reputation, expose personal information, create identity-theft risks, and disrupt critical infrastructure. The Colonial Pipeline, Change Healthcare, ICBC, and MGM cases illustrate how dependence on interconnected digital systems -

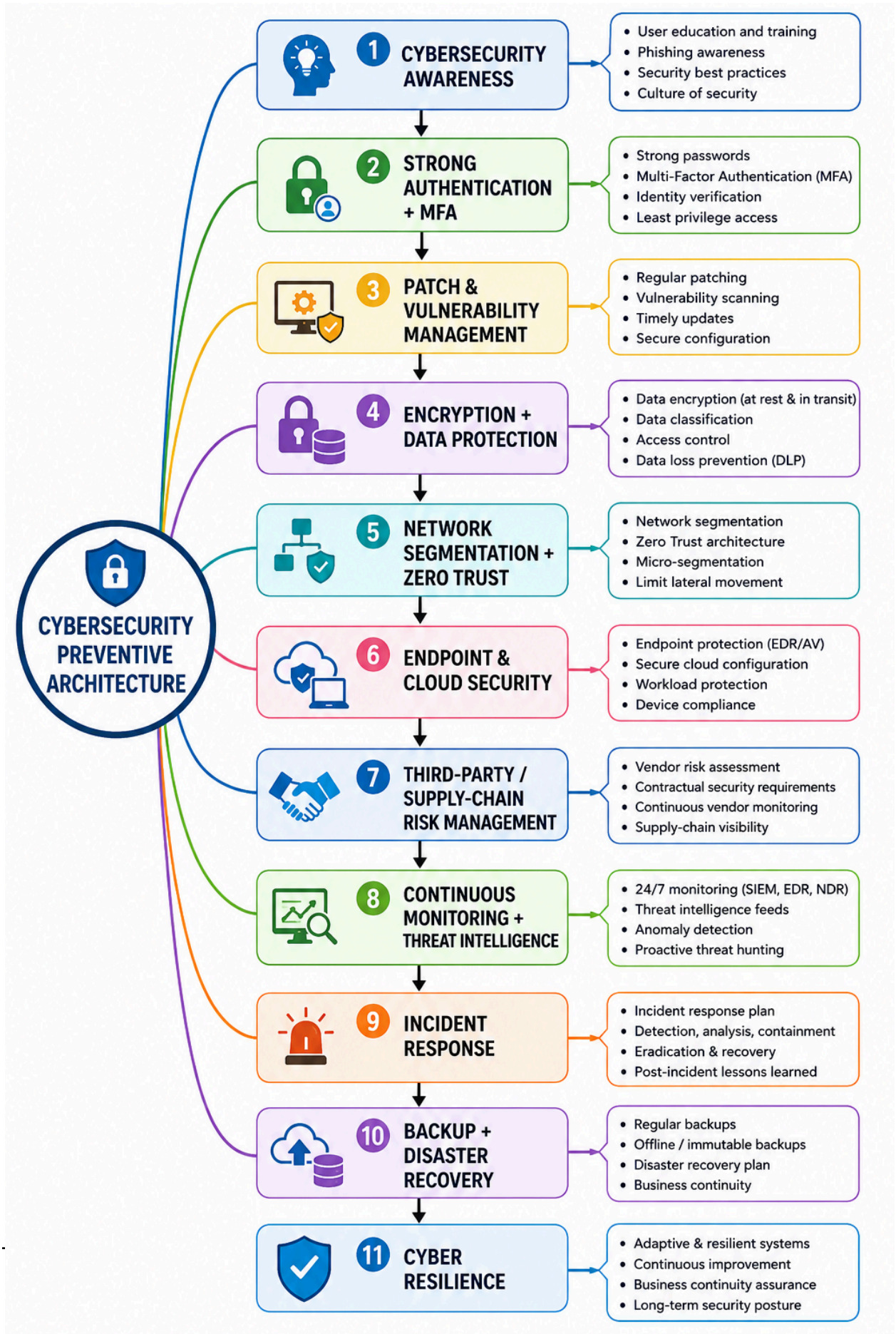
Table 2: Cross-Case Analysis

Major Challenge Identified from Cases	Examples	Associated Threat	Preventive Measure
Failure to patch known vulnerabilities	WannaCry, Equifax, Log4Shell	Malware, ransomware, remote-code execution	Automated vulnerability management and timely patching
Weak authentication	Colonial Pipeline, MGM, Snowflake, Lapsus$	Credential theft, account takeover	MFA, phishing-resistant authentication
Third-party/vendor dependence	Target, SolarWinds, MOVEit	Supply-chain attack, credential compromise	Third-party risk management
Poor network segmentation	Target, Equifax, Marriott	Lateral movement and data exfiltration	Zero trust and network segmentation
Weak cloud configuration	Capital One, Snowflake	Cloud data theft	Cloud security posture management and least privilege
Human error/social engineering	Target, MGM, Lapsus$	Phishing, impersonation, credential theft	Employee training and identity verification
Inadequate monitoring	Equifax, Marriott, Yahoo	Long-term undetected intrusion	SIEM, EDR, continuous monitoring
Excessive data retention	Marriott, Equifax	Data theft and privacy exposure	Data minimization and secure deletion
Insufficient MFA	Marriott, Colonial Pipeline, Snowflake	Account compromise	Mandatory MFA
Legacy systems	WannaCry, healthcare incidents	Malware/ransomware	System modernization and compensating controls
Inadequate backups	Ransomware cases	Operational shutdown	Offline/immutable backups

Poor incident response	Equifax, Marriott, MGM	Extended disruption and larger losses	Tested incident-response plans
Supply-chain concentration	SolarWinds, MOVEit	Mass compromise	Software bill of materials, vendor monitoring
Privileged-access weaknesses	Capital One, Equifax, SolarWinds	Data theft/system takeover	PAM and least privilege
Insufficient employee awareness	Target, MGM, Ashley Madison	Phishing/social engineering	Continuous cybersecurity awareness
Inadequate encryption	Marriott, Yahoo, Ashley Madison	Exposure of sensitive data	Encryption at rest and in transit
Poor software-update governance	SolarWinds, CrowdStrike	Supply-chain compromise/operational failure	Staged deployment and testing
Centralization of critical services	Colonial Pipeline, Change Healthcare, MGM	Large-scale operational disruption	Redundancy and resilience
Insufficient digital forensics	Yahoo, Equifax, Marriott	Delayed detection/investigation	Forensic readiness and centralized logging
Regulatory/governance weaknesses	Equifax, Marriott	Reputational/legal consequences	Board oversight, audits, compliance and accountability

can transform a cyber incident into a broader operational crisis. At the same time, the CrowdStrike incident demonstrates that cybersecurity risk is not limited to malicious attacks; technology failures and poorly managed software updates can also create large-scale disruption. Therefore, organizations need to consider both cyber threats and operational technology risks when developing security strategies.

Overall, the evidence supports the need for a multi-layered and continuous cybersecurity approach rather than reliance on a single security technology or control. The preventive measures emerging from the cases include cybersecurity awareness, strong authentication and MFA, timely patching and vulnerability management, encryption and data protection, network segmentation and Zero Trust, endpoint and cloud security, third-party risk management, continuous -


CYBERSECURITY PREVENTIVE ARCHITECTURE
1 CYBERSECURITY AWARENESS
• User education and training
• Phishing awareness
• Security best practices
• Culture of security
2 STRONG AUTHENTICATION + MFA
• Strong passwords
• Multi-Factor Authentication (MFA)
• Identity verification
• Least privilege access
3 PATCH & VULNERABILITY MANAGEMENT
• Regular patching
• Vulnerability scanning
• Timely updates
• Secure configuration
4 ENCRYPTION + DATA PROTECTION
• Data encryption (at rest & in transit)
• Data classification
• Access control
• Data loss prevention (DLP)
5 NETWORK SEGMENTATION + ZERO TRUST
• Network segmentation
• Zero Trust architecture
• Micro-segmentation
• Limit lateral movement
6 ENDPOINT & CLOUD SECURITY
• Endpoint protection (EDR/AV)
• Secure cloud configuration
• Workload protection
• Device compliance
7 THIRD-PARTY / SUPPLY-CHAIN RISK MANAGEMENT
• Vendor risk assessment
• Contractual security requirements
• Continuous vendor monitoring
• Supply-chain visibility
8 CONTINUOUS MONITORING + THREAT INTELLIGENCE
• 24/7 monitoring (SIEM, EDR, NDR)
• Threat intelligence feeds
• Anomaly detection
• Proactive threat hunting
9 INCIDENT RESPONSE
• Incident response plan
• Detection, analysis, containment
• Eradication & recovery
• Post-incident lessons learned
10 BACKUP + DISASTER RECOVERY
• Regular backups
• Offline / immutable backups
• Disaster recovery plan
• Business continuity
11 CYBER RESILIENCE
• Adaptive & resilient systems
• Continuous improvement
• Business continuity assurance
• Long-term security posture

monitoring and threat intelligence, incident-response preparedness, secure backups, disaster recovery, and organizational governance. These measures collectively contribute to cyber resilience, enabling organizations not only to prevent attacks but also to detect, contain, respond to, recover from, and learn from cyber incidents. Thus, the central lesson from the case studies is that effective cybersecurity is a continuous organizational responsibility involving technology, people, processes, governance, and preparedness, rather than merely an IT function.

6. Findings

6.1 Cybersecurity Challenges

The analysis of the selected real-world cyber crime and cybersecurity cases reveals that organizations face multiple and interconnected cybersecurity challenges. The most prominent challenges identified are the rapidly evolving nature of cyber threats, human error and social engineering, weak authentication and compromised credentials, unpatched and vulnerable software, third-party and supply-chain vulnerabilities, inadequate network segmentation and excessive privileges, cloud misconfiguration and identity-management weaknesses, inadequate security monitoring and delayed detection, weak incident-response and recovery capabilities, and insufficient cybersecurity governance and awareness. These challenges are evident across different sectors, including banking, healthcare, retail, hospitality, technology, government, and critical infrastructure. The cases demonstrate that vulnerabilities do not exist only at the technological level; rather, they emerge from the interaction of people, processes, technologies, third-party relationships, and organizational governance. Consequently, cybersecurity has to be treated as a continuous organizational risk-management responsibility rather than merely a technical function.

6.2 Cybersecurity Threats

The findings further indicate that these challenges create a chain of interconnected cyber threats that can progressively increase the severity of an incident. Phishing and social engineering can result in credential theft, which may subsequently lead to account takeover and unauthorized access. Attackers can then introduce malware or ransomware, obtain unauthorized access to databases, and conduct data breaches and data exfiltration. In financial environments, such activities may develop into online financial fraud, while in organizational environments they may result in significant operational disruption and reputational damage. Stolen personal information may further contribute to identity theft, whereas sophisticated attacks can support cyber espionage and attacks against critical infrastructure. The cases therefore demonstrate that cyber threats should not be viewed as isolated categories; rather, they frequently form an interconnected attack chain in which one vulnerability can facilitate multiple stages of compromise and magnify the eventual impact.

6.3 Preventive Measures

Based on the findings from the case analysis, effective cybersecurity requires a multi-layered preventive architecture in which different security measures operate together rather than independently. The preventive process begins with cybersecurity awareness, as informed users are better positioned to recognize phishing, social engineering, and other suspicious activities. This should be followed by strong authentication and multi-factor authentication (MFA), patch and vulnerability management, and encryption and data protection to reduce unauthorized access and protect sensitive information. Network segmentation and Zero Trust can restrict attackers from moving across systems after an initial compromise, while endpoint and cloud security can protect devices and increasingly cloud-based organizational environments. Organizations should additionally implement third-party and supply-chain risk management because external vendors and software providers can become entry points for attacks. Continuous monitoring and threat intelligence are necessary for early detection, followed by effective incident response when an attack occurs. Finally, backup and disaster recovery mechanisms are required to restore critical operations and reduce the consequences of ransomware and other disruptive attacks. These measures collectively lead toward the broader objective of cyber resilience, which represents the ability of an organization to prevent, withstand, detect, respond to, recover from, and learn from cyber incidents.

7. Conclusion

The study concludes that cyber crime and cybersecurity have become critical concerns in an increasingly digital and interconnected environment. The analysis of real-world cases demonstrates that major cybersecurity incidents are rarely caused by a single technical weakness; rather, they generally result from the interaction of technological vulnerabilities, human behaviour, weak authentication, inadequate governance, third-party dependencies, insufficient monitoring, and ineffective incident-response mechanisms. The consequences can extend beyond data and financial losses to include operational disruption, loss of customer trust, privacy violations, identity theft, damage to organizational reputation, and disruption of critical services. Therefore, organizations need to move beyond a purely defensive approach and adopt a defence-in-depth and cyber-resilience framework that integrates cybersecurity awareness, strong authentication, vulnerability management, encryption, Zero Trust, endpoint and cloud protection, supply-chain security, continuous monitoring, threat intelligence, incident response, and reliable backup and recovery systems. Ultimately, effective cybersecurity is a continuous and shared responsibility involving people, technology, processes, governance, and preparedness, and its success depends on the ability of organizations to continuously adapt to the changing nature of cyber threats.

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TARK TANSAKU
ISSN: 3139-7700
Volume 1, Issue 2, June 2026

Bridging Policy and Practice: A Governance Review of Suicide Prevention in India

Pragnesh B. Dalwadi
Assistant Professor
Government Arts and Commerce College
Barwala, Botad, Gujarat

Deepa C. Chandwani
Assistant Professor
R. J. Tibrewal Commerce College
Ahmedabad, Gujarat

Abstract: Suicide remains a major public health challenge in India despite significant legislative and policy reforms, including the Mental Healthcare Act, 2017 and the National Suicide Prevention Strategy. This paper critically examines India's suicide prevention framework through a governance lens and uses secondary data from government reports, international guidelines and academic literature. The analysis identifies substantial gaps between policy intent and implementation, driven by workforce shortages, regional disparities, limited financing, weak inter-sectoral coordination and fragmented surveillance systems. While India has shifted toward a rights-based and public health approach, institutional capacity constraints continue to hinder effective and equitable service delivery. Strengthening accountability, financing, workforce development and monitoring systems is essential to achieving sustainable reductions in suicide mortality in India.

Keywords: Suicide prevention, Mental health policy, National Suicide Prevention Strategy, Mental health services, Public health governance

1. Introduction

1.1 Background and Context

Suicide has emerged as a major public health and social policy challenge in contemporary India. Beyond representing tragic individual loss, suicide reflects deeper psychological, socio-economic and institutional vulnerabilities rooted within society. According to the *Accidental Deaths and Suicides in India 2024* report, approximately 1.70 lakh suicide deaths were recorded in 2024, indicating a persistently high burden (NCRB, 2024). The national suicide rate remains around 12 per 100,000 population, with significant variation across states, occupational groups, gender and age cohorts. Particularly concerning is the high prevalence of

suicide among young people aged 15–29 years. It is one of the main causes of early death in this age group. Contributing factors in the Indian context include academic pressure, unemployment, indebtedness, family conflict, chronic illness, substance use and broader socio-economic stressors. Suicide must be understood not merely as an individual mental health condition but as a multidimensional public health and governance issue requiring systemic policy responses. The social and economic costs of suicide, including productivity loss, family disruption and long-term psychological trauma, further reinforce the urgency of effective prevention strategies.

Trend Data: Suicide Rate Changes (2010–2024)

Table 1: Suicide Deaths and Rate in India (2010–2024)

Year	Total Suicides (Incidence)	Suicide Rate (per 100,000)
2010	134,599	11.4
2011	135,585	11.2
2012	135,445	11.0
2013	134,799	11.0
2014	131,666	10.6
2015	133,623	10.6
2016	131,008	10.3
2017	129,887	9.9
2018	134,516	10.2
2019	139,123	10.4
2020	153,052	11.3
2021	164,033	12.0
2022	170,924	12.4
2023	171,418	12.3
2024	1,70,746	12.2

(Source: NCRB, various years)

A review of suicide trends over the past decade indicates a fluctuating but overall increasing trajectory. Between 2010 and 2017, the suicide rate declined marginally from approximately 11.4 to 9.9 per 100,000 population. However, post-2017, a steady rise is observable, with suicide deaths increasing sharply during and after the COVID-19 period. By 2024, reported suicide deaths crossed 1.7 lakh, indicating that despite legal reforms and strategic policy commitments, a measurable reduction in suicide mortality has not yet been achieved.

1.2 Policy Shift: From Criminalization to Public Health Approach

Historically, suicide in India was addressed primarily through a criminal justice lens. Section 309 of the Indian Penal Code criminalised attempted suicide, reinforcing stigma and discouraging help-seeking behaviour. A major policy transformation occurred with the enactment of the

Mental Healthcare Act (MHCA), 2017, which effectively decriminalised attempted suicide by presuming individuals to be under severe stress and entitled to care, treatment and rehabilitation. This change moved the approach from punishment to a rights-based and public health approach, in line with international human rights standards. After this reform, the Government of India launched the National Suicide Prevention Strategy (NSPS) in 2022. The strategy aims to reduce suicide deaths by 10% by 2030 by improving data systems, expanding mental health services, promoting well-being in schools and strengthening research and training.

1.3 Rationale for a Critical Policy Review

India's suicide prevention architecture includes the National Mental Health Programme (NMHP), the District Mental Health Programme (DMHP), Tele-MANAS services and various education-sector initiatives. However, the effectiveness of these interventions varies significantly across states and districts.

Key concerns include:

- Shortages of trained mental health professionals
- Uneven rural–urban distribution of services
- Limited inter-sectoral coordination
- Inadequate and fragmented financing
- Weak monitoring and evaluation mechanisms
- Persistent stigma and low mental health literacy

Although policies follow global best practices, limited institutional capacity and administrative fragmentation often prevent effective implementation on the ground. This gap between policy and practice raises questions about governance, accountability, and long-term sustainability. Suicide prevention also represents a significant public policy and governance challenge because effective implementation requires coordination across multiple administrative sectors, including health, education, labour and social welfare**.** Therefore, a systematic review is necessary to examine whether India's suicide prevention policies match suicide trends, institutional capacity and equity needs.

Despite growing policy attention to suicide prevention in India, existing studies primarily focus on epidemiological trends, risk factors or clinical aspects of suicide. Limited research systematically examines suicide prevention from a governance and policy implementation perspective. In particular, there is insufficient analysis of how national policy commitments translate into institutional capacity, service delivery and accountability mechanisms across different governance levels. This study addresses this gap by providing a governance-oriented evaluation of suicide prevention policies in India.

1.4 Objectives of the Study

The present study undertakes a comprehensive and critical review of suicide prevention governance in India. The specific objectives are:

1. To examine the evolution of suicide prevention policy in India.
2. To analyse major national-level policies and legal frameworks related to suicide prevention.
3. To assess institutional capacity and implementation mechanisms across governance levels.
4. To identify systemic gaps, challenges and emerging policy concerns.
5. To propose evidence-based recommendations for strengthening suicide prevention governance and accountability.

1.5 Methodology of the Study

This study adopts a qualitative, descriptive and analytical policy review design. It is a non-empirical investigation based on systematic document analysis of national policy documents, legislative frameworks, government reports, international guidelines and peer-reviewed academic literature.

Documents reviewed include:

- National legislative instruments (e.g., Mental Healthcare Act, 2017)
- National programmatic frameworks (e.g., NMHP, DMHP, NSPS)
- Official surveillance reports (e.g., NCRB publications)
- WHO and international suicide prevention guidelines
- Scholarly research on mental health systems and suicide epidemiology

The analysis uses a governance-based evaluation approach that focuses on relevance, effectiveness, equity, efficiency, sustainability and accountability. The study not only describes policies but also examines how well policy goals match institutional capacity and service delivery at the national and state levels.

2. Conceptual And Analytical Framework

2.1 Concept of Suicide Prevention in Public Policy

Suicide prevention is increasingly conceptualised within public policy as a comprehensive public health responsibility rather than a narrow clinical or individual-level intervention. The World Health Organization (WHO) defines suicide prevention as a set of coordinated actions aimed at reducing the incidence of suicidal behaviour through population-based, community-based and individual-level strategies (World Health Organization [WHO], 2014). This approach recognises suicide as a complex outcome of interactions among psychological, biological, social, cultural and economic factors.

Public policy frameworks usually classify suicide prevention into three levels: primary, secondary and tertiary prevention. Primary prevention aims to reduce risk factors and strengthen protective factors in the population. This includes promoting mental well-being, reducing stigma, limiting access to suicide methods and addressing socio-economic problems. Secondary prevention focuses on early identification and timely help for people at high risk through screening, counselling and crisis support. Tertiary prevention includes treatment after a suicide attempt, rehabilitation and follow-up care to prevent another attempt and to support survivors and their families (Tishler & Reiss, 2009).

In India, suicide prevention policy has gradually adopted these multi-level prevention strategies, especially after the Mental Healthcare Act, 2017, introduced a public health and rights-based approach.

2.2 Public Health Approach to Suicide Prevention

The public health approach to suicide prevention is grounded in the principle that suicide is preventable through systematic, evidence-based interventions implemented at scale. This approach emphasises four core components: surveillance, risk factor identification, intervention development & evaluation and implementation of proven strategies (Centres for Disease Control and Prevention [CDC], 2018; WHO, 2014).

Surveillance systems play a critical role in generating reliable data on suicide trends, high-risk groups and geographic patterns. In India, the National Crime Records Bureau (NCRB) serves as the primary source of suicide data that provides essential inputs for policy planning and monitoring. The public health framework also emphasises addressing social determinants of mental health, including poverty, unemployment, education, family dynamics, substance abuse and social isolation. From this perspective, suicide prevention is not solely the responsibility of the health sector but requires coordinated action across education, labour, social welfare, rural development and justice systems.

2.3 Rights-Based and Equity-Oriented Framework

The United Nations and WHO advocate for mental health policies that respect dignity, autonomy, non-discrimination and equitable access to services. India's Mental Healthcare Act, 2017, represents a significant shift toward a rights-based framework by guaranteeing the right to access mental health care and by recognising persons who attempt suicide as individuals in need of care and rehabilitation. An equity-oriented lens is also critical for policy analysis, as suicide risk and access to prevention services are unevenly distributed across regions, socio-economic groups and demographic categories. Rural populations, economically disadvantaged groups, students, farmers and marginalised communities often face higher vulnerability and lower access to quality mental health services.

2.4 Policy Analysis Framework for Suicide Prevention

To critically assess suicide prevention policies, this study adopts a structured public policy analysis framework based on commonly accepted criteria in health policy evaluation. These criteria include:

- **Relevance:** The extent to which policies address the major determinants and patterns of suicide in India.
- **Effectiveness:** The degree to which policies achieve stated objectives and contribute to measurable reductions in suicide risk or improved access to care.
- **Equity:** The extent to which policies ensure fair and inclusive access across socio-economic and regional groups.
- **Efficiency:** The relationship between resources invested and outcomes achieved.
- **Sustainability:** The capacity of policies to be maintained and scaled over time.
- **Accountability and Governance:** The presence of monitoring, evaluation and institutional responsibility mechanisms (Buse, Mays, & Walt, 2012).

This framework supports a systematic comparison between policy intent and policy outcomes and helps identify gaps between formal policy commitments and actual service delivery.

2.5 International Best Practices and Benchmarking

WHO recommends that countries adopt comprehensive national suicide prevention strategies that include: restricting access to means of suicide, responsible media reporting, life skills training, early identification and treatment of mental disorders and community-based support systems. Countries such as Japan, Australia and the United Kingdom have demonstrated that sustained national strategies combined with strong surveillance systems and community-based interventions can lead to measurable reductions in suicide rates. For India, international benchmarks provide useful reference points for assessing whether existing policies reflect global best practices and whether implementation mechanisms are sufficiently robust to translate policy goals into measurable outcomes.

2.6 Analytical Lens Adopted in the Present Study

Based on the above conceptual foundations, this study adopts a multi-dimensional analytical lens that integrates public health, rights-based and governance perspectives. The analysis focuses on: Alignment of Indian suicide prevention policies with international standards

- Adequacy of institutional and human resource capacity
- Inter-sectoral coordination across health, education and social welfare
- Equity in access to prevention and care services
- Strength of monitoring, evaluation and data systems

3. Overview of Suicide Prevention Policies in India

3.1 Evolution of Suicide-Related Policies in India

The policy approach to suicide in India has undergone a significant transformation over the past few decades. Over time, growing recognition of suicide as a mental health and public health issue led to a gradual policy shift. Influenced by international human rights standards and recommendations from the World Health Organization (WHO), India began moving away from criminalisation toward a treatment- and care-oriented framework. This transition culminated in the enactment of the Mental Healthcare Act, 2017, which effectively decriminalised attempted suicide by presuming that individuals attempting suicide are under severe stress and require care, treatment and rehabilitation rather than punishment (Government of India, 2017).

3.2 National Suicide Prevention Strategy (NSPS)

A major milestone in India's suicide prevention policy landscape was the launch of the National Suicide Prevention Strategy (NSPS) by the Ministry of Health and Family Welfare. This represents India's first comprehensive, nationally coordinated policy framework dedicated specifically to suicide prevention. The NSPS aims to reduce suicide mortality in India by 10% by 2030 and is structured around a multi-sectoral and evidence-based approach (Ministry of Health & Family Welfare [MoHFW], 2022). The strategy is built on four core pillars:

1. **Strengthening surveillance and data systems** to improve the accuracy, timeliness and use of suicide-related data for policy planning and monitoring.
2. **Enhancing mental health services at the district and community levels**, particularly through the expansion of the District Mental Health Programme (DMHP).
3. **Promoting mental well-being and life skills**, especially among vulnerable populations such as adolescents, students and high-risk occupational groups.
4. **Encouraging research, innovation and evidence generation** to inform policy design and evaluation.

3.3 National Mental Health Programme (NMHP) And District Mental Health Programme (DMHP)

The National Mental Health Programme (NMHP), launched in 1982, is one of the oldest national mental health initiatives in India. Although not originally designed specifically as a suicide prevention program, the NMHP plays a central role in the broader suicide prevention ecosystem by expanding access to mental health care services.

A key operational component of the NMHP is the District Mental Health Programme (DMHP), which aims to integrate mental health services into district-level public health systems. The DMHP focuses on:

- Early identification and treatment of mental disorders
- Community-based mental health services
- Training of primary healthcare personnel

- Public awareness and stigma reduction

By strengthening mental health care at the primary and secondary levels, the NMHP and DMHP indirectly contribute to suicide prevention by addressing major risk factors such as depression, anxiety and substance use disorders (Murthy, 2017).

3.4 Mental Healthcare Act, 2017

The Mental Healthcare Act, 2017**,** provides a strong legal foundation for suicide prevention in India by implementing suicide-related provisions within a rights-based mental health governance framework. The Act guarantees the right to access mental health care and treatment for all persons and emphasises dignity, autonomy and non-discrimination. Importantly, Section 115 of the Act presumes that a person who attempts suicide is under severe stress and mandates that the government provide care, treatment, and rehabilitation. This provision effectively decriminalises attempted suicide and reframes it as a public health and social welfare issue rather than a criminal act (Government of India, 2017).

3.5 Tele-Manas and Digital Mental Health Initiatives

Recognising the need to expand access to mental health support, particularly in underserved and remote areas, the Government of India launched Tele-MANAS (Tele Mental Health Assistance and Networking across States) as a national tele-mental health program. Tele-MANAS provides a 24×7 toll-free mental health helpline offering psychological support, crisis intervention and referral services. It is designed to address barriers related to geographic access, stigma and the shortage of mental health professionals at the local level (MoHFW, 2022).

3.6 Role of Education and Youth-Focused Policies

Educational institutions are increasingly recognised as key settings for suicide prevention, given the high vulnerability of adolescents and young adults. The National Education Policy (NEP) 2020 emphasises holistic development, student well-being and mental health support systems within educational institutions. Moreover, the University Grants Commission (UGC) and other regulatory bodies have issued guidelines encouraging higher education institutions to establish counselling centers, student support systems and grievance redressal mechanisms. These institutional policies are intended to address academic stress, emotional distress, and psychosocial challenges that contribute to student suicide risk.

3.7 Substance Use and Related Policy Linkages

Substance use, particularly alcohol and drug abuse, is a significant risk factor for suicide. India’s suicide prevention policy framework, therefore, intersects with broader substance use and addiction control policies, including national drug de-addiction programs and alcohol control

initiatives. Integration between mental health services and substance use treatment programs is essential for comprehensive suicide prevention.

Table 2: Policy Mapping of Suicide Prevention Initiatives in India

Policy/ Program	Year	Nodal Ministry/ Agency	Key Objectives	Target Population	Key Components	Source
Mental Healthcare Act (MHCA)	2017	Ministry of Health & Family Welfare	Decriminalize suicide attempts; ensure access to mental healthcare	General population	Rights-based mental healthcare; treatment for suicide attempt survivors	Government of India (2017)
National Mental Health Programme (NMHP)	1982 (rev.2014)	MoHFW	Integrate mental health into primary care	Rural & urban populations	Community mental health; district services	MoHFW (2014)
District Mental Health Programme (DMHP)	1996	MoHFW & State Govts	Decentralised mental health services	District populations	Psychiatric services; outreach; awareness	Murthy (2017)
National Suicide Prevention Strategy (NSPS)	2022	MoHFW	Reduce suicide mortality by 10% by 2030	All age groups	Surveillance; early identification; capacity building	MoHFW (2022)
Tele-MANAS (14416)	2022	MoHFW	24×7 tele mental health support	General population	Helpline; crisis counseling; referrals	MoHFW (2022)
Kiran Mental Health Helpline	2020	MoHFW	Mental health support	Vulnerable groups	Crisis counselling; referrals	MoHFW (2020)
Rashtriya Kishor Swasthya Karyakram (RKSK)	2014	MoHFW	Adolescent mental well-being	Adolescents	Counselling; peer educators	MoHFW (2014)
National Education Policy (NEP)	2020	Ministry of Education	Student well-being & counselling	Students	Counselling; holistic education	Ministry of Education (2020)

(Source: Compiled by the authors: Government of India, 2017; Ministry of Health and Family Welfare [MoHFW], 2014, 2020, 2022, 2023; Ministry of Education, 2020; Murthy, 2017)

4. Critical Assessment of Policy Implementation

4.1 Institutional and Administrative Capacity

Effective implementation of suicide prevention policies depends heavily on institutional and administrative capacity at national, state and district levels. Although India has established a comprehensive policy framework through the National Suicide Prevention Strategy (NSPS), National Mental Health Programme (NMHP) and Mental Healthcare Act, 2017, implementation capacity remains uneven across states and districts. A major constraint is the shortage of trained mental health professionals. India has a significantly low psychiatrist, psychologist and psychiatric social worker-to-population ratio compared to global benchmarks. Administrative capacity at the district level is particularly variable. The effectiveness of the District Mental Health Programme (DMHP) depends on local leadership, the availability of trained staff and coordination with primary healthcare facilities. In many districts, DMHP units face staffing shortages, high staff turnover and limited infrastructure, reducing their ability to provide consistent community-based services (Murthy, 2017).

4.2 Coverage and Accessibility of Services

Despite policy commitments, significant disparities persist in coverage and accessibility, particularly between urban and rural areas. Urban centers generally have better availability of psychiatrists, psychologists and private mental health facilities, while rural and tribal areas often lack even basic mental health services. This geographic inequality limits the reach of suicide prevention interventions among populations that may face high levels of socio-economic stress and vulnerability (WHO, 2021). Digital initiatives such as Tele-MANAS have helped to partially bridge access gaps by providing remote counselling and crisis intervention. However, reliance on digital platforms also raises concerns related to digital literacy, internet access, language barriers, and continuity of care.

4.3 Financing and Resource Allocation

Adequate and sustained financing is essential for effective suicide prevention. In India, public spending on mental health remains very low compared to the overall health budget. This limited funding restricts the expansion of services, workforce development, and infrastructure needed for prevention efforts. Although programs such as the National Mental Health Programme (NMHP) and District Mental Health Programme (DMHP) exist, their budget allocations remain small compared to the scale of the problem. Shortage of funds affects the recruitment of trained professionals, the availability of medicines, and awareness programs. Mental health receives less than 1% of India’s health budget, which shows a clear gap between disease burden and financial support.

4.4 Monitoring, Evaluation and Data Systems

Robust monitoring and evaluation (M&E) systems are essential for assessing policy effectiveness and guiding evidence-based improvements. In India, suicide surveillance relies

primarily on data from the National Crime Records Bureau (NCRB). While NCRB data provides valuable national-level trends, several limitations have been noted, including underreporting, misclassification and variations in reporting practices across states. Health system data on suicide attempts, self-harm and suicidal ideation are not systematically integrated with NCRB records. This fragmentation limits the ability to conduct comprehensive epidemiological analysis and to track the impact of policy interventions over time.

4.5 Human Resource Constraints

Human resource shortages represent one of the most significant structural barriers to effective policy implementation. India faces a substantial deficit of mental health professionals, including psychiatrists, clinical psychologists, psychiatric social workers and trained counsellors. This shortage is particularly acute in public sector facilities and in rural and remote areas. Limited training capacity, uneven distribution of professionals and inadequate incentives for rural service contribute to persistent workforce gaps. Task-shifting approaches, in which non-specialist health workers are trained to provide basic mental health and psychosocial support, have been recommended by WHO as a pragmatic strategy in low- and middle-income countries.

Table 3: Mental Health Workforce Density in India

Professional Category	Current Density (Approx.)	WHO Recommended
Psychiatrists	0.75	3.0
Clinical Psychologists	0.07	1.5
Mental Health Nurses	0.12	1.0
Psychiatric Social Workers	0.07	1.0

(Sources: WHO Mental Health Atlas; Thirthalli & Kumar, 2022)

India's mental health workforce density remains significantly below global benchmarks. With less than one psychiatrist per lakh population and even lower availability of psychologists and psychiatric social workers, service capacity constraints severely limit the operationalisation of suicide prevention strategies, particularly in rural and underserved regions.

4.6 Equity and Inclusion Concerns

A critical dimension of policy implementation relates to equity and inclusion. Vulnerable populations such as economically disadvantaged groups, rural communities, farmers, students, daily wage workers and marginalised social groups often face higher suicide risk and lower access to prevention services. Policies frequently adopt a universal approach without sufficient targeting of high-risk groups. Without culturally sensitive and context-specific interventions, policy effectiveness remains constrained.

4.7 Role of Non-Governmental and Community Stakeholders

Non-governmental Organizations (NGOs), community-based Organizations and civil society groups play an important complementary role in suicide prevention in India. These non-state actors often provide crisis helplines, community outreach, psychosocial support and awareness programs, particularly in areas with limited public sector capacity. However, coordination between government programs and non-governmental initiatives is often ad hoc and fragmented.

4.8 State-Level Implementation Experiences: Comparative Insights

While national policies provide a uniform framework, state-level implementation reveals significant variation in institutional capacity and service delivery effectiveness.

- **Kerala: Integration of Community Mental Health Services**

  Kerala has demonstrated relatively stronger integration of mental health services within primary healthcare through decentralised service delivery and community participation. The state's Mental Health Policy (2018) and long-standing investment in public health infrastructure have enabled better operationalisation of the District Mental Health Programme (DMHP). Community-based outreach, school counselling initiatives and collaboration with local self-government institutions have contributed to improved mental health literacy and service uptake. However, challenges persist in addressing youth suicide and substance use disorders, particularly in urban areas (Kumar & George, 2022).

- **Maharashtra: Tele-Mental Health and Urban–Rural Disparities**

  Maharashtra has been an early adopter of tele-mental health services and crisis helplines, complementing the national Tele-MANAS platform. Urban centres such as Mumbai and Pune benefit from higher concentrations of mental health professionals and institutional support, while rural districts continue to face workforce shortages and infrastructure limitations. Evaluations specify that digital services have extended initial access to counselling but require stronger referral linkages to district-level public health facilities to warrant continuity of care (Patel et al., 2023).

These contrasting cases illustrate that governance capacity, fiscal prioritisation and local institutional leadership significantly shape the translation of national suicide prevention policies into effective on-ground interventions.

5. Key Challenges, Gaps and Emerging Issues

5.1 Policy–Practice Gap

One of the most significant challenges in India's suicide prevention landscape is the persistent gap between policy formulation and policy implementation. These policies have not yet translated into uniformly effective implementation. Implementation varies considerably across

states and districts, reflecting differences in administrative capacity, political prioritisation and resource availability. As a result, individuals' access to suicide prevention and mental health services is highly dependent on geographic location, leading to uneven outcomes. This policy–practice gap weakens the credibility and effectiveness of national strategies and limits their potential impact on suicide mortality.

5.2 Persistent Stigma and Low Mental Health Literacy

Social stigma surrounding mental illness and suicidal behaviour remains a major structural barrier to effective suicide prevention in India. Cultural norms, misconceptions and fear of social judgment discourage individuals and families from seeking timely professional help. Many individuals are unable to recognise early warning signs of psychological distress or are unaware of available mental health and counselling services. WHO emphasises that stigma reduction and public awareness are essential components of effective suicide prevention strategies (World Health Organization [WHO], 2014).

5.3 Human Resource and Training Gaps

India's chronic shortage of trained mental health professionals continues to be a critical gap in suicide prevention policy. There is a limited number of psychiatrists, psychologists, psychiatric social workers and trained counsellors, which restricts service availability, particularly in public sector facilities and rural areas. Many frontline health workers, teachers and community workers lack formal training to identify and manage suicide risk, despite being in positions where early detection is possible.

5.4 Fragmented Inter-Sectoral Coordination

Suicide is influenced by a wide range of determinants, including education-related stress, employment insecurity, family conflict, substance abuse, chronic illness and social isolation. Effective suicide prevention, therefore, requires coordinated action across multiple sectors, including health, education, labour, agriculture, social welfare and justice. In practice, inter-sectoral coordination in India remains weak. Policies are often designed and implemented within sectoral silos, resulting in fragmented interventions and limited synergy. This fragmentation reduces the overall coherence and effectiveness of suicide prevention efforts.

5.5 Data Limitations and Underreporting

Reliable data is essential for evidence-based policy making and evaluation. In India, suicide surveillance relies heavily on NCRB data, which, while valuable, is subject to limitations such as underreporting, misclassification and variability in reporting practices across states. Social stigma, legal concerns and cultural factors may lead families and institutions to underreport suicide deaths or misclassify them as accidental deaths, limiting the ability to generate a comprehensive picture of suicide risk and trends.

5.6 Emerging Issues and New Risk Factors

India's suicide prevention policies must also adapt to emerging social and technological changes that shape mental health and suicide risk. Key emerging issues include:

- **Student and Youth Suicide:** Rising academic pressure, competitive examinations, social comparison and uncertainty about employment prospects have intensified psychological stress among students and young adults.
- **Occupational and Economic Stress:** Farmers, daily wage workers and individuals in insecure employment continue to face high levels of economic stress, debt, and income instability, contributing to suicide risk.
- **Digital Stress and Social Media:** Increased use of digital technologies and social media has created new forms of psychological stress, including cyber bullying, online harassment and harmful social comparison.

Table 4: Gap Analysis in Suicide Prevention Policies

Domain	Existing Provision	Identified Gap	Impact	Evidence
Surveillance & Data	NCRB suicide statistics	Underreporting; lack of real-time data	Weak evidence-based policy	WHO (2023); NCRB (2022)
Rural Mental Health	DMHP coverage	Shortage of psychiatrists	Limited rural access	Patel et al. (2018)
School Counseling	NEP 2020 provisions	No mandatory counsellor ratio	Poor early detection	Ministry of Education (2020)
College Mental Health	UGC advisories	Weak implementation	Rising student suicides	UGC (2021); NCRB (2022)
Workforce Capacity	Training programs	Shortage of trained counsellors	Service gaps	WHO (2022)
Stigma Reduction	Awareness campaigns	Persistent stigma	Low help-seeking	Reddy et al. (2020)
Private Sector Integration	Limited integration	Fragmented care pathways	Missed prevention	Murthy (2017)

Legal Awareness	MHCA 2017	Poor public awareness	Fear of seeking help	Government of India (2017)

(*Source: Compiled by the authors, World Health Organization [WHO], 2022, 2023; National Crime Records Bureau [NCRB], 2022; Patel et al., 2018; Ministry of Education, 2020; University Grants Commission [UGC], 2021; Reddy et al., 2020; Murthy, 2017; Government of India, 2017)*

5.7 Governance-Based Implementation Scorecard Model

Dimension	Indicator	Current Status	Risk Level
Surveillance	Real-time integrated suicide registry	Partial	High
Workforce	≥3 psychiatrists per lakh	Not achieved	High
Financing	Dedicated suicide prevention budget	Limited	High
Rural Access	DMHP is functional in all districts	Uneven	Medium–High
Education Sector	Mandatory counsellor ratio	Not enforced	High
Inter-sectoral Coordination	Formal national task force	Limited	Medium
Monitoring & Evaluation	Annual independent evaluation	Absent	High

To systematically assess implementation gaps, this study proposes a governance-based Suicide Prevention Implementation Scorecard model. Preliminary evaluation suggests that most structural indicators remain either partially achieved or unmet, indicating high systemic risk in achieving the NSPS target of 10% reduction by 2030.

6. Policy Recommendations

Table 5: Recommendation Matrix for Strengthening Suicide Prevention in India

Policy Area	Recommendation	Responsible Agency	Timeframe	Expected Outcome	Supporting Source
Surveillance	Real-time suicide surveillance system	MoHFW, NCRB	Short-term	Improved data accuracy	WHO (2023)
Workforce	Mandatory counsellor training at PHCs & schools	MoHFW, States	Short-Medium	Increased service capacity	WHO (2022)

Education Sector	Mandatory counsellor-student ratio (1:500)	Ministry of Education, UGC	Medium	Early identification	Ministry of Education (2020)
Rural Access	Tele-psychiatry expansion	MoHFW, States	Medium	Improved rural access	Patel et al. (2018)
Stigma Reduction	National anti-stigma campaigns	MoHFW, I&B Ministry	Short	Improved help-seeking	Reddy et al. (2020)
Student Mental Health	Campus mental health clinics	UGC, Universities	Medium	Reduced student risk	UGC (2021)
Inter-sectoral Coordination	National suicide prevention task force	MoHFW	Short	Policy coherence	MoHFW (2023)
Research	Dedicated suicide prevention funding	ICMR, DST	Long	Evidence-based policy	WHO (2022)
Legal Literacy	MHCA awareness campaigns	States, NGOs	Short	Reduced fear	Government of India (2017)

(Source: Compiled by the authors: World Health Organization, 2022, 2023; Ministry of Health and Family Welfare, 2023; Ministry of Education, 2020; University Grants Commission, 2021; Patel et al., 2018; Reddy et al., 2020; Government of India, 2017)

6.1 Strengthening Policy Design and Governance

The National Suicide Prevention Strategy should be operationalised with state-specific action plans, timelines and performance benchmarks. Establishing dedicated suicide prevention units or focal points within state health departments could improve coordination, monitoring, and ownership of implementation efforts.

6.2 Expanding and Strengthening the Mental Health Workforce

Policy priorities should include:

- Expansion of training capacity for psychiatrists, psychologists, counsellors and psychiatric social workers
- Incentives for rural and underserved area postings
- Integration of suicide risk assessment and crisis intervention into standard training curricula

- Large-scale task-shifting models to train primary care providers, teachers and community workers in basic mental health and suicide prevention skills

6.3 Enhancing Inter-Sectoral Coordination

Suicide prevention should be mainstreamed across education, labour, agriculture, social welfare and social justice policies. Formal inter-ministerial coordination mechanisms can help align programs and reduce fragmentation. For example, student mental health initiatives should be systematically linked with public mental health services and occupational stress interventions should be integrated with employment security, debt relief and social protection measures.

6.4 Improving Surveillance, Research and Evaluation

Strengthening suicide surveillance systems is critical for evidence-based policy making. Integration of health system data with NCRB records can improve accuracy and enable more comprehensive monitoring of suicide attempts and self-harm. Regular independent evaluations of suicide prevention programs should be institutionalised to assess effectiveness, cost-efficiency, and equity impacts.

6.5 Scaling Up Community-Based and Culturally Responsive Interventions

Community-based mental health and suicide prevention programs can enhance accessibility, cultural relevance, and trust. Partnerships with NGOs, community Organizations and local leaders should be strengthened to expand outreach, reduce stigma and promote help-seeking behaviour.

6.6 Leveraging Technology Responsibly

Digital platforms, tele-mental health services, and mobile-based interventions offer significant opportunities to expand access to support, particularly in underserved areas. At the same time, policies must address emerging digital risks, including cyber bullying and harmful online content, through regulatory frameworks, digital literacy initiatives and collaboration with technology platforms.

7. Conclusion

India has made significant progress in recognising suicide as a public health and human rights issue through legal reforms and the development of a comprehensive National Suicide Prevention Strategy. However, this review demonstrates that substantial gaps persist between policy intent and operational reality. Structural deficits in financing, workforce capacity, surveillance integration, and inter-sectoral coordination continue to constrain implementation effectiveness. Achieving the NSPS target of a 10% reduction in suicide mortality by 2030 will require measurable performance benchmarks, strengthened institutional accountability, and

sustained fiscal prioritisation. Suicide prevention must be embedded within a long-term governance framework that integrates public health systems, education institutions, community actors, and social protection mechanisms. Only through systematic institutional reform and continuous evaluation can policy commitments translate into sustained reductions in suicide mortality.

Suicide prevention in India cannot be addressed solely through isolated health sector interventions. It requires a coordinated governance approach that integrates public health systems, educational institutions, labour policies and community-based support networks. Strengthening institutional accountability, ensuring sustainable financing and improving surveillance systems will be essential to translate policy commitments into measurable reductions in suicide mortality. Future policy efforts must prioritise implementation capacity alongside policy design to bridge the persistent gap between national strategy and local service delivery.

Limitations

This study relies on secondary data, including government documents, international guidelines and scholarly literature. It does not include primary data such as interviews or field observations, limiting insight into local implementation and socio-cultural factors. Dependence on official statistics may involve underreporting biases. Future research should adopt mixed-method approaches with qualitative interviews and quantitative district-level evaluations.

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TARK TANSAKU
ISSN: 3139-7700
Volume 1, Issue 2, June 2026

Role of MSMES In Employment Generation In India: An Empirical and Analytical Perspective

Kiran Kumari B. Varma
Assistant Professor
Shree Parakh Science and Arts Commerce College,
Mahuva, Bhavnagar, Gujarat

Abstract: Employment generation remains a central concern of India's development strategy because the expansion of the working-age population needs to be accompanied by adequate productive employment opportunities. Within this framework, Micro, Small and Medium Enterprises (MSMEs) occupy a distinctive position because of their wide geographical distribution, entrepreneurial orientation and relatively labour-intensive production structure.
The present study examines the role of MSMEs in employment generation in India by analysing official secondary data and relevant government reports. Particular attention is given to the scale of employment associated with registered MSMEs, the role of micro enterprises, rural and urban employment, women's participation, skill development and government-supported entrepreneurship programmes.
The latest data available on the Ministry of MSME's official dashboard indicate that, as of 15 August 2026, 92,815,987 Udyam and Udyam Assist Platform registrations had been recorded, with reported employment of 411,319,331 persons, equivalent to approximately 41.13 crore persons. MSME Dashboard Historical estimates reported by the Ministry further indicate that MSMEs accounted for approximately 1,109.89 lakh persons of employment, with micro enterprises constituting the dominant employment-generating category. MSME Annual Report 2022–23
The study argues that the employment significance of MSMEs cannot be assessed merely by counting enterprises. Their contribution is also reflected in self-employment, local economic activity, women's economic participation, youth entrepreneurship and regional employment opportunities. However, limitations relating to access to finance, technological adoption, skills, market access, infrastructure and delayed payments continue to constrain their potential. The study concludes that strengthening the MSME ecosystem can make an important contribution to employment-led and inclusive economic growth in India.

Keywords: MSMEs, Employment Generation, Entrepreneurship, Labour Market, Skill Development, Self-Employment, Inclusive Growth, India.

1. Introduction

India's economic transformation is closely linked with its ability to generate productive employment. Economic growth by itself does not necessarily ensure adequate employment

opportunities for all sections of the population. Consequently, the structure of production and the employment intensity of different sectors have become important considerations in development policy.

Micro, Small and Medium Enterprises represent one of the most widely distributed components of India's productive economy. Unlike large industrial establishments that are often concentrated in selected locations, MSMEs operate across villages, towns, semi-urban centres and metropolitan regions. This geographical spread enables them to connect local labour, entrepreneurship and resources with economic activity. The employment relevance of MSMEs becomes particularly significant in an economy where a substantial section of the workforce depends on small-scale production, self-employment and informal or semi-formal business activities. The current official MSME Dashboard provides a useful indication of the scale of this sector. As on 15 August 2026, Udyam and UAP registrations together stood at 92.82 million, while employment reported through these registrations was approximately 411.32 million persons.

These figures demonstrate why MSMEs deserve considerable attention in employment policy. At the same time, registration-based employment data should be interpreted carefully because registered enterprise data do not represent the entire universe of India's MSMEs.

2. Statement of the Problem

India faces the dual challenge of creating sufficient employment and improving the quality and productivity of existing employment. A growing labour force requires continuous expansion of employment opportunities, particularly for youth, women and workers with limited access to formal employment. Large industries alone cannot absorb the entire additional labour force. MSMEs therefore become important because they can create employment through relatively small investments and can operate in sectors where local resources and labour are readily available. The central research question of this study is therefore:

To what extent can MSMEs contribute to employment generation and inclusive economic development in India, and what constraints limit their employment potential?

3. Objectives of the Study

The study has the following objectives:

1. To examine the importance of MSMEs in India's employment structure.
2. To analyse recent official data on MSME registrations and reported employment.
3. To examine the employment contribution of micro, small and medium enterprises.
4. To analyse the rural and urban employment dimension of MSMEs.
5. To examine the role of MSMEs in women's and youth economic participation.

6. To assess the importance of entrepreneurship and skill development for employment creation.
7. To identify major constraints affecting MSME employment generation.
8. To suggest policy measures for improving the employment potential of MSMEs.

4. Research Methodology

The study follows a descriptive, analytical and empirical approach based on secondary data.
Data have been collected from:

- Ministry of Micro, Small & Medium Enterprises, Government of India
- MSME Dashboard
- MSME Annual Reports
- Udyam Registration-related official information
- Udyam Assist Platform
- Government policy documents
- Relevant academic literature

The study uses comparative interpretation of available official statistics rather than relying on a primary survey.

Important methodological limitation

A distinction should be maintained between registered MSME employment and total employment generated by the entire MSME sector. The latest dashboard figure of 411.32 million refers to employment reported through Udyam and UAP registrations; it should not automatically be interpreted as a complete estimate of all MSME employment in India.

5. MSMEs as an Employment-Generating Sector

The employment contribution of MSMEs operates through several channels. First, enterprises directly employ workers in manufacturing and services. Second, self-employed entrepreneurs themselves become economically active. Third, MSMEs generate indirect employment through suppliers, distributors, transporters and service providers. Thus, the employment impact of an MSME is broader than the number of workers formally employed within the enterprise.

The latest official data provides the following picture.

Table 1: Registered MSMEs and Reported Employment

Indicator	Number
Udyam + UAP Registrations	92,815,987
Reported Employment	411,319,331 persons
Reported Employment in Crore	41.13 crore

Reference date: 15 August 2026
Source: Ministry of MSME, Government of India, MSME Dashboard.
The magnitude of reported employment indicates the substantial role of registered MSMEs in India's employment ecosystem.

6. Dominance of Micro Enterprises in Employment

An important feature of the MSME employment structure is the dominant role of micro enterprises.
The Ministry of MSME's Annual Report 2022–23, based on NSS 73rd Round estimates, reported total MSME employment of 1,109.89 lakh persons. Of this, approximately 1,076.19 lakh persons were associated with micro enterprises, compared with 31.95 lakh in small enterprises and 1.75 lakh in medium enterprises.

Table 2: Estimated Employment by Enterprise Size

Category	Employment (Lakh Persons)	Approx. Share
Micro	1,076.19	97.0%
Small	31.95	2.9%
Medium	1.75	0.2%
Total	1,109.89	100%

Source: Ministry of MSME, Annual Report 2022–23.

The table suggests that employment policy cannot focus exclusively on relatively larger MSMEs. Micro enterprises are particularly important because of their sheer employment absorption capacity.

7. Rural–Urban Dimension of MSME Employment

MSMEs have an important role in distributing economic activity across geographical regions.

Official estimates for 2022–23 indicate that approximately 497.78 lakh persons were employed in rural MSMEs, while approximately 612.10 lakh persons were employed in urban MSMEs.

Table 3: Rural and Urban MSME Employment

Location	Employment (Lakh Persons)	Approx. Share
Rural	497.78	44.85%
Urban	612.10	55.15%
Total	1,109.89	100%

The figures indicate that MSME employment is not exclusively an urban phenomenon. Nearly half of the estimated employment in this dataset was located in rural areas.

This has important policy implications because rural MSME development can generate local employment and reduce excessive dependence on migration towards large urban centres.

8. MSMEs and Women's Economic Participation

The MSME sector can provide women with both employment and entrepreneurship opportunities.

- Women's participation is particularly visible in activities such as:
- Food processing
- Garments and textiles
- Handicrafts
- Beauty and personal services
- Retail activities
- Home-based enterprises
- Digital services
- Small-scale manufacturing

The MSME Dashboard also provides registration data by gender. As reported on the dashboard, female registrations constitute a substantial proportion of registered MSME registrations. However, registration should not be equated directly with employment. A woman-owned enterprise and the number of women employed by that enterprise are separate indicators. Future research should therefore examine female employment within MSMEs independently.

9. MSMEs and Youth Employment

Youth unemployment and underemployment remain important labour-market concerns. MSMEs can contribute to addressing these concerns through two mechanisms.

1. **First: Wage Employment -** Young people can obtain employment in manufacturing, services, trade, logistics, repair services and other MSME activities.
2. **Second: Entrepreneurship -** Young people can establish their own enterprises and create self-employment. This second dimension is especially important because entrepreneurship changes the role of young people from **job seekers to potential job creators**.

The effectiveness of youth entrepreneurship, however, depends on access to credit, business knowledge, digital skills, market information and mentoring.

10. MSMEs and Skill Development

The availability of employment opportunities does not automatically guarantee employability. Enterprises require workers with appropriate technical, managerial and digital skills. The MSME

Ministry's Skill Development Dashboard reports that cumulative training under relevant MSME institutions reached 4,242,208 trainees from 2014–15 to 31 May 2026.

Table 4: MSME Skill Development

Indicator	Figure
Period	2014–15 to 31 May 2026
Cumulative trainees	4,242,208

Source: Ministry of MSME, Skill Development Dashboard.

Skill development can improve:
Skills → Productivity → Employability → Enterprise Competitiveness → Employment
Therefore, MSME employment policy should be integrated with vocational education, digital literacy and industry-oriented skill development.

11. MSMEs and India's Economic Performance

Employment is only one dimension of MSME contribution.
According to the Ministry of MSME, the sector contributed approximately 30.1% of India's GDP in FY 2022–23 and around 45% of goods and services exports.

Table 5: Selected Economic Indicators of MSMEs

Indicator	Contribution	Reference Period
GDP	30.1%	FY 2022–23
Goods & Services Exports	Approx. 45%	FY 2022–23
Reported employment under Udyam + UAP	41.13 crore	15 Aug. 2026

Sources: Ministry of MSME and MSME Dashboard**.**

The combination of employment, output and exports indicates that MSMEs have a multidimensional role in India's economic development.

12. Government Support and Employment Creation

Government policy can influence MSME employment through finance, infrastructure, skills, technology and market access. One important programme is the **Prime Minister's Employment Generation Programme (PMEGP)**, which promotes self-employment through the establishment of micro enterprises. According to the MSME Dashboard, from FY 2021–22 to 8 June 2026, PMEGP recorded **587,393 projects**, with **₹60,750.13 crore of bank loans sanctioned** and estimated employment of **3,633,354 persons**.

Table 6: PMEGP: Selected Indicators

Indicator	Achievement

Period	FY 2021–22 to 8 June 2026
Projects	587,393
Bank Loan Sanctioned	₹60,750.13 crore
Estimated Employment	3,633,354 persons

Source: Ministry of MSME, Government of India.

The data indicate how entrepreneurship-oriented public policy can contribute to employment generation.

13. Major Constraints on MSME Employment Generation

Despite their employment potential, MSMEs face several constraints.

S. No.	Constraint	Description / Impact on MSMEs
1	Access to Finance	Insufficient working capital and limited access to affordable institutional credit can restrict MSMEs from expanding production, investing in business activities, and creating additional employment opportunities.
2	Technology Adoption	Modern machinery, software, and digital systems can improve productivity and efficiency; however, their relatively high cost can make technology adoption difficult, particularly for micro enterprises with limited financial resources.
3	Skill Mismatch	A gap may exist between the skills possessed by available workers and the skills required by MSMEs. This mismatch can reduce productivity, increase training requirements, and make it difficult for enterprises to recruit suitable employees.
4	Market Access	Small enterprises may face difficulties in accessing larger domestic and international markets because of limited market networks, resources, scale, and competitive capabilities.
5	Delayed Payments	Delayed payments from buyers can create liquidity and working-capital problems for MSMEs. Such financial pressure may affect their ability to maintain regular business operations and employment.
6	Infrastructure	Poor logistics, inadequate physical infrastructure, and unreliable utilities can increase operating and transaction costs, thereby reducing the efficiency and competitiveness of MSMEs.
7	Competition	MSMEs face competition from large domestic enterprises as well as imported products. Differences in scale, technology, financial resources, branding, and production efficiency can make it difficult for smaller enterprises to compete effectively.

14. Major Findings

The study arrives at the following findings:

- MSMEs occupy an important position in India's employment structure.
- The latest registered-enterprise dashboard data indicate reported employment of approximately 41.13 crore persons as on 15 August 2026.
- Historical official estimates demonstrate the dominant employment role of micro enterprises.
- MSMEs generate employment in both rural and urban regions.
- MSMEs provide opportunities for both wage employment and self-employment.
- Women can use MSMEs as an important route towards economic participation and entrepreneurship.
- Youth entrepreneurship can help transform employment seekers into employment creators.
- Skill development is essential for improving MSME productivity and employment quality.
- MSMEs contribute significantly to GDP and exports.
- Finance, technology, skills, infrastructure and market access remain critical determinants of MSME employment performance.

15. Policy Recommendations

Based on the analysis, the following policy recommendations are proposed:

- **Expand affordable credit:** Special attention should be given to the financing requirements of micro enterprises.
- **Strengthen digital finance:** Digital banking and financial literacy should be expanded among small entrepreneurs.
- **Promote technology adoption:** Financial incentives and technical support can help MSMEs adopt modern technologies.
- **Develop industry-linked skills:** Skill programmes should be designed around actual enterprise requirements.
- **Promote women entrepreneurship:** Dedicated credit, training and market-support mechanisms should be strengthened.
- **Support youth entrepreneurship:** Young entrepreneurs require mentoring in addition to finance.
- **Improve market access:** E-commerce, digital marketing and government procurement can provide additional market opportunities.
- **Reduce payment delays:** Timely payment is particularly important for micro and small enterprises with limited working capital.

- **Develop rural clusters:** Cluster-based development can strengthen local production networks.
- **Improve infrastructure:** Better logistics, electricity and digital connectivity can reduce enterprise costs.
- **Strengthen value-chain integration:** MSMEs should be connected with large firms and export-oriented supply chains.
- **Improve policy coordination:** Central and state-level MSME programmes should be better coordinated.

16. Conclusion

The evidence presented in this study establishes that MSMEs have a substantial role in India's employment-generation process. Their importance arises not simply from the number of enterprises but from their ability to combine entrepreneurship, local resources, labour and relatively modest capital requirements. The latest official dashboard data report 411.32 million persons of employment under Udyam and UAP registrations as on 15 August 2026. This figure illustrates the enormous scale of the registered MSME employment ecosystem, although it should not be treated as a complete estimate of total employment in every MSME in India. The historical evidence further shows that micro enterprises account for the overwhelming majority of MSME employment, while rural and urban areas both benefit substantially from MSME activity. MSMEs also provide an important platform for self-employment, women's economic participation and youth entrepreneurship. Nevertheless, employment generation cannot be sustained merely by increasing the number of enterprises. The long-term employment contribution of MSMEs depends on productivity, competitiveness, technological capability, access to finance, skills, infrastructure and market opportunities.

Therefore, India's MSME policy should move beyond enterprise creation towards sustainable enterprise growth and quality employment generation. A coordinated strategy combining finance, technology, skill development, digitalisation, entrepreneurship and market access can enable MSMEs to become an even stronger foundation for inclusive and employment-oriented economic growth.

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TARK TANSAKU
ISSN: 3139-7700
Volume 1, Issue 2, June 2026

Evolution of Goods and Services Tax Research: A Bibliometric and Thematic Analysis of Intellectual Trends and Emerging Frontiers

Pankaj Sharma
Assistant Professor
Shri K. K. Shastri Government Commerce College `

Manoj Bansal
Assistant Professor
University School for Graduate Studies, Chaudhary Devi Lal University

Abstract: This study examines the evolution and intellectual structure of Goods and Services Tax (GST) research using bibliometric and thematic analysis. Data were retrieved from the Dimensions database, resulting in 2,391 articles across 415 sources and 3,649 authors after data cleaning. Bibliometrix/Biblioshiny was used to analyse publication trends, citations, sources, authors, geographical contributions, collaboration, and thematic development. Title and abstract analysis using unigram, bigram and trigram techniques was further employed to identify dominant and emerging research themes. The findings reveal an established but fragmented research field, characterised by limited international collaboration. The thematic evolution shows a shift from economic, institutional, investment and tax-policy issues toward tax administration, compliance, digital transformation, digital economy, artificial intelligence, data analytics and intelligent tax systems. Recent research increasingly reflects the integration of taxation with digital technologies and data-driven governance. The study concludes that the GST research agenda is moving beyond conventional tax reform toward digital and technology-enabled tax administration, creating new opportunities for research on e-invoicing, digital compliance, AI-based tax administration, taxpayer behaviour and international comparative GST systems.

Keywords: Goods and Services Tax (GST); Bibliometric Analysis; Tax Compliance; Digital Taxation; Artificial Intelligence

1. Introduction and Literature Review

1.1 Introduction

Goods and Services Tax (GST) has emerged as one of the most significant tax reforms undertaken by several economies to simplify indirect taxation, reduce cascading effects, improve tax compliance and create a more integrated market. The transition from multiple indirect taxes to a value-added tax-based system has generated considerable academic interest because taxation is closely associated with government revenue, economic efficiency, business decisions, consumer behaviour and fiscal policy. In developing economies, GST is particularly important

because the effectiveness of the tax system depends not only on its legislative design but also on administrative capacity, taxpayer awareness, compliance behaviour and technological infrastructure.

In India, the introduction of GST on 1 July 2017 represented a major structural transformation of the indirect taxation system. The reform attempted to subsume several central and state indirect taxes into a common destination-based taxation framework. Consequently, GST became an important area of research in economics, commerce, accounting, public finance, taxation, management and public administration. The initial literature predominantly focused on the conceptual framework, structure, implementation and economic implications of GST, whereas subsequent research increasingly examined tax compliance, taxpayer behaviour, tax administration, revenue mobilisation and the impact of GST on businesses.

With the progressive digitalisation of GST administration, the research agenda has further expanded. Online registration, electronic return filing, e-way bills, e-invoicing, input-tax-credit reconciliation and data-based monitoring have transformed GST from a conventional tax administration mechanism into a highly technology-dependent system. Consequently, recent studies increasingly connect GST with digital transformation, digital taxation, information systems, data analytics, artificial intelligence and intelligent tax administration.

The growing volume and multidisciplinary nature of GST research make it increasingly difficult to understand the development of the field through conventional narrative review alone. Bibliometric analysis provides an appropriate methodological approach for systematically examining the growth, structure and intellectual development of a research domain. It enables researchers to analyse publication trends, citation structures, influential authors, sources, countries, institutions, collaboration networks and thematic developments. In the present study, bibliometric analysis is further complemented by textual analysis of titles and abstracts through unigram, bigram and trigram techniques to identify established, emerging and future-oriented research themes.

1.2 Literature Review

Dhar and Khandelwal (2020) conducted a bibliometric analysis of GST research covering the period from 2004 to 2019. The study examined publication growth, citation patterns, prolific authors, influential journals, countries, institutions and keyword occurrences. The findings indicated a substantial increase in GST-related publications, particularly during the later part of the study period, and highlighted the growing importance of India in GST research. The study provided an important foundation for understanding the development of GST scholarship from a bibliometric perspective. However, the study period ended in 2019, before the substantial expansion of research relating to digital compliance, e-invoicing, digital taxation, artificial intelligence and data-driven tax administration. Therefore, an updated bibliometric investigation is necessary to capture the recent transformation of the GST research landscape.

Cnossen (2015) examined the development and functioning of value-added taxation and highlighted the importance of VAT/GST as a major source of government revenue. The study discussed the design and administration of VAT systems and emphasised the importance of an appropriately designed tax base, rate structure and compliance mechanism. The study is important for GST research because it establishes the broader theoretical and economic foundation of GST as a value-added consumption tax. Thus, the early GST literature can be

understood as being strongly rooted in the broader international literature on VAT, consumption taxation and tax-system design.

Ajzen (1991) developed the Theory of Planned Behavior (TPB), explaining that behavioural intention is influenced by attitude, subjective norms and perceived behavioural control. Although the theory was not developed specifically for taxation, it has subsequently become an important theoretical framework for understanding compliance behaviour. The relevance of TPB to GST research lies in its ability to explain why taxpayers may comply with tax regulations beyond purely economic considerations such as penalties and tax rates. The theory therefore provides a behavioural foundation for the increasing body of GST compliance research.

Garg et al. (2022) examined the determinants of GST taxpayer compliance behaviour and argued that compliance cannot be explained solely through economic variables. The study highlighted the importance of factors such as taxpayer knowledge, satisfaction with GST services and behavioural characteristics in influencing compliance. The findings indicate that taxpayer compliance is multidimensional and is influenced by the interaction between taxpayers and the tax administration system. This study therefore represents an important transition in GST literature from a predominantly structural and economic perspective toward a behavioural perspective.

Garg et al. (2024) applied the Theory of Planned Behavior to examine GST compliance behaviour among Indian taxpayers. The study demonstrated the relevance of behavioural constructs in explaining taxpayers' compliance intentions and highlighted the importance of psychological and perceptual factors in GST compliance. The study is significant because it extends GST research beyond conventional economic models and introduces behavioural theory into the analysis of taxpayer decisions. This indicates that contemporary GST research is increasingly incorporating concepts from psychology, behavioural economics and management.

Ramkumar et al. (2023) investigated Indian taxpayers' perceptions of GST using structural equation modelling. The study examined variables such as taxpayer attitude, tax knowledge, tax equity and perceived fairness and attempted to identify their relationship with taxpayers' GST-related perceptions and behaviour. The findings demonstrated that taxpayers' perceptions and knowledge are important components of the GST compliance environment. The study therefore indicates that the effectiveness of GST depends not only on administrative mechanisms but also on taxpayers' understanding and perception of the tax system.

Shacheendran (2024) examined the barriers affecting GST compliance among Indian business owners using interpretive structural modelling and MICMAC analysis. The study identified different barriers and examined their interrelationships to understand the structural factors affecting compliance. The findings are particularly relevant for small businesses because compliance with GST involves registration, documentation, accounting, return filing and technological requirements. The study demonstrates that GST compliance is not merely an individual taxpayer decision but can also be influenced by organisational and technological constraints.

Kumar and Gokhru (2025) examined GST compliance behaviour among Indian taxpayers by considering factors such as tax knowledge, perceived fairness, compliance costs and legal enforcement. The study demonstrated that taxpayer behaviour is influenced by a combination of informational, economic, perceptual and institutional factors. The study further strengthens the

argument that GST compliance research has moved from a narrow focus on enforcement toward a broader understanding of taxpayer behaviour.

Jagtiani (2026) examined the relationship between digital compliance and GST revenue buoyancy in India during the period 2017–2024. The study highlighted the importance of digital infrastructure, GSTN, e-invoicing, e-way bills and automated return matching in strengthening tax compliance and revenue collection. The study also pointed out challenges related to digital capabilities, infrastructure and governance. This study is particularly important for the present research because it demonstrates the increasing convergence between GST, digital transformation and tax administration.

Uma Maheshwari and Alivelu (2026) examined the implications of the evolving GST framework for small and medium-sized enterprises. The study highlighted the importance of compliance requirements and technological changes for businesses operating under the GST regime. The study indicates that the digital transformation of taxation may generate both opportunities and challenges for smaller businesses depending upon their technological capabilities and resources. Thus, GST research is increasingly concerned with the differential impact of digital tax administration on various categories of taxpayers.

The literature on GST and business performance has also expanded considerably. Several studies have examined the implications of GST for business costs, working capital, pricing, supply chains and operational efficiency. The underlying argument is that GST can potentially reduce tax cascading and improve supply-chain efficiency, but businesses may simultaneously experience transitional costs associated with system implementation, accounting changes and compliance requirements. This strand of research demonstrates that GST should be evaluated not only as a government revenue mechanism but also as a factor influencing business decision-making.

The literature on GST and economic performance has similarly developed over time. Earlier studies generally examined whether GST could improve economic efficiency, simplify indirect taxation and enhance revenue mobilisation. Later studies increasingly employed empirical methods to examine the relationship between GST and economic growth, inflation, investment and government revenue. This evolution reflects a movement from ex-ante evaluation of GST as a proposed reform toward ex-post empirical assessment of GST outcomes.

The fiscal-federal dimension of GST has also received substantial scholarly attention. Since Indian taxation involves both central and state governments, GST implementation required significant institutional coordination. Researchers have therefore examined GST in relation to revenue sharing, state finances, fiscal autonomy and intergovernmental relations. This literature establishes that GST is not merely an indirect tax but also an important institutional mechanism affecting the functioning of Indian fiscal federalism.

Another important stream of literature concerns tax evasion and tax avoidance. Traditional tax research has examined the determinants of non-compliance and the effectiveness of enforcement mechanisms. Under the GST system, however, the availability of transaction-level digital information has created new possibilities for detecting tax evasion. The integration of invoices, returns, e-way bills and input-tax-credit information enables tax authorities to identify inconsistencies and potentially suspicious transactions. Consequently, recent research

increasingly connects GST compliance with data analytics, digital monitoring and risk-based tax administration.

The emergence of digitalisation has fundamentally changed the direction of GST research. Earlier research largely considered information technology as an administrative tool, whereas contemporary studies increasingly view digital technology as an integral component of tax governance. Digital transformation has affected registration, return filing, invoicing, payment, reconciliation, audit and enforcement. Therefore, recent GST scholarship increasingly intersects with information systems, accounting technology, data science and digital governance.

The emergence of e-invoicing represents another important development in this literature. E-invoicing enables transaction information to be generated and transmitted electronically in a standardised format. This can improve invoice verification, reduce manual intervention and support input-tax-credit reconciliation. Consequently, research on e-invoicing increasingly connects accounting information systems with tax administration and compliance.

The emergence of artificial intelligence and data analytics represents the latest stage of this transformation. The large volume of GST transaction data creates opportunities for advanced analytical techniques to identify abnormal transaction patterns, classify taxpayers according to risk, detect fraudulent invoices, predict compliance behaviour and improve audit selection. Consequently, recent GST research is beginning to move toward AI-enabled tax administration.

This emerging literature suggests that the future of GST administration may increasingly involve the transition from conventional digital systems toward intelligent tax systems. Such systems could integrate transaction data, taxpayer information, historical compliance behaviour and predictive analytics to support automated risk assessment and targeted enforcement. However, this transition also introduces new research questions concerning algorithmic transparency, data privacy, cybersecurity, fairness, explainability and taxpayer rights.

The literature also indicates an increasing connection between GST and the digital economy. The growth of e-commerce, digital platforms and cross-border digital services has created new challenges for consumption-tax administration. Traditional tax systems were designed largely around physical transactions and identifiable business locations, whereas digital commerce can involve multiple jurisdictions and complex transaction structures. Therefore, GST research increasingly intersects with digital taxation and international tax governance.

The literature on GST is also becoming increasingly connected with sustainable development. Tax revenues provide governments with resources for financing public infrastructure, healthcare, education and social programmes. Consequently, effective tax administration can contribute indirectly to sustainable development. Recent research has therefore begun connecting taxation with sustainable development, sustainable business practices and inclusive economic growth.

Overall, the literature demonstrates a clear evolution in the intellectual focus of GST research. The earliest studies were primarily concerned with tax reform, GST design, economic efficiency and fiscal federalism. The subsequent literature shifted toward revenue, economic performance, business implications and tax administration. A further transition occurred toward taxpayer compliance, taxpayer knowledge, fairness, behavioural intentions and enforcement. The most recent research increasingly focuses on digital compliance, e-invoicing, digital taxation, data analytics, artificial intelligence and intelligent tax administration.

This progression provides the central intellectual basis for the present bibliometric study. While previous research has examined individual dimensions of GST, there remains a need to systematically map how these themes have developed collectively and how the intellectual structure of GST research has changed over time.

Dhar and Khandelwal (2020) provided an important initial bibliometric assessment of GST research, but their analysis ended in 2019. Since then, GST research has experienced important developments in digitalisation, taxpayer behaviour, compliance technology, e-invoicing and AI-enabled tax administration. Therefore, the present study extends the existing literature by examining a much broader and more recent body of research and by combining descriptive bibliometric analysis with title- and abstract-based textual analysis.

In particular, the use of unigram, bigram and trigram analysis enables the present study to identify not only the most frequently occurring individual terms but also the combinations of concepts through which new research themes emerge. Unigram analysis identifies dominant concepts, bigram analysis identifies contextual relationships between concepts, and trigram analysis provides more specific research expressions. The temporal distribution of these terms further enables the identification of established themes, transitional themes and emerging research frontiers.

Thus, the present study attempts to fill an important gap by answering not only "How much GST research has been published?", but also "How has GST research evolved intellectually, which themes have dominated different periods, and what emerging themes are likely to shape the future of GST scholarship?" This positioning distinguishes the present study from conventional GST reviews and provides a comprehensive perspective on the evolution of the GST research domain.

2. Methodology

2.1 Objective of the Study

The study aims to map and critically examine the evolution of research on Goods and Services Tax (GST), with particular emphasis on tax compliance, tax administration, taxpayer behaviour, digitalization, digital taxation, e-invoicing and tax technology. Specifically, the study seeks to identify the growth pattern of the literature, major publication sources and contributors, citation structure, thematic patterns, prominent research terms, and emerging and trending research areas within the GST literature.

2.2 Research Design

The study adopts a quantitative bibliometric research design based on science mapping and descriptive bibliometric techniques. Bibliometric analysis was employed to systematically analyse the existing body of scholarly literature and identify the intellectual, conceptual and thematic development of GST-related research. Particular emphasis was placed on title and abstract content analysis to identify the most relevant terms and emerging research trends without imposing predetermined thematic categories.

2.3 Search Strategy and Data Collection

The bibliographic data were retrieved from the Dimensions database on 14 August 2026. A structured keyword strategy was developed using Boolean operators (AND and OR) and wildcard/truncation operators to capture variations in terminology. The search was conducted using the TITLE-ABS-KEY field to ensure that retrieved publications were directly relevant to the research theme through their titles, abstracts or keywords.

The search query used was:

TITLE-ABS-KEY (("Goods and Services Tax" OR GST OR "goods and service tax" OR VAT OR "value added tax" OR "indirect tax") AND ("tax compliance" OR "tax administration" OR "taxpayer behaviour" OR "taxpayer behavior" OR digitali?ation OR "digital transformation" OR "digital taxation" OR e-invoic OR "tax technolog*"))**

The first conceptual block captured the principal terminology associated with **GST and indirect taxation**, while the second block captured the major dimensions of contemporary GST research, including **tax compliance, tax administration, taxpayer behaviour, digitalisation, digital transformation, digital taxation, e-invoicing and tax technology**. The use of digitali?ation was intended to capture both the British spelling *digitalisation* and American spelling *digitalization*, while truncation operators were used to capture relevant word variants.

2.4 Data Screening and Preparation

The initial bibliographic records were exported in full-data format from Dimensions. During data preparation, **186 duplicate records were identified and removed** to ensure that each publication was represented only once in the final dataset. The cleaned dataset was subsequently used for bibliometric analysis. The database export covered the available publication period represented in the retrieved dataset. For hyper-authored publications containing more than 100 authors, the database export does not provide author names and affiliations; this database-level limitation was considered during interpretation of author and collaboration indicators.

2.5 Data Analysis and Tools

The cleaned bibliographic dataset was analysed using **Bibliometrix/Biblioshiny**, an R-programming-based bibliometric analysis environment. The analysis primarily employed descriptive bibliometric indicators and science-mapping techniques to examine the structure and evolution of GST research. The study employed a range of bibliometric techniques to assess publication growth, citation performance, influential sources, authors and documents, author productivity and collaboration, regional contributions and international co-authorship. Further analyses included source-level H-index, Bradford's Law, Reference Publication Year Spectroscopy, life-cycle and cumulative growth analysis, and a three-field plot to examine relationships among sources, authors and thematic terms, thereby providing a comprehensive assessment of the intellectual structure, development and thematic evolution of GST research.

2.6 Title and Abstract-Based Text Analysis

A major component of the study focuses on **textual analysis of titles and abstracts** to identify the conceptual and thematic development of GST research. Rather than relying exclusively on author-assigned keywords, the study analyses the actual textual content of publications to identify frequently occurring and emerging terminology.

The textual analysis was conducted at three levels:

Unigram analysis identifies individual words that occur most frequently in titles and abstracts, thereby highlighting the dominant concepts within the literature.

Bigram analysis examines frequently occurring two-word combinations and provides greater contextual meaning than individual terms. For example, combinations such as *tax compliance*, *tax administration* or *digital taxation* can reveal established conceptual relationships.

Trigram analysis examines three-word combinations and enables the identification of more specific research themes and emerging conceptual expressions within the GST literature.

The frequency and temporal occurrence of these unigrams, bigrams and trigrams were examined to identify **dominant terms, emerging terminology and trending research topics**. Particular attention was given to recent terms to distinguish established themes from emerging research fronts.

3. Bibliographic Results

Table 1: Main Information of Data Entered for Bibliometric Analysis on GST

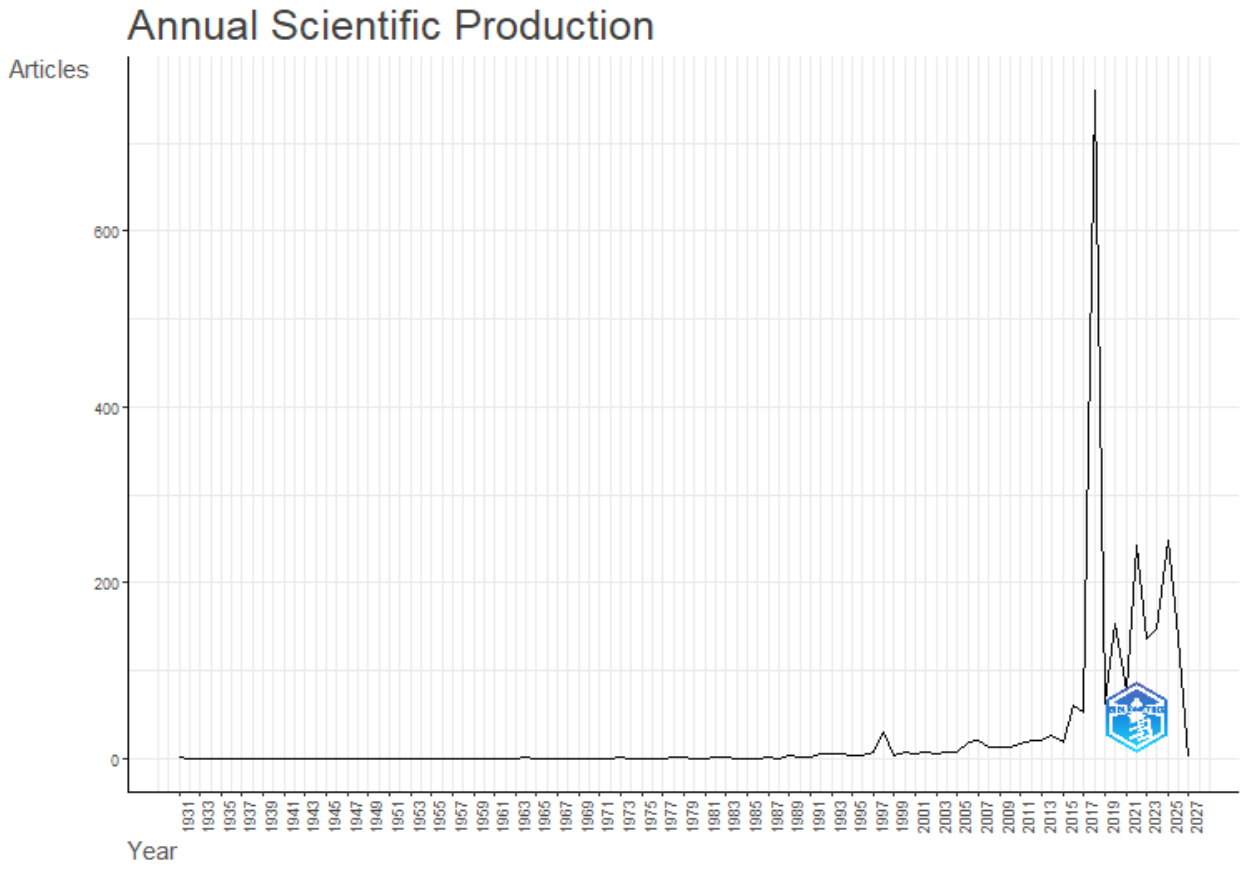
Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	1931:2027
Sources (Journals, Books, etc)	415
Documents	2391
Annual Growth Rate %	0.72
Document Average Age	7.17
Average citations per doc	8.563
References	30549
DOCUMENT CONTENTS	
Keywords Plus (ID)	1
Author's Keywords (DE)	1
AUTHORS	
Authors	3649
Authors of single-authored docs	457
AUTHORS COLLABORATION	
Single-authored docs	581
Co-Authors per Doc	2.01
International co-authorships %	3.722
DOCUMENT TYPES	
article	2391

The bibliometric dataset comprises 2,391 articles published across 415 sources between 1931 and 2027, indicating a relatively established but gradually evolving research base on GST. The low annual growth rate (0.72%) suggests that GST research has expanded slowly rather than experiencing rapid scholarly acceleration. With an average document age of 7.17 years and 8.56 citations per document, the literature demonstrates moderate scholarly influence but limited recent dynamism. The presence of 3,649 authors and an average of 2.01 co-authors per document indicates considerable author participation but relatively modest collaboration intensity. Most notably, international co-authorship is only 3.72%, revealing weak global research collaboration

and suggesting substantial scope for cross-country comparative GST research. Overall, the findings indicate a broad but fragmented research landscape with limited international integration, warranting deeper analysis of its thematic evolution and emerging research fronts.

Table 2: Annual Scientific Production

Year	Articles
2018	760
2025	248
2022	242
2020	153
2024	148
2026	138
2023	136
2021	77
2019	63
2016	61

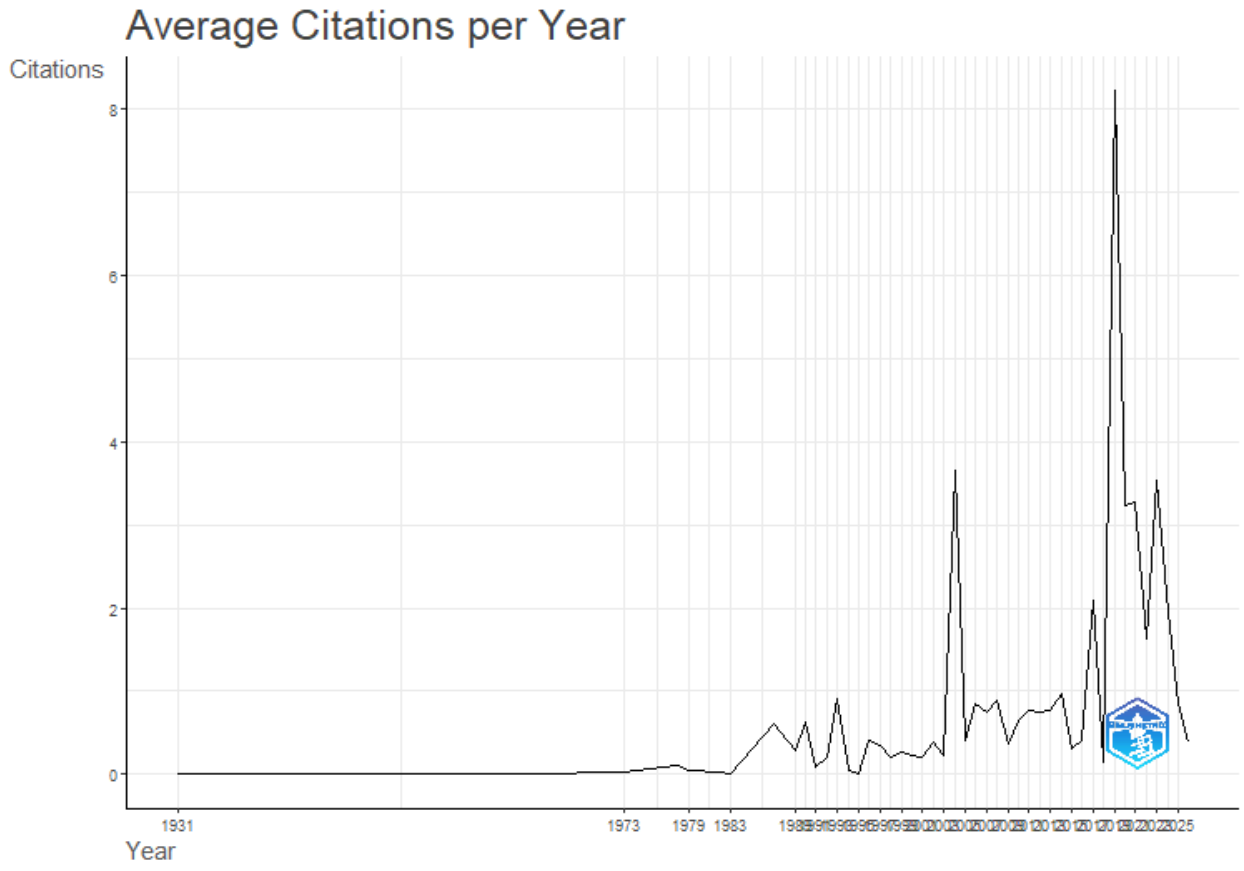


The publication pattern shows a highly uneven temporal distribution, with an exceptional spike of 760 articles in 2018, followed by a sharp decline to 63 in 2019 and then a gradual recovery.

Research output remained relatively strong during 2020–2025, peaking again at 248 articles in 2025. The unusually high 2018 volume may indicate a database/indexing or metadata anomaly and should therefore be critically verified before interpreting it as a genuine research surge. The continued output after 2020 nevertheless suggests sustained scholarly interest in GST. Overall, the trend reflects episodic rather than consistently accelerating growth, warranting further investigation of thematic and policy-related factors driving publication fluctuations.

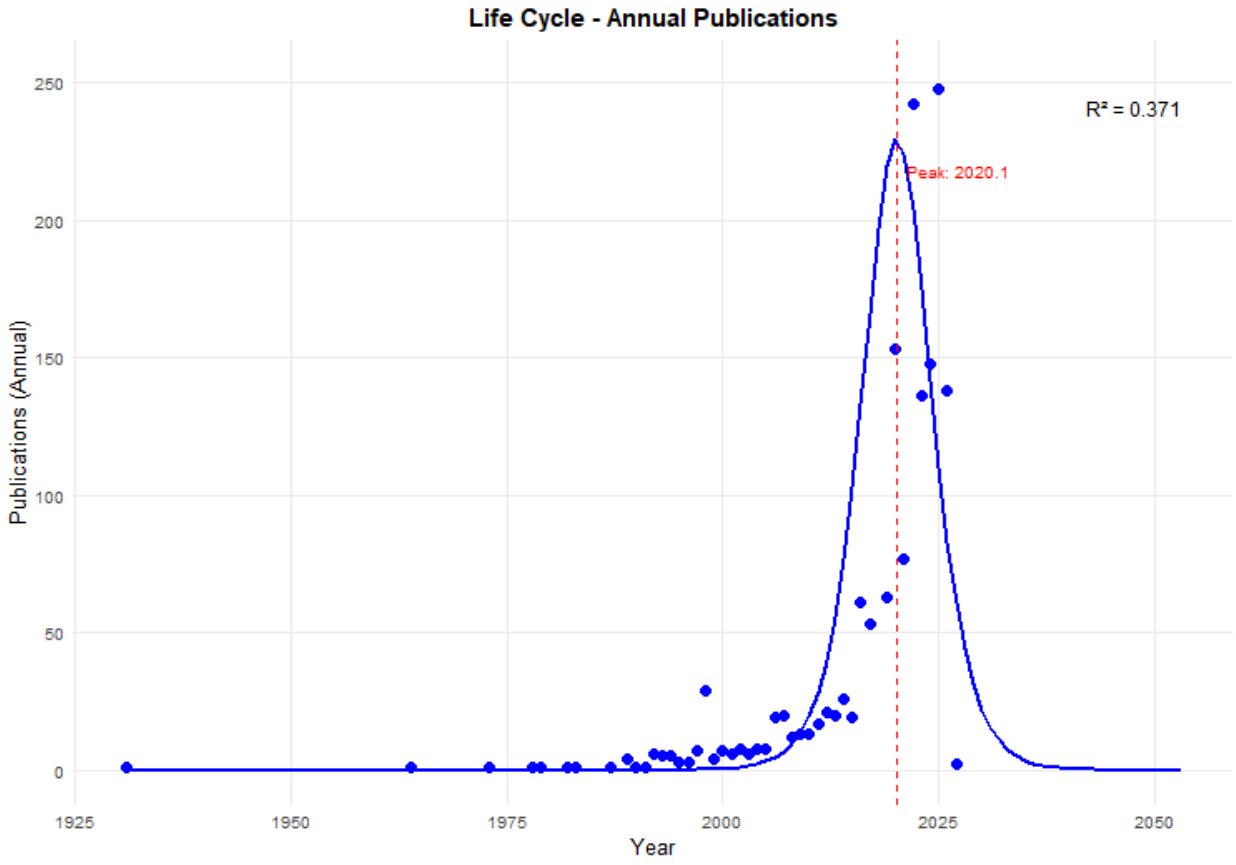
Table 3: Average Citation Per Year

Year	MeanTCperArt	N	MeanTCperYear	CitableYears
2019	65.75	63	8.22	8
2004	83.88	8	3.65	23
2023	14.15	136	3.54	4
2021	19.61	77	3.27	6
2020	22.71	153	3.24	7
2017	21.04	53	2.1	10
2024	5.89	148	1.96	3
2022	8.21	242	1.64	5
2014	12.65	26	0.97	13
1993	31	5	0.91	34



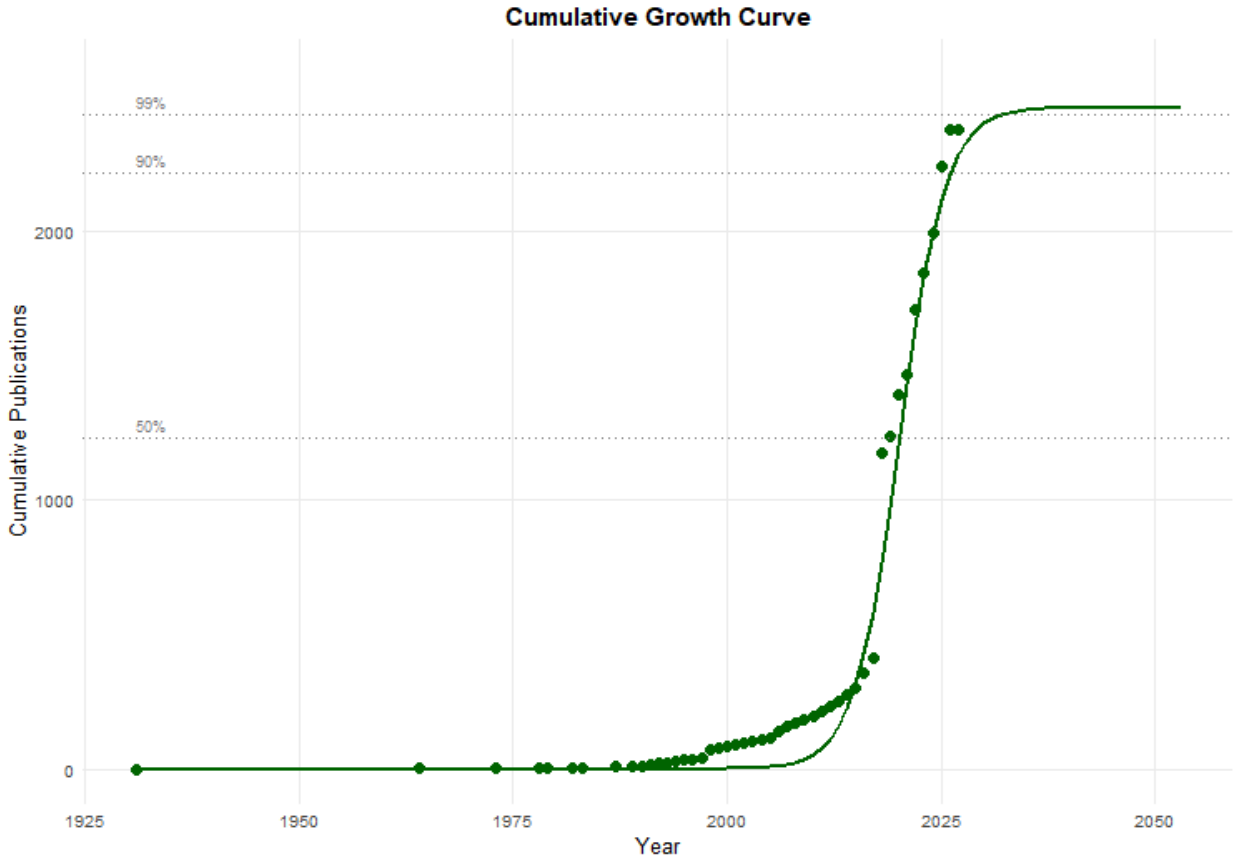
The citation profile shows considerable variation across publication years, with 2019 recording the highest mean citations per article (65.75) among the more recent years, followed by 2020 (22.71) and 2021 (19.61). The exceptionally high citation impact of 2004 (83.88 citations/article) is based on only eight documents and should therefore be interpreted cautiously. More recent publications, particularly 2022–2024, show lower mean citations largely because of their shorter citation windows, rather than necessarily lower research quality. The MeanTCperYear measure reinforces this temporal effect, with older studies generally benefiting from longer exposure to citations. Overall, the results indicate that citation impact is strongly influenced by publication age and document volume, making normalized and field-sensitive indicators essential for evaluating the influence of GST research.

Chart 1: Life Cycle Analysis



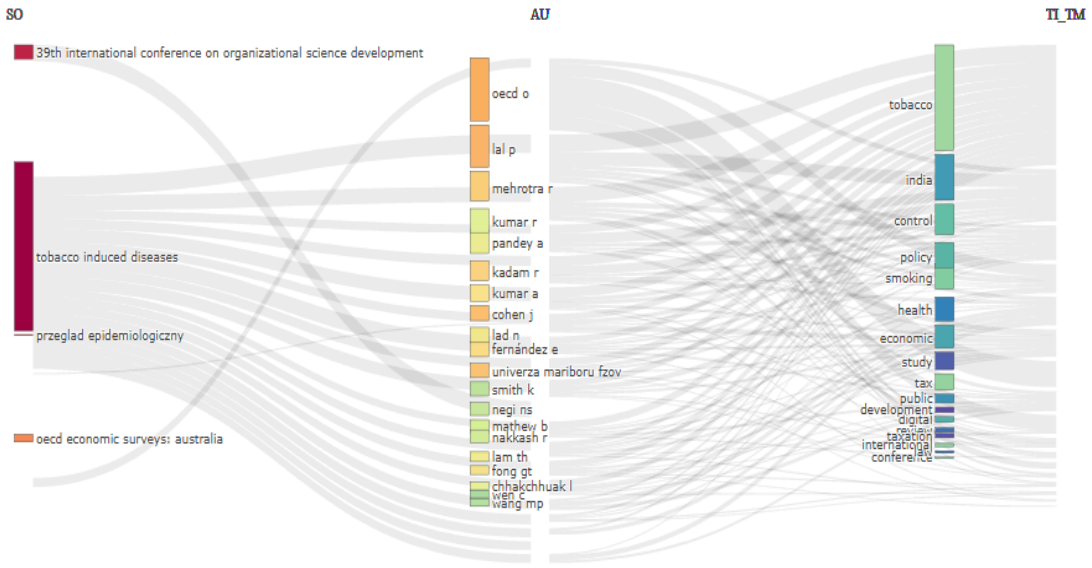
The life-cycle analysis indicates that GST research experienced gradual growth before accelerating sharply, reaching its estimated publication peak around 2020.1, followed by a decline in subsequent years, suggesting that the field has moved from rapid expansion toward a more mature phase.

Chart 2: Cumulative Growth Curve



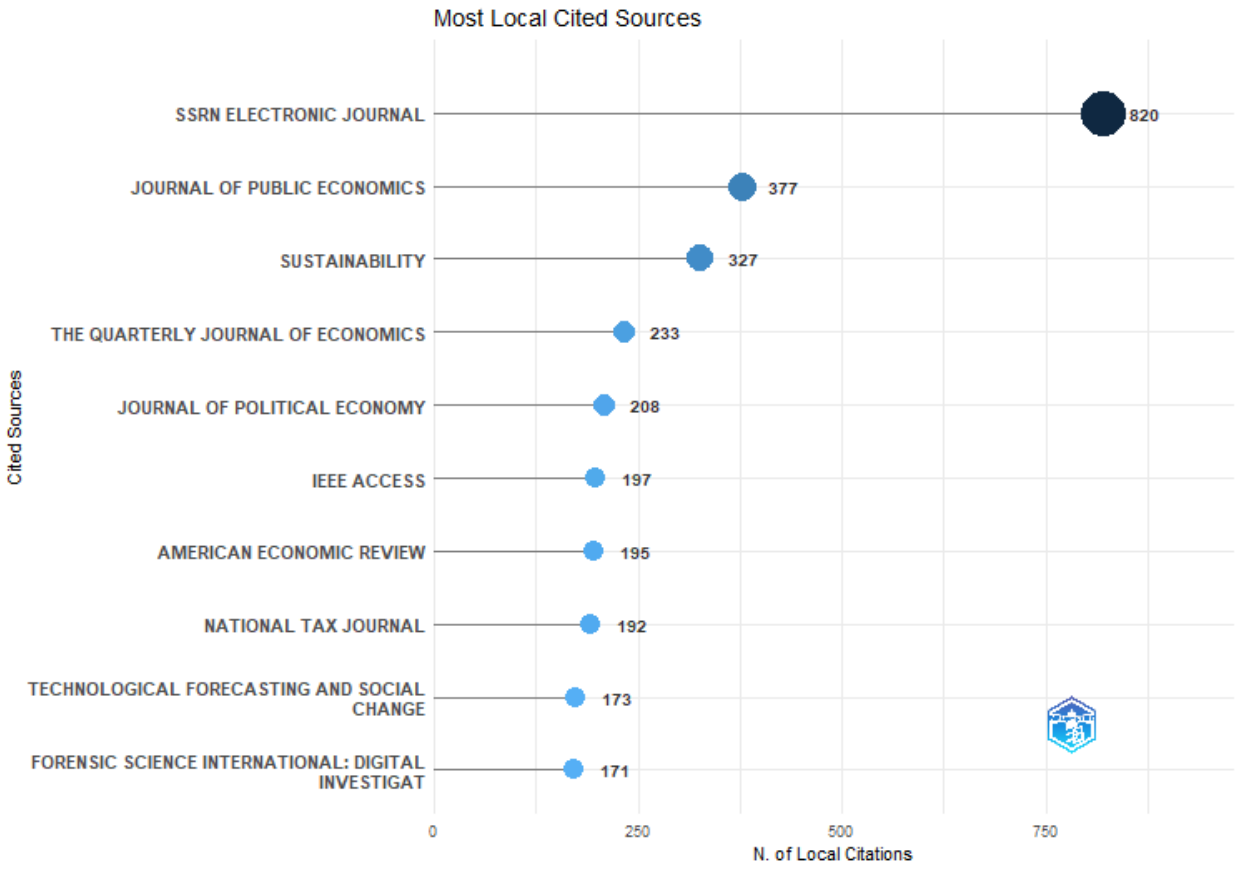
The cumulative growth curve indicates that GST research remained limited until the 2000s, followed by rapid expansion after 2015, with approximately 50% of publications accumulated around 2020 and nearly 99% by the late 2020s, indicating a sharp acceleration followed by an emerging saturation phase.

Chart 3: Three-Field Plot



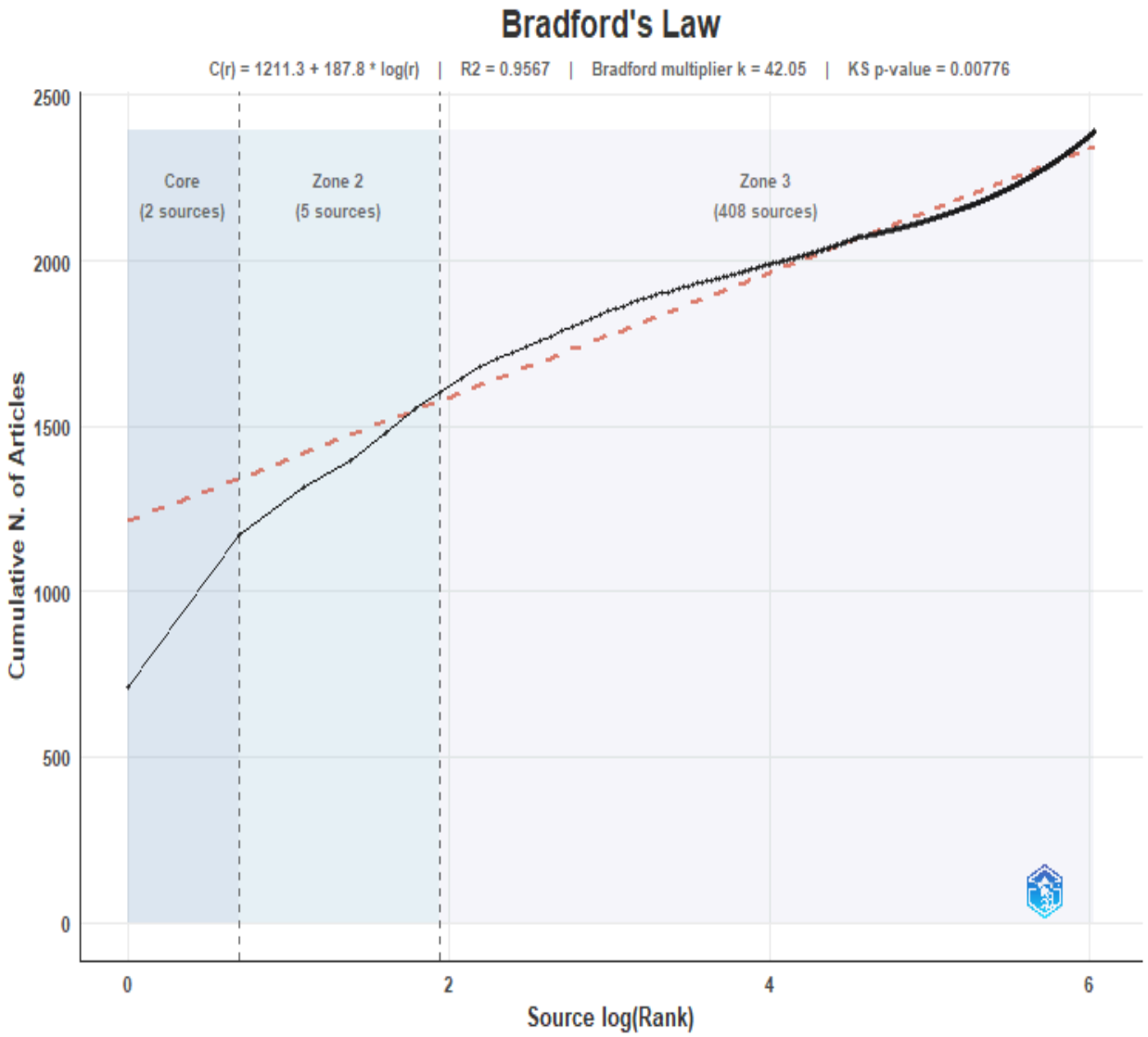
The three-field plot indicates that GST research is concentrated around a relatively small group of influential authors and source publications, with tobacco, India, control, policy, smoking, health and economic themes emerging as prominent keywords. Strong linkages between sources, authors and thematic terms suggest that GST-related research is interdisciplinary and context-driven, although the concentration around specific health and policy themes indicates some thematic clustering. The presence of tax, public policy, development, digitalisation and taxation toward the lower part of the keyword field suggests an expanding connection between GST and broader economic-policy issues. Overall, the plot reflects a diverse but uneven intellectual structure, with opportunities to explore emerging themes and underrepresented research areas.

Chart 4: Most Local Cited Sources



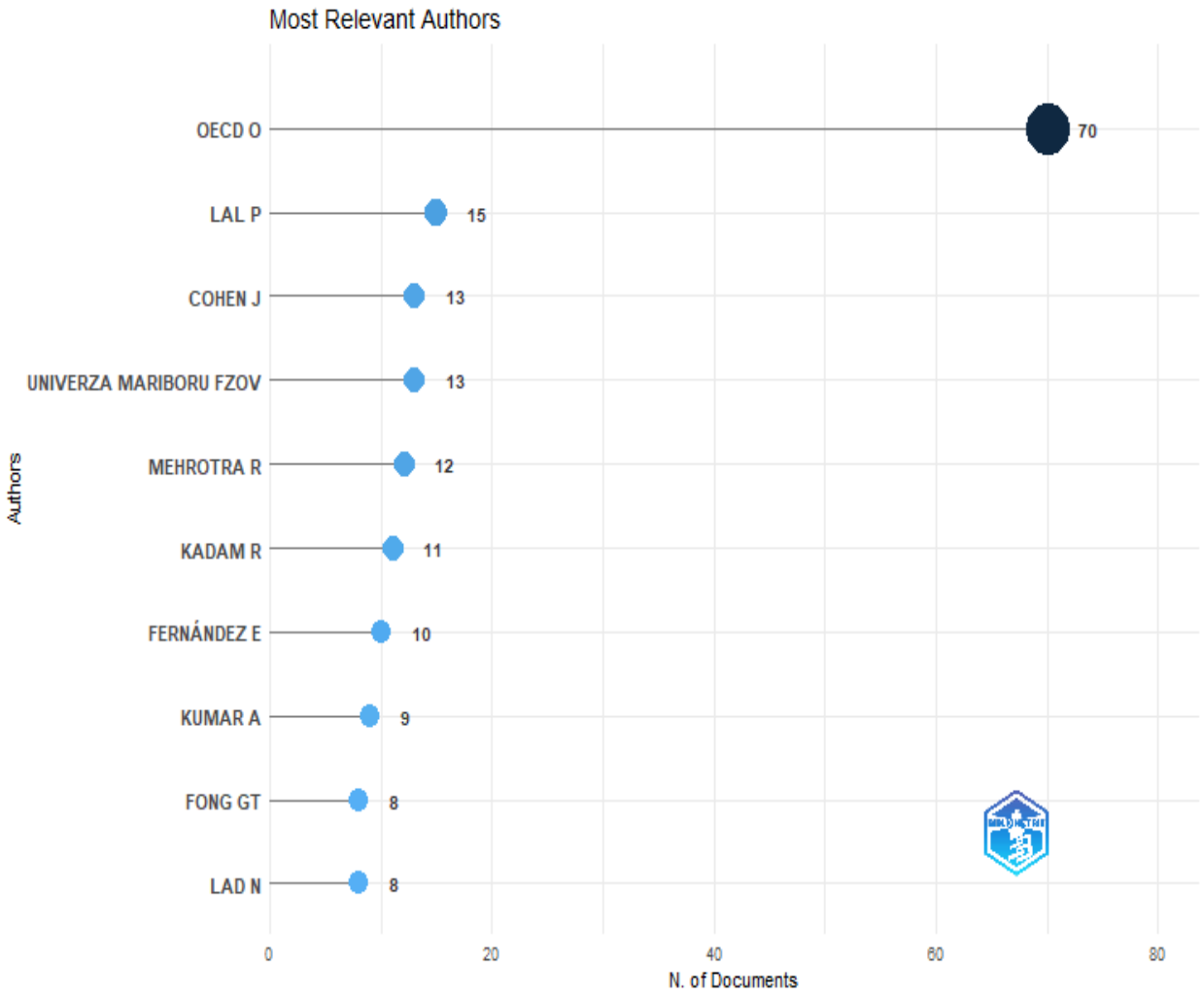
The local citation analysis shows that SSRN Electronic Journal (820 citations) is the most influential source within the dataset, followed by the Journal of Public Economics (377) and Sustainability (327). The presence of leading economics, taxation, technology and interdisciplinary journals indicates that GST research draws upon a diverse intellectual knowledge base. However, the relatively high influence of SSRN and broad disciplinary spread suggest that the field is not confined to conventional taxation research but intersects with public economics, sustainability, technology and policy studies. This diversity indicates an increasingly interdisciplinary knowledge structure, although the citation concentration in a few sources suggests that influential knowledge remains relatively centralized.

Chart 5: Bradford's Law



Bradford's Law shows a highly concentrated core of GST research sources, with only 2 sources forming the core zone, 5 sources in Zone 2, and 408 sources in the third zone. The high R^2 of 0.9567 indicates a strong fit with Bradford's distribution, while the Bradford multiplier (k = 42.05) confirms substantial dispersion of GST publications across sources. This suggests that a very small group of core sources carries a disproportionate share of the literature, whereas the majority of sources contribute relatively fewer publications. Overall, the findings demonstrate strong source concentration alongside extensive journal dispersion, indicating a fragmented but well-established publication structure in GST research.

Chart 6: Most Relevant Authors

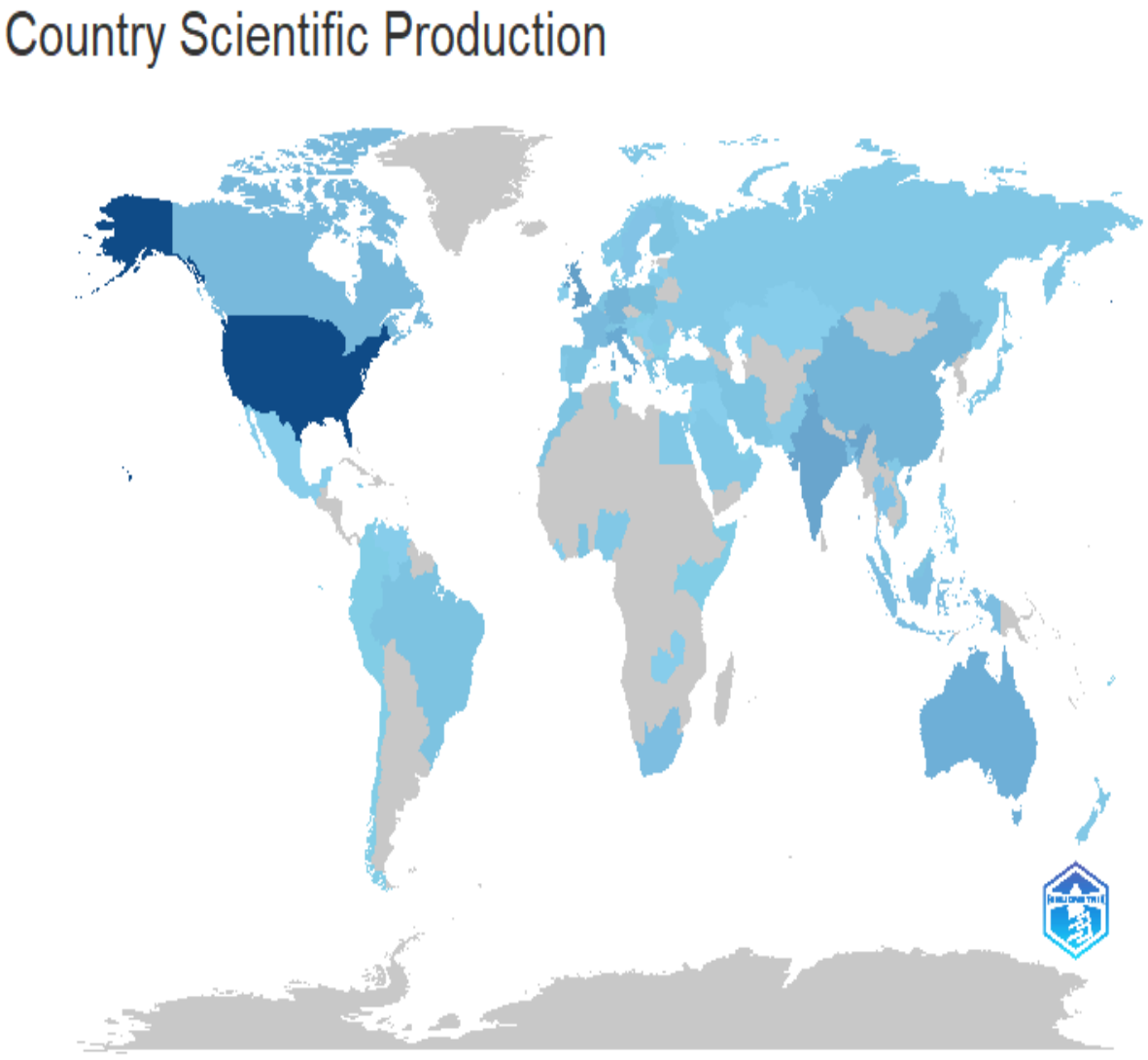


The author productivity analysis shows a highly concentrated contribution pattern, with OECD emerging as the most prolific author/source with 70 documents, substantially ahead of Lal P (15) and Cohen J and Univerza Mariboru FZOV (13 each). The sharp gap between the leading contributor and the remaining authors indicates uneven research productivity and concentration of contributions among a limited number of entities. The presence of authors from diverse geographical and institutional backgrounds suggests an international dimension, although the dominance of OECD warrants careful interpretation because it may represent an institutional/organizational author rather than an individual researcher. Overall, the results indicate a fragmented author landscape with a small number of highly productive contributors.

Table 4: Country's Scientific Production

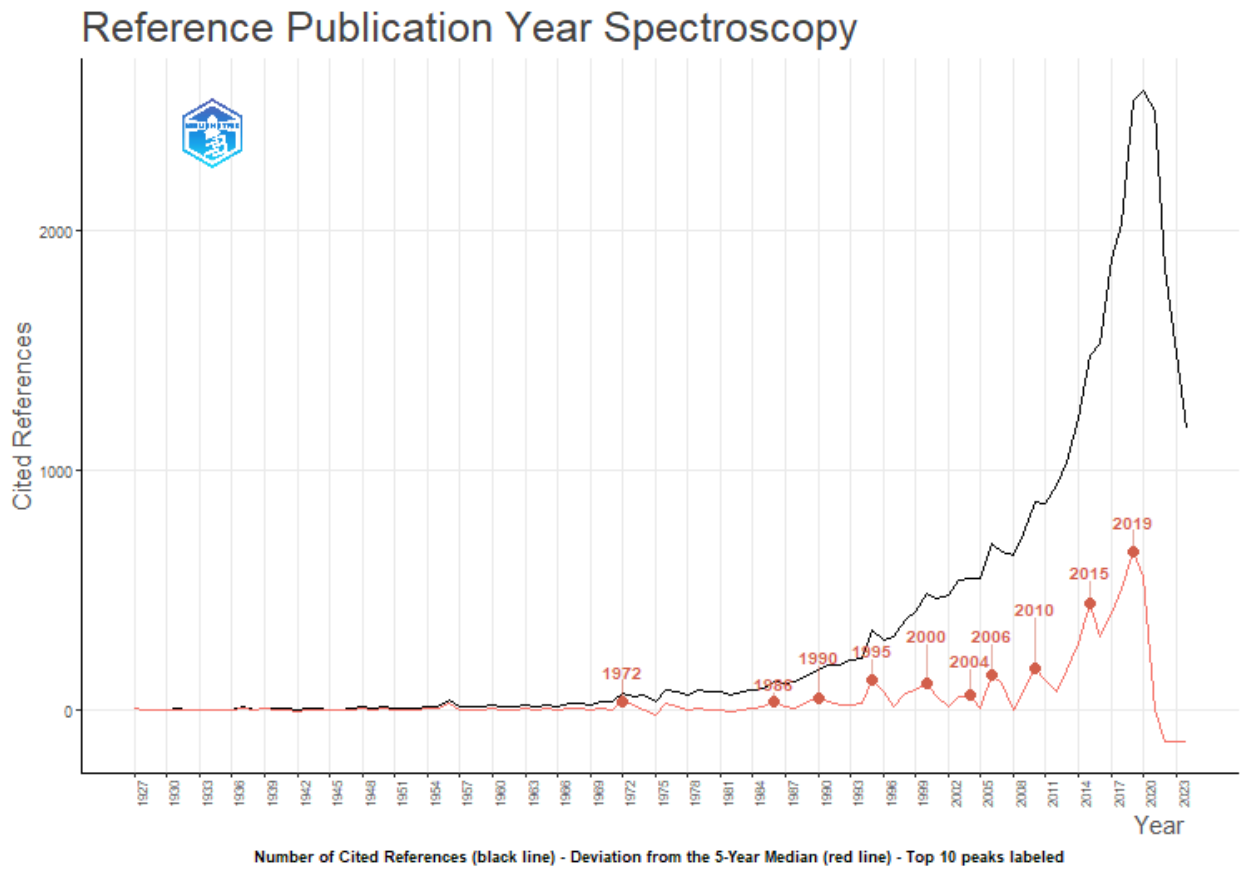
Region	Freq
USA	120
UK	38
INDIA	34
ITALY	31
AUSTRALIA	25

CHINA	24
GERMANY	21
FRANCE	18
CANADA	17
POLAND	15



The regional distribution indicates that the USA is the dominant contributor with 120 publications, substantially ahead of the UK (38), India (34), Italy (31), and Australia (25). India ranks third globally, indicating a significant contribution to the research field, while China, Germany, France, Canada, and Poland show comparatively moderate participation. Overall, the distribution demonstrates strong geographical concentration in the USA and other developed research economies, although the presence of India and China indicates growing contributions from emerging research systems.

Chart 8: Spectroscopy



The reference publication year spectroscopy indicates a progressive strengthening of the GST knowledge base, with cited references increasing substantially from the 1990s and showing pronounced peaks in 2014, 2015, and particularly 2019. The 2019 peak represents the strongest recent influence of foundational references, while the sharp rise in the black line indicates a rapidly expanding citation base in the field. Overall, the pattern suggests that GST research increasingly builds upon a growing and diverse body of prior literature, with 2010–2020 emerging as a particularly influential period in the development of the research domain.

3. Title and Abstract Analysis – Relevant Term

Table 5: Most Relevant Title Terms

Title Words 1	Occurrences	Title Words 2	Occurrences	Title Words 3	Occurrences
tobacco	489	tobacco control	119	oecd economic surveys	26
tax	189	international conference	93	systematic literature review	19
international	173	smoking cessation	40	trade policy review	15
smoking	151	artificial intelligence	39	pictorial health warnings	13
conference	137	digital transformation	39	internal tourism consumption	10
proceedings	137	tobacco industry	33	economic surveys australia	8
control	134	smokeless tobacco	30	intelligent systems proceedings	8

policy	132	oecd economic	28	tobacco control policy	8
digital	131	economic surveys	26	national tobacco control	7
economic	122	information systems	22	purposes peer reviews	7
india	116	tobacco products	20	secondhand smoke exposure	7
public	113	digital economy	19	tax purposes peer	7
business	112	systematic literature	19	tobacco control policies	7
health	109	health warnings	18	tobacco industry tactics	7
law	107	policy review	18	electronic nicotine delivery	6
review	95	systematic review	18	oecd investment policy	6
management	88	pictorial health	17	tobacco control law	6
study	87	tobacco cessation	16	corporate social responsibility	5
taxation	83	economic development	15	cross sectional study	5
development	76	tax evasion	15	global adult tobacco	5
analysis	75	trade policy	15	health warning labels	5
global	75	domestic inbound	14	investment policy reviews	5
systems	75	outbound tourism	14	smokeless tobacco slt	5
industry	72	public administration	14	tobacco industry interference	5
economy	70	south africa	14	adult tobacco survey	4
cessation	68	cigarette smoking	13	august september proceedings	4
social	66	european union	13	corporate tax avoidance	4
volume	66	public health	13	federal tax procedure	4
cigarette	63	tobacco free	13	ifip wg international	4
technology	62	bibliometric analysis	12	information systems perspective	4





Table 5 presents the most frequently occurring terms identified from the titles and abstracts of the selected literature. The analysis provides an overview of the dominant concepts, themes, policy concerns, and emerging research directions within the tobacco-related research domain. The results are presented at three levels individual title words, two-word terms, and three-word terms which together provide a more comprehensive understanding of the research focus.

At the individual word level, "tobacco" is by far the most dominant term, with 489 occurrences, confirming that tobacco constitutes the central subject of the analysed literature. The next highly occurring terms are "tax" (189), "international" (173), "smoking" (151), "conference" (137), "proceedings" (137), "control" (134), and "policy" (132). The high frequency of tax, taxation (83), economic (122), economy (70), development (76), and industry (72) indicate that the literature extends beyond the health consequences of tobacco and gives substantial attention to its economic and fiscal dimensions. In particular, the prominence of taxation suggests that tobacco taxation is an important policy instrument examined in the literature for controlling tobacco consumption and addressing associated economic consequences.

The strong occurrence of "international" (173), "global" (75), "India" (116), "European," "South Africa," and other geographical terms reflects the international and comparative nature of tobacco research. The prominence of India indicates that the Indian context represents an important geographical component of the literature. Similarly, the frequent appearance of "public" (113), "health" (109), "law" (107), "policy" (132), and "social" (66) demonstrates that tobacco research is closely associated with public health, regulatory frameworks, legislation, governance, and social policy.

The appearance of "digital" (131), "systems" (75), and "technology" (62) is particularly noteworthy. These terms indicate the emergence of a technological dimension within the research landscape. The literature appears to be gradually incorporating digital transformation, information systems, artificial intelligence, and intelligent systems into discussions related to tobacco, public policy, economics, and health. Thus, tobacco research is not restricted to traditional health and policy perspectives but is increasingly connected with digitalisation and technological innovation.

At the two-word level, "tobacco control" is the most frequently occurring term, with 119 occurrences, establishing tobacco control as the principal thematic focus of the literature. This is followed by "international conference" (93) and "smoking cessation" (40). The occurrence of "artificial intelligence" (39) and "digital transformation" (39) demonstrates the emergence of technology-oriented research. Furthermore, "tobacco industry" (33), "smokeless tobacco" (30), "OECD economic" (28), "economic surveys" (26), and "information systems" (22) indicate the multidisciplinary character of the research.

The frequent occurrence of "smoking cessation" (40), "tobacco cessation" (16), "health warnings" (18), "pictorial health" (17), and "pictorial health warnings" (13) indicates continued attention to behavioural interventions and public-health strategies. These terms suggest that researchers are examining mechanisms for reducing tobacco consumption, encouraging cessation, and improving awareness of the health risks associated with tobacco use. The presence of "smokeless tobacco" (30), "tobacco products" (20), and "electronic nicotine delivery" (6) further indicates that research encompasses multiple forms of tobacco and nicotine consumption rather than focusing exclusively on conventional cigarettes. The economic and policy dimension is also evident from terms such as "trade policy review" (15), "economic development" (15), "tax evasion" (15), "trade policy" (15), "public administration" (14), and "policy review" (18). These terms suggest that tobacco research intersects with tax policy, trade regulation, economic

development, public administration, and international economic governance. This is important because tobacco control involves not only health interventions but also complex questions concerning taxation, trade, industry regulation, and government policy.

At the three-word level, "OECD economic surveys" is the most frequent term, occurring 26 times, followed by "systematic literature review" (19) and "trade policy review" (15). The occurrence of "pictorial health warnings" (13) reflects the continuing importance of regulatory health communication. Other terms such as "internal tourism consumption" (10), "economic surveys Australia" (8), "intelligent systems proceedings" (8), "tobacco control policy" (8), and "national tobacco control" (7) demonstrate that the dataset also contains research connecting tobacco-related issues with broader economic, tourism, information-system, and national policy contexts.

The occurrence of "systematic literature review" (19), "systematic literature" (19), "systematic review" (18), "policy review" (18), and "bibliometric analysis" (12) indicates an increasing use of evidence-synthesis and bibliometric approaches. This suggests that the research field has developed sufficiently to encourage scholars to systematically examine accumulated knowledge, identify research trends, and map emerging thematic areas. The presence of these methodological terms is also indicative of an increasingly structured and mature research domain.

Overall, Table 5 demonstrates that the research landscape is highly multidisciplinary and evolving. The dominant research core is formed by tobacco, smoking, tobacco control, health, taxation, and policy, while a second layer is represented by economics, law, trade, industry, public administration, and international governance. At the same time, the emergence of artificial intelligence, digital transformation, information systems, and technology indicates newer research directions. The combination of health-oriented terms such as smoking cessation and health warnings with economic terms such as taxation, tax evasion, and economic development and technological terms such as artificial intelligence and digital transformation suggests that contemporary tobacco research is increasingly moving toward an integrated health economic policy technology perspective. Therefore, the title-term analysis indicates three broad research orientations: (1) tobacco control and public health, (2) economic, fiscal, legal, and policy regulation, and (3) digital and technological transformation. These interconnected themes provide evidence that tobacco research has expanded from a predominantly health-focused field into a broader interdisciplinary area involving public policy, economics, business, technology, governance, and international development.

Table 6: Most Relevant Abstract Terms

Abstract Words 1	Occurrences	Abstract Words 2	Occurrences	Abstract Words 3	Occurrences
tax	1297	digital transformation	316	business models coupled	76
book	1182	international conference	266	changing established business	76
tobacco	1017	tobacco control	191	decisions changing established	76
digital	995	artificial intelligence	152	digital technology organizations	76

development	972	organizational sciences	152	digital transformation experiences	76
international	784	business models	106	established business models	76
background	763	digital technology	101	human innovation process	76
research	753	information technology	98	increasingly integrates academic	76
business	673	tobacco products	94	individual society organizations	76
technology	670	technological advances	83	innovation process development	76
economic	668	society organizations	78	integrates academic knowledge	76
challenges	636	change management	77	organizational sciences adopts	76
data	636	information systems	77	organizational sciences traditionally	76
policy	620	modern organizations	77	promotes change management	76
public	573	academic knowledge	76	sciences traditionally encourages	76
management	556	changing established	76	streamline digital transformation	76
study	529	decisions changing	76	technology promotes change	76
information	519	development timeline	76	todays individual society	76
countries	517	digital economy	76	Traditional performance structures	76
economy	516	digital users	76	transformation experiences ideas	76
innovation	515	environment requires	76	uncertain decisions changing	76
financial	503	established business	76	analyses tourism performance	38
conference	477	experiences ideas	76	covering domestic inbound	38
global	464	fostering competitiveness	76	data covering domestic	38
systems	458	human innovation	76	internal tourism consumption	38
tourism	445	increasing synergy	76	outbound tourism enterprises	38
law	430	increasingly integrates	76	active tourism policies	37
analysis	424	individual society	76	biennially analyses tourism	37
health	416	innovation process	76	economies providing up-to-date	37
organizations	392	integrates academic	76	global economic crisis	37



Table 6 presents the most frequently occurring terms identified from the abstracts of the selected studies. Unlike title-term analysis, abstract-term analysis provides a more detailed representation of the conceptual focus, research context, methodological orientation, and emerging themes within the literature. The results indicate that the research landscape is broad and

multidisciplinary, with strong representation of taxation, tobacco control, digital transformation, business, technology, economics, policy, management, innovation, and public health.

At the individual-word level, "tax" is the most frequently occurring term, with 1,297 occurrences, followed by "book" (1,182), "tobacco" (1,017), "digital" (995), "development" (972), and "international" (784). The exceptionally high frequency of tax demonstrates the central importance of taxation and fiscal policy within the analysed literature. In the context of tobacco research, taxation can be associated with tobacco pricing, consumption reduction, government revenue, tax policy, and regulatory intervention. The high occurrence of tobacco (1,017) confirms the core subject orientation of the dataset, while the prominence of digital (995) indicates that digitalisation has become another major component of the research landscape.

The high frequency of development (972), economic (668), economy (516), financial (503), and countries (517) demonstrates a strong economic and developmental dimension. This suggests that the literature does not treat tobacco merely as a health issue but also considers its implications for economic development, financial systems, national economies, and international policy. Similarly, the occurrence of policy (620), public (573), law (430), and health (416) highlights the importance of government intervention, legislation, public policy, and health outcomes.

A particularly important finding is the strong presence of technology-oriented terms, including technology (670), information (519), systems (458), innovation (515), organizations (392), and data (636). This indicates that contemporary research is increasingly examining the relationship between technology, organisations, innovation, and decision-making. The presence of data (636) also points toward the increasing importance of data-driven research and digital information in contemporary organisational and policy environments.

At the two-word level, "digital transformation" emerges as the most frequent term, with 316 occurrences, followed by "international conference" (266) and "tobacco control" (191). The prominence of digital transformation is particularly significant because it indicates that the literature has moved beyond simply discussing technology and is increasingly concerned with the organisational and strategic transformation resulting from technological change. The occurrence of "artificial intelligence" (152), "organizational sciences" (152), "business models" (106), "digital technology" (101), and "information technology" (98) reinforces this interpretation.

The combination of digital transformation, artificial intelligence, digital technology, information technology, technological advances, information systems, and change management indicates an emerging research stream centred on how organisations respond to technological disruption. The occurrence of "change management" (77) and "modern organizations" (77) suggests that digital transformation is increasingly being studied not merely as a technological phenomenon but as a managerial and organisational transformation process. This indicates an interdisciplinary connection between technology, management, organisational behaviour, innovation, and business strategy.

The term "tobacco control" (191) remains an important research theme at the two-word level. It is accompanied by "tobacco products" (94), demonstrating continued interest in tobacco regulation and consumption. This confirms that the dataset retains a strong tobacco-control component even though the abstracts also contain substantial material related to economics,

business, and digital transformation. Thus, the research landscape appears to consist of multiple interconnected knowledge streams rather than a single narrowly defined research theme.

At the three-word level, several clusters are visible. The most frequently occurring terms include "business models coupled," "changing established business," "decisions changing established," "digital technology organizations," and "digital transformation experiences," each with 76 occurrences. These terms reveal a strong emphasis on business-model transformation, organisational change, innovation, and digital experiences. The repeated appearance of phrases such as "established business models," "human innovation process," "innovation process development," "academic knowledge," "individual society organizations," and "promotes change management" suggests a conceptual focus on how technological developments disrupt established organisational structures and encourage innovation.

The repeated three-word expressions related to digital transformation and organisational change are particularly significant. Phrases such as "streamline digital transformation," "technology promotes change," "digital transformation experiences," "digital technology organizations," and "changing established business models" indicate that researchers are examining how organisations adapt to changing technological environments. This points towards an emerging research agenda involving digital transformation, innovation capability, business-model redesign, organisational adaptation, and strategic change.

Another important thematic component relates to tourism and economic analysis. Terms such as "analyses tourism performance" (38), "covering domestic inbound" (38), "internal tourism consumption" (38), "outbound tourism enterprises" (38), "active tourism policies" (37), and "global economic crisis" (37) indicate the presence of a distinct tourism–economic research stream within the dataset. This suggests that the abstracts include studies examining tourism consumption, tourism enterprises, tourism policies, and economic performance, demonstrating the broad and heterogeneous nature of the retrieved literature.

The abstract analysis also reveals the importance of innovation and competitiveness. Terms such as "human innovation," "innovation process," "fostering competitiveness," "increasing synergy," and "human innovation process" indicate that innovation is increasingly conceptualised as a mechanism through which organisations respond to technological and environmental changes. This is complemented by terms related to uncertainty, decision-making, established business models, and organisational transformation, suggesting that contemporary research is concerned with how organisations maintain competitiveness under rapidly changing conditions.

Overall, Table 6 reveals three major thematic dimensions within the abstract-level literature. The first is the tobacco–health–policy dimension, represented by terms such as tobacco, tax, tobacco control, policy, public, health, law, and tobacco products. The second is the digital–technology–organisation dimension, represented by digital transformation, artificial intelligence, digital technology, information technology, technology, information systems, business models, and change management. The third is the economic–development–innovation dimension, represented by development, economic, economy, financial, innovation, competitiveness, and business.

The comparison of individual, two-word, and three-word terms therefore indicates that the literature is highly interdisciplinary and increasingly interconnected. While tobacco, taxation, and tobacco control remain important foundational themes, the abstracts demonstrate a

substantial expansion toward digital transformation, artificial intelligence, innovation, organisational change, business-model transformation, and data-driven decision-making. The coexistence of health-policy themes with economic, technological, and organisational themes suggests that the research field is evolving from a conventional tobacco-control perspective toward a broader socio-economic, technological, and policy-oriented research landscape.

Importantly, the presence of "digital transformation" (316) at the two-word level, together with "artificial intelligence" (152) and several organisational transformation-related three-word terms, indicates that digitalisation and emerging technologies represent important contemporary research directions. At the same time, the continued prominence of tax (1,297), tobacco (1,017), and tobacco control (191) demonstrates that traditional tobacco-policy and fiscal research remains highly influential. Thus, the abstract analysis identifies a research landscape characterised by the convergence of tobacco control, taxation, public policy, economics, digital transformation, innovation, and organisational management.

5. Title and Abstract Analysis - Trending Topics

Table 7: Title Trend Topics – Unigram

Term	Frequency	Year (Q1)	Year (Median)	Year (Q3)
aspects	9	1998	2000	2019
issue	13	1998	2002	2018
direct	6	2000	2004	2012
relations	7	2006	2009	2012
oecd	46	2002	2010	2018
federal	11	2000	2010	2014
chapter	5	2007	2011	2017
reviews	17	2005	2012	2013
excise	5	2012	2012	2018
surveys	32	2002	2013	2018
investment	23	2005	2013	2022
exchange	9	2013	2013	2016
forum	10	2013	2014	2018
foreign	9	2001	2014	2020
asia	20	2010	2015	2022
reform	19	2006	2015	2018
lithuania	7	2010	2015	2019
tourism	44	2016	2016	2016
australia	22	2006	2016	2020
domestic	17	2016	2016	2016
fraud	7	2014	2017	2020
tobacco	489	2018	2018	2018
smoking	151	2018	2018	2018
control	134	2018	2018	2018
taxation	83	2014	2019	2022
comparative	22	2017	2019	2023

lessons	15	2018	2019	2022
tax	189	2016	2020	2023
law	107	2018	2020	2023
analysis	75	2018	2020	2025
theory	22	2015	2021	2022
world	21	2018	2021	2024
context	15	2018	2021	2022
development	76	2018	2022	2024
economy	70	2018	2022	2025
financial	61	2018	2022	2024
international	173	2020	2023	2025
digital	131	2021	2023	2025
review	95	2018	2023	2025
conference	137	2023	2024	2025
business	112	2020	2024	2025
volume	66	2021	2024	2026
proceedings	137	2023	2025	2026
systems	75	2022	2025	2026
intelligence	46	2024	2025	2026
intelligent	22	2024	2026	2026
isbm	7	2026	2026	2026
icab	5	2025	2026	2026

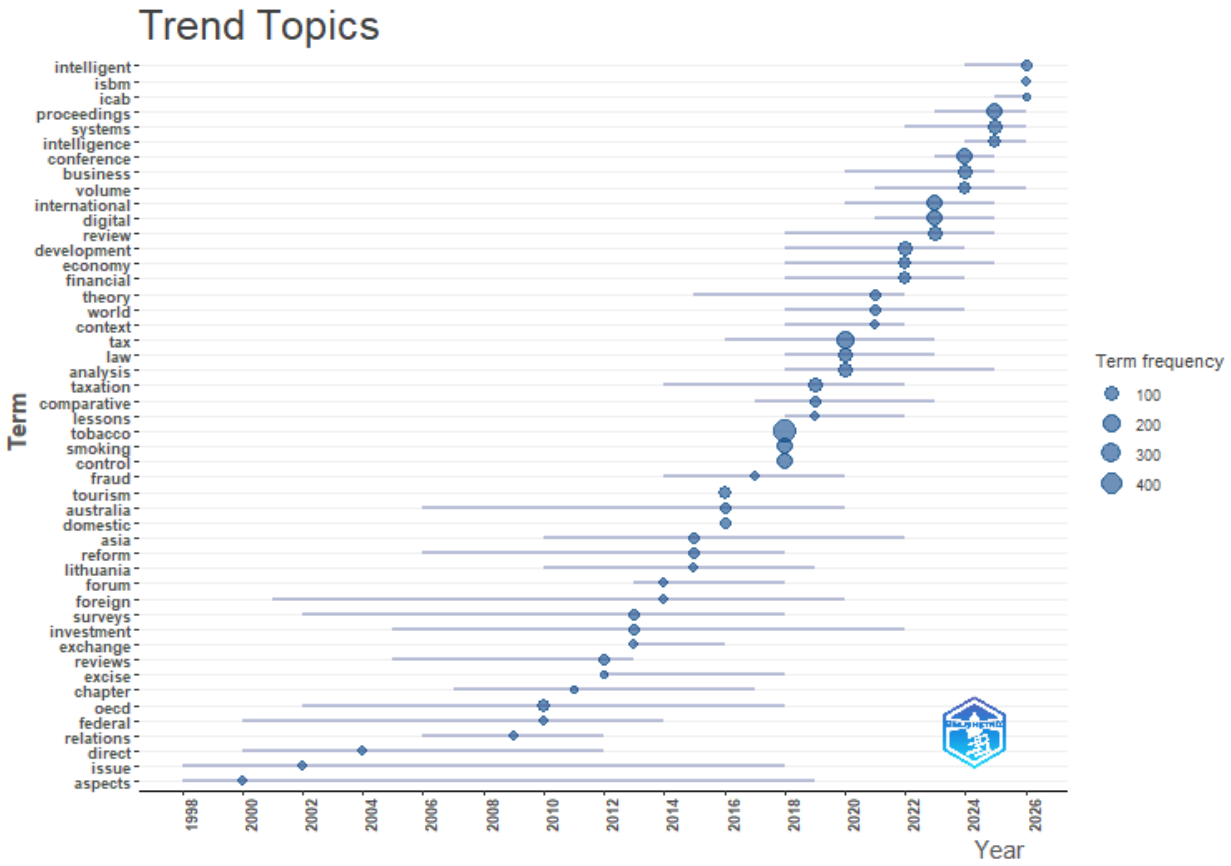


Table 7 presents the **trend topics identified from unigram analysis of the titles**, showing the frequency of individual terms along with their first quartile (Q1), median, and third quartile (Q3) years of occurrence. The Q1–Median–Q3 distribution provides an indication of the **temporal evolution, persistence, and recent emergence of research themes**. Overall, the results reveal a clear transition from relatively general economic, policy, and institutional themes in the earlier period toward **tobacco control, taxation, digitalisation, internationalisation, business, artificial intelligence, and intelligent systems** in the more recent period.

In the early phase of the research landscape, terms such as "aspects" (9), "issue" (13), "direct" (6), "relations" (7), "OECD" (46), "federal" (11), and "chapter" (5) appear predominantly between the late 1990s and early 2010s. For example, *aspects* has a Q1 of 1998 and median of 2000, while *issue* has a median of 2002. The term *OECD*, with a relatively higher frequency of 46, has a median year of 2010, indicating its sustained relevance across the earlier development of the literature. These terms suggest that the initial research agenda was largely concerned with institutional, regulatory, international economic, and general policy issues.

The period from approximately 2005 to 2015 demonstrates an increasing emphasis on reviews, surveys, investment, foreign relations, reform, and regional economic issues. The term "reviews" (17) has a median year of 2012, while "surveys" (32) has a median of 2013. Similarly, *investment* (23) has a median year of 2013, whereas *reform* (19) has a median of 2015. The emergence of Asia (20), Australia (22), Lithuania (7), and foreign (9) indicates growing attention to country-specific and regional comparative studies. This phase can therefore be interpreted as a

period of expanding geographical coverage and increasing interest in economic reforms, investment, surveys, and international policy.

A distinct thematic shift becomes visible around 2016–2019, particularly with the emergence of tourism, domestic issues, fraud, tobacco, smoking, control, and taxation. The term "tourism" (44) is concentrated around 2016, while *domestic* (17) also has a median of 2016. More importantly, "tobacco" records the highest frequency among all terms, with 489 occurrences, with Q1, median, and Q3 all equal to 2018. This concentration demonstrates a particularly strong period of research activity around tobacco-related topics. "Smoking" (151) and "control" (134) similarly have their Q1, median, and Q3 all at 2018, indicating that tobacco, smoking, and control formed a highly concentrated and influential thematic cluster during this period.

The emergence of "taxation" (83), with a median of 2019, further strengthens the importance of fiscal and regulatory approaches. The relationship between tobacco, smoking, control, taxation, tax, and law suggests that the literature increasingly examined tobacco through the perspectives of public policy, taxation, legal regulation, and behavioural control. The term *comparative* (22), with a median of 2019, also indicates increasing use of comparative approaches during this period.

The period from 2018 to 2023 represents a major transition toward tax, law, analysis, theory, development, economy, and financial themes. The term "tax" (189) has a median year of 2020, while "law" (107) has a median of 2020 and *analysis* (75) extends from 2018 to 2025. This suggests that research increasingly moved beyond the broader concept of tobacco control toward more specific taxation, legal, analytical, and policy dimensions. At the same time, "development" (76), "economy" (70), and "financial" (61) have medians of 2022, indicating the growing integration of economic and financial perspectives into the research agenda.

A particularly important recent development is the emergence of "international" (173), "digital" (131), "review" (95), and "business" (112). The term *international* has a median year of 2023, while *digital* has a median of 2023 and extends to 2025. This indicates that the research landscape has increasingly become international and digitally oriented. The rise of *digital* is especially important because it reflects the growing relevance of digital transformation and technology-enabled research in the recent literature.

The most recent period, approximately 2023–2026, demonstrates a clear shift toward conference-related outputs, business, systems, intelligence, and intelligent systems. The term "conference" (137) has a median year of 2024, while "proceedings" (137) has a median of 2025. These terms suggest an increase in conference proceedings and related scholarly publications in the most recent period. "Volume" (66) similarly has a median year of 2024, reinforcing the publication-oriented nature of the recent research landscape.

More importantly, "systems" (75) has a median of 2025, while "intelligence" (46) has a median of 2025 and "intelligent" (22) has a median of 2026. The appearance of ISBM (7) in 2026 and ICAB (5) around 2025–2026 further indicates the emergence of specialised contemporary research streams and events. These trends suggest that the field is increasingly incorporating artificial intelligence, intelligent systems, information systems, and technologically enabled approaches.

The temporal progression can therefore be broadly divided into four stages. The first stage, from approximately 1998–2012, is characterised by general institutional, OECD, federal, relational, and policy-oriented themes. The second stage, around 2012–2017, shows increasing attention to surveys, investment, reforms, international/regional issues, tourism, and economic studies. The third stage, approximately 2017–2022, is dominated by tobacco, smoking, control, taxation, tax, law, development, economy, and financial themes. The fourth and most recent stage, from approximately 2020–2026, demonstrates increasing prominence of international, digital, business, systems, intelligence, and intelligent technologies.

Overall, Table 7 demonstrates a clear thematic evolution rather than a static research agenda. The literature appears to have progressed from broad economic and institutional concerns toward a highly specialised focus on tobacco control and taxation, followed by increasing integration of economic, legal, digital, business, and technological perspectives. The very recent emergence of *digital, systems, intelligence,* and *intelligent* suggests that artificial intelligence and intelligent-system research may represent emerging frontier topics within the contemporary research landscape.

The frequency and temporal distribution also indicate that tobacco remains the dominant historical theme, with 489 occurrences, followed by *smoking* (151), *control* (134), *international* (173), *tax* (189), and *conference/proceedings* (137 each). However, frequency alone does not determine whether a topic is emerging. The Q1–Median–Q3 pattern shows that digital, systems, intelligence, and intelligent are positioned toward the most recent years, making them particularly relevant as emerging or future-oriented research directions. Thus, the trend-topic analysis indicates a gradual transformation of the research field from traditional policy and tobacco-control concerns toward digitally enabled, internationally oriented, business and intelligent-system research.

Table 8: Title Trend Topics – Bigram

Term	Frequency	Year (Q1)	Year (Median)	Year (Q3)
volume issue	9	1998	2002	2002
oecd economic	28	1999	2006	2017
surveys australia	8	2002	2006	2017
economic surveys	26	2000	2008	2017
economic outlook	7	2000	2009	2019
investment policy	7	2006	2010	2017
policy reviews	5	2010	2010	2013
oecd investment	6	2010	2012	2019
financial crisis	5	2012	2012	2022
public finance	9	2004	2013	2018
global forum	8	2013	2013	2015
tax purposes	8	2013	2013	2015
environmental taxation	5	2012	2014	2016
policy review	18	2011	2016	2019
trade policy	15	2012	2016	2019
domestic inbound	14	2016	2016	2016
risk management	5	2017	2017	2023
tobacco control	119	2018	2018	2018

smoking cessation	40	2018	2018	2018
tobacco industry	33	2018	2018	2018
transfer pricing	9	2012	2019	2021
health care	8	2018	2019	2022
human rights	7	2018	2019	2022
european union	13	2012	2020	2023
public policy	9	2019	2020	2023
electronic government	6	2019	2020	2022
tax law	10	2018	2021	2024
ifip wg	5	2020	2021	2022
international tax	5	2010	2021	2021
tax evasion	15	2020	2022	2025
public administration	14	2019	2022	2022
public sector	11	2014	2022	2023
digital transformation	39	2022	2023	2025
economic development	15	2020	2023	2024
blockchain technology	9	2021	2023	2024
international conference	93	2023	2024	2025
systematic literature	19	2020	2024	2025
additive manufacturing	10	2023	2024	2025
artificial intelligence	39	2024	2025	2026
digital economy	19	2022	2025	2026
systematic review	18	2019	2025	2026
information systems	22	2024	2026	2026
intelligent systems	9	2026	2026	2026
systems proceedings	9	2026	2026	2026

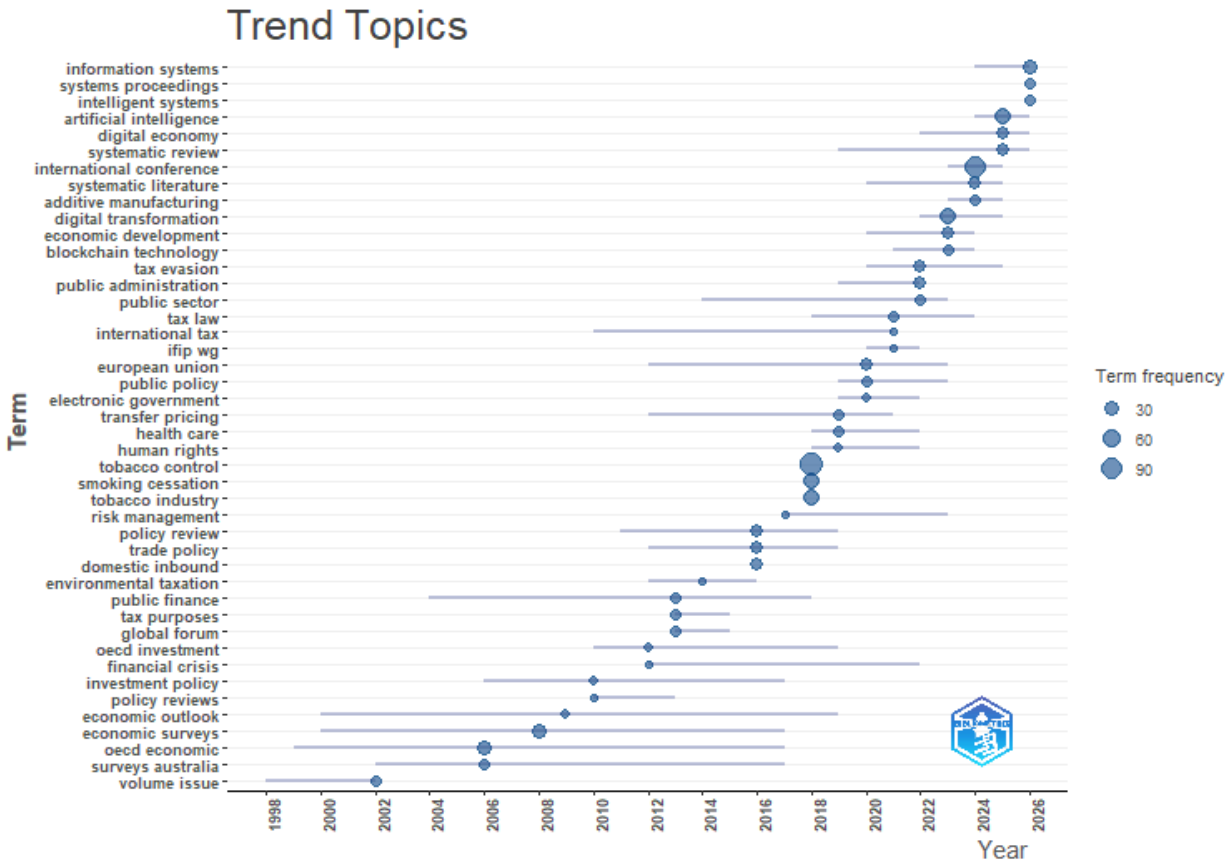


Table 8 presents the trend topics identified through bigram analysis of the titles, where two-word combinations are examined to understand the evolution of more specific research themes over time. The frequency column indicates the prevalence of each bigram, while Q1, Median, and Q3 indicate the temporal distribution of the term. Compared with unigram analysis, bigram analysis provides a more precise understanding of the conceptual combinations, thematic transitions, and emerging research directions in the literature.

The earliest stage of the literature, approximately 1998–2010, is characterised by broad economic and institutional expressions such as “volume issue” (9), “OECD economic” (28), “surveys Australia” (8), “economic surveys” (26), “economic outlook” (7), and “investment policy” (7). *Economic surveys* has a relatively high frequency of 26 and a median year of 2008, while *OECD economic* extends from 1999 to 2017. These terms indicate that the initial research landscape was strongly associated with macroeconomic assessment, international economic institutions, economic surveys, investment, and policy outlooks.

During the period from approximately 2010–2016, the literature increasingly incorporated more specialised policy and fiscal expressions. Terms such as “policy reviews” (5), “OECD investment” (6), “financial crisis” (5), “public finance” (9), “global forum” (8), “tax purposes” (8), and “environmental taxation” (5) emerged during this period. *Public finance*, with a median of 2013, and *environmental taxation*, with a median of 2014, suggest an increasing interest in the relationship between taxation, public finance, environmental concerns, and government policy.

A further transition is evident around 2016–2019, with the emergence of "policy review" (18), "trade policy" (15), "domestic inbound" (14), "risk management" (5), and "transfer pricing" (9). These terms demonstrate increasing attention to trade policy, international business, risk management, taxation, and tourism-related economic activity. The term *domestic inbound*, concentrated in 2016, appears to represent the tourism-related component of the dataset. Meanwhile, *transfer pricing* has a median of 2019, indicating its increasing relevance within the taxation and international business literature.

A particularly important thematic concentration occurs in 2018, when the terms "tobacco control" (119), "smoking cessation" (40), and "tobacco industry" (33) become highly prominent. These three bigrams have identical Q1, median, and Q3 values of 2018, indicating a highly concentrated period of research activity. Among all bigrams, "tobacco control" has the highest frequency at 119, making it one of the strongest specific research themes identified in the analysis. The simultaneous emergence of *smoking cessation* and *tobacco industry* demonstrates that the literature during this period focused not only on tobacco consumption but also on control mechanisms, cessation interventions, and industry-related issues.

The subsequent period, approximately 2018–2022, shows an expansion from tobacco-specific research toward broader health, legal, public-policy, and international taxation issues. Terms such as "health care" (8), "human rights" (7), "European Union" (13), "public policy" (9), "electronic government" (6), "tax law" (10), "international tax" (5), and "tax evasion" (15) indicate a growing multidisciplinary orientation. In particular, *tax law* has a median of 2021, while *tax evasion* has a median of 2022 and extends to 2025. This suggests increasing scholarly attention to tax compliance, tax regulation, tax avoidance/evasion, and legal frameworks.

The appearance of "public administration" (14) and "public sector" (11), with median years of 2022, further demonstrates that the research agenda has expanded toward governance and public-sector applications. This indicates a transition from narrowly defined economic and tobacco-control studies toward wider questions involving public administration, government policy, taxation, regulation, and institutional systems.

The most significant recent transition is the emergence of digital and technological themes. "Digital transformation" (39) has a median year of 2023, while "blockchain technology" (9) has a median of 2023. These are followed by "economic development" (15), *international conference* (93), and *systematic literature* (19). The emergence of digital transformation and blockchain indicates that technological innovation has become an important component of the contemporary research landscape.

The term "international conference" (93) has a particularly high frequency and a median year of 2024, suggesting that recent publications are strongly represented by conference-related scholarly outputs. Similarly, "systematic literature" (19) has a median year of 2024, indicating increasing use of systematic literature-based research approaches in the recent literature. *Additive manufacturing* (10), with a median of 2024, also represents an emerging technology-oriented research stream.

The most recent period, 2024–2026, is characterised by a pronounced emergence of artificial intelligence, digital economy, systematic review, information systems, and intelligent systems. "Artificial intelligence" (39) has a median year of 2025 and extends to 2026, while "digital economy" (19) has a median of 2025. "Systematic review" (18) also has a median of 2025. These trends indicate that contemporary research is increasingly oriented toward AI-enabled transformation, digital economic systems, and evidence-synthesis methodologies.

The most recent and potentially emerging frontier is represented by "information systems" (22), "intelligent systems" (9), and "systems proceedings" (9). *Information systems* has a median year of 2026, while both *intelligent systems* and *systems proceedings* are concentrated entirely in 2026. Their very recent temporal positioning suggests that these themes are newly emerging rather than historically established themes. This is consistent with the trend-topic visualization, where these terms appear at the extreme right-hand side of the temporal axis.

Overall, the bigram analysis reveals a progressive transformation of the research landscape. The literature initially concentrated on economic surveys, OECD-related studies, investment policy, and public finance. It subsequently moved toward taxation, trade policy, tobacco control, smoking cessation, and regulatory issues, followed by increasing attention to tax law, tax evasion, public administration, and public-sector policy. In the latest period, the focus has increasingly shifted toward digital transformation, blockchain, artificial intelligence, digital economy, information systems, and intelligent systems.

The findings can therefore be broadly interpreted through four thematic phases:

1. Economic and institutional phase (1998–2010): *economic surveys, OECD economic, economic outlook, investment policy*.
2. Policy, taxation and tobacco-control phase (2011–2019): *policy review, trade policy, public finance, tobacco control, smoking cessation, tobacco industry*.
3. Regulatory and governance phase (2019–2023): *tax law, tax evasion, public administration, public sector, European Union*.
4. Digital and intelligent-technology phase (2022–2026): *digital transformation, blockchain technology, artificial intelligence, digital economy, information systems, intelligent systems*.

Thus, Table 8 demonstrates a clear shift from traditional economic and policy-oriented research toward technology-enabled and intelligent research themes. While "tobacco control" (119) remains the most prominent substantive bigram in the historical dataset and "international conference" (93) has substantial recent frequency, the temporal positioning of artificial intelligence, digital economy, information systems, intelligent systems, and systems proceedings suggests that these areas represent the most recent and potentially emerging research frontiers. The bigram analysis therefore complements the unigram findings by showing not only *which individual concepts are important*, but also how specific concepts have increasingly combined to form new research directions over time.

Table 9: Title Trend Topics – Trigram

Term	Frequency	Year (Q1)	Year (Median)	Year (Q3)

economic surveys australia	8	2002	2006	2017
oecd economic surveys	26	2000	2008	2017
investment policy reviews	5	2010	2010	2013
oecd investment policy	6	2010	2012	2019
purposes peer reviews	7	2013	2013	2014
tax purposes peer	7	2013	2013	2014
trade policy review	15	2012	2016	2019
internal tourism consumption	10	2016	2016	2016
pictorial health warnings	13	2018	2018	2018
tobacco control policy	8	2018	2018	2018
national tobacco control	7	2018	2018	2018
systematic literature review	19	2020	2024	2025
intelligent systems proceedings	8	2026	2026	2026

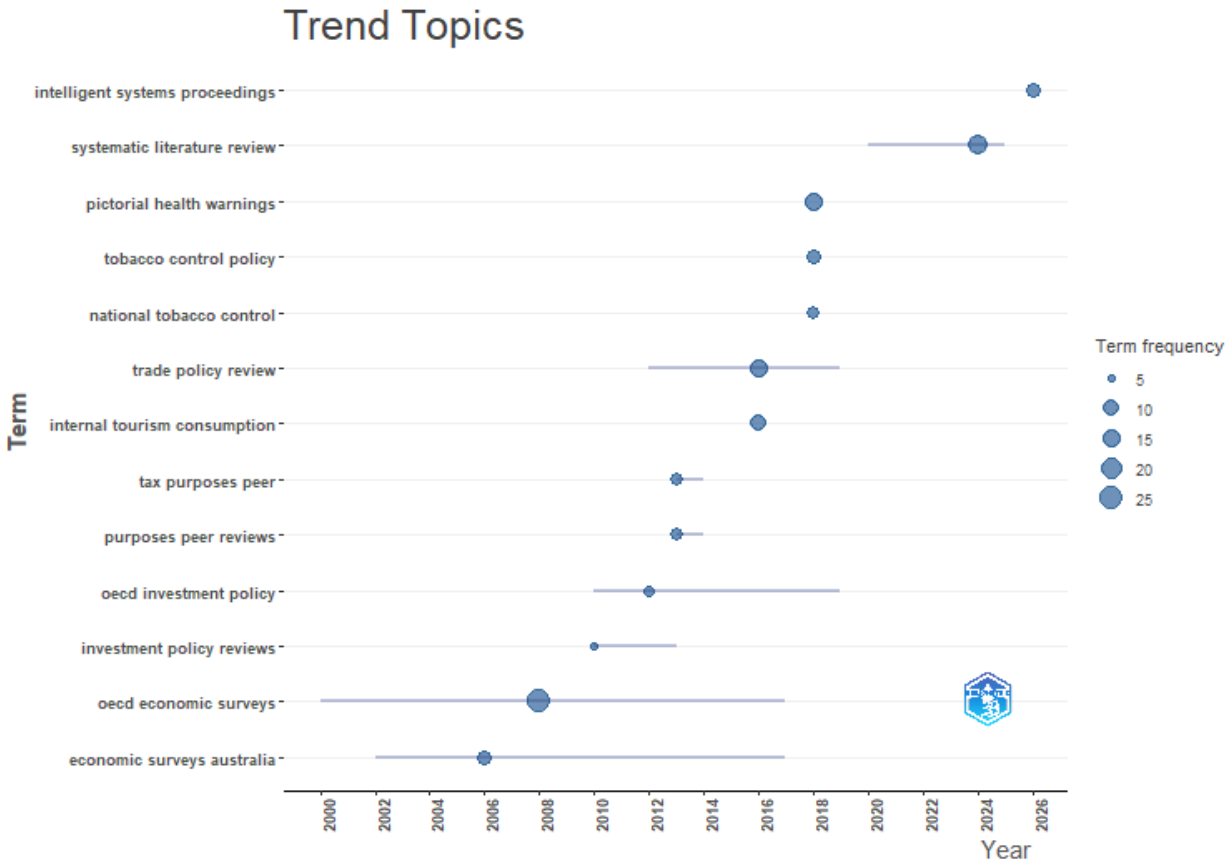


Table 9 presents the trend topics identified through trigram analysis, focusing on three-word combinations appearing in the titles of the selected literature. Trigram analysis provides a more specific representation of the evolution of research themes because it captures closely connected three-word concepts rather than individual terms or two-word combinations.

The early research period, from approximately 2000 to 2012, is dominated by economically and institutionally oriented trigrams. “OECD economic surveys” is the most frequent early trigram, with 26 occurrences, and has a median year of 2008, extending from 2000 to 2017. Similarly,

"economic surveys Australia" occurs 8 times, with a median year of 2006. These findings indicate that the initial research landscape was substantially influenced by OECD economic assessments, national economic surveys, and country-specific economic analysis. The relatively long temporal span of these terms suggests that economic-survey-based research formed an important foundational theme.

The next phase, around 2010–2014, shows increasing attention to investment and taxation policy. Trigrams such as "investment policy reviews" (5) and "OECD investment policy" (6) emerged during this period, while "purposes peer reviews" (7) and "tax purposes peer" (7) were concentrated around 2013. These terms suggest an increasing emphasis on policy evaluation, investment regulation, peer-review mechanisms, and tax-related policy analysis. Although their frequencies are relatively modest, their temporal positioning demonstrates a shift from broad economic assessment toward more specialised policy-oriented research.

A further transition is visible during 2012–2019, particularly through "trade policy review" (15) and "internal tourism consumption" (10). The former has a median year of 2016 and indicates sustained interest in international trade policy and policy evaluation, whereas the latter is concentrated in 2016, reflecting a distinct research stream concerning tourism consumption and economic activity. This demonstrates that the literature was becoming increasingly diversified across economic policy, international trade, and sector-specific economic issues.

One of the most distinctive thematic concentrations occurs in 2018, with the emergence of three tobacco-related trigrams: "pictorial health warnings" (13), "tobacco control policy" (8), and "national tobacco control" (7). All three have Q1, median, and Q3 values of 2018, indicating a highly concentrated period of research activity. These terms reveal a specific thematic focus on public-health interventions, tobacco regulation, warning labels, and national tobacco-control strategies. The appearance of these related trigrams together suggests that tobacco-control research constituted a clearly identifiable thematic phase within the literature.

The period from approximately 2020 to 2025 is marked by the emergence of systematic review methodology. The trigram "systematic literature review" has 19 occurrences, making it the second-highest-frequency trigram in the table, with a median year of 2024 and a Q3 of 2025. Its comparatively recent temporal position indicates a strong contemporary movement toward structured evidence synthesis and systematic literature-based research. This is particularly important because it suggests that the research field is not only changing in terms of substantive topics but also in terms of research methodology.

Finally, the most recent frontier is represented by "intelligent systems proceedings", which occurs 8 times and is concentrated entirely in 2026. Its Q1, median, and Q3 are all 2026, indicating that this is an emerging and very recent research theme. Its appearance at the extreme right of the trend-topic visualization confirms the movement toward intelligent systems and technology-oriented research.

Overall, the trigram analysis demonstrates a clear temporal evolution from traditional economic and institutional research toward policy-oriented, health-related, methodological, and technology-driven research themes. The progression can be broadly understood as:

OECD/Economic Surveys → Investment & Trade Policy → Taxation & Policy Review → Tobacco Control & Public Health → Systematic Literature Review → Intelligent Systems.

Thus, Table 9 provides evidence of a substantial transformation in the research agenda. Earlier studies were primarily concerned with economic surveys, OECD assessments, investment policies, and trade policy, whereas later research increasingly addressed tobacco-control policies and public-health interventions. The most recent literature demonstrates a methodological shift toward systematic literature reviews and, ultimately, an emerging technological orientation toward intelligent systems. The trigram results therefore reinforce the broader bibliometric finding that the research domain has evolved from conventional economic and policy analysis toward interdisciplinary, evidence-based, and technology-enabled research.

Table 10: Abstract Trend Topics – Unigram

Term	Frequency	Year (Q1)	Year (Median)	Year (Q3)
accountancy	6	1992	1992	1992
eds	8	1994	1994	2024
privatisation	5	1996	1997	2001
unternehmen	8	1998	1998	2004
ec	7	1998	1998	2009
nicht	5	1998	1998	2002
restructuring	9	1992	1999	2017
budget	24	1999	2001	2020
von	15	1999	2002	2022
das	10	1999	2002	2022
bei	9	1998	2002	2021
oecds	29	2000	2003	2008
den	19	2002	2003	2020
periodic	8	1999	2003	2006
subnational	12	1999	2004	2017
commerce	37	2006	2006	2025
estonia	16	2001	2006	2020
inflation	14	2002	2006	2022
fdi	23	2003	2007	2014
responsibilities	15	2006	2007	2020
cent	13	2003	2007	2013
fta	15	2008	2008	2008
gatt	15	2004	2008	2014
supreme	10	2006	2008	2016
expenditure	13	2006	2009	2011
contracting	8	1998	2009	2020
tables	8	2008	2009	2019
foreign	106	2000	2010	2023
commission	40	2007	2010	2021
taxing	14	2002	2010	2021
collect	16	2006	2011	2019
uniformity	12	2011	2011	2011

sich	10	2002	2011	2020
ttcs	15	2012	2012	2012
transnational	11	2006	2012	2018
expropriation	10	2000	2012	2015
forum	92	2013	2013	2021
jurisdictions	64	2013	2013	2019
phase	47	2013	2013	2016
congress	16	2013	2014	2023
equal	16	2013	2014	2020
fall	12	2013	2014	2019
investment	211	2002	2015	2022
federal	64	2010	2015	2021
procedure	27	2013	2015	2017
tourism	445	2016	2016	2016
oecd	157	2010	2016	2020
reforms	133	2014	2016	2021
taxes	131	2011	2017	2021
reform	108	2006	2017	2020
reviews	104	2013	2017	2021
tobacco	1017	2018	2018	2018
background	763	2018	2018	2018
countries	517	2016	2018	2023
national	213	2018	2019	2023
economies	178	2016	2019	2024
income	177	2016	2019	2021
development	972	2020	2020	2023
challenges	636	2018	2020	2024
policy	620	2017	2020	2024
tax	1297	2016	2021	2024
international	784	2019	2021	2024
global	464	2016	2021	2025
digital	995	2020	2022	2025
technology	670	2020	2022	2025
economic	668	2016	2022	2024
book	1182	2020	2023	2025
business	673	2020	2023	2025
data	636	2018	2023	2025
research	753	2022	2024	2025
systems	458	2021	2024	2026
technologies	347	2022	2024	2025
ai	285	2024	2025	2026
intelligence	199	2023	2025	2026
insights	189	2023	2025	2025

thematic	59	2024	2026	2026
language	42	2024	2026	2026
peer-reviewed	29	2025	2026	2026

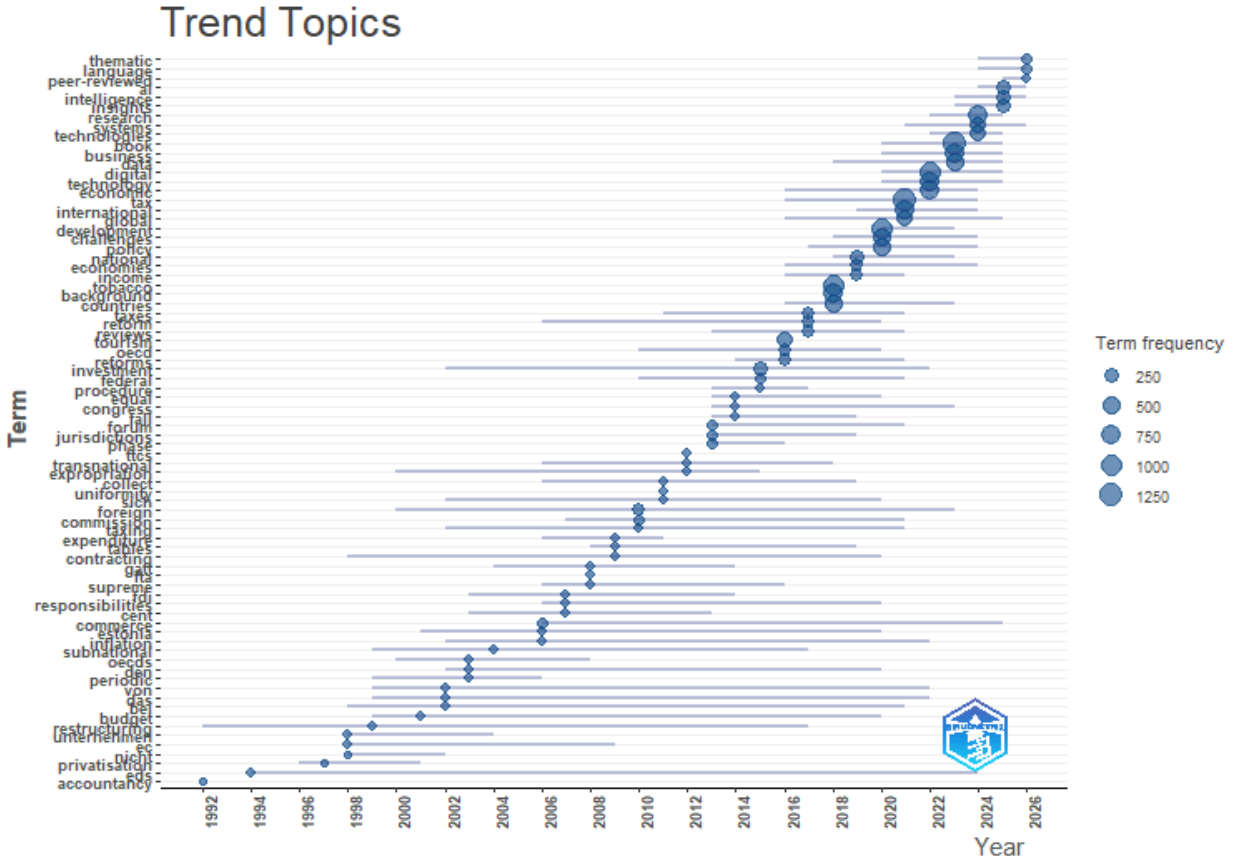


Table 10 presents the trend topics identified from the abstracts using unigram analysis, showing the frequency and temporal distribution of individual terms across the selected literature. Unlike title-based analysis, abstract analysis provides a deeper representation of the conceptual content, research objectives, contexts, and emerging themes addressed by the studies. The results reveal a substantial transformation in the research landscape from traditional accounting, restructuring, investment and economic-policy concerns toward taxation, tobacco, development, digitalisation, technology, data, artificial intelligence, and contemporary evidence-based research.

The earliest period, from 1992 to the early 2000s, is characterised by terms such as "accountancy," "privatisation," "restructuring," "budget," "subnational," "OECDs," and "periodic." The term *accountancy* appears only 6 times and is concentrated in 1992, indicating that the earliest research had a relatively strong accounting and institutional orientation. *Privatisation* has a median year of 1997, while *restructuring* extends from 1992 to 2017, suggesting an early emphasis on organisational restructuring, public-sector transformation and economic reforms. The relatively long temporal range of *budget* (1999–2020) also indicates the continuing relevance of public budgeting and fiscal management.

During the early and middle 2000s, the research agenda expanded toward commerce, foreign investment, inflation, international economic relations and institutional governance. *Commerce*

occurs 37 times, while *foreign* has a substantially higher frequency of 106 occurrences. Similarly, *investment* records 211 occurrences, making it one of the most prominent terms in the earlier-to-middle phase of the literature. The median year of investment is 2015, with the topic extending from 2002 to 2022. Terms such as *FDI*, *FTA*, *GATT*, *transnational*, *expropriation*, and *commission* further demonstrate an emphasis on foreign investment, international trade, economic integration and cross-border policy issues.

The period from approximately 2010 to 2017 demonstrates a stronger focus on OECD-related research, taxation, reforms, policy reviews and institutional processes. The term *OECD* occurs 157 times, with a median year of 2016, while *reforms* occurs 133 times and *taxes* 131 times. *Reform* itself has 108 occurrences and extends from 2006 to 2020. The increasing prominence of *reviews*, *federal*, *procedure*, *jurisdictions*, and *policy-related terminology* suggests that research increasingly examined regulatory systems, taxation structures, institutional reforms and comparative policy frameworks. The term *tourism*, with an exceptionally high frequency of 445 occurrences, is concentrated in 2016, indicating a distinct period of strong research attention toward tourism-related economic and policy issues.

A major thematic shift is evident around 2018, when *tobacco* emerges with 1,017 occurrences, making it one of the most dominant terms in the entire dataset. Interestingly, *tobacco* has Q1, median and Q3 all equal to 2018, indicating a highly concentrated thematic period. The simultaneous emergence of *background* (763 occurrences), *countries* (517), *national* (213), *economies* (178), and *income* (177) suggests that this period involved substantial research examining tobacco-related issues across countries, national contexts and economic settings. The concentration of tobacco-related research represents a major thematic phase in the evolution of the literature.

The subsequent period, particularly 2018–2024, is characterised by increasingly prominent terms such as “development,” “challenges,” “policy,” “tax,” “international,” and “global.” *Development* is exceptionally frequent, with 972 occurrences, while *tax* is the most frequent term in the table with 1,297 occurrences. The median year of *tax* is 2021, and its temporal range extends from 2016 to 2024, demonstrating the growing importance of taxation and tax-related research in the recent literature. Similarly, *policy* occurs 620 times and *international* 784 times, reflecting a strong movement toward international policy analysis, taxation, development and global economic issues.

A particularly important contemporary transformation is the emergence of digital and technological terminology. The term *digital* occurs 995 times, with a median year of 2022, while *technology* occurs 670 times with the same median year. The terms *business* (673), *data* (636), *systems* (458), and *technologies* (347) also become increasingly prominent in the recent period. This pattern indicates a transition from predominantly traditional economic and policy-oriented research toward digital transformation, technology-enabled business models, data-driven decision-making and information systems. The relatively recent Q1 values of these terms further demonstrate that digitalisation is not merely a persistent topic but an emerging contemporary research direction.

The most recent phase, particularly 2023–2026, reveals a strong movement toward artificial intelligence and intelligent technologies. The term *AI* occurs 285 times, with a median year of 2025 and a range from 2024 to 2026. *Intelligence* occurs 199 times, while *insights* occurs 189 times. Furthermore, *systems* has a median year of 2024 and extends to 2026, indicating growing

interest in intelligent systems, AI-enabled research and technology-driven insights. The appearance of *thematic* (59), *language* (42), and *peer-reviewed* (29) in 2024–2026 further suggests increasing attention to advanced research synthesis, thematic analysis, language-oriented technologies and systematic scholarly evaluation.

Overall, the abstract unigram analysis demonstrates a clear chronological evolution of research themes. The literature initially focused on accountancy, privatisation, restructuring and public-sector economic issues, followed by increasing attention to investment, foreign economic relations, OECD activities, reforms and taxation. Around 2016–2018, tourism and tobacco-related research became highly visible, followed by broader concerns with development, tax, policy, internationalisation and global economic issues. From approximately 2020 onwards, the research agenda increasingly shifted toward digitalisation, technology, business, data and systems, culminating most recently in AI, intelligence, thematic analysis and peer-reviewed research.

Thus, the trend can be summarised as:

Traditional Accounting & Economic Reform → Investment & International Economics → OECD, Taxation & Policy → Tobacco & Public/Global Issues → Development & Internationalisation → Digitalisation & Data → AI, Intelligent Systems & Advanced Research Methods.

The findings demonstrate that the research domain is undergoing a substantial digital and methodological transformation. The increasing frequency and recency of *digital*, *technology*, *data*, *AI*, *intelligence*, and *systems* indicate that future research is likely to become increasingly technology-enabled, data-driven, interdisciplinary and AI-oriented, while taxation, internationalisation, development and policy remain important foundational themes.

Table 11: Abstract Trend Topics – Bigram

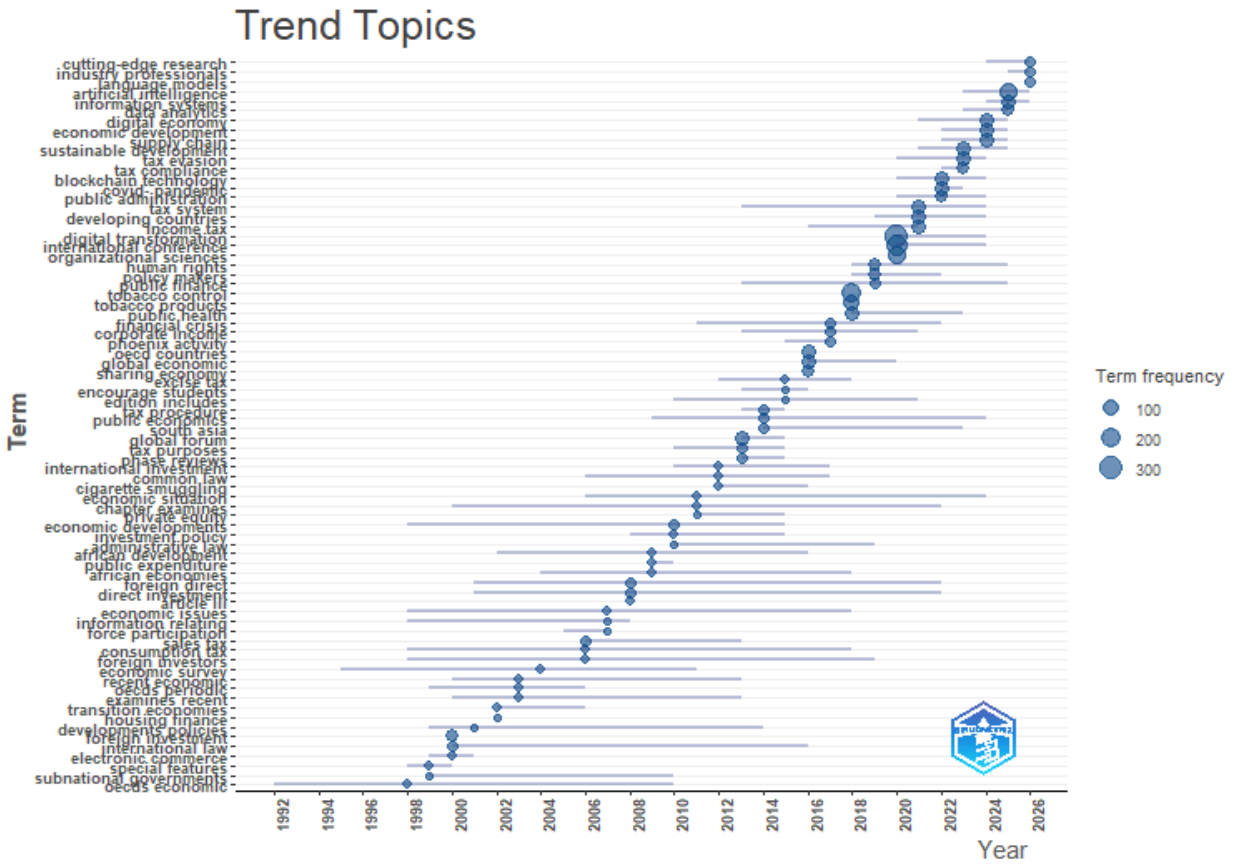
Term	Frequency	Year (Q1)	Year (Median)	Year (Q3)
oecds economic	6	1992	1998	2010
special features	6	1998	1999	2000
subnational governments	5	1999	1999	2010
foreign investment	45	2000	2000	2000
international law	17	2000	2000	2016
electronic commerce	8	1999	2000	2001
developments policies	5	1999	2001	2014
transition economies	9	2002	2002	2006
housing finance	5	2002	2002	2002
recent economic	11	2000	2003	2013
oecds periodic	8	1999	2003	2006
examines recent	7	2000	2003	2013
economic survey	10	1995	2004	2011
sales tax	15	2006	2006	2013
consumption tax	11	1998	2006	2018
foreign investors	10	1998	2006	2019

economic issues	8	1998	2007	2018
force participation	5	2005	2007	2007
information relating	5	1998	2007	2008
direct investment	12	2001	2008	2022
foreign direct	12	2001	2008	2022
article iii	9	2008	2008	2008
african development	7	2002	2009	2016
african economies	6	2004	2009	2018
public expenditure	6	2009	2009	2010
economic developments	12	1998	2010	2015
investment policy	8	2008	2010	2015
administrative law	5	2010	2010	2019
chapter examines	8	2000	2011	2022
economic situation	8	2006	2011	2024
private equity	5	2011	2011	2015
international investment	10	2010	2012	2017
common law	9	2006	2012	2017
cigarette smuggling	6	2012	2012	2016
global forum	69	2013	2013	2015
tax purposes	24	2010	2013	2015
phase reviews	21	2013	2013	2015
tax procedure	16	2013	2014	2015
public economics	14	2009	2014	2024
south asia	13	2014	2014	2023
excise tax	8	2012	2015	2018
edition includes	5	2010	2015	2021
encourage students	5	2013	2015	2016
oecd countries	59	2016	2016	2016
global economic	51	2016	2016	2020
sharing economy	44	2016	2016	2016
financial crisis	21	2011	2017	2022
corporate income	17	2013	2017	2021
phoenix activity	16	2015	2017	2017
tobacco control	191	2018	2018	2018
tobacco products	94	2018	2018	2018
public health	69	2018	2018	2023
human rights	47	2018	2019	2025
policy makers	41	2018	2019	2022
public finance	22	2013	2019	2025
digital transformation	316	2020	2020	2024
international conference	266	2020	2020	2024
organizational sciences	152	2020	2020	2020
tax system	59	2013	2021	2024

developing countries	52	2019	2021	2024
income tax	51	2016	2021	2021
blockchain technology	61	2020	2022	2024
covid- pandemic	51	2022	2022	2023
public administration	48	2020	2022	2024
sustainable development	73	2021	2023	2025
tax evasion	61	2020	2023	2024
tax compliance	43	2022	2023	2023
digital economy	76	2021	2024	2025
economic development	72	2022	2024	2025
supply chain	71	2022	2024	2025
artificial intelligence	152	2023	2025	2026
information systems	77	2024	2025	2026
data analytics	35	2023	2025	2025
cutting-edge research	17	2024	2026	2026
industry professionals	16	2025	2026	2026
language models	15	2026	2026	2026

Table 11 presents the **trend analysis of bigram terms extracted from the abstracts**, highlighting the evolution of two-word conceptual combinations over time. The analysis provides a more specific understanding of the research themes than unigram analysis because bigrams reveal **contextual relationships between concepts**, rather than isolated keywords. The results indicate a clear transition from traditional economic and institutional themes toward taxation, public policy, tobacco control, digital transformation, sustainable development, and, most recently, artificial intelligence and advanced information technologies.

In the **early phase of the literature (1992–2000)**, the prominent bigrams largely reflect **macroeconomic, institutional and structural concerns**. Terms such as *OECDs economic*, *subnational governments*, *foreign investment*, *international law*, and *electronic commerce* appear during this period. *Foreign investment* has a frequency of 45 and is concentrated in 2000, demonstrating an early and focused research interest in **cross-border investment and international economic activity**. The emergence of *electronic commerce* around 2000 also provides an early indication of the transition toward technology-enabled commercial activity.



During the 2000–2010 period, the literature increasingly addressed transition economies, economic development, taxation and foreign investment. Bigrams such as *transition economies*, *economic survey*, *sales tax*, *consumption tax*, *foreign investors*, *economic issues*, *direct investment*, and *foreign direct* demonstrate growing attention to economic transformation, taxation and international investment flows. The term *consumption tax* extends from 1998 to 2018, indicating that taxation remained relevant beyond its initial emergence. Similarly, *direct investment* and *foreign direct* extend up to 2022, suggesting the continuing importance of foreign investment within the broader research agenda.

The 2010–2016 period demonstrates a stronger emphasis on investment policy, administrative and legal frameworks, tax procedures and international economic governance. Bigrams such as *investment policy*, *administrative law*, *international investment*, *common law*, *global forum*, *tax purposes*, *phase reviews*, and *tax procedure* become increasingly visible. Particularly noteworthy is *global forum*, with a frequency of 69 and a median year of 2013, alongside *tax purposes* with a frequency of 24. This indicates a substantial movement toward international tax governance, regulatory review and institutional policy mechanisms. The emergence of *OECD countries* and *global economic* around 2016 further reinforces the importance of comparative and international policy analysis.

A distinct thematic phase emerges around 2016–2019, characterised by globalisation, financial conditions, public health, human rights and policy-making. Terms such as *sharing economy*, *financial crisis*, *corporate income*, *tobacco control*, *tobacco products*, *public health*, *human rights*, and *policy makers* become prominent. The *sharing economy* is concentrated in 2016,

while *financial crisis* extends from 2011 to 2022. Most notably, *tobacco control* records a frequency of 191, with Q1, median and Q3 all equal to 2018, indicating a highly concentrated research burst. This is accompanied by *tobacco products* and *public health*, suggesting that the literature during this phase strongly addressed tobacco regulation, health consequences and public-policy interventions.

From approximately 2020 onwards, the research landscape undergoes a significant transformation toward digitalisation and technology-driven research. *Digital transformation* is particularly prominent, with a frequency of 316 and a median year of 2020. It is followed by *international conference* (266), *organizational sciences* (152), *blockchain technology* (61), and *digital economy* (76). These patterns demonstrate a movement away from exclusively traditional economic and regulatory concerns toward digital transformation, emerging technologies, organisational change and technology-enabled economic systems. The emergence of *blockchain technology* between 2020 and 2024 is particularly important because it indicates growing scholarly interest in decentralised and technology-enabled systems.

The 2021–2024 period reveals a stronger convergence between taxation, digitalisation, sustainability and economic development. Bigrams such as *tax system*, *developing countries*, *income tax*, *sustainable development*, *tax evasion*, *tax compliance*, *digital economy*, *economic development*, and *supply chain* demonstrate that contemporary research is increasingly interdisciplinary. *Sustainable development* has a frequency of 73 and a median year of 2023, while *digital economy* has a frequency of 76 and a median year of 2024. The simultaneous growth of *tax compliance* and *tax evasion* indicates that taxation research is increasingly examining behavioural, regulatory and compliance dimensions within changing economic environments.

The most recent phase, 2023–2026, clearly demonstrates the emergence of artificial intelligence, information systems, data analytics and language models. *Artificial intelligence* has a frequency of 152, with a median year of 2025 and a range extending to 2026. *Information systems* appears with a frequency of 77 and a median year of 2025. The emergence of *data analytics* (35), *cutting-edge research* (17), *industry professionals* (16), and *language models* (15) demonstrates that the research frontier is increasingly moving toward AI-enabled systems, data-driven analysis, advanced computational methods and generative/language-based technologies. The fact that *language models* is concentrated entirely in 2026 strongly suggests a very recent and emerging research direction.

Overall, Table 11 reveals a progressive evolution from conventional economic and institutional research toward increasingly technology-intensive and interdisciplinary research. The trajectory can be broadly understood as:

Economic Institutions & Foreign Investment → International Law & Economic Development → Taxation & Policy Governance → Globalisation & Public Health → Digital Transformation & Blockchain → Sustainable/Digital Economy → AI, Data Analytics & Language Models.

The bigram analysis therefore provides stronger evidence of thematic convergence and research specialisation than the unigram analysis. While taxation, investment, international policy and economic development remain important foundational themes, the recent emergence of *digital transformation*, *blockchain technology*, *digital economy*, *artificial intelligence*, *information systems*, *data analytics*, and *language models* demonstrates a substantial shift toward

technology-driven and AI-enabled research. In particular, the latest period suggests that AI, intelligent information systems, data analytics and language models are becoming the new research frontier, indicating considerable potential for future studies integrating commerce, economics, taxation, digital transformation and emerging technologies.

Table 12: Abstract Trend Topics – Trigram

Term	Frequency	Year (Q1)	Year (Median)	Year (Q3)
oecds economic survey	6	1992	1998	2010
world trade organisation	5	2000	2000	2000
economic developments policies	5	1999	2001	2014
examines recent economic	7	2000	2003	2013
recent economic developments	8	1998	2006	2014
labour force participation	5	2005	2007	2007
foreign direct investment	12	2001	2008	2022
tax purposes access	6	2007	2008	2009
gatt article iii	5	2008	2008	2013
african development bank	5	2002	2009	2009
foreseeably relevant information	14	2013	2013	2014
model tax convention	8	2013	2013	2015
oecd model tax	8	2013	2013	2015
federal tax procedure	8	2013	2014	2015
analyses tourism performance	38	2016	2016	2016
covering domestic inbound	38	2016	2016	2016
data covering domestic	38	2016	2016	2016
corporate income tax	12	2014	2017	2021
illegal phoenix activity	8	2015	2017	2017
tobacco control policies	22	2018	2018	2018
national tobacco control	15	2018	2018	2018
world health organization	15	2018	2018	2020
eu customs law	6	2019	2019	2019
de hautes études	5	2019	2019	2019
en administration publique	5	2019	2019	2019
business models coupled	76	2020	2020	2020
changing established business	76	2020	2020	2020
decisions changing established	76	2020	2020	2020
proportional income tax	8	2021	2021	2021
international tax system	7	2021	2021	2023
sustainable development goals	18	2021	2022	2024
corporate social responsibility	16	2020	2022	2025
topics covered include	8	2018	2022	2024
fourth industrial revolution	14	2020	2023	2024
social tax deductions	11	2023	2023	2023
industrial revolution ir	7	2021	2023	2023

artificial intelligence ai	34	2023	2024	2025
systematic literature review	28	2023	2024	2025
supply chain management	17	2020	2024	2025
foreign tax credit	9	2025	2025	2025
public sector accounting	8	2024	2025	2025
sustainable business practices	7	2025	2025	2026
book includes selected	9	2025	2026	2026
includes selected papers	9	2025	2026	2026
corporate tax avoidance	8	2024	2026	2026

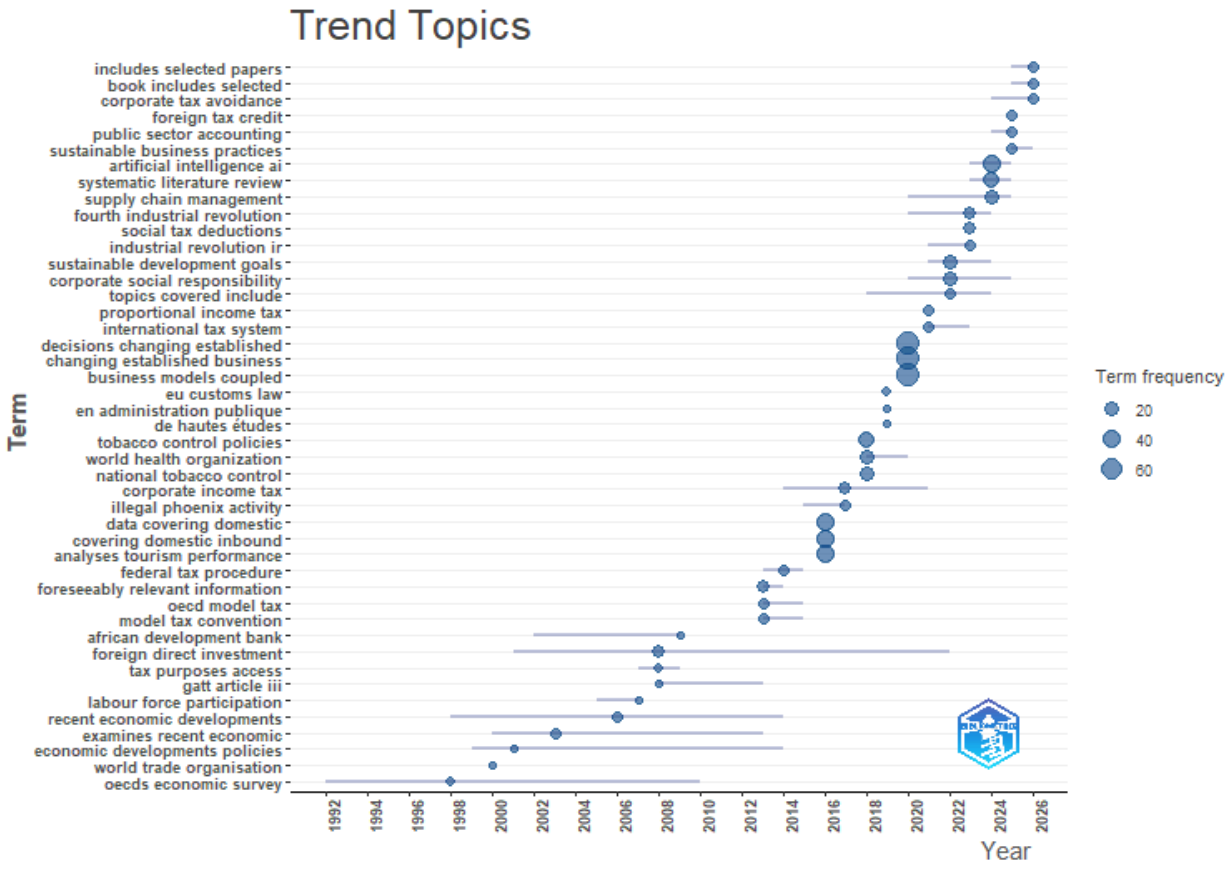


Table 12 presents the trend analysis of trigram terms extracted from the abstracts, showing the evolution of three-word research expressions over time. Compared with unigram and bigram analyses, trigram analysis provides a more refined picture of the specific research contexts, themes and conceptual combinations that have emerged within the literature. Overall, the findings demonstrate a clear movement from traditional economic surveys, trade and investment issues toward taxation, public policy, sustainability, digital transformation, artificial intelligence and emerging technology-oriented research.

In the early period from 1992 to 2000, the research landscape was primarily associated with economic surveys, international trade and macroeconomic policy. The term *OECDs economic*

survey appears as an early theme, with a median year of 1998, while *World Trade Organisation* is concentrated in 2000. Other early expressions such as *economic developments policies*, *examines recent economic*, and *electronic commerce* indicate an emphasis on understanding economic developments, international institutions and the early emergence of technology-enabled commerce. This period therefore represents the institutional and macroeconomic foundation of the research field.

During the 2000–2010 period, the literature increasingly focused on foreign direct investment, economic development, labour participation and international economic relationships. The trigram *foreign direct investment* has a frequency of 12 and extends from 2001 to 2022, indicating that international investment remained a persistent research theme. Similarly, *labour force participation*, *African development bank*, *African economies*, *economic developments policies*, and *recent economic developments* reflect growing interest in development economics, employment and emerging economies. The presence of *GATT Article III* also highlights the importance of international trade regulations and legal frameworks.

The 2010–2015 phase shows a noticeable strengthening of international taxation and tax administration research. Terms such as *tax purposes access*, *model tax convention*, *OECD model tax*, *federal tax procedure*, and *foreseeably relevant information* become prominent. The repeated appearance of OECD-related tax terminology suggests increasing attention to international tax cooperation, tax information exchange, tax conventions and regulatory procedures. The median year of 2013 for *model tax convention* and *OECD model tax* indicates a concentrated period of interest in international taxation frameworks.

A particularly distinctive thematic concentration occurs around 2016. The trigrams *analyses tourism performance*, *covering domestic inbound*, and *data covering domestic* each have a frequency of 38 and are concentrated in 2016. This indicates a specific research cluster related to tourism performance and domestic inbound tourism. The emergence of *corporate income tax* and *illegal phoenix activity* around 2017 further broadens the research agenda toward corporate taxation, business regulation and tax-related misconduct.

The period around 2018–2020 demonstrates a strong emphasis on public health, tobacco control, international governance and changing business environments. The terms *tobacco control policies* (frequency 22), *national tobacco control* (15), and *World Health Organization* (15) are concentrated around 2018, indicating a significant research burst relating to tobacco regulation and public-health policy. At the same time, *EU customs law*, *public administration*, and other institutional terms demonstrate continuing attention to regulatory and governance issues.

A major transition becomes evident around 2020 with the emergence of trigrams associated with business transformation and technological change. *Business models coupled*, *changing established business*, and *decisions changing established* each have a frequency of 76 and are concentrated in 2020. These terms suggest that the literature increasingly examined how established business models and organisational decisions were being transformed, potentially reflecting broader structural changes in the business environment. The appearance of *fourth industrial revolution* subsequently reinforces the transition toward technology-driven economic and organisational research.

From 2021 to 2024, the literature increasingly integrates sustainability, corporate responsibility, digitalisation and emerging technologies. The trigram *Sustainable Development Goals* has a frequency of 18 and a median year of 2022, while *corporate social responsibility* has a frequency of 16 and extends to 2025. The emergence of *fourth industrial revolution*, *industrial revolution IR*, and *supply chain management* demonstrates increasing interest in Industry 4.0, technology-enabled production and digitally transformed supply chains. This period therefore reflects the growing integration of economic development with sustainability and technological transformation.

The most important recent development is the rapid emergence of artificial intelligence and systematic literature review methodologies. *Artificial intelligence AI* has a frequency of 34, with a median year of 2024 and a range extending to 2025. Similarly, *systematic literature review* has a frequency of 28, with a median year of 2024. These findings indicate that recent scholarship is not only adopting AI as a substantive research topic, but is also becoming increasingly methodologically sophisticated through systematic evidence synthesis.

The 2024–2026 period represents the current research frontier. New trigrams such as *foreign tax credit*, *public sector accounting*, *sustainable business practices*, *book includes selected*, *includes selected papers*, and *corporate tax avoidance* appear during this period. Of particular significance is *corporate tax avoidance*, which extends from 2024 to 2026, indicating renewed contemporary interest in corporate taxation, tax planning and regulatory compliance. At the same time, *sustainable business practices* extends into 2026, demonstrating the continuing relevance of sustainability alongside emerging digital technologies.

Overall, the evolution of trigram topics reveals a multi-stage transformation of the research field:

Economic Surveys & International Trade → Foreign Investment & Economic Development → International Taxation → Tourism & Public Policy → Tobacco/Public Health → Business Transformation → Sustainability & Industry 4.0 → AI, Systematic Reviews & Contemporary Tax Issues.

The trigram analysis therefore provides strong evidence that the research domain has become increasingly interdisciplinary and technology-oriented. Traditional themes such as economic development, foreign investment, taxation and international policy continue to provide the foundation, but newer research is increasingly connecting these themes with digital transformation, artificial intelligence, sustainable development, supply-chain management and advanced research methodologies. The latest terms particularly *artificial intelligence AI*, *systematic literature review*, *sustainable business practices*, *public sector accounting* and *corporate tax avoidance* suggest that the field is currently moving toward a combination of AI-enabled research, sustainable business transformation, evidence-based scholarship and contemporary taxation challenges.

6. Results and Discussion

The bibliometric analysis provides a comprehensive picture of the development, intellectual structure, thematic orientation and emerging research frontiers of Goods and Services Tax (GST) research. Based on the cleaned dataset of 2,391 articles published across 415 sources, the

literature demonstrates a relatively established but uneven research base. The analysis identified 3,649 authors, with an average of 2.01 co-authors per document and only 3.72% international co-authorship, indicating that although GST research has attracted a substantial number of scholars, international research collaboration remains comparatively weak. The low annual growth rate of 0.72% further indicates that the literature has expanded gradually rather than experiencing continuous rapid growth. The average document age of 7.17 years and average citation count of 8.56 citations per document suggest moderate scholarly influence, although citation performance is strongly affected by publication age. Consequently, the field can be characterized as established but fragmented, with considerable scope for stronger international collaboration and comparative research.

The temporal publication pattern indicates that GST-related research has not followed a smooth linear growth trajectory. Instead, the literature demonstrates several periods of acceleration and decline. An exceptional concentration of 760 publications in 2018, followed by only 63 publications in 2019, represents an unusually large fluctuation that may partly reflect database indexing, metadata, document-type classification or search-retrieval effects rather than an actual collapse in scholarly activity. Publication output subsequently recovered, with research remaining relatively active during 2020–2025 and reaching approximately 248 publications in 2025. Therefore, although the broad publication trajectory indicates increasing scholarly attention over time, the 2018 peak should not be interpreted uncritically as a genuine research explosion. The life-cycle analysis similarly indicates that the field experienced gradual development followed by rapid expansion, reaching an estimated publication peak around 2020.1, after which the growth curve indicates movement toward maturity and possible saturation.

The citation analysis demonstrates considerable variation in scholarly influence across publication years. Recent publications generally have lower average citation counts because they have had less time to accumulate citations. In contrast, older publications benefit from a longer citation window. The exceptionally high citation impact recorded for 2004, at approximately 83.88 citations per article, is based on only eight documents and should therefore be interpreted cautiously. Among relatively recent publication years, 2019 records a particularly high mean citation impact of 65.75 citations per article, followed by 2020 and 2021. The reference publication year spectroscopy further demonstrates that the knowledge base strengthened progressively from the 1990s onward, with particularly pronounced citation peaks around 2014, 2015 and 2019. This suggests that the period from approximately 2010 to 2020 played an important role in consolidating the intellectual foundations of the research domain.

The source-level analysis demonstrates that GST-related scholarship draws upon a broad disciplinary knowledge base. SSRN Electronic Journal, with 820 local citations, represents the most influential source in the dataset, followed by the Journal of Public Economics and Sustainability. The presence of economics, taxation, sustainability and interdisciplinary publication outlets indicates that GST research extends beyond conventional accounting and taxation scholarship and intersects with public economics, fiscal policy, sustainability, technology and public policy. At the same time, the concentration of citations within a limited number of influential sources suggests that the intellectual structure remains relatively centralised. Bradford's Law provides additional evidence of this pattern, with only two sources forming the core zone, five sources in the second zone and 408 sources in the third zone. The high Bradford fit ($R^2 = 0.9567$) confirms substantial conformity with Bradford's distribution and

demonstrates that GST research is simultaneously characterised by a small influential core and extensive dispersion across peripheral sources.

The author-level results similarly demonstrate an uneven contribution structure. OECD appears as the most prolific contributing entity, with 70 documents, substantially exceeding the contribution of the next most productive contributors. This result requires careful interpretation because OECD represents an institutional or organisational author rather than a conventional individual researcher. The presence of organisational contributors alongside individual scholars reflects the strong role of international institutions and policy organisations in taxation-related research. The geographical distribution further indicates that the USA is the leading contributor, with 120 publications, followed by the UK, India, Italy and Australia. India's position among the leading contributors is particularly relevant because GST represents a major component of India's indirect-tax framework. Nevertheless, the comparatively low international co-authorship rate indicates that geographical participation has not yet translated into strong cross-country collaboration.

The three-field analysis provides evidence of an interdisciplinary and context-dependent research structure. The relationships among sources, authors and terms demonstrate the importance of taxation, policy, development, digitalisation, economics and international issues. However, the concentration of certain terms and contributors indicates that some thematic areas are more strongly represented than others. The research therefore appears to be evolving from conventional taxation and economic-policy analysis toward a broader knowledge structure involving digitalisation, technology, business, data and emerging intelligent systems. This development is particularly relevant to GST because contemporary tax administration increasingly depends on digital reporting, electronic transactions, data integration, automated compliance and technology-enabled administration.

The title-based trend analysis provides further evidence of this thematic evolution. The unigram results indicate an early emphasis on economic institutions, OECD-related issues, investment, reforms, surveys and international economic relations, followed by increasing prominence of taxation, tobacco-related policy, development, internationalisation and economic issues, and finally the emergence of digital, business, systems and intelligence-oriented terminology. The temporal distribution is particularly important because frequency alone cannot establish whether a topic is emerging. Terms such as *digital*, *systems*, *intelligence* and *intelligent* are positioned toward the most recent years, indicating that technology-oriented themes represent newer research directions. The progression suggests a movement from broad institutional and economic concerns toward increasingly specialised and technology-enabled research.

The bigram analysis provides greater contextual clarity by identifying combinations such as economic surveys, investment policy, tax procedures, tobacco control, tax evasion, digital transformation, blockchain technology, digital economy, artificial intelligence, information systems and data analytics. Historically, the research landscape was strongly associated with economic surveys, international investment, public finance and policy governance. It subsequently expanded into taxation, regulatory frameworks and public policy. In the more recent period, the emergence of *digital transformation*, *blockchain technology*, *digital economy*, *artificial intelligence*, *information systems* and *language models* demonstrates a significant technological shift. The frequency of digital transformation (316) and artificial intelligence (152)

in the abstract-level bigram analysis is particularly notable and indicates that technology is becoming an increasingly important component of the contemporary research agenda.

The trigram analysis provides the most specific evidence of thematic evolution. Earlier expressions such as OECD economic surveys, World Trade Organisation, foreign direct investment, economic developments policies and OECD model tax demonstrate the historical importance of international economic institutions, trade, investment and taxation. The subsequent emergence of tobacco control policies, national tobacco control and World Health Organization represents a distinct health-policy-oriented phase in the retrieved literature. More recent terms such as business models coupled, changing established business, sustainable development goals, corporate social responsibility, artificial intelligence AI, systematic literature review, sustainable business practices and corporate tax avoidance demonstrate an increasingly interdisciplinary research environment.

Taken together, the unigram, bigram and trigram analyses demonstrate a transition across several broad phases. The early literature was dominated by economic institutions, investment, trade and policy analysis. The middle phase increasingly addressed taxation, regulation, public policy and sector-specific issues. A subsequent phase demonstrated strong representation of tobacco control and public-health policy, while the latest literature has increasingly incorporated digital transformation, artificial intelligence, data analytics, sustainability, information systems and contemporary tax issues. This temporal evolution suggests that GST research is increasingly embedded within a broader transformation of the tax ecosystem in which digital technologies, data infrastructures and intelligent systems influence tax administration and taxpayer interaction.

An important finding emerging from the trend-topic analysis is the growing significance of digitalisation and artificial intelligence. The appearance of AI, intelligence, intelligent systems, information systems, data analytics and language models in the most recent years indicates movement toward technologically enabled taxation research. Within the GST context, this emerging frontier has considerable relevance to e-invoicing, automated tax compliance, digital payment ecosystems, real-time reporting, fraud detection, predictive analytics, taxpayer risk assessment and intelligent tax administration. Thus, future GST scholarship may increasingly move beyond analysing GST as a tax reform and instead investigate GST as part of a wider digital fiscal infrastructure.

The findings also demonstrate that GST research should increasingly adopt a comparative and international perspective. The low international co-authorship rate of 3.72% indicates that researchers working on taxation, compliance and digital tax administration remain relatively weakly connected across countries. This is an important research opportunity because GST and VAT systems differ substantially in their institutional design, tax rates, compliance mechanisms, digital infrastructure and administrative capacity. Comparative studies between India and other GST/VAT jurisdictions could therefore provide valuable evidence regarding tax compliance, e-invoicing, digital tax administration, taxpayer behaviour and technology-enabled enforcement.

7. Conclusion

This study mapped the intellectual, thematic and temporal evolution of research associated with Goods and Services Tax using bibliometric analysis and title- and abstract-based textual analysis. Based on 2,391 publications from 415 sources and 3,649 contributing authors, the findings demonstrate that the research domain has developed into a broad and multidisciplinary field

involving taxation, economics, public policy, international relations, development, technology and organisational transformation. However, the relatively low annual growth rate and limited international co-authorship indicate that the field remains fragmented and has considerable scope for stronger international and cross-disciplinary collaboration.

The bibliometric findings demonstrate a highly uneven publication structure, with substantial fluctuations in annual output and a particularly pronounced publication concentration in 2018. The life-cycle analysis indicates that the field progressed from gradual development to rapid expansion and is now moving toward a more mature phase. Citation analysis further demonstrates that scholarly influence is strongly associated with publication age, while the source analysis reveals a small influential core surrounded by a very large number of peripheral sources. The results from Bradford's Law reinforce this conclusion by demonstrating strong concentration and dispersion simultaneously.

The thematic analysis provides particularly important evidence regarding the changing research agenda. Earlier research was primarily associated with economic surveys, international institutions, foreign investment, economic development, reforms and tax policy. Subsequently, research attention expanded toward tax administration, taxation, regulation, compliance, public policy and international tax governance. The later emergence of terms related to digital transformation, digital economy, blockchain, artificial intelligence, information systems, data analytics and language models demonstrates that the contemporary research environment is increasingly technology-oriented.

The study therefore identifies a transition from viewing taxation primarily as a policy and fiscal mechanism toward understanding taxation as part of a broader digital and data-driven governance ecosystem. For GST research, this transformation is particularly significant. The future of GST is increasingly connected with digital invoicing, digital payments, automated reporting, data analytics, artificial intelligence, risk-based compliance, fraud detection and technology-enabled taxpayer services. Consequently, future research should investigate how emerging technologies can improve tax compliance while simultaneously addressing issues of privacy, transparency, algorithmic accountability, taxpayer trust and digital inclusion.

The findings also highlight the need for greater international comparative research. The low international collaboration rate indicates that GST research remains geographically fragmented despite the inherently comparative nature of GST/VAT systems. Future studies could compare India with other GST/VAT jurisdictions to examine differences in tax compliance, taxpayer behaviour, digital tax administration, e-invoicing, tax fraud detection and administrative efficiency. Such comparative research could strengthen the theoretical and practical contribution of the field.

Finally, the study suggests that the emerging frontier of GST research lies at the intersection of taxation, digital transformation, artificial intelligence, data analytics, sustainable development and intelligent public administration. The research agenda is therefore moving beyond the conventional question of whether GST improves taxation toward more complex questions concerning how digital technologies can transform tax administration, how taxpayers respond to technology-enabled compliance systems, and how intelligent systems can create more efficient, transparent and responsive tax ecosystems.

Nevertheless, the interpretation of the present findings should be accompanied by an important methodological caution. The occurrence of substantial tobacco-, tourism- and public-health-related terminology in the extracted trend-topic results indicates that the retrieved corpus may contain topic contamination or search-retrieval heterogeneity. Consequently, the dataset should be re-screened against the stated GST inclusion criteria before the final conclusions are generalised to GST research as a whole. Addressing this issue would substantially strengthen the internal validity, conceptual coherence and publishability of the study.

Overall, the study establishes that GST research has evolved from a predominantly economic, institutional and taxation-oriented field into an increasingly interdisciplinary, digital and technology-enabled research domain. The convergence of GST, tax compliance, digitalisation, data, artificial intelligence and intelligent tax administration represents a promising research frontier and provides substantial opportunities for future empirical, comparative and policy-oriented research.

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