CAN ALGORITHMS IMPROVE JUDICIAL INFRASTRUCTURE ALLOCATION? A JUSTICE-BASED FRAMEWORK FOR INDIA

by

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ABSTRACT

Currently, India has more than 56 million pending cases and despite the constitutional guarantees under Articles 14 and 21, systemic judicial deficiencies, such as lack of courtrooms, judges, staff and limited digital capacity, continue to be a major cause of case pendency and unequal access to justice.[1] In India, the number of judges per million population is now about 20, which is below the 50 per million suggested by the Law Commission.[2] This is because the current allocation practice in the country is based on demographic projections, budgetary ceilings, and administrative discretion, thus a reactive rather than predictive planning model. A lot of research is dedicated to artificial intelligence for decision making and unlike predictive policing, there has been little research on algorithmic techniques for organizing the institutional framework of justice delivery.[3] This study addresses that gap. Instead of prescribing the outcomes of judicial architecture, it argues that algorithmic systems should be constitutionally constrained by decision-support tools that augment human authorities rather than substitute for them. To operationalise this argument, the Justice-Based Judicial Infrastructure Allocation Framework (JJIAF), an innovative weighted-indicator model, is developed which generates a district-level Judicial Need Score from case pendency (25%), population (20%), accessibility (15%), rural need (15%), judicial vacancies (10%), digital infrastructure (10%) and disaster

[1] [1]Department of Justice, Government of India. (n.d.). *Judicial infrastructure.* Retrieved June 23, 2026, from https://doj.gov.in/judicial-infrastructure/; see also *Pendency of court cases in India.* (2026). In Wikipedia. Retrieved June 23, 2026, from https://en.wikipedia.org/wiki/Pendency_of_court_cases_in_India (reporting, on National Judicial Data Grid figures, over 56 million pending cases nationally as of June 2026).

[2] Drishti IAS. (n.d.). *Infrastructure facilities for judiciary.* Retrieved June 23, 2026, from https://www.drishtiias.com/daily-news-analysis/infrastructure-facilities-for-judiciary; Law Commission of India. (1987). *120th report on manpower planning in judiciary: A blueprint* (recommending an increase from 10.5 to 50 judges per million population).

[3] Angwin, J., Larson, J., Mattu, S., & Kirchner, L. (2016, May 23). Machine bias. *ProPublica.* https://www.propublica.org/article/machine-bias-risk-assessments-in-criminal-sentencing

risk (5%).[4] The framework is benchmarked against practices in the US, UK, Singapore and Kenya where data-driven court administration has enhanced efficiency without compromising judicial control.[5] It is also tested against the constitutional values of equality, access to justice, and natural justice under Articles 14, 21 and 39A.[6] The report concludes with six policy recommendations, including a National Judicial Infrastructure Dashboard, mandated explainability, and independent bias audits, to ensure that algorithmic allocation strengthens, rather than undermines, the constitutional oversight of the Indian judiciary.

Keywords: *judicial infrastructure; algorithmic governance; access to justice; artificial intelligence; Constitution of India; resource allocation*

Introduction

The quality and availability of institutions providing justice is a crucial aspect of what constitutes good justice. Even after all the efforts made on the part of the government to bring about reforms and to increase and allocate huge amounts of resources to justice delivery system, there were a lot of infrastructural issues like poorly equipped court, inadequate judges, no adequate staffs, inadequate technological facilities in court, disparity in access to court among different regions etc. still holding them back.[1] They also restrict access to justice, case congestion and delays which have been guaranteed under the constitution as fast and efficient justice.[2]

Judicial infrastructure allocation has been historical based on demographic indicators, budget constraints, administrative discretion, and periodic policy changes.[3] These methods have helped in achieving incremental improvements, but they are not working proactively to adjust litigation trends, population growth, geographic availability, socio-economic differences, and new judicial

[1] See Department of Justice, Government of India, 'Judicial Infrastructure' <https://doj.gov.in/judicialinfrastructure/> accessed 23 June 2026, noting that many district and subordinate courts remain understaffed and under-equipped notwithstanding sustained central funding.

[2] As of June 2026 over 56 million cases were pending across all levels of the Indian judiciary, more than 85 per cent of them in the district courts: 'Pendency of Court Cases in India', Wikipedia <https://en.wikipedia.org/wiki/Pendency_of_court_cases_in_India> accessed 23 June 2026, citing National Judicial Data Grid figures.

[3] Sarthak Gupta, 'Why the Central Scheme for Judicial Infrastructure Needs an Urgent Overhaul' (Observer Research Foundation, 10 January 2025) <https://www.orfonline.org/expertspeak/why-the-central-scheme-for-judicialinfrastructure-needs-an-urgent-overhaul> accessed 23 June 2026.

needs. As a result, judicial infrastructure planning often must be reactive, and not predictive, which leads to inefficiencies for litigants and the administration of justice.

The latest improvements in Artificial intelligence (AI), learning of machines and predictive analytics are revolutionizing decision making across a myriad of industries, including healthcare, transport, urban planning and public administration.[4] Algorithmic systems are being used by governments increasingly to maximize the use of resources, to predict demand, and to deliver better policy results in a data-driven government.[5] This begs a pertinent question: Can a similar algorithmic model be used in India, with due considerations to constitutional ideals, institutional independence and the principles of justice, to improve judicial infrastructure planning?

The answer is not simple, however. Algorithms can process complex data on population density, case intake, case pendency, judicial vacancies, distance travelled, socio-economic factors, demographic trends, and more to pinpoint areas that need critical infrastructural development. Meanwhile, algorithmic decision-making raises substantial legal and ethical questions: transparency, bias, lack of accountability, data quality problems, and the potential for it to supplant the process of making public decisions.[6] While mathematical optimization is one necessary criterion for allocating judicial infrastructure, it must also reflect constitutional values of equality, access to justice, federal balance, and social inclusion.

While there is a wealth of research about AI in adjudication, predictive policing, and algorithmic bias, not as much research has been conducted on the use of algorithmic systems in the governance of judicial infrastructure[7]. The literature thus far mainly has examined algorithms as decision

[4] World Bank, 'Five Ways Digital Technologies Are Transforming Courts and Access to Justice' (World Bank Blogs, 21 March 2025) <https://blogs.worldbank.org/en/governance/five-waysdigital-technologies-aretransforming-courts-and-acces> accessed 23 June 2026.

[5] NITI Aayog, National Strategy for Artificial Intelligence: #AIforAll (Government of India, June 2018) <https://www.niti.gov.in/sites/default/files/2023-03/National-Strategy-for-ArtificialIntelligence.pdf> accessed 23 June 2026, identifying healthcare, agriculture, education, smart cities and mobility as priority sectors for government AI deployment.

[6] Muthu Ramachandran, 'Ethical Challenges in AI' in Muthu Ramachandran, Engineering Ethics of AI by Design (Springer 2026) 133, 173 <https://doi.org/10.1007/978-981-95-2909-4_4> accessed 23 June 2026.

[7] See, eg, Julie Angwin and others, 'Machine Bias' (ProPublica, 23 May 2016) <https://www.propublica.org/article/machine-bias-risk-assessments-in-criminal-sentencing> accessed 23 June 2026, illustrating the predominant focus of existing literature on algorithms as adjudicative or predictive-policing tools rather than as infrastructure-planning instruments.

makers in the legal process, but not as a planning tool for bolstering the institutional infrastructure of the justice delivery system. This is an important gap in research, especially in the Indian context since judicial infrastructure is one of the key reasons behind systemic delays.

This paper makes the point that algorithmic systems should not be used to make decisions but should be used to support human decision-making in a role allowed by the constitution to guide infrastructure allocation decisions. It suggests the integration of objective data analytics with constitutional rights of equality, transparency, accountability, accessibility, and procedural fairness within the context of a Justice Based Algorithmic Allocation Framework. The paper aims to reconceptualize infrastructure planning from the point of view of algorithmic justice, showing how technology can help inform evidence-based policy, without losing sight of the human values that are central to the rule of law.

2) Understanding Judicial Infrastructure in India

This chapter aims to provide a brief background on judicial infrastructure in India. This chapter is an effort to give a brief background of judicial infrastructure in India.

2.1 Meaning of Judicial Infrastructure

Judicial infrastructure refers to physical, technological, administrative, and human resources that collectively allow the effective operation of the judiciary. It encompasses the courtrooms, judges, judicial staff, digital systems, legal aid providers, libraries, record management centers, security measures, as well as other services integral to the efficient delivery of justice that do not take place in the confines of a court building.

Judicial infrastructure in contemporary judicial systems also involves technological elements like e-filing systems, video conferencing systems, case administration software, electronic record keeping facilities, cyber security, and artificial intelligence (AI) based administrative support.[8] Enabling judicial infrastructure therefore means that the judiciary has the overall capacity to deliver accessible, efficient, transparent, and timely justice.

[8] Press Information Bureau, 'Judicial Infrastructure' (Government of India, 14 July 2022) <https://www.pib.gov.in/Pressreleaseshare.aspx?PRID=1843360&reg=48&lang=2> accessed 23 June 2026.

2.2 Importance of Judicial Infrastructure

Judicial infrastructure is necessary for efficient management in the branch of justice as well as for ensuring the protection of constitutional guarantees. Although judicial independence and good law are the normatively sound foundations of justice, they are crucial to being realized in the context of resources that are available in institutions.

Good judicial organization is a factor that helps to achieve:

- Gathering cases and minimizing pendency.
- Enhanced access to justice, including economically and geographically marginalized communities.
- Improved judicial administration.
- Improved working conditions for the judges and staff of the courts.
- A rise in confidence from the public in the legal system.
- The successful implementation of digital justice programs.
- Cost and delay savings in litigation.

The other part is, on the other hand, poor infrastructure leads to overcrowding in Courts, delay in justice, absence of courts, inefficiency in administration and inequality in access to justice which in turn adversely affects the concept of justice enshrined in Article 14 and 21 of the Constitution of India.[9]

The judiciary is fairly weak and undeveloped. Indian judiciary is still in a developmental phase. India contemporarily is having one of the largest judiciary systems in the world, but the capacity of the judiciary is not in proportion to the growth of number and cases of litigants.[10] Although much work has been accomplished through the centrally sponsored schemes and digital means, there are still major issues. There are many understaffed, under-equipped, under-resourced district courts, both in terms of staffing and courtroom space, and in terms of technology and

[9] Constitution of India 1950, arts 14, 21. See further Hussainara Khatoon v Home Secretary, State of Bihar AIR 1979 SC 1369 (Article 21 held to include the right to a speedy trial).

[10] As at 2025, India had approximately 22 judges per million population, against a Law Commission benchmark of 50 per million recommended in 1987: '22 Judges per Million, 26 Lakh Cases Pending: India's Judicial Gap Widens Despite Years of Reform' (ThePrint, 22 March 2026) <https://theprint.in/judiciary/22-judges-per-million-26-lakhcases-pending-indiasjudicial-gap-widens-despite-years-of-reform/2885551/> accessed 23 June 2026.

administrative aspects.[11] There are several court premises which are housed in leased buildings or divided premises with other courts, impacting efficiency and public access.[12]

Heavy workload for Courts is a result of the large-scale urbanization, an increase in commercial litigations, increasingly complex regulatory litigation and increasing legal awareness. Unfortunately, infrastructure development to accommodate these changes has been slow, resulting in congestion and delays in traffic.

2.3 Components of Judicial Infrastructure

A. Court Buildings

The physical structure of judicial administration is court buildings. Modern court complexes should have adequate court room space, judges's room, record room, waiting room, mediation room, legal aid clinic, washroom, barrier-free access for people with disabilities, and security system, as well as parking facilities.

However, in some districts court complexes are still poorly maintained, congested, and not in accordance with modern standards of accessibility.

B. Courtrooms

The availability of adequate courtrooms is crucial for speedy proceedings. Even when judges have been appointed, lack of operational courts directly impacts judicial capacity.[12] In contemporary courts, Video conferencing facilities, Digital evidence presentation systems, electronic display boards, Audio recording facilities, Secure digital networks are increasingly demanded. Many sub-courts still don't have these facilities, especially in rural areas.

[11] Law Commission of India, 120th Report on Manpower Planning in Judiciary: A Blueprint (1987), recommending an increase in judge strength from 10.5 to 50 judges per million population, referenced in Press Information Bureau, 'Judge Population Ratio' <https://www.pib.gov.in/newsite/PrintRelease.aspx?relid=75772> accessed 23 June 2026.
[12] Gupta (n 5) noting that 'several courts are still functioning in rented premises with insufficient space and some in a dilapidated condition without basic amenities'.

[12] As of 2022, the sanctioned strength of judicial officers stood at 24,991 against only 20,115 available courtrooms nationally: Gupta (n 5).

C. Judge Strength

The effectiveness of judicial infrastructure is greatly reliant on adequate judicial officers. Although the sanctioned posts of judges keep increasing from time to time, there is a huge difference between sanctioned strength and working strength of judges because of recruitment delays and prolonging vacancies.[13] A low judge to population ratio leads to longer case backlogs, longer court processes, and too many cases for the judges to manage.

D. Court Staff

Trained ministerial staff, registrars, stenographers, clerks, process servers, system officers and technical personnel are required for efficient judicial administration. Support staff is often lacking in many courts, causing delays in record management, scheduling, filing and administrative processing.

E. Digital Infrastructure

The technology infrastructure is now a critical part of modern judicial processes.

It includes:

- Electronic Filing systems.
- Digital case management.
- Digital hearing platforms.
- Electronic document repositories.
- Online cause lists.
- Digital payment facilities. Artificial Intelligence Legal Research.
- Cybersecurity infrastructure.[14]

[13] 'India's Judge-Population Ratio Stands at 21: Law Minister Tells LS' (Business Standard, 8 December 2023) <https://www.business-standard.com/india-news/india-s-judge-populationratio-stands-at-21-law-minister-tells-ls123120801256_1.html> accessed 23 June 2026.

[14] National Informatics Centre, 'National Judicial Data Grid' <https://www.nic.gov.in/project/national-judicial-datagrid/> accessed 23 June 2026, describing the NJDG as a decision-support system enabling resource-management and judicial-governance decisions.

The e-Courts Project has made much progress, but there are still gaps between states and districts when it comes to digital readiness.[15]

F. Legal Aid Centers

Legal aid centers encourage access to justice through free legal service to the economically weaker sections, women, children and persons with disabilities and other vulnerable groups.[16] These centers operate via the legal services of authorities and provide legal representation, mediation, legal awareness, and pre-litigation support.[18] However, their effectiveness is still compromised by the inequalities in distribution, inadequate staffing levels, and low awareness among the public.

G. Accessibility

Geographical access to courts is not the only measure of accessibility. It includes physical accessibility of people with disabilities like Affordable legal services, Availability of public transport, multilingual services, Digital accessibility to legal information available, safe court environment. Accessibility continues to be the cornerstone of the constitutional principle of equal access to justice.

2.4 Judicial infrastructure faces the following challenges.

A. Case Pendency

There is a huge number of to be decided cases in India at all the levels of Indian courts.[17] Justice is delayed when pendency, costs of litigation, investment and public trust in the justice system suffer due to high pendency. Lack of infrastructure, appointments, time delays, growing litigation, and limited administrative capacity are all factors that impact the problem.[18]

[15] Press Information Bureau (n 6).
[16] Legal Services Authorities Act 1987 (India) s 12, read with art 39A of the Constitution of India 1950. '8 Key Functions of NALSA: Free Legal Aid & Justice for All' (The Legal School) <https://thelegalschool.in/blog/functions-of-nalsa> accessed 23 June 2026.
[17] 'Pendency of Court Cases in India' (n 2), recording over 56 million pending cases nationally as of June 2026, including more than 180,000 cases pending for over thirty years.
[18] PRS Legislative Research, 'Pendency and Vacancies in the Judiciary' (6 May 2026) <https://prsindia.org/policy/vital-stats/pendency-and-vacancies-in-the-judiciary> accessed 23 June 2026.

B. Judicial Vacancies

Vacancies of sanctioned judicial posts continue to be a big number on account of delayed recruitment and appointment processes. If a judge is absent, then the judge who has to fill their seat has to take up more work than they normally would, and the judiciary as a whole has less capacity to dispose of cases efficiently.[19]

C. Unequal Distribution of Judicial Resources

The availability of judicial facilities varies from state to state and district to district. Although many rural and remote districts still lack courtrooms, judges, support staff, digital infrastructure and legal aid facilities, some urban districts have quite adequate facilities. This inequality ensures speedy justice to the citizens.

D. Rural–Urban Disparities

The lack of uniformity of judicial infrastructure in urban versus rural areas is one of the biggest problems. Better technological facilities, larger court complexes, greater judicial manpower and improved administrative support are the factors generally in favor of urban courts. On the other hand, however, rural courts are generally less well-equipped with buildings, internet access, judges, and have a lower institutional capacity, and for litigants travel time is longer.[20] These differences are starkly reflected in the economically disadvantaged sections of society, and they are a threat to the constitutional goal of equal justice.

2.5 Existing Schemes and Policies

India has taken several steps to bolster the judiciary branch and enhance access to justice.

[19] PRS Legislative Research (n 13); see also All India Judges' Association v Union of India (2002) 4 SCC 247 (Supreme Court of India), directing the increase of judge strength from 13 to 50 per ten lakh population within five years.

[20] Drishti IAS, 'Infrastructure Facilities for Judiciary' <https://www.drishtiias.com/dailynewsanalysis/infrastructure-facilities-for-judiciary> accessed 23 June 2026, contrasting India's judgepopulation ratio (about 20 per million) with comparator jurisdictions (50–70 per million).

(i) The Centrally Sponsored Scheme (CSS)

Building Infrastructure for the Judiciary supports the second phase of the project. The Secondary stage of the project falls under Centrally Sponsored Scheme (CSS) for Development of Infrastructure Facilities for Judiciary.

The scheme offers financial support to State and Union Territories to build halls for lawyers, residential quarters for judicial officers, court halls, toilet complexes, digital facilities and other infrastructure.[21] It aims to address the gaps in infrastructure in subordinate courts and enhance its physical capability. It aims to address infrastructural gaps in the subordinate courts and to enhance their physical capacity. The scheme has been in operation since 1993–94 and is funded on a 60:40 Centre–State basis, with more favorable ratios for north eastern and Himalayan States and full central funding for Union Territories.[22]

(ii) Electronic Courts Mission Mode Project (e-Courts)

The e-Courts Project, is a part of the National e-Governance Plan, is designed to go paperless with court processes, introduce virtual hearings, electronic case management, online cause lists,[23] Electronic records and video conferencing. It is the backbone of India's journey towards techenabled justice. To promote the development of justice in the country by implementing legal reforms. To foster the development of justice in the country by making legal changes. The mission's thrust is on judicial process re-engineering, infrastructure development, reduction of delays, accountability and increased use of information technology. Phase I of the project, concluded in 2015, computerised 14,249 court sites; Phase II proceeded with an outlay of approximately Rs 1,670 crore.[24]

[21] Department of Justice (n 1); Press Information Bureau, 'Cabinet Approves Continuation of the Centrally Sponsored Scheme (CSS) for Development of Infrastructure Facilities for Judiciary for Further Five Years' (Government of India, 28 July 2021) <https://www.pmindia.gov.in/en/news_updates/cabinet-approves-continuationof-the-centrallysponsored-scheme-css-for-development-of-infrastructure-facilities-for-judiciary-for-furtherfiveyears/> accessed 23 June 2026.

[22] Press Information Bureau, 'Centrally Sponsored Scheme for Development of Infrastructure Facilities for The Judiciary' (25 May 2023) <https://www.pib.gov.in/PressReleaseIframePage.aspx?PRID=1927473&reg=3&lang=2> accessed 23 June 2026.

[23] Press Information Bureau (n 6).

[24] Press Information Bureau (n 6) (Phase I/II figures).

(iii) Nyaya Vikas

Nyaya Vikas is an online platform for planning, monitoring, and managing judicial infrastructure projects. It helps to measure infrastructure needs based on data, track financial monitoring, project tracking, and make decisions based on data, which leads to better transparency and efficiency in infrastructure development. [25] The Indian Space Research Organization's National Remote Sensing Center provided technical support for the development of the portal, and its upgraded 'Nyaya Vikas 2.0' version uses satellite-based geo-tagging to verify the physical and financial progress of individual projects.[26]

(iv) Legal Advisor(s)

The National Legal Services Authority (NALSA), State Legal Services Authority and District Legal Services Authority facilitate access to justice by providing free legal aid, legal literacy programmes, mediation, Lok Adalat's etc., especially for the marginalized groups.[27]

2.6 Need for a New Allocation Framework

Although these efforts have been made, judicial infrastructure planning is still largely based on ad hoc assessments and traditional allocation approaches. [28] Current models do not incorporate realtime data on pendency, judicial vacancies, population growth, geographical accessibility, socioeconomic vulnerability, and digital readiness as part of their resource allocation process.

The need for an evidence-based, transparent, and constitutionally informed allocation model is highlighted here. An algorithmic decision support system that can manage complex decisionmaking, among multiple variables, can help policymakers in identifying priority areas, optimizing infrastructure investment and distribution of judicial resources without losing constitutional values and barriers to human control.

[25] Department of Justice, Government of India, 'National Mission & JR Desk'

[26] 'Nyaya Vikas Portal' (The Open View, 28 July 2023) <https://theopenview.in/2023/07/28/nyaya-vikas-portal/> accessed 23 June 2026.

[27] Legal Services Authorities Act 1987 (India), enforced 9 November 1995, giving effect to art 39A of the Constitution of India 1950; National Legal Services Authority, 'About NALSA' <https://nalsa.gov.in/> accessed 23 June 2026.

[28] Gupta (n 5), observing that erratic and poorly monitored fund utilisation has persisted despite decades of central funding under the CSS.

3) Existing Framework for Judicial Infrastructure Allocation

3.1 Institutional Framework

Judicial infrastructure in India is a devolved responsibility of Union Government, State Government, High Court and District Courts.[29] The Union Government formulates policies on a national level and extends financial support through schemes like the Centrally Sponsored Scheme (CSS) for Development of Infrastructure Facilities for Judiciary in the Department of Justice. State Governments are responsible for the design, construction, maintenance and funding of court buildings, accommodation and judicial facilities as these forms of facilities are primarily a State responsibility. High Courts review the requirements of infrastructure of the Subordinate Courts, recommend the building of new court complexes, monitor the current projects of the courts and coordinate with the State Government for implementation. The District Courts will identify local infrastructural requirements, report its inadequacy and submit proposals to the respective High Courts according to the workload and requirement of the district court.

3.2 Present Method of Allocation

Currently, the allocation of judicial infrastructure is based mainly on population and projected demand for judicial services. The financial and budgetary availability. The schemes to be submitted by the State Governments and High Courts are called infrastructure proposals. Administrative assessments, policy priorities, Past allocation and current infrastructure levels. These are all considerations for building new courthouses, establishing courtrooms, hiring staff, and budgeting resources.

The current framework has some restrictions. The existing system has aided the development of judicial infrastructure, but it is still highly reliant on periodic evaluations by administrative bodies and traditional planning approaches.[30] It does not always include real-time information on case backlogs, judges' vacancies, geographical availability, socio-economic factors, and trends in litigation. This consequently means that allocation may not be optimal and reflect judicial needs, which results in imbalances across regions, poor use of the available resources, and sustained

[29] 31 Department of Justice (n 1).

[30] Gupta (n 5), noting that central allocation rose from a meagre Rs 180 crore between 1993 and 1997 to approximately Rs 1,245 crore by 2011, an average of only Rs 69.18 crore per year for all States and Union Territories.

delays in the justice delivery system. These are some of the weaknesses that underscore the need for a more objective, data-driven, and transparent method for allocating judicial infrastructure.

4) What are Algorithms?

An algorithm may be a sequence of instructions or rules to be followed to process data, solve a problem, or make decisions. Governance uses algorithms to analyze vast amounts of information, prioritize, and support decision making.[31] They are not meant to replace human judgment, but act as decision support tools to make things efficient, consistent, and objective.

This course introduces the fundamentals of algorithms, artificial intelligence, machine learning, and predictive analytics. This course covers the basics of algorithms, predictive analytics, machine learning, and artificial intelligence.

Although the terms are occasionally used synonymously, they have different meanings:

Algorithms: a sequence of instructions that transform input into output according to a set of rules. The general term used to describe how AI empowers machines to carry out tasks that would otherwise require human intelligence. Machine Learning (ML) is a branch of AI that involves algorithms being trained on past data and then making predictions that can be improved as more data becomes available without the algorithm ever needing to be programmed specifically for each instance. Predictive Analytics applies statistical methods and machine learning to uncover patterns and insights from past and current data that can be used to predict future events or trends. Algorithms have already been used in public resource allocation to a certain extent. Algorithms are already being used in public resource allocation, albeit to a limited degree.

Governments are already a big user of algorithms for resource allocation and enhancing public service. They are used in healthcare for forecasting patient numbers, efficient bed management, and scheduling doctors and nurses. [32] Algorithms can be used as a key element of traffic management systems to control traffic flows, decrease traffic congestion, and optimize travel

[31] NITI Aayog (n 4) 9, describing AI as enabling 'high-level cognitive processes like thinking, perceiving, learning, problem solving and decision making'.

[32] NITI Aayog (n 4) 11–15, discussing AI-based diagnostics, population health analytics, and decision-support applications in the Indian healthcare sector.

routes.[33] In times of disaster, algorithms help authorities predict floods, high risk zones and provide information for the relief effort. Likewise, public transport systems employ algorithms to plan routes, schedule services, and allocate vehicles based on demand.

Examples of successful deployment of algorithmic systems in these sectors show that governments are already using systems based on data to enhance efficiency and resource allocation. An interesting question that arises is, therefore, whether algorithms can help with the allocation of judicial infrastructure in an efficient, transparent, and constitutional framework as well.

5. Can Algorithms Improve Judicial Infrastructure Allocation?

The current system of allocation of court infrastructure is mainly based on policy recommendations, regular reports, and administrative reviews. Despite the insightful results obtained using these techniques, they are often tedious, subjective, and cannot deal with several variables at the same time. Algorithmic decision-support systems, on the other hand, provide a more data-driven approach, analyzing huge databases to decide on the areas that require judicial infrastructure the most.

An algorithm can consider a range of objective indicators how many cases are pending, how large the population is, how far the nearest court is, how high the crime rate is, how litigation is occurring, how many judges are vacant, how long litigants spend travelling on average, and even how much digital infrastructure a district has. By looking at these variables together, the system can work out the Judicial Need Score of each district and prioritize them. [34] Eg. A district with a high number of vacant judges' positions, a large population, a high backlog of cases, fewer courtrooms, and poor digital connectivity, for example, would be prioritized over a district with lower demand and better infrastructure. It allows legislators to better and more equitably allocate new courthouses, additional judges, funding and technical infrastructure. Importantly, the algorithm is not meant to take the place of a human decision maker. Rather, it is a tool to assist governments and the judiciary in making informed decisions on infrastructure, providing evidence-

[33] 'National Strategy for Artificial Intelligence' (NEXT IAS) <https://blog.nextias.com/nationalstrategy-forartificial-intelligence> accessed 23 June 2026, describing NITI Aayog's identification of AI-based trafficmanagement systems, including sensors and automatic numberplate recognition, as a priority smart-mobility use case.

[34] Cf National Judicial Data Grid <https://njdg.ecourts.gov.in/njdgnew/> accessed 23 June 2026, which already publishes district- and court-level pendency data of the kind such a model would draw upon.

based recommendations. Human oversight remains important to take account of local circumstances, constitutional values, and policy agendas that may not be fully captured by statistics alone. The use of algorithmic methods can improve the transparency, consistency and responsiveness of judicial infrastructure allocation to the changing demands of India's justice delivery system by combining objective data analysis with human judgement.

6. Challenges of Algorithmic Allocation

Algorithmic decision-support systems have many advantages, but they also raise ethical and legal concerns about the distribution of judicial infrastructure. If the data they work on is not accurate, complete, and high quality, the algorithms will not work well. Recommendations based on outdated, inadequate, and biased data sources may help to entrench inequality rather than alleviate it. Data bias is a huge issue. For example, a district might seem to be using less court resources, but this could be due to socioeconomic problems, lack of access to the courts, or a lack of knowledge of the law. Thus, underprivileged or rural areas may be compromised due to a potentially biased algorithm based on the number of cases. [35] Lack of transparency is another challenge, especially where complex or "black box" algorithms are utilized. [36] When decisions are not understood, it is more difficult to ensure they will be fair or to question incorrect recommendations. Another question of accountability arises that who is accountable for the algorithm and its outcome if it leads to unequal distribution of judicial infrastructure whether the software developers, government, or judicial administrators?[37] The algorithmic systems can be susceptible to political influence, in terms of which data is selected, how the variables are weighted, or the manipulation of the data to make it favorable to specific regions. This would jeopardize the objective that algorithms are supposed to foster.

[35] Cf Julie Angwin and others (n 7), finding that a recidivism-risk algorithm used in US sentencing produced systematically skewed error rates against Black defendants when relied upon without adequate scrutiny of the underlying data.

[36] State v Loomis 881 NW 2d 749 (Wis 2016), in which the Wisconsin Supreme Court permitted reliance on a proprietary, non-disclosed risk-assessment algorithm at sentencing subject to judicial discretion and an accompanying list of cautionary disclosures.

[37] See generally the critique in Ben Green, 'The Flaws of Policies Requiring Human Oversight of Government Algorithms' (2022) Computer Law & Security Review, arXiv:2109.05067, arguing

Algorithmic allocation should not be an alternative to human judgment, therefore. Rather, algorithms should be designed as means of assistance, as tools to be interpreted, opened and audited, and decisions made in accordance with human judgment, which should be guided by constitutionally important values like equality, access to justice and fairness.

7. Constitutional Perspective

Any algorithmic systems used for allocating resources for judicial structures should be aligned with the fundamental principles of the Indian judicial system. Algorithms can increase efficiency and objectivity but should not act in a way that infringes on the basics of rights and judicial independence.

The judicial interpretation of Article 21 to include the rights to access justice and to a speedy trial means that the State must maintain an efficient and accessible judicial system.[38] A well-designed algorithm capable of identifying regions of higher infrastructural need can facilitate these goals; misinformed recommendations, however, risk obstructing access to justice.

The Constitution offers equality before the law and equal protection of the laws under Article 14. [41] Judicial resources therefore need to be distributed fairly and without discrimination by an algorithm. Districts may receive less resources because of biased or incomplete data, which could be an infringement on the principle of equality.

This broader, purposive reading of Article 21 requiring that any procedure depriving a person of liberty or access to a remedy be fair, just and reasonable originates in the Supreme Court's 'golden triangle' jurisprudence linking Articles 14, 19 and 21.[39] The judicial interpretation of Article 21 to include the rights to access justice and to a speedy trial, means the State must have an efficient and accessible judicial system. These goals can be facilitated by a well-designed algorithm that can

[38] Hussainara Khatoon v Home Secretary, State of Bihar AIR 1979 SC 1369, 1979 SCR (3) 532 (P N Bhagwati J), holding that the right to a speedy trial is an essential ingredient of the 'reasonable, fair and just' procedure guaranteed by art 21, and linking the obligation to provide free legal aid to art 21 read with art 39A. [41] Constitution of India 1950, art 14.

[39] Maneka Gandhi v Union of India AIR 1978 SC 597, holding that the 'procedure established by law' under art 21 must be just, fair and reasonable and may not be arbitrary.

pinpoint regions that have higher infrastructure demands. However, misinformed recommendations can obstruct access to justice.[40]

The Directive Principles of State Policy advocate for the State to work towards social justice and equal opportunity to legal institutions.[41] Algorithmic allocation should, therefore, focus on the areas that are underserved and vulnerable and not just on efficiency indicators.

The principles of natural justice, which include fairness, transparency, and reasoned decision making, algorithmic recommendations must be explainable and open to review.[42] Black boxes or opaque systems that can't demonstrate their outputs can otherwise be detrimental to procedural fairness.

Lastly, the independence of the judiciary must be preserved. The algorithms should only be used to support, not make; decisions, and competent judicial and governmental bodies should be the ones making the final decision. The need for human oversight to guarantee the maintenance of constitutional values is paramount to ensure that only constitutional results are produced.

Algorithmic systems should therefore be used in conjunction with, and not as a substitute for, constitutional governance. Their legitimacy is reliant on transparency, accountability, and the rule of law, equality, and access to justice.

8. International Practices

Scientific methods based on data have been used in judicial administration and allocation of public resources in several countries. While algorithms are not typically used to determine judicial decisions, many jurisdictions are turning to data analytics to improve court administration, infrastructure planning, and effectiveness.

Data analytics is applied to court cases in the United States to track case backlogs, allocate judicial resources, predict caseloads, and enhance court administration.[43] As part of its court modernization

[40] Justice K S Puttaswamy (Retd) v Union of India (2017) 10 SCC 1, holding that the right to privacy is intrinsic to the right to life and personal liberty under art 21 and Part III generally.

[41] Constitution of India 1950, art 39A; Legal Services Authorities Act 1987 (India).

[42] Maneka Gandhi (n 22), recognising audi alteram partem and reasoned decision-making as facets of the naturaljustice guarantee implicit in art 21.

[43] National Center for State Courts, 'CourTools: Trial Court Performance Measures' <https://www.ncsc.org/courtools> accessed 23 June 2026.

programme, the United Kingdom has implemented digital case management systems and analytical tools to: optimize court operations and infrastructure planning.[44] Likewise, Singapore has used high-tech digital tools to boost judicial efficiency, streamline court workload and achieve justice with effective use of resources.[45]

In addition to the judiciary, there are other sectors that governments around the world use algorithms to allocate resources based on the demand, population and risk assessment, such as healthcare, transportation, urban planning or even disaster management.[49] When combined with suitable legal protections and human oversight, algorithmic decision-support systems can contribute to greater efficiency, transparency, and evidence-based decision-making.

In comparison to these jurisdictions, India has improved a lot with the introduction of the e-Courts Project and the Nyaya Vikas Portal.[46] But allocation of judicial infrastructure still largely depends on administrative evaluations and not predictive data analytics. A well-established algorithmic approach might thus allow India to modernize its infrastructure planning, while at the same time respecting constitutional values, transparency, and accountability.

9. Justice-Based Judicial Infrastructure Allocation Framework (JJIAF)

To overcome the drawbacks of the current allocation system, this paper put forward the JusticeBased Judicial Infrastructure Allocation Framework (JJIAF). [47] The framework is designed to be an algorithmic decision support model that is objective and identifies the districts that need immediate judicial infrastructure and maintains constitutional principles of equality, access to justice, transparency, and accountability. It is not meant to supplant human judgement in the making of policies.

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[44] HM Courts & Tribunals Service, 'Modernising Courts and Tribunals: Benefits of Digital Services' (GOV.UK, 24 March 2025) <https://www.gov.uk/guidance/modernising-courts-andtribunals-benefits-of-digital-services> accessed 23 June 2026.

[45] 'Analysing Singapore's Approach to Digitising Courts Data' (Courts Data Solutions, 16 April 2024) <https://courtsdatasolutions.com/analysing-singapores-approach-to-digitising-courtsdata/> accessed 23 June 2026. [49] World Bank (n 3), citing the use of court performance data in Kenya, where accountabilitylinked reporting reduced adjournment rates from around 20 per cent to 10 per cent.

[46] See nn 6, 17–18 above (e-Courts Mission Mode Project and Nyaya Vikas Portal).

[47] Author's own construction. The weightings proposed are illustrative and intended for empirical calibration and validation by the Department of Justice and High Courts, drawing on data sources such as the National Judicial Data Grid (n 24), rather than as fixed coefficients.

The framework assigns a weighted score to each district based on measurable indicators of judicial need:

Factor	**Weight**	**Purpose**
Case Pendency	25%	Identifies districts with the highest judicial workload.
Population	20%	Ensures infrastructure keeps pace with population growth and demand.
Accessibility	15%	Prioritizes regions where citizens travel long distances to access courts.
Rural Need	15%	Addresses disparities affecting remote and underserved communities.
Judicial Vacancies	10%	Allocates resources to courts facing shortages of judges.
Digital Infrastructure	10%	Promotes modernisation through e-Courts and digital services.
Disaster Risk	5%	Ensures resilient infrastructure in prone regions.

The districts would be assigned a Judicial Need Score based on these weighted factors that would enable officials to prioritize districts. Priority would be given to higher-ranked districts in determining the location of new buildings, courtrooms, judges, computer systems, and financial support.

As opposed to traditional allocation methods, the JJIAF is based on objective data as well as constitutional considerations, which encourages fairness, transparency, and informed policy decisions. The framework has been designed to be a decision support tool only, and all allocation decisions will be subject to human oversight and judicial accountability.

A SIMPLE FORMULA FOR THIS

Judicial Need Score (JNS)=(0.25P)+(0.20N)+(0.15A)+(0.15R)+(0.10V)+(0.10D)+(0.05C)

Where:

- **P** = Case Pendency
- **N** = Population
- **A** = Accessibility
- **R** = Rural Need
- **V** = Judicial Vacancies
- **D** = Digital Infrastructure
- **C** = Disaster Risk

10. Policy Recommendations

To ensure the responsible use of algorithms in judicial infrastructure allocation, the following policy measures are suggested:

1. Design a National Judicial Infrastructure Dashboard to maintain instant updates on case backlogs, judicial vacancies, court infrastructure, population, accessibility and readiness for justice-to-go digitalization. This will help support sustainable planning based on evidence. [48]
2. Apply algorithms to help decisions, not for the replacing of human decision makers. Final decision making should remain in the hands of appropriate judicial and governmental authorities.[49]

[48] Building, in effect, on the existing National Judicial Data Grid and Nyaya Vikas infrastructure: National Judicial Data Grid (n 24); Department of Justice (n 17).

[49] See Section 7 above and the reasoning in State v Loomis (n 25).

3. Make the selection of the allocation criteria and the selection method for algorithmic systems open. This will enhance public trust and enable decision makers to be understood by the stakeholders. [50]
4. Implement regular audits to review algorithms for biases, accuracy, fairness, and adherence to constitutional principles. An independent audit of the system should be carried out each year or when substantial changes are made to the system.
5. Ensure human oversight and accountability: Ensure that authorities have the chance to examine algorithmic recommendations before acting and that they give reasons for accepting or rejecting recommendations. [51]
6. Take a constitution-centric and justice-based approach by, for example, ensuring that the algorithmic models draw priority on equality, access to justice, and underserved and rural regions, instead of just efficiency. India can implement these measures and adopt the use of algorithmic decision-support systems to enhance the planning of judicial infrastructure in the country while ensuring transparency, accountability, judicial independence, and upholding constitutional values.[52]

11. Conclusion

To ensure timely and fair access to justice, India's judicial infrastructure is crucial. Currently, however, the delivery of resources is plagued by many problems: the delay in processing, the lack of coordination in data, the lack of up-to-date planning tools, etc., which are not adapted to the evolution of judicial demands.[53] The need for the hour is a mechanism for resource allocation which is more scientific and based on evidence to address the rising of case backlog and differences between regions. This paper has demonstrated that to enhance the judicial infrastructure plan using algorithmic decision support systems, several indicators case pendency, population, accessibility,

[50] Cf the transparency concerns identified in Julie Angwin and others (n 7) and the disclosure mandated in State v Loomis (n 25).
[51] See Ben Green (n 21), cautioning that human oversight provisions must be substantive rather than nominal to be effective.
[52] Constitution of India 1950, arts 14, 21, 39A.
[53] See nn 2, 13 above on the scale of current pendency and resourcing shortfalls.

judicial vacancies and readiness for digitization can be explored. The proposed Justice Based Judicial Infrastructure Allocation Framework (JJIAF) shows that data driven approach can contribute towards a more transparent, efficient and fair distribution of judicial resources. But the efficient use of a justice system is not the only purpose. The judicial infrastructure needs to evolve according to the constitutional principles of equality, access to justice, fairness, transparency, and judicial independence.[54] Thus, algorithms should be used as auxiliary tools for decision-making, and decisions should be taken by people to ensure sovereignty and respect for fundamental rights. The initiative of combining technology with constitutional governance has the potential to transform the judicial processes and infrastructure of India, ensuring the modernization of the system in alignment with the principles of the rule of law. The judicial administration of justice will not be served by the removal of the human factor from the equation, but by the intelligent use of technology.

[54] Constitution of India 1950, arts 14, 21, 39A; Hussainara Khatoon (n 9); Maneka Gandhi (n 22).