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Mapping the Science of Law: A Jurimetrics Analysis

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Mapping the Science of Law: A Jurimetrics Analysis

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0. Abstract:

This article provides an outline for jurimetrics and its role in finding most relevant and influential decisions of Supreme Court of India particularly in the topic of sexual harassment covering the period of 5 years (2012 to 2016). It retrieved 35 precedents that cited 662 legal information sources. These precedents are further analyzed with the network measures such as degree centrality, closeness centrality and authoritative scores to find out the influential and relevant decisions in sexual harassment. The precedents of Supreme Court of India ($V_n=575$) legal citation network is created to map the science of law.

Keywords: Citation Network, Network Analysis, Legal Citation Analysis, Precedent, Network Algorithms, Visualization, Legal Authority.

1. Introduction

The term metrics means measurement. It indicates application of mathematical and statistical techniques to any field of study. Librametrics, bibliometrics, informetrics, scientometrics, webometrics, altmetrics have been derived from the term metrics fusion with library, bibliography, information, science, world wide web respectively. These metric studies are used by the librarian, information professionals, decision and policy makers, research funding agencies to evaluate collection, services, users and to analyses the research activity from micro to macro level.

Similarly the word metrics suffixed to juris which means law describes application of quantitative methods and often especially statistics to law (Bryan, 2001). The term jurimetrics was first coined by Lee Loevinger in 1949 in the article entitled “Jurimetrics: the next step forward”. According to him, Jurimetrics is concerned with such matters as the quantitative analysis of judicial behaviour, the application of communication and information theory to legal expression, the use of mathematical logic in law, the retrieval of legal data by electronic and mechanical means, and the formulation of a calculus of legal predictability. Justice Holmes in 1895 believed that “an ideal system of law should draw its postulates and its legislative justification from science”. He further expands his view “the man of the future is the man of statistics”. He asserted that the techniques of physical science could solve the most basic problems of law. In 1709 Nicolaus I Bernoulli was the first person to submit his doctoral thesis on this topic.

The Indian constitution has provided a unified judicial system. It provides for one single integrated judiciary having jurisdiction and providing remedies in all cases arising under the constitutional law, the civil or criminal. The Supreme Court of India occupies the highest position in the judiciary hierarchy. It is the final interpreter of the Constitution of India and also of the general law of India. It is regarded as the guardian of the fundamental rights of the people. It is the highest Court of appeal in all civil and criminal matters. As per the Constitution of India, Article 141 states that the law declared by the Supreme Court shall be binding on all courts within the territory of India.

Decisions are given by judges who are experts in the study of law. A judicial decision can make a law but cannot alter it. Decisions are normally supported by the legal information sources such as relevant precedents, statutes, law reports, journals, books. Advent of information and communication technologies in the 20th century has tremendously changed the landscape of legal information sources and the channel of legal reporting. There are enormous open access legal information sources and services are available. Hence legal fraternity and professionals has to develop technological skills to retrieve relevant decisions, analyses judicial behavior of the judges, and to find out the most influential case laws to support their arguments.

This research work is aims to create awareness about the techniques available to analysis the Jurists’ information source use pattern, find out the most relevant case laws related to their case, analyze the distribution of citations among different types of source materials, and create legal citation network to reveal the most authoritative and influential decision. This work also helps the librarian working at law libraries includes academic,

professional and Legislative libraries in selecting, subscribing, and weeding out of legal information sources.

2. Objectives

The objectives of the study are,

1. To find out the chronological distribution of the cited precedents
2. To identify the use of different sources of information cited by the jurists
3. To find out the geographical distribution of cited precedents.
4. To create legal citation network
5. To find out the most authoritative and influential decisions

3. Scope and Limitations

This study limited to the decision of Supreme Court of India in sexual harassment. Totally 87 precedents are retrieved for sexual harassment from the open source legal database Legal Institute of India from the period 1950 to 2016. This study analyzed 37 precedents that cited 689 legal sources during the year 2012 – 2016. Two precedents are eliminated from the study due to its replication in the legal database.

4. Methodology

Sources of Data: The present research is confined to the analysis of citations referred in the decisions of Supreme Court of India from the year 2012 – 2016. The precedents and its citations are harvested from the public domain of Legal Institute of India and saved in MS Excel to check the consistency of records. Bibexcel and Pajek were used to create legal citation network.

5. Methods of data analysis:

1. Descriptive statistics: such as citation counts, percentile employed for description of type of sources, subject area of citing decisions, age of literature etc..
2. Bibliographic coupling: in this network analysis used to study the relationship between documents, share one or more reference in decisions of Supreme Court of India.
3. Measures of centrality: citations in decisions of Supreme Court of India are analyzed with the network analysis such as measures of closeness centrality, betweenness centrality, in degree, out degree centrality. Pajek network program is used for data analysis.

6. Data Analysis and Interpretation

Table 1 depicts the chronological distribution of cited precedents in sexual harassment during the year 2012 – 2016. Totally 662 citations from 35 precedents with an average of 19 citations per precedents were decided by the Supreme Court of India. There is a decreasing trend of precedents observed in sexual harassment.

Table 1 Chronological distribution of Cited Precedents in Sexual Harassment During 2012 – 2016.

Year	No of Precedents	No of Citations
2012	9	105
2013	9	261
2014	7	92
2015	6	140
2016	4	64
Total	35	662

Table 2 analysis the Jurists' legal information source use pattern. 98.48% Jurists cited precedents and 1.4% cited legislation. Precedents are concerned as source of law. The above table proves that judicial decisions become binding precedents for the determination of like cases in the future.

Table 2 Distribution of Citation by Legal Information Sources

Year	Precedents	Journals	Legislations
2012	100	0	5
2013	259	1	1
2014	90	0	2
2015	140	0	0
2016	63	0	1
Total	652	1	9

The table 3 and 4 illustrates the geographical distribution of cited decisions. Totally 11 countries decision are cited by the Jurists of Supreme Court of India. Decisions of United States Supreme Court occupied first place with 45 citations, followed by the Australia (12) and third place by the United Kingdom with 11 citations.

Table 3 Geographical Distribution of Cited Decisions

Year	Indian Jurisdiction	Foreign Jurisdiction
2012	97	8
2013	226	35
2014	75	17
2015	108	32
2016	58	6
Total	564	98

Table 4: Citations Ranges

Citation Ranges	Precedents	Percentage
1 to 10	18	51.43
11 to 20	9	25.71
21 to 50	4	11.43
More than 50	4	11.43

Sub network of Sexual Harassment Decisions of Supreme Court of India with >2 line values induced by the clusters

A legal citation network is created for sexual harassment decision of Supreme Court of India. In this network decisions, statues, legal treaties, legislations and law articles are considered as nodes ($V_n = 575$) and these nodes are linked to other through citations to existing precedents are known as edges or arcs ($E_n = 14178$). The average degree of the network is 49.31.

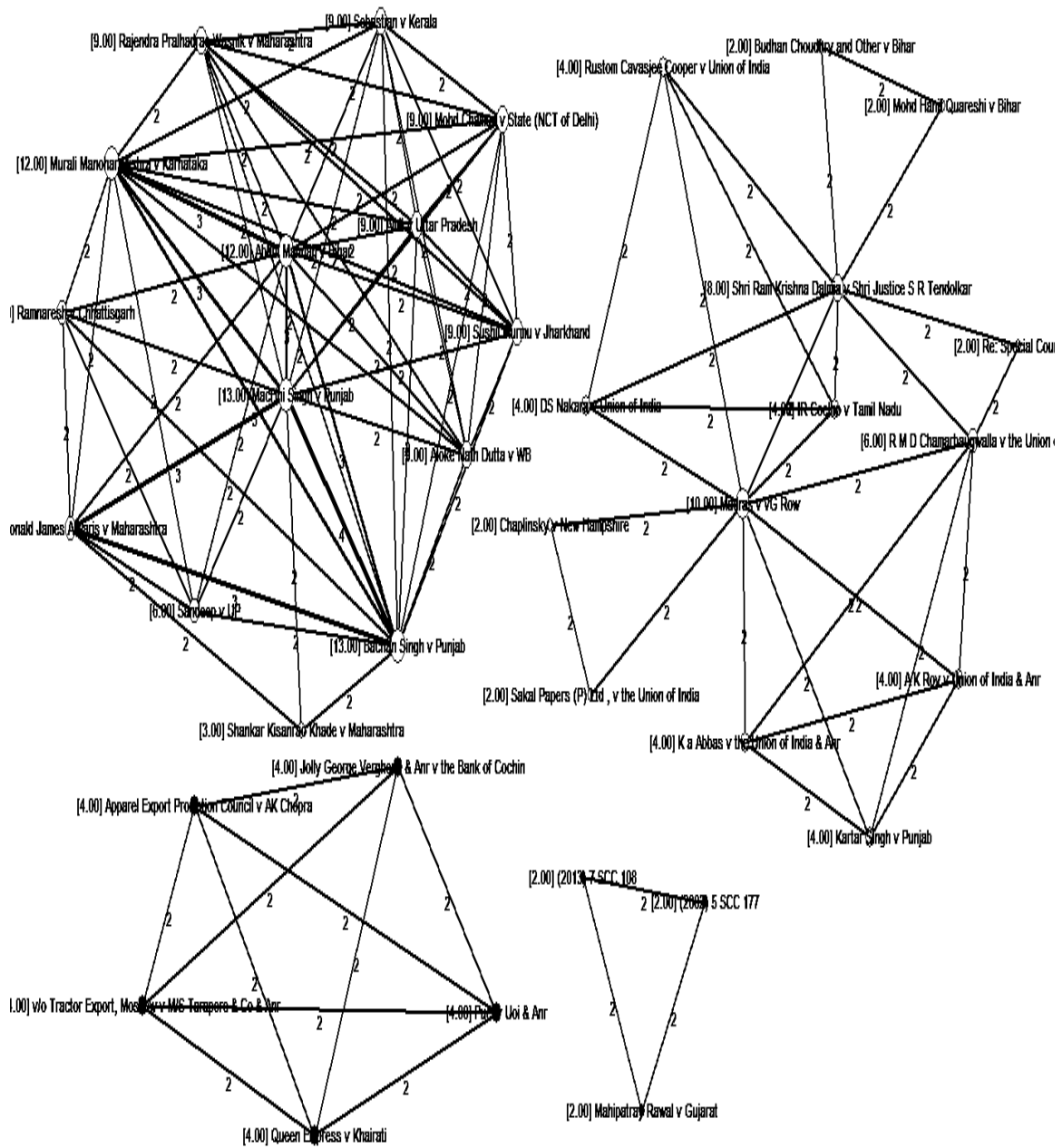


Figure 1 Sub network of Sexual Harassment Decisions of Supreme Court of India with >2 line values induced by the clusters

A sub network was created with removal of >2 line values with strong component was created and depicted in the figure 1. The fundamental unit of a network is a vertex is also called as node (V). The size of the node is determined by the degree of inward (cited) and outward (citing) citations received by each decision. The best level of measures in network analysis is centrality measure. All degree both in-degree and out-

degree centrality measures for Bachan Singh v Punjab (1983) and MacHhi Singh v Punjab (1983) decisions are 13. Abdual Mannan v Bihar is 12, Madras v V G Row is 9 respectively are high degree in the overall network of sexual harassment decisions. There are four strong components ($V_n = 36$) in the sub network in which a node belongs to a component is a set of nodes that can be reached from it by paths running along edges of the graph. In the figure 1 decisions in the cluster 1 ($V_n = 14$) are related to each other in terms of meaning and subject matter. Example Bachan Singh v Punjab (1983) decision was cited by the cases of 2012 INSC 678, 2013 INSC 474, 2014 INSC 479 and 2014 INSC 508. It reveals that these four cases are closely related to each other. Likewise MacHhi Singh v Punjab (1983) decision is also cited by the above mentioned four cases of Supreme Court of India. The semantic relationship between Bachan Singh v Punjab (1983) and MacHhi Singh v Punjab (1983) is indicated by the line value (4) and thickness of the lines in the cluster 1. Another measure in network analysis is closeness centrality which measures the closeness between the citing and cited precedents and the number of shortest paths passing through a precedent. It also describes the extent of influence of a precedent on the network. Most influential precedents can be derived by this measure.

Table 5 All Closeness Centrality for Sub Network of Sexual Harassment Decisions of Supreme Court of India with >2 line values induced by the clusters

S.No	All Closeness Centrality of Clusters	Values
1	Cluster 1	0.48
2	Cluster 2	0.55
3	Cluster 3	0
4	Cluster 4	0

The table 5 closeness centrality of $V_n = 575$ cannot be computed since the network is not weakly connected. Hence all closeness centrality for sub network of sexual harassment decisions of supreme court of India with >2 line values induced by the clusters are calculated and provided in the table 5. The value of the closeness centrality 0 indicates decentralized network. One another measures of network analysis are Authority Scores. The authority scores of a case depend on the number of times it is cited by the other relevant cases and the quantity of the cases that cite it. The authority score implies the inwardly relevant cases, widely cited by other prestigious decisions. The high

authority score of a case helps political scientists, legal experts, judges, law professionals to identify the most important case of “land mark cases”. It also predicts the most important or landmark case in the future also. The authority scores will also use to rank the importance of every case in the network with a fraction of the time and effort and without the any ideological bias.

Table 6 Top 10 Most Authoritative Decisions Derived by Authority Scores

Rank	Precedents
1	BachanSingh v Punjab
2	Abdul Mannan v Bihar
3	Sebastian v Kerala
4	Mohd Chaman v State (NCT of Delhi)
5	Amit v Uttar Pradesh
6	Sushil Murmu v Jharkhand
7	Aloke Nath Dutta v WB
8	MacHhi Singh v Punjab
9	Murali Manohar Mishra v Karnataka
10	Rajendra Pralhadrao Wasnik v Maharashtra

Top most 10 authoritative decisions of Supreme Court of India in sexual harassment are calculated with pajek. The values of all 10 authoritative decisions are 2 mentioned in the table 6.

7. Major Findings and Conclusions

- Decreasing trend of precedents observed in sexual harassment does not mean that the offence of sexual harassment is also decreasing. A large number of cases may be pending at lower courts.
- Precedents (98.48%) are the major legal information sources cited by the Supreme Court of India in sexual harassment decisions. Because legal system of India is basically derived from English common law. It operates on the principles of *stare decisi set non quietamovere* (to stand by decisions and not to disturb settled matters). Judicial law owes its importance to the doctrine of precedent. Major judicial law making exercise can be found in the historic judgment of Vishaka v State of Rajasthan (1997). The Supreme Court has

laid down a full length law penalizing sexual harassment; which the court stressed should operate as binding law upholding the gender equality, the court gave a specific direction that the guidelines and norms must be strictly observed in all working places by treating them as declared under Article 141.

- Most cited precedents in sexual harassment are Bachan Singh v Punjab (1983) and MacHhi Singh v Punjab (1983) decisions are 13. Abdul Mannan v Bihar (1988) is 12, Madras v V G Row (1952) is 9 respectively. This result exhibits the properties of legal citation network “Legal citation network follow a temporal flow (i.e. a newer document can cite an older document, but not the other way round). Vertices and edges added to the legal citation networks are permanent and cannot be removed at a later time”
- The concept of bibliographical coupling is also applicable to the legal citation network. This is revealed by the co-occurrence of precedents Bachan Singh v Punjab (1983) and MacHhi Singh v Punjab (1983) are cited by the cases of 2012 INSC 678, 2013 INSC 474, 2014 INSC 479 and 2014 INSC 508. The value of bibliographical coupling of the above mentioned precedents are 4 respectively.
- The most influential decisions calculated by closeness centrality measures in sexual harassment network is Jagmohan Singh v UP (0.43), Madras v VG Row (0.40) and RMD Chamarbaugwalla v the Union of India (0.40)
- The most authoritative decisions are Bachan Singh v Punjab, Abdul Mannan v Bihar and Sebastian v Kerala

The article has just scratched the surface of a broad subject. This study also elucidates that the tools and techniques borrowed from the social network theories are utilized in legal networks helps to study about the overall structures of legal citation networks and evince the most relevant decisions which assist the legal professionals, jurists in stare decisis. This study explores that network algorithms such as degree centrality helps to identify the most legally central cases. The relationship between the citing and cited precedents and the context which it prevailed are studied through the

algorithms of closeness centrality. Authority Score is also employed in identifying the highly authoritative decisions.

This article may motivate additional theoretical and empirical analysis of legal citation network and its role in structuring the bounds of collective conception. The legal citation network is intricate creatures as new decision or over ruled opinions changes the overall structure of the legal citation network. Hence findings of any study in this field as well lead to scope for new research areas.

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