

Evaluation factors of e-justice intelligent services: an fsQCA analysis

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Abstract. E-justice intelligent services plays a significant role in promoting judicial efficiency and fairness. Based on previous studies, this research evaluates the quality of e-justice intelligent services from four factors, which are smart adjudication, class case recommendation, litigation risk assessment and big data analysis. We gain the data through expert interviews and analyze how these factors affect the quality of e-justice intelligent services using fsQCA. The results indicates that no single condition on its own leads to high quality of e-justice intelligent services. Smart adjudication, class case recommendation, big data analysis are core causal conditions, and litigation risk assessment is peripheral causal condition. Smart adjudication and class case recommendation have the most solutions. This study analyzes the evaluation factors of e-justice intelligent services, aiming at promoting the quality of e-justice intelligent services, so as to improve judicial efficiency.

1 Introduction

With the development of artificial intelligence and other technologies, intelligent services have been widely used in various public sectors, including the judicial system. E-justice intelligent services are applied in many countries expecting to promote efficiency and fairness. Thus the evaluation of e-justice intelligent services is important. Previous studies considered open judiciary development processes [1], the influence of information and communication technology (ICT) strategies in judiciary system [2], and the effects of investment in ICT on productivity of courts [3]. However, empirical studies showing the evaluation of e-justice intelligent services are limited. This study seeks to fill the gap. The questions to be answered in this article are: 1) What are the evaluation factors of e-justice intelligent services? 2) How do the factors affect the quality of e-justice intelligent services?

The paper is structured as follows. Section 2 presents a review of e-justice intelligent services and existing e-justice evaluation research. The research is provided in Section 3 using fsQCA. Section 4 provides the findings of this study. Section 5 provides a discussion. Section 6 presents conclusions pertaining to this study.

2 Literature review

2.1 E-justice intelligent services

Gardner presented a computational framework for legal reasoning in 1984 [4]. Waterman and Peterson described

a rule-based computer model for settlement in civil cases [5].

Ross, launched by ROSS Intelligence, is the first AI lawyer providing online legal consulting services for human lawyers [6]. The United States developed COMPAS, PSA and LSI-R for risk assessment with regard to criminal procedure [7]. The US criminal institution applied COMPAS into recidivism risk prediction and sentencing to help correctional interventions and reduce recidivism [8].

Judges in China use AI generation of judgment documents as an assistant for judges when writing judgment documents [9]. In 2014, the supreme court of China developed the big data analyzing platform to gather all the case information of Chinese courts pertaining to any type of case, making it possible to analyze any trial situation [10].

2.2 Evaluation factors of e-justice services

Jneid et al. [11] proposed a conceptual model of e-justice success from three dimensions, including technological, organizational and human resources. Contini and Cordella [12] realized the emergent of information system and information infrastructure and suggested cultivation as an appropriate method to cope with challenges facing the Italian Ministry of Justice in developing e-justice program and infrastructure. Lv and He [13] evaluated the current situation of China e-justice from the aspects of trial, litigation service and judicial supervision. The business evaluation factors are comprehensive, but the technical performance, economic efficiency, social impact and other aspects are

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not involved. Yu and Xia [10] evaluated China’s e-justice in four aspects, which includes technology, management, economic effect and social effect. But they didn’t analyze the importance of each factor or their relations.

3 The research

3.1 Evaluation factors of e-justice intelligent services

According to previous research [10], e-justice intelligent services include smart adjudication, class case recommendation, litigation risk assessment and big data analysis. Smart adjudication can be used as an assistant for judges when writing adjudications. Class case recommendation can support judges in searching similar cases and provide unified judgment standards. The litigation risk assessment allows the public or lawyers to obtain the basic information of a case and thereby evaluate the possible judgment outcome in advance. Big data analysis provides social governance with analysis reports in respect of various cases to support the scientific decisions-making on social governance.

We use Delphi method to acquire the data required for this study. In-depth interviews were conducted with 20 experts in the field of e-justice and questionnaires were distributed. Experts opinions were summarized and fed back for each round, and the factors were revised and adjusted until opinions unified and the evaluation factors of e-justice intelligent services were determined. A total of 20 questionnaires were issued each round, with 18 effective for the first round and 17 effective for the second round. By analyzing the proportion of "very important" and "important" and the average of the importance of each factor, it is found that the expert group has a very high acceptance rate of the evaluation factors, reaching 94% on average, and the average score is above 3.5 points, with relatively unified opinions among experts. Finally, the evaluation factors of e-justice intelligent service are established, as shown in Table 1.

Table 1. Evaluation factors of e-justice intelligent services.

Construct	Items	Measurements
E-justice intelligent services	Smart adjudication (SA)	Accuracy rate of legal instruments
		Integrity of content
		Coverage degree of cause of action
	Class case recommendation (CCR)	Precision of recommendation
		Number of similar cases
	Litigation risk assessment (LRA)	Accuracy of assessment
		Simplicity of use
		Accuracy of analysis

Construct	Items	Measurements
	Big data analysis (BDA)	Accuracy of judicial opinions

3.2 fsQCA

Based on the evaluation factors of smart adjudication, class case recommendation, litigation risk assessment and big data analysis, we gain the data through expert interviews. Then we analyze how these factors affect the quality of e-justice intelligent services.

fsQCA (Fuzzy Set Qualitative Comparative Analysis), developed by sociologist Ragin, is a set theoretical approach designed for case-oriented exploration of phenomena [14]. As an extended version of QCA, fsQCA is a diversity-oriented approach that proposes different alternative paths to understand results and is suitable for observing random but complex phenomena, especially for the analysis of a small number of cases. The method can also be applied to large data sets. fsQCA has been used in politics, sociology, organizational science, and marketing.

3.3 Data collection

E-justice intelligent services can be evaluated in terms of smart adjudication, class case recommendation, litigation risk assessment and big data analysis. We use the four factors as antecedent conditions and e-justice intelligent services as outcome. The measurements and explanations are shown in Table 2.

Table 2. Definition of variables.

Type	Conditions	Symbol	Definition
Antecedent Conditions	Smart adjudication (SA)	Accuracy rate of legal instruments	The accuracy of case hearing report and judgment generated by the system
		Integrity of content	The content integrity of the hearing report and judgment in the case of obtaining a complete trial record and confirming the facts of the case in court
		Coverage degree of cause of action	The coverage degree of cause of action in the case trial
	Class case recommendation (CCR)	Precision of recommendation	Precision of recommendation when searching for cases
		Number of similar cases	The number of guiding cases, communicate cases, typical

Type	Conditions	Symbol	Definition
	Litigation risk assessment (LRA)		cases and reference cases
		Accuracy of assessment	The difference between litigation risk assessment and the outcome of the case
	Simplicity of use	It is friendly, convenient and instructive to participants in proceedings	
	Big data analysis (BDA)	Accuracy of analysis	The accuracy of analysis of hot social issues through reports on big data
		Accuracy of judicial opinions	The accuracy of advice based on big data
Outcome	E-justice intelligent services (EIS)	The level of e-justice intelligent services	The quality of e-justice intelligent services

The required data was obtained through expert interviews. In-depth interviews were conducted with 20 experts in the field of e-justice and questionnaires were issued. Each expert took the symbol as the dimension, gave the weight and score for each symbol. Then we calculated the weight value of each symbol as the input of fsQCA.

3.4 Data calibration

Variables were calibrated before the fsQCA analysis. Based on the fuzzy set membership score, the resulting score represents the degree to which the case belongs to a set, as well as any set of different objects that can be described by certain attributes or characteristics. Likert scores are converted into fuzzy set membership scores, and the membership of the variable in a set of cases is calibrated to produce a score from full no membership (0.00) to full membership (1.00), where 0.5 indicates the intersection point and maximum ambiguity.

4 Findings

4.1 Analysis of necessary conditions

In fuzzy set analysis, an analysis of necessary conditions determines whether a causal condition should be considered a necessary condition for the outcome. If a factor is a relationship of necessity or sufficiency for a specific outcome, it is a core condition and is not included in subsequent sufficient condition analysis. The consistency of a condition to be necessary must be greater than 0.9.

Table 3 shows the analysis of necessary conditions considering both the presence or the absence of the condition.

Table 3. Analysis of necessary conditions.

Outcome: EIS	Consistency	Coverage
SA	0.696905	0.794404
~SA	0.839915	0.668081
CCR	0.758805	0.761242
~CCR	0.737460	0.648218
LRA	0.858057	0.724324
~LRA	0.645678	0.679775
BDA	0.567769	0.690909
~BDA	0.822839	0.626829

Given that the highest consistency for ~SA (0.839915) is below 0.9, our analysis shows that no single factor is a necessary condition for the output “E-justice intelligent services”. It means that no single condition on its own leads to the output. The result of high e-justice intelligent service is complex, and the configuration of forming it is multivariate.

4.2 Analysis of necessary conditions

Since there is no single necessary condition for high e-justice intelligent services, analysis of sufficient conditions is carried out to explore the influence of different combination of factors on the outcome. On the basis of the above calibration and analysis of necessary conditions, fsQCA 3.0 is used for analysis of sufficient conditions to determine configurations that sufficiently produce the outcome. We set the case frequency threshold to 1 and the consistency threshold to 0.80. When the proportional reduction inconsistency (PRI) value is above 0.75, the encoding is 1 and it’s identified as consistently producing high e-justice intelligent services. When the PRI value is above 0.75, the encoding is 0. Table 4 is the table of truth.

Table 4. Table of truth.

SA	CCR	LRA	BDA	Number of cases	Consistency	EIS
0	0	0	0	6	0.760125	0
0	0	1	0	2	0.799652	0
1	1	1	1	1	0.847458	1
0	1	0	0	1	0.861301	1
0	0	0	1	2	0.862069	1
0	1	1	0	3	0.877676	1
1	0	1	0	1	0.886939	1

Based on the truth table, we presented the core and peripheral conditions of each configuration in Table 5 using fsQCA 3.0 software.

Table 5. Results from fsQCA.

Causal conditions	Solution			
	A1	A2	A3	A4
Smart adjudication (SA)	⊗	⊗	•	•
Class case recommendation (CCR)	•	⊗	⊗	•
Litigation risk assessment (LRA)		⊗	•	•

Causal conditions	Solution			
	A1	A2	A3	A4
Big data analysis (BDA)	⊗	•	⊗	
Raw coverage	0.65208 1	0.42689 4	0.48559 2	0.4802 56
Unique coverage	0.19530 4	0.00640 351	0.04802 57	0.0661 687
Consistency	0.81466 7	0.86206 9	0.88693 9	0.8474 58
Overall solution coverage	0.800427			
Overall solution consistency	0.866871			

^a Note. • = core causal condition present; ⊗ = core causal condition absent; • = peripheral causal condition present; ⊗ = peripheral causal condition absent.

According to the results from fsQCA, smart adjudication, class case recommendation, big data analysis are core causal conditions, and litigation risk assessment is peripheral causal condition.

From the perspective of core causal conditions, smart adjudication and class case recommendation have the most solutions, which indicates that the role of smart adjudication and class case recommendation is significant in the evaluation of e-justice intelligent services. Since smart adjudication and class case recommendation are services for judges, the accuracy and completeness of these services have a direct impact on the evaluation of using e-justice intelligent services. Then it comes to big data analysis. It analyzes hot social issues and provides judicial suggestions according to the big data. High accuracy of analysis of hot social issues through reports on big data and high accuracy of advice based on big data will promote the quality of e-justice intelligent services.

From the perspective of peripheral causal conditions, litigation risk assessment has a profound effect on the evaluation of e-justice intelligent services, indicating that a small difference between litigation risk assessment and the outcome of the case and its friendly, convenient and instructive to participants in proceedings will lead to high quality of e-justice intelligent services.

5 Discussion

The fsQCA returns four configuration paths that lead to high quality of e-justice intelligent services.

Solution 1 (~SA*CCR*~BDA) shows that class case recommendation can promote the quality of the e-justice intelligent services, regardless of the use of smart adjudication and big data analysis. This path explains 65.2% of the cases. The aim of class case recommendation is to help judges find highly matched class cases, and take the rules of adjudication provided by previous class cases as a measure to match the criteria in pending cases. With the improvement of the class case retrieval system, class case recommendation, which automatically pushes class cases to judges, is widely used. It recommends guiding cases and similar judgments according to the current case, and even automatically generates case retrieval reports. The

application and development direction is reflected in the refining and coordination of judgment rules, as well as the interaction and cooperation between human and technology.

Solution 2 (~SA*~CCR*~LRA*BDA) shows that big data analysis can promote the quality of the e-justice intelligent services, regardless of the use of smart adjudication, class case recommendation and litigation risk assessment. This path explains 42.7% of the cases. Big data is the basis of e-justice intelligent services. It supports the scientific decisions-making on social governance and plays a significant role in e-justice intelligent services.

Solution 3 (SA*~CCR*LRA*~BDA) indicates that smart adjudication and litigation risk assessment can promote the quality of the e-justice intelligent services, regardless of the use of class case recommendation and big data analysis. This path explains 48.6% of the cases. Smart adjudication turns litigation materials into structured documents, smartly assisting judges in efficiently generating various legal instruments through data extraction and semantic analysis. Litigation risk assessment guides users to input key elements of the case, and then it analyzes through big data, artificial intelligence and other technologies, so as to provide a predicted litigation outcome for the parties. The parties can make decisions more clearly on the basis of fully understanding the possibility of winning or losing the case.

Solution 4 (SA*CCR*LRA) shows that smart adjudication, class case recommendation and litigation risk assessment can promote the quality of the e-justice intelligent services. This path explains 48.0% of the cases. The combination of these services can jointly improve the quality of e-justice intelligent services from the perspectives of the parties and the court.

6 Conclusion

This study verifies conditions for high e-justice intelligent services. According to the results from fsQCA, no single condition on its own leads to high quality of e-justice intelligent services. Smart adjudication, class case recommendation, big data analysis are core causal conditions, and litigation risk assessment is peripheral causal condition. From the perspective of core causal conditions, smart adjudication and class case recommendation have the most solutions, which indicates that the role of smart adjudication and class case recommendation is significant in the evaluation of e-justice intelligent services. Then it comes to big data analysis. From the perspective of peripheral causal conditions, litigation risk assessment has a profound effect on the evaluation of e-justice intelligent services, indicating that a small difference between litigation risk assessment and the outcome of the case and its friendly, convenient and instructive to participants in proceedings will lead to high quality of e-justice intelligent services. The fsQCA also returns four configuration paths that lead to high quality of e-justice intelligent services.

This work is supported by National Key R&D Program of China (Grant no: 2022YFC3301504).

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