E-Government Enterprise Architecture Research in China: A Critical Assessment

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ABSTRACT
With the further advancement of China's e-government, enterprise architecture has become one of the major practice and research topics in the field. This paper conducts quantitative and qualitative analyses of research articles on this topic published in Chinese journals over the last five years. For each paper we examine author's institutional association and department, published journal names and issues, paper length, research themes, research methods, level of analysis, and geographical focus in order to take a multi-faceted perspective. Findings from the study suggest that most Chinese papers on enterprise architecture are descriptive in terms of research method. This indicates that China's e-government Enterprise Architecture research was still at its early developmental stage, this research field in generally is lack of rigorous theoretical and empirical studies. In terms of research themes, most studies on enterprise architecture in China focuses on institutional structure building, while a few touch service design.

Categories and Subject Descriptors
C.2.1 Network Architecture and Design

General Terms
Management, Measurement, Performance, Design

Keywords
E-government; Enterprise Architecture; China; Current Research

1. INTRODUCTION
In recent years, the Chinese government pays great attention to e-government development. As a result, e-government has made great achievements in China, and played a major role in improving administrative efficiency and the quality of public services. As e-government develops further, more and more questions surfaced out, such as poor information sharing and integration. According to Ji-Jiang Yang's view, e-government architecture design (EA) tends to address these issues with a systematic view, and analyzes, describes and designs the entire framework with multi perspectives and aspects [22]. In 2006, China's National Informatization Leading Taskforce issued the "Overall Framework of National e-government," which aims at establishing a uniformed national e-government network, to achieve interoperability across key applications, information sharing and business collaboration, in order to reduce the e-government construction and maintenance cost of e-government projects, to guarantee the quality of the project construction, and to improve the returns on investment [1].

Based on China's practices on EA, this paper attempts to systematically analyze China's e-government EA research in a systematic way, as progress on research could guide the real-world practice. This paper is organized as follows. First, the research method of the study will be illustrated. Based on a multifaceted methodology, the paper presents the findings and results in the third part followed by discussion and implications. The paper is ended with a conclusion.

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2. METHODOLOGY
2.1 Selection of Journals
This paper tends to focus on high-quality Chinese papers in EA area, so we chose the largest database of China, the China National Knowledge Infrastructure (CNKI, www.cnki.net), which contains 6642 kinds of domestic academic journals, including 2460 kinds of core journals and important database. This database contains no less than 99% of all the journals and 99.9% of the papers written in Chinese language. Given to the completeness of this database, we chose the core journals in this database to collect papers for study. In this research, core journals particularly refer to journals listed in the "Main list of the Chinese core journals" developed and published by Peking University Library every four years. In addition, since e-government is still a quite new research field in China, no e-government journals in China have been recognized as core journals. However, among non-core journals, the China "E-government Journal" has enjoyed a high reputation and influence in the field and many researchers have chosen to publish high quality papers in this journal. Therefore, we decided to include the China "E-government Journal" into the database. In sum, core journals and the China "E-government Journal" are the source of searching papers in this study.

2.2 Selection of Papers
We searched papers in the abovementioned database by using several combinations of key words, such as "electronic and EA"(Dianzi and Dingcengsheji), "electronic and top-level

framework" (Dianzi and Dingcengjiagou), "e-government and management system"(Dianzizhengwu and Guanlitizhi) etc. As a result of searching in database and manual scanning, we collected 41 papers focusing on the topic of e-government EA for the final analysis. We then coded each paper in the EA pool according to the classification schemes to be explained below. During the coding process, we re-evaluated each paper again for its relevance to EA design.

2.3 Multifaceted Coding Methods

Owing to its interdisciplinary nature, EA design encompassed an array of rich research ingredients. Therefore, we conducted a multifaceted view to code the papers we collected. After referring to previous studies [25] and brain-storming among authors, we finally defined the various aspects and ingredients of EA design studies. As a result, we decided to pay special attention to author, author's institutional affiliation and department, publish journal and issues, paper length, research themes, research methods, level of analysis, and geographical focus (See Table 1). The reasons and purposes of setting these facets are as follows:

- Author institutional affiliation: to know which institutions are the major players in the research area, and from which sector of the society;
- Author's disciplinary department in universities or research institutions: Given the interdisciplinary nature of e-government research, this indicator intends to explore to which disciplinary department the scholars belong. After referring to the "China National Standard Subject Classification and Code" and the international subject classification practice, the research team carry out its classification of subjects;
- Publish journal: this indicator could suggest publish venues of EA papers, and determine which journals publish more studies in this area;
- Journal issue: to examine publications in the field over time and to explore the research tendency;
- Paper length in terms of page numbers: to take paper length as one of indicators of paper quality;
- Research themes: to classify the research themes by its subjects in order to explore the major focus of current studies in this area;
- Research methods: with reference to previous methods home and abroad [7] [35], we classify the research methods into theoretical, empirical, and descriptive in order to summarize the major methods adopted in existing researches;
- Level of analysis: to classify the governmental levels of analysis of current studies;
- Geographical focus: to categorize the geographic focus of current studies into domestic, foreign and comparative studies;

After categorizing and coding data, we carried on a quantitative analysis with the aid of the SPSS software, and then further conducted a qualitative analysis to the literature to examine the research questions, progress and trends of the EA research in China.

3. FINDINGS AND RESULTS

3.1 Quantitative Analysis

3.1.1 Author

The study of e-government EA is a newly developed area in recent years. According to data, up till now there's no author who has ever published two or more related papers in this area as the first author. However, when examining the papers published by authors from universities, we found that there were four papers published by authors from Peking University, two from Science and Technology University of Dalian and Quanzhou Normal University.

3.1.2 Sector

Out of all 41 first authors, twenty-four work in universities or research institutions, accounting for 58.5%, twelve authors are from government, accounting for 29.3%, and the rest four are from enterprises and social organizations, accounting for 12.2%.

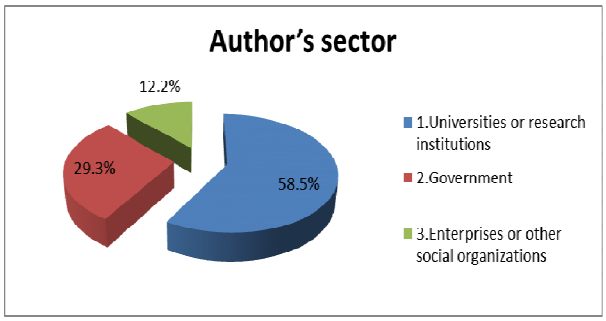


Figure1. Author's sector

3.1.3 Disciplinary Department

We further classified the disciplinary departments for the 24 authors who work in universities or research institutions. We could see (table 2) that Public Administration and Business Administration are the two most concentrated disciplinary departments with ten and seven papers for each, accounting for 71% of the total published papers. Five papers come from the Information Management department, accounting for 20.8%, and one is from the Computer Science and Engineering department.

Table 2. Author's disciplinary department

	Frequency	Percentage
Computer science and engineer	1	4.1
Information management	5	20.8
Public administration	10	41.7
Business administration	7	29.3
others	1	4.1
Total	24	100.0

Table 1. Multifaceted Coding Schema			
Facets	**Codes/categories**		**Definitions and Descriptions**
Author's sector	Universities or research institutions		Universities; Research centers; Research institutions
	Government		Government agencies
	Enterprises or other social organizations		Enterprises; NGOs; NPOs
Author's department	Computer science and engineer		Computer Science or Engineering Department
	Information management		Information Resources Management School or Department
	Public administration		Public Administration Department; Public Policy or Public Affair Department
	Business administration		Management School; Business Administration School or Department
	Economics		Economics Department or Research Center
	Others		Department or Center that does not fall into either of the above categories
Paper Length			The total number of the paper no matter the size of characters. If the page is less than a whole sheet, it is counted into one page.
Research themes	Institutional structure and framework		Institutional structure and framework building of e-government EA
	Law, policy and regulation		legal, policy and regulatory issues related to e-government EA
	System design		System design of e-government EA including technology and security issues
	Multi-themes		Covering more than one topic but not focus on one specific aspect
Research methods	Theoretical	Theoretical framework building	Theory construction based on existing literatures and theories
		Critical literature Review	Review existing literature in terms of the research themes and key findings; make comments and summary, identify, their achievements and gaps, and then put forward directions future studies.
	Empirical	Interview	In-depth interviews conducted on an individual or group basis with a qualitative approach
		Survey	Collect data through questionnaires with a quantitative approach.
		Observation	Involves large number of participatory or non-participatory observations with quantitative or/and qualitative approach.
		Secondary-data	Analyze data collected from secondary sources.
		Comparative studies	Comparative analysis of two or multiple case in different context.
		Case studies	In-depth analysis of one or multiple cases
	Descriptive	Theoretical and practice Integration	Apply theory in practice, and build practice framework, methods or tools
		Practice illustrations and introduction	Introduce or describe practices or applications, but does not conduct systematic analysis with academic approach
		View points	Express personal viewpoints, give advice or guidance for practice
Level of Analysis	General		Does not indicate any level of analysis
	Central Government		Central government ministries
	Regional		Cross-regional studies
	Provincial		Provincial level, including municipalities directly under the jurisdiction of Central Government (Beijing, Shanghai, Tianjin, Chongqing)
	Municipal		Cities and districts/counties of municipalities (Beijing, Shanghai, Tianjin, Chongqing).
	County		Districts and counties.
	Grassroots		Grassroots government and self-autonomy organizations
Geographical Focus	Foreign		Foreign countries and Hong Kong, Macau and Taiwan.
	Domestic		Mainland China
	Comparative		Comparative studies between two or more countries or regions.

3.1.4 Year of Publications

Among 41 published papers on EA during 1999-2010, four was published in 2005, and the number of published papers climbed to the peak in 2010. There are eight papers in 2006, accounting for 19.5%; ten in 2009, accounting for 24.4%; fourteen in 2010, accounting for 34.1%; four, two and three in 2005, 2007 and 2008, accounting for the rest 22%.

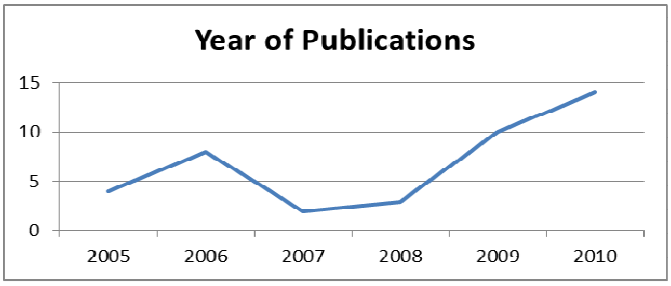
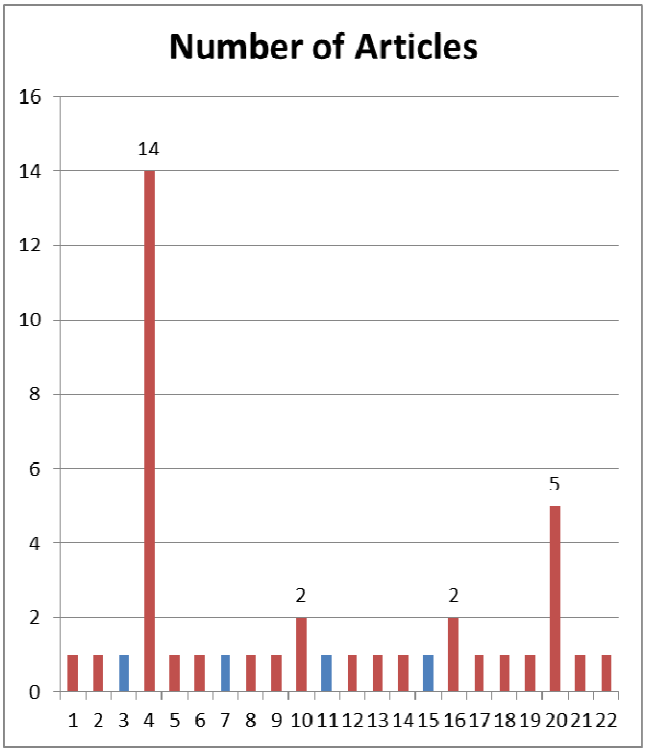


Figure 2. Year of Publications

3.1.5 Journals of Published Papers

Most authors published only one paper on e-government EA. Of all the 41 papers, only four journals published more than one paper. The Journal of Information and Journal of Informative Construction published two papers, and Journal of Information in China published five papers accounting for 18.5%;. The journal publishing most EA papers is the Journal of Digital Political Affairs which published seven papers, occupying 25.9% of all EA papers.



1.Tianjin Science and Technology
2.Computer Knowledge and Technology
3.E-commerce
4.E-government
5.Fujian Building Materials
6.Application Research of Computers
7.Science and Technology Management Research
8.Science and Technology Consulting Herald
9.Charming China
10. Journal of Intelligence
11.Quest
12. Journal of Quanzhou Normal University
13.Digital Space
14.Tech Information Development and Economy
15.Modern Management Science
16.Information Construction
17.China Computer Users
18.Forum on Science and Technology in China
19.China Market
20.China Information Times
21.The Administration of China
22.The Information Technology of China's Management

Figure 3. Statistics of published journals

3.1.6 Core Journals vs. Non-Core Journals

As the Table shows, Seven papers out of 41 papers were published core journals, accounting for 17.1%, while 34 published in non-core journals, occupying the rest 82.9%.

Table 3. Frequency of core journals or non-core journals

	Frequency	Percentage
Core journals	7	17.1
Non-core journals	34	82.9
Total	41	100.0

3.1.7 Paper Length

Among all the 41 papers, the mean of paper length is 3.70 pages with the minimum at one page and maximum at ten. Up to 32 papers contain less than four pages, accounting for 78% of 41 papers, and 8 papers contain five to eight pages, accounting for 19.6%, while only one paper lasts over 10 pages.

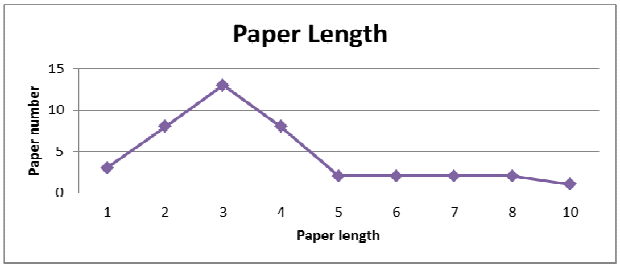


Figure 4. Papers' length

3.1.8 Research Methods

Table 4 shows that only two papers adopt empirical methods with case studies, while no paper adopts interview, survey, observation, secondary data or comparative study methods. In contrast, up to 29 papers adopt descriptive methods, accounting for 95.1% of all papers, including eighteen practice illustrations and introduction (43.9%), nineteen view points (46.3%), and two theoretical and practice integration article.

Table 4. Frequency of research methods

	Research Methods	Frequency	Percentage	Total %
Theoretical	Theoretical framework building	0	0.0	0. 0
	Critical literature review	0	0.0	
Empirical	Interview	0	0.0	4.9
	Survey	0	0.0	
	Observation	0	0.0	
	Secondary-data	0	0.0	
	Comparative studies	0	0.0	
	Case studies	2	4.9	
Descriptive	Practice illustrations and introduction	18	43.9	95.1
	view points	19	46.3	
	Theoretical and practice integration	2	4.9	
Total		41	100.0	100.0

3.1.9 Research Themes

Twenty-five papers focus on institutional structure and framework, accounting for 61% of 41 papers, and seven papers address system design, accounting for additional 17.1%. The rest six papers are multi-themes, and three is related to themes of legal, policy and regulation issues.

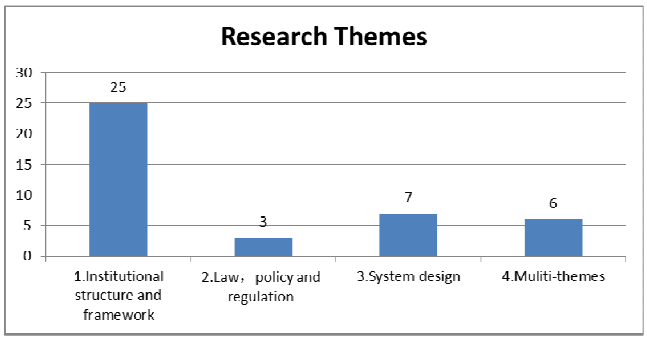


Figure 5. Description of Research Themes

3.1.10 Levels of Analysis

We could see from Table 5 that about 87.8% of papers do not indicator any government level of analysis, 4.9% of papers focus on the provincial level, 4.9% of them on the county level, and 2.4% on the municipal level. No paper is analyzed at the level of central government agency or regional or grassroots.

Table 5. Frequency of level of analysis

	Frequency	Percentage
General	36	87.8
Central government agency	0	0.0
Regional	0	0.0
Provincial	2	4.9
Municipal	1	2.4
County	2	4.9
Grassroots	0	0.0
Total	41	100.0

3.1.11 Geographic Focus

Table 6 shows that up to 95.1% of the papers focus on domestic issues and only 4.9% on foreign experience; while no paper conducts systematic comparative study.

Table 6. Frequency of geographic focus

	Frequency	Percentage
Domestic	39	95.1
Foreign	2	4.9
Comparative	0	0.0
Total	41	100.0

3.1.12 Cross-tab Analysis between the Author's Sector and Research Methods

Figure 6 depicts the cross-tab analysis between the author's sector and research methods. Generally speaking, all the two empirical studies are from academia, while descriptive papers are from the academia, governments, enterprises and other social organizations.

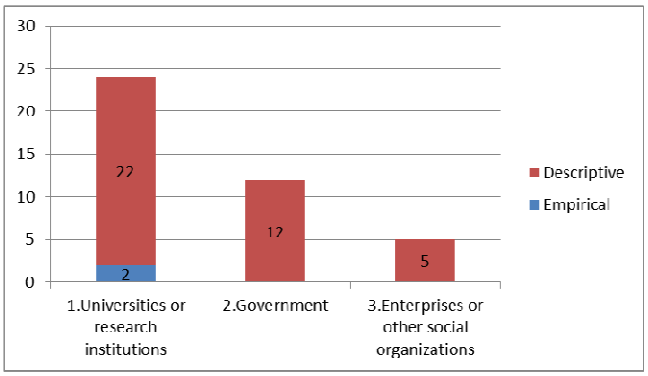


Figure 6. Cross-tab analysis between the author's sector and research methods

3.1.13 Cross-tab Analysis between the Author's Sector and Journal

Table 7 presents the result of cross-tab analysis between the author's sector and journals. Obviously, universities and research institutions are the major contributor of core journal article, while most articles written by any of the three sectors are published in the non-core journals.

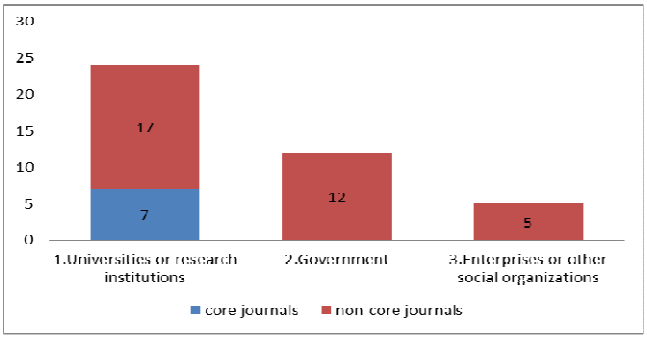


Figure 7. Cross-tab analysis between the author's sector and core journals or non-core journals

3.1.14 Cross-tab Analysis between the Research Themes and Research Levels

The figure 8 explains the relationship between the research themes and research levels. From figure 8, we could see that general papers in terms of government level of analysis also tend to be multi-themed. It might indicate that these papers are not specific and in-depth in quality.

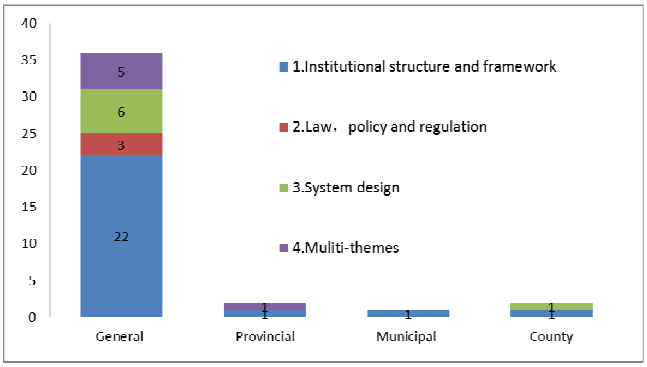


Figure 8. Cross-tab analysis between research themes and research levels

3.2 Qualitative Analysis

The in-depth qualitative analysis of the papers shows that current research topics concentrate on institutional structure and framework; legal, policy and regulatory issues; system design; and multi-themes.

Firstly, most studies of e-government EA are concerned with institutional structure and framework. Some scholars point out that the EA design in China is problematic because most of them focus on infrastructure construction, vary across different regions [14], are lack of efficient evaluation and managing mechanism [22], and lead to information isolation problem [15]. They argue that e-government EA need to unify planning, network building and operation platform. The centralized construction projects and decentralized projects need to be integrated in a unified to reduce cost [10]. They also call for attention to the mechanism and institution design of EA [16].

Secondly, with regard to the study regarding the legal, policy and regulation issues, scholars hold that e-government is a large-scale government reform and the key of promoting e-government is government information resources sharing. In order to address the low quality social service and management caused by horizontal information fragmentation, ensure information sharing across government levels and different functional departments to achieve the goal of inter-organizational effective collaboration, it is necessary to adopt e-government EA perspective and realize collaborative business streamlining, cross-functional team building, and cross-boundary process design. In addition, the implementation of government remodeling, overcoming information monopoly and making policy on government CIO system are also critical [5].

Thirdly, as for the system design of e-government EA, two sub-themes are discussed. One is the introduction of international models. Some authors introduce FEA in the US and GEA in the Europe with a focus on GEA's five top models and the relationship between them. They also introduce the application of GEA through online administrative approval system in order to learn lessons for the development of China's EA design [11]. The other sub-theme is to introduce relevant applicable technology and model through analyzing current problem in China's e-government EA design. Some authors take the "Information Island" issue as the start point to introduce the method of applying IRP (Information resource planning) technology to construct an e-government system. Finally, The study also finds that some papers are involved with multi-themes and didn't focus on a specific question, but generally discussed a number of issues related to e-government EA [7] [17] [27].

4. DISCUSSIONS AND IMPLICATIONS

4.1 Insufficient Research Attention to EA

According to the above analysis on e-government EA study in China, it is obvious that the topic still receives little attention by scholars. Firstly, in terms of the total number of published papers, only 41 papers on EA research were published from 1999 to 2010, roughly 3.4 papers per year, and most of them were published from 2005 to 2010. EA was not paid serious attention to until the national e-government structure was issued by the National Information Leading Group in 2006. Especially since 2008, more and more scholars began to study this field and have made some progress. With the emergence and development of EA in China, it can be deduced that more and more researchers will pay more attention to the EA of e-government.

4.2 Unsatisfactory Research Quality

Among the 41 papers, 39 are descriptive articles accounting for 95.1%, while only two papers are empirical and none of them takes a theoretical approach. Among these descriptive papers, nineteen of them are simply expressing viewpoints and eighteen of them are practice illustrations and introduction. These findings suggest that most current researches are taking a relatively subjective and superficial approach in research. Thus, future

studies in China on EA should carry out more rigorous empirical and theoretical studies.

Second, in terms of the paper length, most of papers on EA are pretty short between 1-4 pages, occupying 78% of all 41 papers. In addition, when we analyze the journals where these papers were published, we can see that just seven of them were published on core journals, accounting for 17.1% of 41 papers; while 34 papers published on non-core academic journals, among which fourteen were published on China E-Government Journal. It can be attributed to several reasons: (1) the research on EA still receives little attention by core journals; (2) the quality of these research papers are not high enough to meet the criteria of core journals; and (3) Journals that focus on e-government, such as the China E-government Journal, and has published seven papers on EA, have not been recognized as core journals.

The fact that 87.8% of papers does not focus on any specific level of government may indicate that e-government EA practice and research in China are still at their preliminary period. The finding also shows that Chinese scholars may need to consider conducting more international research such as systematic comparative studies to expand the vision and dimension of current research on e-government EA, since many foreign countries have accumulated quite many knowledge and successful practical experiences in the EA field.

5. CONCLUSION AND FUTURE STUDY

The paper analyzes and discusses current Chinese studies on e-government EA. Findings from the study suggest that most Chinese papers on enterprise architecture are descriptive in terms of research method. This indicates that China's e-government Enterprise Architecture research was still at its early developmental stage, this research field in generally is lack of rigorous theoretical and empirical studies. In terms of research themes, most studies on enterprise architecture in China focuses on institutional structure building, while a few touch service design.

One limitation of this paper is that we only choose the China core Journals and the China E-government Journal as the sources of search paper, but it is likely that some high quality papers were published in other journals, while papers publish on core journals and the China E-government journals may not be truly good ones.

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