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Examining e-government enterprise architecture research in China: A systematic approach and research agenda

Tuo Zheng, Lei Zheng*

School of International Relations and Public Affairs, Fudan University, 220 Handan Rd., Shanghai 200433, China

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ABSTRACT

With the further advancement of China's e-government, enterprise architecture has become one of major topics in the e-government field. This paper attempts to examine the status and progress of e-government enterprise architecture research in China in a systematic approach and frame a research agenda. This paper conducts quantitative and qualitative analyses of research articles on this topic published in Chinese journals over the last six years. For each paper the study examines 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 suggest that EA are receiving more and more attention by Chinese scholars over time with the continuing development of e-government in China. However, the research themes covered by a paper in EA are found to be unbalanced and unfocused, most studies on EA in China focus on architecture frameworks and methodologies, advocate of EA and multi-themes. In terms of research methods, papers in the research field lack academic rigor in general.

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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 public services. As e-government develops further, more questions also surfaced out. In recent years, the conception of enterprise architecture has been introduced into China and received high attentions from Chinese e-government researchers and practitioners. In 2006, China's National Informatization Steering Group 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, to reduce the cost of e-government construction and maintenance, and to improve the project quality and the returns on investment (Du, 2008).

While EA has emerged as a major research topic in the e-government field in China. This paper attempts to examine the status and progress of e-government enterprise architecture (EA) research in China in a systematic approach and make recommendations for researchers in the field for the further development of the field.

2. Enterprise architecture and e-government

2.1. What is enterprise architecture and why?

According to the literature, Enterprise architecture lacks a universally accepted definition (Rohloff, 2005). The idea of enterprise architecture is that it can be used to guide design decisions and that it limits the solution space by setting constraints (Janssen & Kuk, 2006). Gartner (2012) defined enterprise architecture as the process of translating business vision and strategy into effective enterprise change by creating, communicating and improving the key requirements, principles and models that describe the enterprise's future state and enable its evolution. The MIT Center for Information Systems Research (CISR) defines enterprise architecture as the organizing logic for business processes and IT infrastructure reflecting the integration and standardization requirements of the company's operating model. The operating model is the desired state of business process integration and business process standardization for delivering goods and services to customers (Weill, 2007). Enterprise architecture, considered as the foundation of enterprise systems engineering, has emerged as a 'tool' to help stakeholders to manage system engineering and changes. It is not only an IT issue, but first of all a strategic and organizational challenge (Chen, Doumeingts, & Vernadat, 2008). Therefore, enterprise architecture is a kind of city plan that details policies and standards for the design of infrastructure technologies, databases, and applications (Goodhue, Kirsch, Quillard, & Wybo, 1992), whose frameworks and models provide ways to deal with the complexity including work (who, where), function (how), information (what) and infrastructure (how to) (Ross, 2003).

* Corresponding author.

E-mail addresses: zhengtuo@fudan.edu.cn (T. Zheng), zhengl@fudan.edu.cn (L. Zheng).

Based on the definition, the term “enterprise” refers to the scope of the architecture, dealing with the organization as a whole or multiple agencies rather than with a certain organizational part or individual components and/or projects (Bouwman, Versteeg, Janssen, & Wagenaar, 2005). An enterprise may be a company, an institution, or a department within a company or an institution (Guijarro, 2007). Architecture aims at creating some kind of structure in a chaotic environment using systematic approaches (Armour & Kaisler, 2001). Usually, architecture has various meanings depending on its contextual usage: (1) a formal description of a system at component level to guide its implementation; (2) the structure of components, their interrelationships and the principles and guidelines governing their design and evolution over time; (3) organizational structure of a system or component (Open Group, 2000).

Although there is no one universally accepted definition, based on the literature, the essential conception of enterprise architecture is to align the information, technology, standards, process, policy, and framework of an organization with the goals and strategies of the organization as a whole in order to foster enterprises' standardization, integration, consistency, and compliance.

2.2. Enterprise architecture and e-government

According to Beryl and Felix (2004), enterprise architectures are essential for evolving information systems and developing new systems that optimize their mission value. This is accomplished in logical or business terms (e.g., mission, business functions, information flows, and systems environments) and technical terms (e.g., software, hardware, communications), and includes a sequencing plan for transitioning from the baseline environment to the targeted e-government environment. Enterprise architecture is a management tool and the commitment of an e-government agency depends on the familiarity of the executive officers with this concept (Guijarro, 2007).

2.3. Research objectives

According to the literature review, the conception of enterprise architecture was originated in private sectors in western countries and currently majority of the researches on e-government architecture enterprise were conducted by researchers in America and Europe. Zheng and Ren (2011) reviews e-government research in China with a systematic approach. However, the paper only covers Chinese journal papers from 2008 through 2010 and does not focus on the topic of enterprise architecture particularly. A paper written in English by Kluver and Yang (2005) reviews research on the internet in China in a holistic and particularistic perspective, and conducts case studies to discern the development of internet studies.

Until now, there are very few studies focusing on reviewing China's e-government enterprise architecture in a systematic approach. Therefore, this paper attempts to fill this gap by examining the status and progress of e-government enterprise architecture research in China in a systematic approach, and then makes recommendations for researchers and practitioners on the topic.

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.

3. Methodology

3.1. 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 sources of searching papers in this study.

3.2. Selection of papers

Given that the selection of keywords might act as a limited filter and some papers may be missed in this study, we searched in both the “titles” and “key words” of papers in the database by using several combinations of key words in Chinese to minimize this limitation, while still keeping the searching process feasible. Those combinations of key words include “Dianzi and Dingcengsheji” (English meaning: electronic and enterprise architecture), “Dianzizhengwu and Dingcengsheji” (English meaning: e-government and enterprise architecture), Dianzizhengwu and Guanli (English meaning: e-government and management) etc. In Chinese language, synonyms are not used as much as they are in English. In particular, words like information architecture, enterprise architecture, business architecture and electronic do not have synonyms in Chinese, so the current keywords used for searching papers in the study are appropriate in Chinese language.

As a result of searching in database and manual scanning, we collected 41 papers focusing on the topic of e-government EA for analysis. We then coded each paper according to the classification schemes to be described below. During the coding process, we re-evaluated each paper again for its relevance to EA.

In addition to Chinese Journals, we also used key words such as “electronic + enterprise architecture + China”, “technology + government + enterprise architecture + China” and “e-government + enterprise architecture + China” to search papers written in English in databases including “EBSCO”, “Science Direct” and “JSTOR”. However, we did not find papers written in English particularly focusing on China's e-government EA.

3.3. Multifaceted coding methods

Owing to its interdisciplinary nature, EA encompassed an array of rich research ingredients. Therefore, we conducted a multifaceted view to code the papers we collected. After referring to previous studies (Wang, 2009) and brain-storming among authors, we finally defined a number of aspects of EA studies. As a result, we decided to pay special attention to author, author's institutional affiliation and department, published journal and issues, paper length, research themes, research methods, level of analysis, and geographical focus (See Appendix A). 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 carries out its classification of subjects;
- Published journal: this indicator could suggest publication 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 the 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, descriptive and prescriptive 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 studies, we carried on a quantitative analysis with the aid of the SPSS software to calculate the “frequency” and “crosstab” statistics on each aspect examined, and then further conducted a qualitative analysis to the literature to examine the research questions, progress and trends of the EA research in China.

3.4. Method of qualitative analysis

In the qualitative study, we decided to use the framework by Janssen and Hjort-Madsen (2007) as the basis to categorize current EA research in China. Janssen and Hjort-Madsen develop a framework to compare the National Enterprise Architecture between Denmark and Netherlands. The framework includes five levels: Policies, actors and structures; Governance; Architecture frameworks and methodologies; Architecture principles and standards; and Implementations (see Fig. 1). Meanwhile, given the characteristics of Chinese EA papers, we also add two new categories into the framework, one is “Advocate for Enterprise Architecture”, which refers to papers emphasizing the value of EA and advocate the government to develop EA in China; the other is “Multi-themes” to label papers which cover more than one topic but do not focus on either one specific topic.

4. Findings and results

4.1. Quantitative analysis

4.1.1. 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.

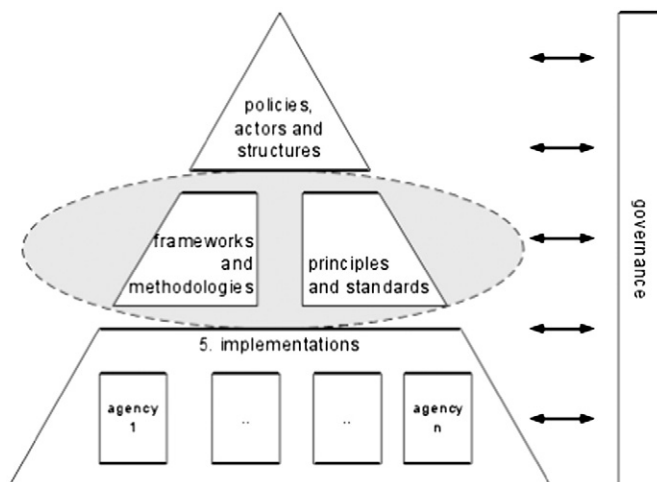


Fig. 1. Janssen and Hjort-Madsen's framework for analyzing national enterprise architectures.

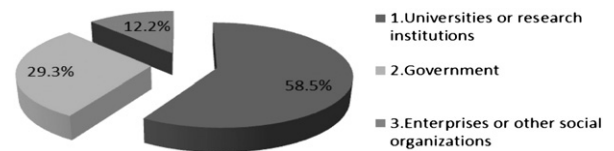


Fig. 2. Author's sector.

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.

4.1.2. 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 remaining four are from enterprises and social organizations, accounting for 12.2%. The result is not a surprise given the different specialization of these sectors (Fig. 2).

4.1.3. Disciplinary department

We further classified the disciplinary departments for the 24 authors who work in universities or research institutions. We could see (Table 1) 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.

There might be two reasons for the results. One is that EA is more of a strategic and managerial concept than a technological term; therefore, it raises more interests of researchers in management disciplinary to study the strategy, the framework, the policy, structure and governance of EA than scientists in computer science and engineering to study the technological details of EA. The other reason could be that EA is still in its stage in China and still remains as a management concept and idea in many places and fewer governments have really started EA implementations which would then involve more technological experts.

4.1.4. 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%; and four, two and three in 2005, 2007 and 2008, accounting for the rest 22%.

The peak and rise might have reflected the attention paid by the Chinese e-government leadership and practitioners to EA. In 2006, the China National Informatization Leading Committee issued the “Overall Framework of National e-government,” which raised researchers' interests in EA, as a result, more academic papers on the topic appeared in that year. In 2007 and 2008, this attention of government to EA might be interrupted due to domestic and international economic downturn. Since 2009, the attention on EA returned and continued to increase (Fig. 3).

Table 1
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

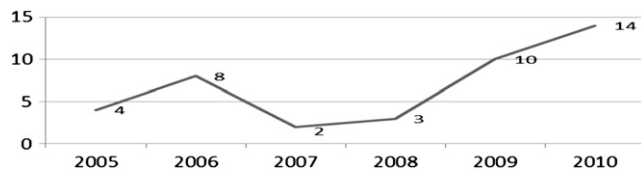


Fig. 3. Year of publications.

4.1.5. 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 Intelligence and Journal of Informative Construction published two papers, and China Information Times published five papers accounting for 12.2%; The journal publishing most EA papers is the journal of e-government which published 14 papers, occupying 34.1% of all EA papers (Fig. 4).

4.1.6. Core journals vs. non-core journals

As Table 2 shows, seven papers out of 41 papers were published core journals, accounting for 17.1%, while 34 were published in non-core journals, occupying the remaining 82.9%.

4.1.7. 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 (Fig. 5).

4.1.8. Research methods

Table 3 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 33 papers adopt descriptive methods, accounting for 80.5% of all papers, including 12 practice illustrations and introductions (29.3%), 19 view points (46.3%), and 2 theoretical and practice integration articles. Meanwhile, 6 papers adopt prescriptive methods, accounting for 14.6% of all papers.

4.1.9. Research themes

The study finds that eleven papers focus on the theme of architecture frameworks and methodologies, accounting for 26.8% of 41 papers, ten papers cover multi-themes, accounting for 24.4%, and nine

Table 2
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

papers are simply advocating enterprise architecture, accounting for 22%. Six papers are about EA governance, three are related to the theme of implementations, and two are related to the policies, actors and structures. There is no paper found to be related with the theme of architecture principles and standards.

The results may indicate that EA practices in China are still in their early stages and more researchers remain at introducing and advocating the conceptions and ideas with a broad but superficial way, and have not gone further into studying the solid and in-depth topics such as principles, standards, policies, governance, and implementation (Fig. 6).

4.1.10. Levels of analysis

We could see from Table 4 that about 87.8% of papers do not indicate 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.

4.1.11. Geographic focus

Table 5 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.

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

Fig. 7 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.

4.1.13. Cross-tab analysis between the author's sector and journal

Fig. 8 presents the result of cross-tab analysis between the author's sector and journals. Obviously, universities and research institutions are

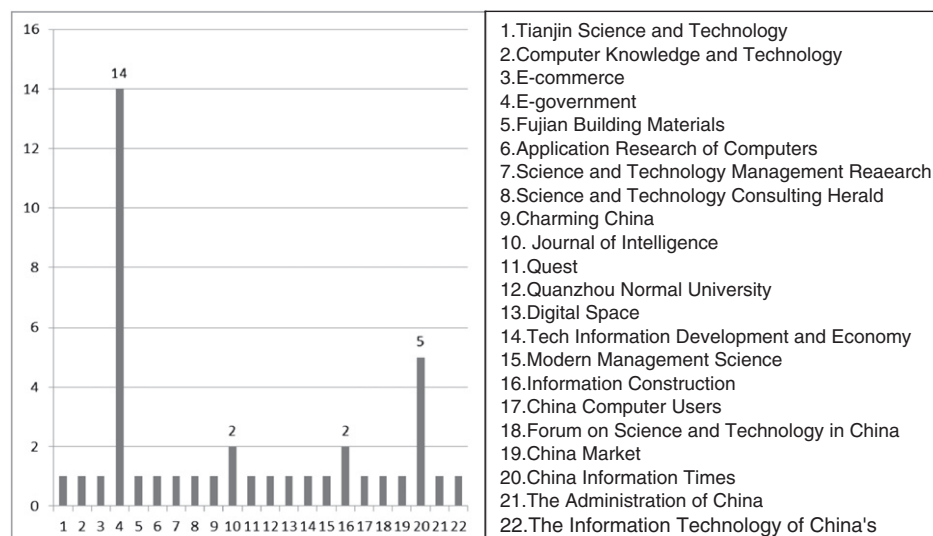


Fig. 4. Statistics of published journals.

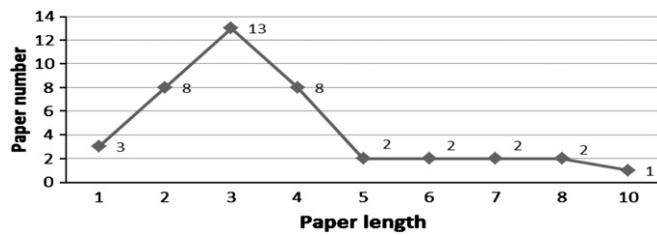


Fig. 5. Papers' length.

Table 3
Frequency of research methods.

Research methods		Frequency	Percentage	Total %
Theoretical	1. Theoretical framework building	0	0.0	0.0
	2. Critical literature review	0	0.0	
Empirical	1. Interview	0	0.0	4.9
	2. Survey	0	0.0	
	3. Observation	0	0.0	
	4. Secondary-data	0	0.0	
	5. Comparative studies	0	0.0	
	6. Case studies	2	4.9	
Descriptive	1. Practice illustrations and introduction	12	29.3	80.5
	2. View points	19	46.3	
	3. Theoretical and practice integration	2	4.9	
Prescriptive		6	14.6	14.6
Total		41	100.0	100.0

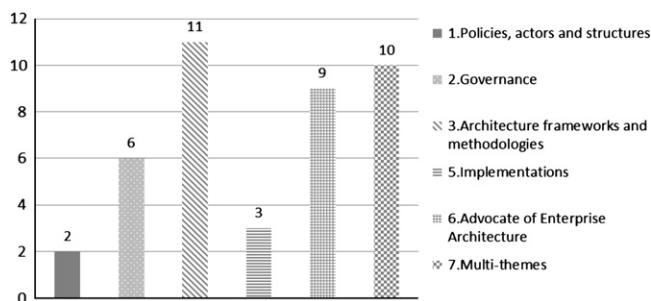


Fig. 6. Description of research themes.

the major contributor of core journal article, while most articles written by any of the three sectors are published in the non-core journals.

4.1.14. Cross-tab analysis between the research themes and research levels

Fig. 9 demonstrates the relationship between research themes and research levels. We can see that majority of the papers in the category of general level are studying multi-themes and advocating enterprise

Table 4
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

Table 5
Frequency of geographic focus.

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

architecture. The result indicates that papers that are not specific in terms of research level also tend to be generic and superficial in terms of research theme.

4.2. Findings of qualitative analysis

According to the analytic framework based on Janssen and Hjort-Madsen's (2007) work, we classified all EA research into seven categories and briefly introduce the content and findings of some major research in each category. In the coding process, we didn't find one paper focusing on the Architecture principles and standards' theme.

4.2.1. Policies, actors and structures

We found few papers focusing on the theme of Policies, actors and structures. Zhang and Huang (2010) mention there are many problems in the process of development the e-governance in China, such as unbalanced regional development, low level of information sharing, low efficiency of the system and argue that these problems are caused not only by the administration system, but also by institutional issues. Therefore, the government needs focus on the development of EA structure and promote the policy development (Zhang & Huang, 2010). Lai (2010) introduces some international best practices into China, such as the Federal Enterprise Architecture (FEA) in the U.S. and Governance Enterprise Architecture (GEA) in the Europe covering various themes including laws and regulations, supportive policies and systems, professional working standards, organization and departments.

4.2.2. Governance

In terms of EA governance, Fan and Meng (2009) suggest government to develop legislations, institutions and performance evaluation to promote information sharing under the function of e-government EA and build a comprehensive and systematic planning of the e-government, and they propose two approaches of enterprise architecture design, which are "bottom-up" and "top-down". In terms of evaluation methods, Li (2006) argued that local governments should identify various objectives of different departments to set up their own evaluation methods based on their actual effectiveness of e-government development in designing "E-government front – back service system".

4.2.3. Architecture frameworks and methodologies

In terms of architecture frameworks, Ou and Zhao (2010) design a local e-government EA in six architectures including business architecture, data-architecture, application-architecture, technical-architecture,

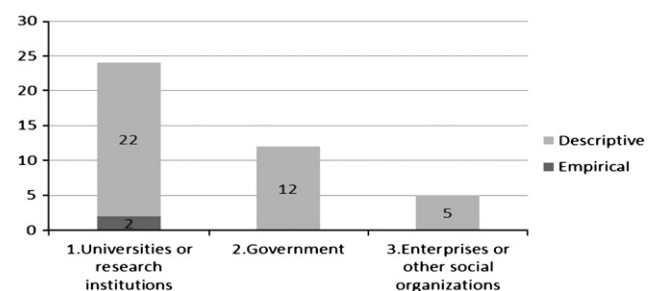


Fig. 7. Cross-tab analysis between the author's sector and research methods.

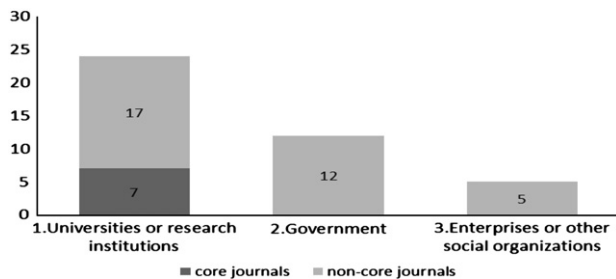


Fig. 8. Cross-tab analysis between the author's sector and core journals or non-core journals.

performance management framework, and security framework. By studying an Information Resource Management Center in Dalian City, Gao, Wang, and Wang's (2009) work focuses on the government information resources integration framework including technical framework, business processes, information resources security, and analysis. Some scholars use case studies to analyze architecture frameworks. Wu (2009) introduces Fujian province's architecture framework which comprises network infrastructure layer, government information resources layer, application layer, and integrated application layer. Zhang (2005) analyzes the enterprise architecture of digital city including the basic support system, platform support system, resources sharing system, application system, standards system, and information security system. Qiu, Ye, Li, and Sun (2009) introduce the modules of GEA and the relationship between them and argued that the government must take a strategic perspective and adopt systematic analysis and planning in designing e-government EA.

4.2.4. Architecture principles and standards

After coding papers, we only found that some paper mentioned EA standards, regulations and rules as one of topic studies in a broad and superficial way. There is no paper focusing on this topic. The reasons might be that China's e-government EA is just at its early stage, and most researches are introducing the general ideas and frameworks of EA, and have gone further into studying the detailed principles and standards of EA yet.

4.2.5. Implementation

As for the implementation of e-government EA, most studies introduce relevant applicable technology and models through analyzing current problems in China's EA practices. Some authors introduce the method of applying IRP (information resource planning) technology to construct an e-government system (Zhao, 2006). Wu and Huang (2010) analyze the electronic monitoring as an innovation tool for the Chinese government to prevent corruption, and because of lacking

enterprise architecture design, the effectiveness of electronic monitoring system turns out to be at a low level.

4.2.6. Advocate of enterprise architecture

In the study, we found that many papers are about advocating the importance of e-government EA and attempt to bring the conception into China. Some authors argue that the reason of developing EA in China is to solve current problems which existed in China's e-government, such as interaction with citizens, information security and integration of resources and EA will also promote cross-organizational communication (Hu, 2010). They point out that currently the key of promoting e-government in China is government information sharing and in order to ensure information sharing across government levels and different functional departments and to improve public service and government administration, it is necessary to adopt e-government EA to facilitate collaborative business streamline, cross-functional team, and cross-boundary process (Hu, 2010). Xiao and Li (2010) emphasize that e-government involves various organizations in the government sector and e-government EA should adopt strategic management and IT governance.

4.2.7. Multi-themed papers

During analysis, we found some papers cover broad and multiple themes of EA, and does not focus on a specific topic. Some scholars point out that the EA design in China have the following problems: 1) Most of them focus on infrastructure construction without clear strategy for implementation; 2) effective management and evaluation mechanism are not in place, and the economic and social benefits of EA are not clear; 3) the construction of EA doesn't have standards, and different regions have different expectations; 4) payless attention to the public service and the citizens' needs; and 5) heavy emphasis on the construction of hardware, and ignore applications, policies and regulations, service quality, and training (Sun, 2010). Jiang and Fan (2009) address that the most important part of developing the e-government EA is innovation, like the institutional innovation, the management innovation, the technology and application innovation, and some specific innovation includes developing CIO system, gathering professionals, and building a safe policy environment. Peng (2010a, 2010b) argues that e-government EA needs to unify planning, network platform and applications, set up standardized and effective mechanism, establish designated EA institutions to provide advices and make strategic planning, build government information data center to support e-government EA, and develop government chief information officer system.

5. Discussions and implications

5.1. Increasing attention to EA

According to the above analysis on e-government EA study in China, it is indicated that overall the topic is receiving more attention by scholars over time with the continuing development of e-government in China. In terms of the total number of published papers, altogether 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 with serious attention until the national e-government structure was issued by the National Informatization Leading Committee Group in 2006. Especially from 2009, more and more scholars began to study this field. With the emergence and development of EA in China, it can be expected that more attention will be paid to the EA of e-government in the years to come.

5.2. Unbalanced and unfocused research themes

According to the qualitative analysis of the papers, we can conclude that Chinese EA scholars have paid more attention to the "Architecture

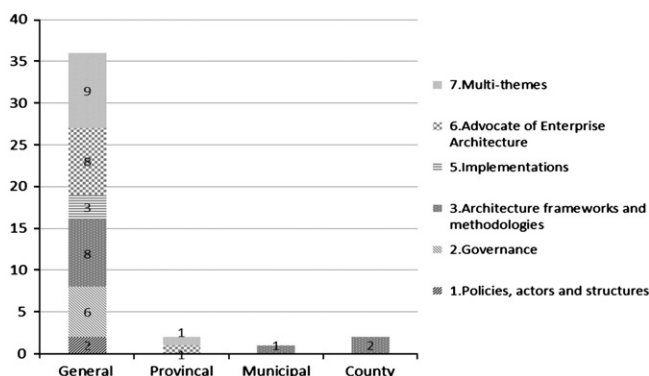


Fig. 9. Cross-tab analysis between research themes and research levels.

frameworks and methodologies”, but less attention to the “policies, actors and structures”, “architecture principles and standards” and “implementation”. Although some scholars mention that building policy environment and standard regulation of EA and involving more actors in the process of develop e-government are important and critical, they remain at providing ideas and did not offer specific instructions and recommendations.

According to the framework for analyzing National EA developed to Janssen and Hjort-Madsen (2007), EA are often initiated at the political levels, diffused using different governance mechanisms, and adopted and used by public agencies. Architecture models, principles and standards make up the content of EA. Therefore, we suggest that Chinese EA researchers should take a more comprehensive and systematic view and expand their research horizons to some under emphasized topics such as EA policies and actors, principles and standards, implementation and governance.

In addition, the study also found that some papers are involved with multi-themes and advocating of Enterprise Architecture, and didn't focus on either specific research topic. The fact that 87.8% of papers do not focus on any specific level of government and 24.4% of papers are multi-themed may indicate that e-government EA practice and research in China need to be more specific and focused.

5.3. Lack of research rigorousness

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

Second, in terms of the paper length, most of the papers on EA are pretty short between 1 and 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 were 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 is 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 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.

6. Conclusions

The paper analyzes and discusses current Chinese studies on e-government EA. Findings suggest that topic of EA is receiving more attention from Chinese scholars over the continuing development of e-government in China. However, the research themes covered by paper in EA are found to be unbalanced and unfocused, and most studies on EA in China focus on Architecture frameworks and methodologies, advocate of EA and multi-themes. In terms of research methods, papers in the field lack academic rigorousness in general. Most Chinese papers on enterprise architecture are descriptive in terms of research method.

Although the study is mainly about EA research in China, it would also have important values and implications for researchers in other countries, especially those in developing countries which have similar conditions as China. In the world there are a huge amount of e-government research written in foreign language and could not be understood by researchers in different languages. Since EA papers analyzed in this research are all written in Chinese, for the first time international researchers could have a chance to have a systematic overview of the status and progress of EA research that are written in Chinese. Therefore, studies like this paper could have the potential to facilitate academic exchange and collaboration among international researchers on e-government.

7. Research agenda for EA

Based on the findings of this paper, we frame a research agenda for future studies in EA. First, future studies should emphasize more on topics like EA policies and actors, principles and standards, implementation and governance. Second, we suggest that future studies on EA in China should carry out more rigorous empirical and theoretical methods.

Third, given that e-government EA is a research topic across nations, comparative studies could be considered in the future to identify the differences and similarities between countries to generalize the findings. Although this study itself has not done a systematic comparative study, it has laid a foundation for future comparative works by developing a framework for comparison and demonstrating findings in China. Particularly, the assessment framework (see Appendix A) developed in this study and Janssen and Hjort-Madsen's framework for analyzing National EA tested in this study (See Fig. 1) would be valuable for researchers in other countries as well. International researchers could use the frameworks to do similar research in their own countries and then compared their findings with those in this paper.

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Appendix A. Multifaceted coding schema

Facets	Codes/categories	Definitions and descriptions
Author's sector	1. Universities or research institutions	Universities; research centers; research institutions.
	2. Government	Government agencies.
	3. Enterprises or other social organizations	Enterprises; NGOs; NPOs.
Author's department	1. Computer science and engineer	Computer science or engineering department.
	2. Information management	Information resources management school or department.
	3. Public administration	Public administration department; public Policy or public affair department.
	4. Business administration	Management school; business administration school or department.
	5. Economics	Economics department or research center.
	6. 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.

Appendix A (continued)

Facets	Codes/categories	Definitions and descriptions
Research themes	1. Policies, actors and structures 2. Governance 3. Architecture frameworks and methodologies 4. Architecture principles and standards 5. Implementations 6. Advocate of enterprise architecture 7. Multi-themes	The environmental and political drivers for EA. Governance structures and mechanisms Frameworks and planning process methodologies Standards, principles and guidelines for guiding implementation Operate across multiple implementations among many agencies and disciplines Advocate the government to develop EA in China Cover more than one topic but does not focus on either one specific topic
Research methods	1. Theoretical 1.1 Theoretical framework building 1.2 Critical literature Review 2. Empirical 2.1 Interview 2.2 Survey 2.3 Observation 2.4 Secondary-data 2.5 Comparative studies 2.6 Case studies 3. Descriptive 3.1 Theoretical and practice integration 3.2 Practice illustrations and introduction 3.3 View points	Theory construction based on existing literatures and theories. 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. In-depth interviews conducted on an individual or group basis with a qualitative approach. Collect data through questionnaires with a quantitative approach. Involves large number of participatory or non-participatory observations with quantitative or/and qualitative approach. Analyze data collected from secondary sources. Comparative analysis of two or multiple case in different context. In-depth analysis of one or multiple cases. Apply theory in practice, and build practice framework, methods or tools. Introduce or describe practices or applications, but does not conduct systematic analysis with academic approach. Express personal viewpoints. Make suggestions or prescribe solutions.
Level of analysis	1. General 2. Central government 3. Regional 4. Provincial 5. Municipal 6. County 7. Grassroots	Does not indicate any level of analysis. Central government ministries. Cross-regional studies. Provincial level, including municipalities directly under the jurisdiction of Central Government (Beijing, Shanghai, Tianjin, Chongqing). Cities and districts/counties of municipalities (Beijing, Shanghai, Tianjin, Chongqing). Districts and counties. Grassroots government and self-autonomy organizations.
Geographical focus	1. Foreign 2. Domestic 3. Comparative	Foreign countries and Hong Kong, Macau and Taiwan. Mainland China. Comparative studies between two or more countries or regions.

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Tuo Zheng is a Ph.D. candidate at the School of International Relations and Public Affairs, Fudan University, China. His research interests are e-government enterprise architecture and social media use in government.

Lei Zheng is an Assistant Professor at the School of International Relations and Public Affairs at Fudan University, China. His research focuses on government information management, cross-boundary information sharing, government use of social media, government information disclosure, transnational information collaboration and comparative digital government research. Lei Zheng received his Ph.D. in Public Administration and Policy at the University at Albany, SUNY, and MPA at the University of Arizona.