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ELECTRONIC ROAD PRICING (ERP): A SYSTEMATIC MAPPING STUDY

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ABSTRACT

Electronic Road Pricing (ERP) has been used to reduce traffic in metropolitan cities. This system has proven to reduce the rate of vehicles entering the limited area effectively as well as increasing the rate of vehicles that use the highway around the limited area thus increasing the usefulness of the road. However, a thorough understanding of the state-of-art on ERP is still needed. Therefore, this article aims to classify, identify scientific publications, and conduct a thematic analysis of the current literature in the ERP to create an extensive and detailed understanding. The results of this mapping are expected to contribute to both researchers and practitioners in determining the research focus gap and the next type of ERP research. The research method is done by systematic mapping study (SMS) to review the scientific publication of ERP conducted time to time, research focus and paper type of the most widely investigated, and research methods that have been applied. SMS Procedures follow established empirical guidelines and mapping data using the Scopus electronic database library. Based on the results of the SMS on research in the field of ERP, it is found out that there are fifty empirical studies that meet the inclusion criteria. The writers classify fifty articles on the research focus areas underneath the categories: ERP, traffic congestion, road pricing, traffic management technology, transportation demand management. Then the studies are grouped into six categories: validation research, evaluation research, solution proposal, philosophical papers and experience papers. Afterall, this article also produces the categorization and quantification of current ERP studies in various dimensions as well as an overview of current research topics and trends.

Keywords: electronic road pricing, congestion, traffic management, literature review

Introduction

A report from United Nations and World Bank shows a relatively high development of the population in a developing country. In the report, it is said that in 2050, more than 85% of the world population will live in developing countries and 80% of the population living in the developing countries will live in big cities or metropolitan cities. According to Goheen (1971), the metropolitan area is created by combining those counties which are integrated in terms of commuting to the central city and the county in which it lies. A metropolitan city is an urban area with its population characteristic that is more prominent compared to a population living in a rural area, like a huge concentration of the population as well as an integrated economic and social unity. A metropolitan city gets problems not only because of its huge amount of population but also different characters (Hau, 1992).

An enormous development of population becomes a matter of concern because not all cities is able to give a sufficient service for the public. It is even worse if the enormous increase of population is followed by the enlargement of the city that needs to be served (Rochaida, 2016). Many cities in Indonesia experience the inadequate service as well. Besides, a metropolitan city has to deal with environmental problems. One of the decreasing qualities of the environment can be seen from the level of pollution in the city due to traffic congestion and improper public transport system (Kusminingrum & Gunawan, 2008).

Based on the National Development Planning Agency, Indonesia has twelve metropolitan areas. One of them is Great Bandung. Great Bandung, also called as Bandung Metropolitan Area, is one of the metropolitan areas in West Java Province that covers Bandung City, Bandung District, West Bandung District, and Cimahi City. Based on the data from the City of Bandung Central Bureau of Statistics (2016), the area of Bandung is 167.31 km^2 divided into thirty sub-districts which cover 151 villages with the population of 2,481,469 people in 2015 in which the composition is 50.51% for male and 49.49% for female. The population sex ratio in 2014 is 102. It means there is 102 male for 100 female. Bandung City also has a high density of population which is 14,831 people/km^2. This number is out of the standard limit set by the World Health Organization (WHO) which is 1,000 people/km^2.

A traffic congestion in a city like Bandung occurs due to the volume of vehicles that grows each day without any construction in terms of the length of road in Bandung. Based on the data from the City of Bandung Road Office (2015), the length of road in Bandung in 2015 is 1,236.48 km. Around 46.63 km or 3.53% is the national road, 32.05 km or 2.59% is the provincial road, and the remaining 93.88% or approximately 1,160.80 km is Bandung City road.

A traffic congestion can bring about various problems that are closely related to the sector of environment, society, and economy (Christiarini, 2011). To reduce the level of traffic and air pollution as the effect of motor vehicles exhaust emission, the government of Bandung through the Department of Transportation has formulated strategies and policies as stated in the Strategic Plans (Renstra) 2013—2018 of Bandung City Department of Transportation (Bandung City Department of Transportation, 2017). Based on the Bandung City Department of Transportation (2016), in Bandung Urban Mobility Project, the government of Bandung plans to implement paid road system using electronic road pricing (Perdana, 2017). ERP is a traffic retribution towards private vehicles in order to be able to reduce the number of private vehicles that pass particular roads with their level of vehicle density in a certain range of time or rush hours (Hau, 1990, 1992; Karyono, 2016).

According to Karyono (2013), ERP is a policy of an enforcement of paid roads for every vehicle that passes them. ERP aims to reduce a traffic congestion in particular roads even though in other road nodes, there would be a worse traffic congestion. ERP was firstly introduced in Singapore. Singapore has done a breakthrough and succeeded in introducing the manually paid road scheme in 1975 and after that, the land transportation system with an automatic system in September 1998. The improving automatic system is called ERP (Ng & Samuel, 1999).

According to Santos (2004), ERP is a simple concept using personal transportation cost on road users and allocating the cost to the government in the form of regional income. ERP is one of the strategies in the sustainable transport system policy and a part of an effort in travel demand management (McCarthy & Tay, 1993).

Learning from the success of the implementation of congestion price as an economic measurement that has been proven in cities like Singapore, London (England), and Stockholm (Sweden), traffic control retribution or ERP becomes one of the parts in government transport strategy that covers a good transport planning, good provision of road network, and good provision of bus and train as the mass public transport system integrated properly (Rasetyono, 2017).

Therefore, to get an existing research perspective, the researchers conduct a systematic mapping study. This study is a literature review using a systematic mapping study about ERP even though there are a few literature reviews related to ERP in Indonesia (Sugiarto et al., 2015; Rizki et al., 2016; and Christiarini et al., 2011), it is only a little that covers a specific systematic mapping study (SMS) regarding ERP (Kahkonen & Smolander, 2013). Then, the aim of this study is to provide an existing literature map to reach a useful result for academics and practitioners to identify research gaps in the future (Akkermans, Bogerd, & van Wassenhove, 2003).

The aim of SMS is to create a further research background as well as to gain a deeper insight regarding an ERP study. In the search, the researchers use an electronic database to find articles about ERP. An SMS study is an exact method as a literature study approach because it is supported by fifty articles from the search on Scopus Electronic Database (Kitchenham, 2007; Petersen et al., 2008).

Overall, the researchers analyze the results from the search of fifty articles using the research questions as follows:

1. RQ1: How are the research focuses on the topic that has been studied?
2. RQ2: What kinds of the method and paper type are used?
3. RQ3: How is the trend of publication in each country time to time?

The result of this research gives a comprehensive approach regarding ERP as well as its implication and guidance for other academics and practitioners.

Research Method

This study uses a systematic mapping study (SMS) which is a secondary study. SMS is rooted from study literature review (SLR) which is popular in medical research (Kitchenham. B, 2004). An implementation of SLR is to identify, evaluate, and interpret all available and relevant literature related to research questions or interested domain (Kitchenham. B, 2004, 2007; Petersen et al., 2008). The most general reasons in conducting SLR are: first of all, to summarize an existing evidence regarding the topic; secondly, to identify gaps in a current

research and give suggestions to observation in the future; and third, to give a background positioning activities of a new research (Kitchenham. B, 2004).

SMS is implemented to elaborate types of research activity that have been done in this study. SMS explains a research at a high level and maps the research instead of observing the research question in detail (Petersen et al., 2008). In other words, SMS can be considered as a method to get a general description regarding a particular research area (Kitchenham et al., 2011) because an SMS research digs information in detail (Brereton et al, 2007).

Research questions

Research questions in SMS are way wider than SLR to discuss a wider research coverage as well (Kitchenham, 2007). The research questions in this study focus on categorizing topic related to ERP.

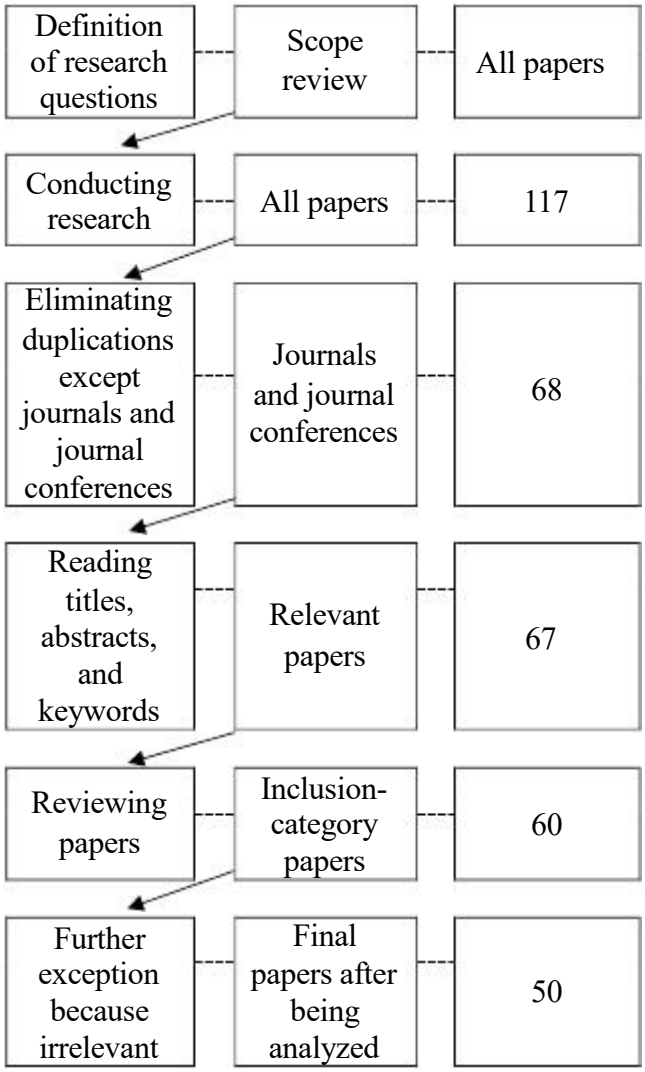
Search steps

To add accuracy in an SMS study, search process and analysis have to be as accurate as possible. Thus, this part features the process of selecting a data source, implementing a strategy to make a search string, and determining the criteria of exclusion and inclusion.

This study adopts the process of search from Petersen et al. (2008) study. In this process, each step has a result and systematic mapping is the final result of the mapping process. In Figure 1, the writers illustrate a complete process of SMS used in this research. The writers refer to the research conducted and according to instructions by Kitchenham (2004) and Petersen et al. (2008).

The writers do a search online from indexed electronic database Scopus. Scopus is a literature database that consists of abstracts and reputable international academic journal articles included in the criteria of Directorate General of High Education (DIKTI) of Republic of Indonesia.

Search string or keywords search is performed using Banaeianjahromi and Smolander's strategy (2016) by referring to the research by Barbosa and Alves (2011). The first step is defining main keywords. The second step is examining studies in the field of ERP. The third one is looking for alternative keywords to be used in the search process. According to Banaeianjahromi and Smolander (2016), the last step uses Boolean's operator that functions to synthesize the search into one string of search. However, this study does not use Boolean operator AND or OR because, on the third step, the writers find that if the string combination is "electronic road pricing" AND ERP then the writers find less than fifty articles. In the end, to widen the result, the last search string article is "electronic road pricing" with 117 articles. The search string is applied to the search in all parts of articles, such as titles, abstracts, keywords, and the main part of Scopus electronic database. The search process was started in May 2017 (Barbosa & Alves, 2011).



Source: (Kitchenham, 2004; Petersen et al, 2008)

Figure 1. SMS Process (Search)

Next, the step to determine the category of exception articles or the criteria of exclusion and inclusion is one of the activities of mapping study not to include irrelevant articles but to cover relevant articles (Petersen et al., 2008). In this study, the writers formulate the criteria of exclusion and inclusion to ease the mapping (Table 1).

Table 1. Criteria for Exclusion and Inclusion

Inclusion	Exclusion
1. The studies that focus on ERP 2. English 3. Only journals and conference papers 4. The papers that have been through peer-reviewed	1. The papers that are not about ERP 2. Languages other than English 3. Dissertations, theses, book chapters, product descriptions, presentations, work reports, trading literature, editorial notes, unclear literature 4. The papers that have not been through peer-reviewed 5. Duplicated research

Source: (Barbosa & Alves, 2011; Banaeianjahromi and Smolander, 2016)

The writers select books, theses, and other types than articles because the number of search result expected is not too high. It is due to the writers have a limitation to analyze all of them. In the end, the writers have a number of articles that talk about ERP on Scopus database which is fifty articles.

Classification scheme

In the process of systematic mapping, to analyze and classify articles that have been selected based on the criteria, the writers develop a scheme of classification that refers to Petersen et al. (2008). The process of article classification is illustrated in Figure 2.

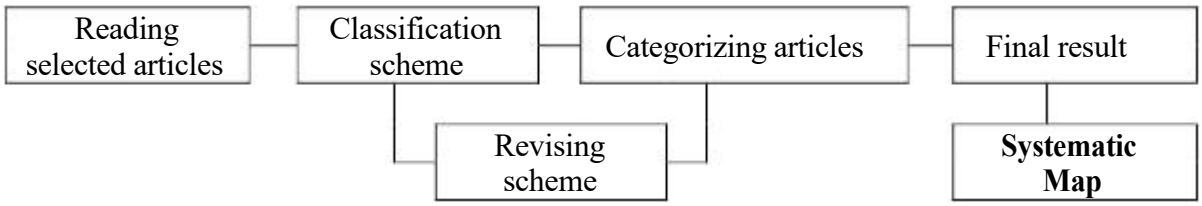


Figure 2. Process of Classification

The writers formulate three aspects to classify the collected articles. In the first category, the writers classify the articles based on a research method from Musianto's study (2002). The second category defines the paper type based on the classification served in Wieringa et al. (2006). Then in the third category, the writers identify three categories (research focus) by applying the keyword method explained in Petersen et al. (2008). Table 2 describes the three categories in the process of classification in this study.

Table 2. Classification Categories

Paper Type	**Explanation**
Validation Research	A new investigation method and has not been implemented in a practice yet (experiment/observation).
Research Evaluation	An investigation method is implemented in a practice and served in an evaluation method.
Solution Proposal	A solution for a problem is proposed. This solution proposal can be in a form of new approach or can be applied to an existing approach.
Philosophical Paper	This research introduces a new perspective regarding something existed using a taxonomy or conceptual framework.
Experience Paper	This research is based on the personal experience of the writer about what and how something has been done in a practice.
Methods	**Explanation**
Qualitative method	A qualitative method is served by the rapid assessment process, secondary data, ethnography, focus group discussions, in-depth interviews, daily books, and language analysis.
Quantitative method	A quantitative method is served in a sample design, hypothesis, and its tests in which all of them are statistic formulations.
ERP	ERP is an electronic toll collecting scheme system to organize traffic by paying electronically in a particular area (Small, Kenneth A, 1998).

Traffic Congestion	Traffic congestion is a situation or a condition of halt or even stop in traffic due to a huge number of vehicles that exceed the road capacity. Traffic congestion is a transportation problem in main cities (Downs, 1992; Litman, 2004; S. N. Riyadi, 2010).
Road Pricing	Road pricing is a direct cost charged to road users, including toll cost, traffic cost, and a cost designed to prevent vehicle use (Small, Kenneth A, 1998).
Traffic Management Technology (TMT)	Traffic management deals with planning, controlling, and purchasing apps and technology for the sake of electronic road pricing.
Transportation Demand Management (TDM)	It covers all methods that can be used to improve facilities utilization and an existing transportation to be more efficient by managing or minimizing the utilization of vehicles by affecting the behavior of travel (Tanariboon, 1992 in I. P. Astuti, 2010).

Source: (Musianto, 2002; Wieringa et al., 2006; Petersen et al., 2008)

Result and Discussion

Result

This part is the result of mapping based on the research questions. Based on the result of the mapping from fifty articles about ERP, it is grouped using Microsoft Excel software with categories: research focus, methods, and paper type. After conducting the mapping systematically, it is found forty-five types of article documents in reputable international journal, one article published on Future Generation Computer Systems media, two types of document in scientific conference, and two types of literature review documents (appendix: Systematic Mapping Study Overview)

Research Focus (RQ1)

To answer RQ1, the writers classify fifty articles in the research focus area with category: ERP, traffic congestion, road pricing, traffic management technology (TMT), transportation demand management (TDM). Figure 3 is the percentage of the topic researched. The topic that is mostly researched is the research with research focus traffic congestion and TMT which is seventeen (25%), ERP which is fourteen (21%), road pricing which twelve (18%), and the least is TMD which is seven (10%) from the total fifty (100%) researches.

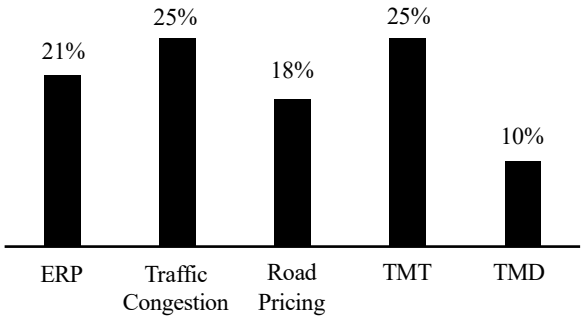


Figure 3. Research Focus

Research Type and Method (RQ2)
The research type shows a research classification that refers to a research by Wieringa et al. (2006) where the research is classified into six categories: validation research, evaluation research, solution research, philosophical research, opinion research, and experience research. To answer RQ2, the writers categorize fifty articles as the result of the classification mapping but because the writers cannot find any research with opinion paper criterion, the writers do not include the research into classification mapping.

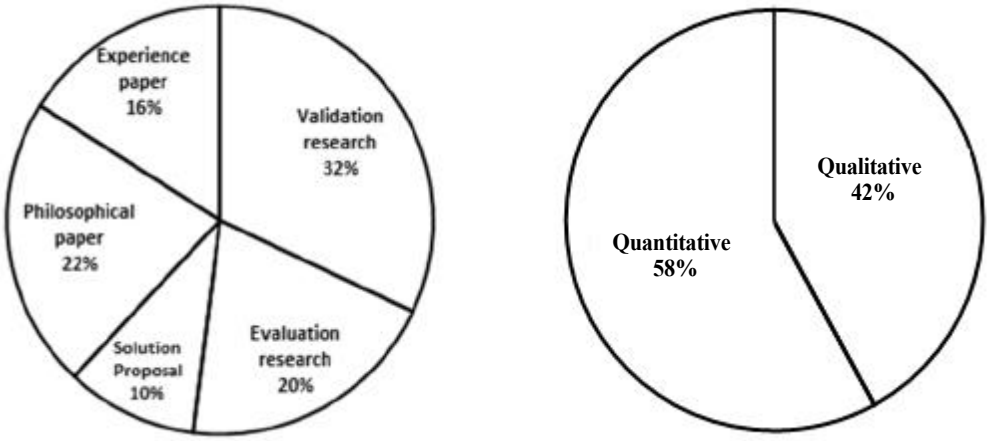


Figure 4. Distribution of Research Type and Method

Figure 4 describes the distribution of paper type based on the categorization by Wieringa et al. (2006). Based on the result of systematic mapping study, the paper type that is mostly conducted is validation research with sixteen articles (32%). The second most conducted research is philosophical paper with eleven articles (22%). Evaluation research and experience paper come consecutively in number three and four with 10 articles (20%) and 8 articles (16%). However, there are only five articles (10%) of solution proposal which is a type of research with a new method of approach or in other words, a type of research that has been evident in solving problems and giving solutions to problems that have occurred and will occur.

The classification of research method refers to Musianto (2002). The approaches of research method used are qualitative and quantitative methods. Adopted from Williams' research (1988), according to Musianto (2002), a quantitative approach engages measurement in its process, hypotheses, direct observation, data analysis, numbering, formulation, calculation, and a numerical data validation. Meanwhile, a qualitative approach engages description in words in its process, hypotheses, direct observation, data analysis, and conclusion. Its writing uses the aspect of tendency, situational description, and in-depth interview.

On average, those fifty articles use the approach with the quantitative method with twenty-nine articles (58%) and qualitative method with 21 articles (42%). Basically, an approach with quantitative method sees reality as single, concrete, observed, and defragmentable. In contrary, a qualitative approach sees plural reality and construction result in a holistic understanding. That is the reason why a research about electronic road pricing is more using a specific quantitative approach, believes directly in the generalist object, and doubts and seeks the next phenomenon in the reality object (William, 1988; Musianto, 2002).

In the systematic mapping study, the writers analyze the relationship between paper types and methods to find out the pattern of the method commonly used in researches about ERP. Figure 5 is a bubble chart that describes the methods in fifty articles based on topic or research focus.

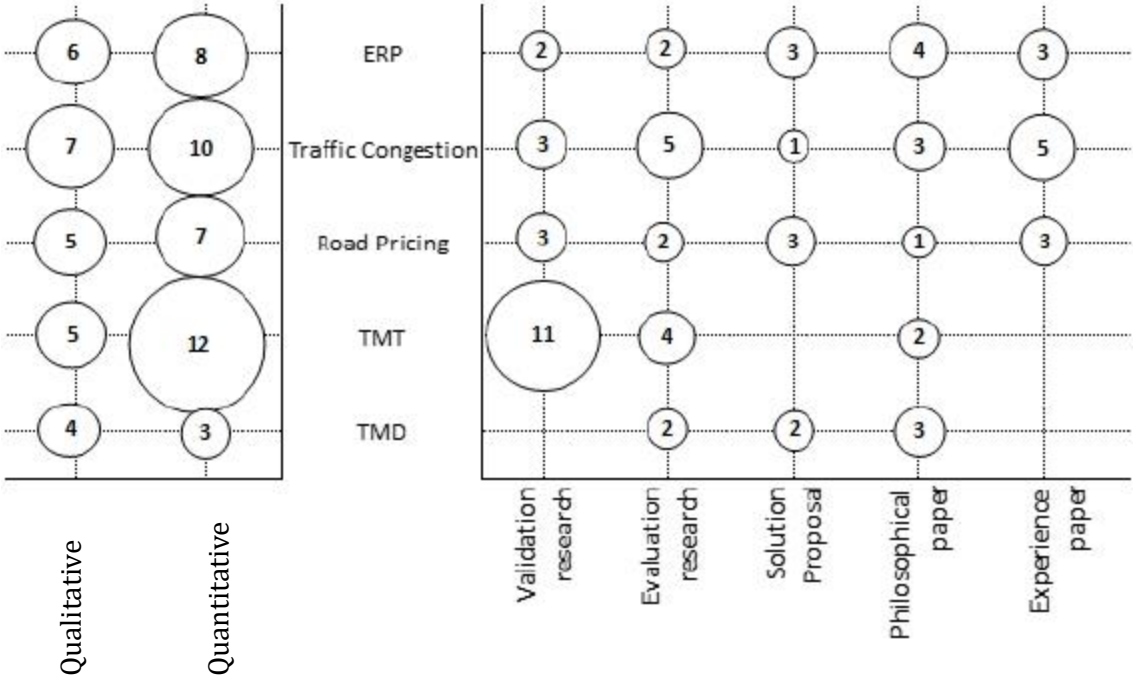


Figure 5. Distribution of Articles Based on Research Type and Method in Research Focus

Of fifty articles, the quantitative approach commonly shows up in Traffic Management Technology (TMT) research focus which is twelve articles and validation research is the most dominant paper type with eleven articles. Figure 6 describes the researches with a quantitative method is more dominant than qualitative, as, in traffic congestion which is ten articles, eight articles of ERP, seven articles of road pricing, and the least one is TMD which three articles. On the other hand, traffic congestion topic dominates the qualitative method researches with seven articles.

The least common topic in terms of research focus is TMD. The writers find that there is no the type of validation research and experience paper in the topic research. There is no the type of solution proposal and experience paper in the TMT topic research.

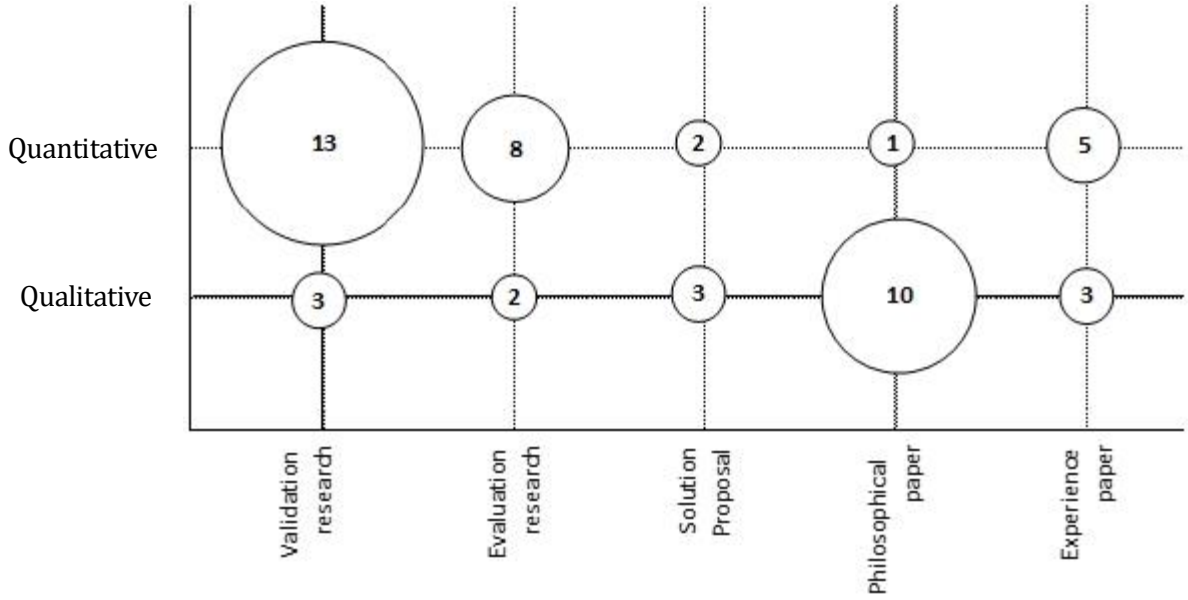


Figure 6. Distribution of Research Method in Paper Type

To analyze the article distribution from other dimensions, Figure 6 serves the number of articles per research method combined with paper type. The qualitative research is the main research method for validation research which is thirteen articles. The second most common is the qualitative method on philosophical paper which is ten articles. However, there is only one philosophical paper that uses a qualitative method. Furthermore, it can be seen that the proposal solution type is the least in terms both quantitative and qualitative method. With the least number of proposal solution, it can be the reason why there are only a few people who conduct that kind of research.

Publication Trend in Each Country Time to Time (RQ3)

Based on the mapping result, it is found that the country with the most ERP research is Singapore with seventeen publications (34%), followed by the United Kingdom with eleven publications (22%), Hongkong and United States with four publications each (8%), Australia, Netherlands, and Spain with two publications each (4%), and one publication comes from Canada, China, India, Indonesia, Poland, Portugal, and Taiwan.

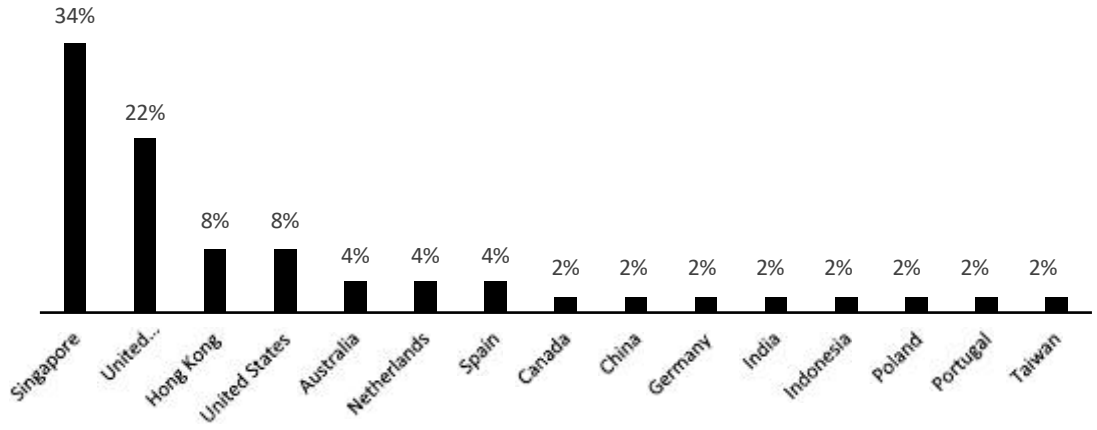


Figure 7. Trend of Publication in Each Country

Figure 8 is a trend of research published on electronic database media since 1975. However, the result of search done by the writers shows that the research does not keep improving. The most publications were published between 1999 and 2001 with ten publications then between 2014—2016, there were eight publications published.

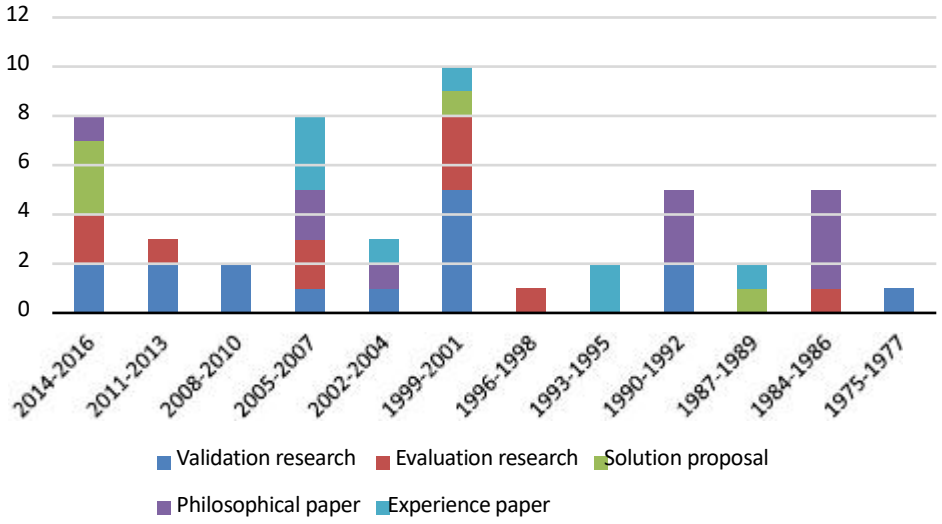


Figure 8. Trend of Publication from 1975—2016

Discussion

Systematic mapping study gives an overall description regarding ERP. Researchers from academics and practitioners can use this research as an initial research. In this SMS, the writers have searched 117 articles from Scopus electronic database. After performing mapping using the guidance in Figure 1 and 2 in this research, the writers find fifty relevant articles and then the writers develop the classification theme that categorizes articles based on research focus, paper type, and research method. (Appendix: Systematic Mapping Study Overview).

Regarding research focus, the writers conclude that "traffic management technology" and "traffic congestion" dominate the number of articles with seventeen articles. The validation research paper type becomes the type of paper that is commonly used. On the other hand, there are only five articles of the solution proposal paper type which are the least research being used. The most dominant approach in the articles is the quantitative method with twenty-nine articles.

Validation research, evaluation research, and experience papers are the most commonly used in the research focusing on traffic management technology and traffic congestion. By using the illustration of bubble chart, the gaps in the area of ERP research can be found and focus on emphasis in this study.

The writers conclude that most validation researches use a quantitative method while philosophical papers engage a qualitative method. It implies that researches about ERP are more studying and making a new work concept in an experimental form and it will be implemented. However, in transportation demand management (TDM) research focus, there is no research using validation research which has not engaged the latest investigation method related to the research focus.

Validation research and evaluation research were the most general paper types between 1999 and 2001 in which they were the most publications of the year. The following year, a decline of publication occurred. Additionally, the validation research paper type was still dominant during 2014—2016. During that time, the solution proposal and evaluation research dominated the trend of publication which implies that an evaluation research, a new approach, and a solution in the field of ERP starts popping up.

In this systematic mapping process, there are some limitations, such as the journal search to one scientific database source which is Scopus so that the search does not cover all existing journal and conference databases. Besides, the writers also take the category of the article in English, international journals, conference papers, and literature reviews, not including books and magazines.

Closure

ERP is implemented a lot in big countries in which traffic congestion is the main problem. In Indonesia, many metropolitan cities cause the problem, such as Bandung. One of the impacts is a paralysis of economic activities and a decline of prosperity in urban society. Therefore, the implementation of ERP is a solution to reduce the number of vehicles and to make the personal vehicle owners shift to public transport. It cannot be happening without the role of the government of Bandung City and other metropolitan cities as well as all related parties including academics that review ERP implementation.

This study maps the existing ERP literature by looking for articles from a scientific literature database. The main motivation of the study mapped is to give a general description of the existing literature regarding ERP as a solution to solve the traffic congestion in metropolitan cities. The writers implement SMS method (Kitchenham, 2007; Petersen et al., 2008) to determine what focus that has been reviewed in the area of this study. Of fifty journal articles that have been mapped systematically, the writers classify the articles based on the research method with the research topic, namely: ERP, traffic congestion, road pricing, traffic management technology, and transportation demand management. Then, the researches are classified into six paper types: validation research, evaluation research, solution proposal, philosophical papers, and experience papers. The writers also map the trend of publication based on the country origin from 1975 to 2016. The research method adopted in SMS is a practical research method to identify the right topic to be observed and which area needed to conduct more research. The result of this study gives a guide to help researchers to plan studies in the future through research finding gaps.

SMS is a literature review that has an implication for practitioners through validation and evaluation research paper type so that the practitioners can find references and literature for the implementation of ERP in metropolitan cities to solve traffic congestion. Then, this SMS study will be an initial research of ERP review.

Although there are lots of ERP studies, it seems there is a significant problem with ERP project. A number of studies have been conducted if society is asking why the implementation of ERP in metropolitan cities keeps failing. One of the reasons is a more complex environment and the area of research that is not in a line with the country, city, or area where ERP will be implemented. Research in the future should consider and learn how the problem of ERP implementation can be solved.

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Appendix: Systematic Mapping Study (SMS) Overview

No.	References	Year	Research Focus	Paper Type	Research Methods	Database Journal	Country
1	Jardí-Cedó R., Castellà-Roca J., Viejo A.	2016	ERP; Road pricing	Solution Proposal	Qualitative	Security and Communication Networks	Spain
2	Agarwal S., Koo K.M.	2016	Congestion charge; Traffic management	Evaluation research	Quantitative	Regional Science and Urban Economics	Singapore
3	Rizki M., Karsaman R.H., Santoso I., Frazila R.B.	2016	ERP; Travel demand management	Solution proposal	Quantitative	International Journal of Technology	Indonesia
4	Agarwal S., Koo K.M., Sing T.F.	2015	Congestion charge; Traffic management	Validation research	Quantitative	Journal of Urban Economics	Singapore
5	Jardí-Cedó R., Mut-Puigserver M., Payeras-Capellà M.M., Castellà-Roca J., Viejo A.	2015	ERP; Road pricing	Solution proposal	Quantitative	Future Generation Computer Systems	Spain
6	Chu S.	2015	Travel demand management; Road pricing	Evaluation research	Quantitative	Transportation Research Part A: Policy and Practice	Singapore
7	Ho S.-H., Wong Y.-D., Chang V.W.-C.	2015	Traffic management; Road pricing	Validation research	Quantitative	IES Journal Part A: Civil and Structural Engineering	Singapore
8	Hüsig S.	2014	Traffic management technologies	Philosophical paper	Quantitative	International Journal of Innovation and Technology Management	Germany
9	Liu Z., Meng Q., Wang S.	2013	Traffic management technologies	Validation research	Quantitative	Transportation Research Part C: Emerging Technologies	Australia
10	Hau T.D., Loo B.P.Y., Wong K.I., Wong S.C.	2011	Congestion	Evaluation research	Quantitative	Singapore Economic Review	Hong Kong
11	Xie L., Olszewski P.	2011	Road pricing	Validation research	Quantitative	Transportation Research Part A: Policy and Practice	Poland

No.	References	Year	Research Focus	Paper Type	Research Methods	Database Journal	Country
12	Verma C., Abegaonkar M.P., Basu A., Koul S.K.	2009	Traffic management technologies	Validation research	Quantitative	IETE Journal of Research	India
13	Hsu L.-L., Lai R.S.Q., Weng Y.-T.	2008	ERP for SMEs	Validation research	Quantitative	International Journal of Technology Management	Taiwan
14	Hin L.T.W., Subramaniam R.	2006	ERP; congestion pricing	Experienc e paper	Quantitative	International Journal of Heavy Vehicle Systems	Singapore
15	Lam S.H., Toan T.D.	2006	Road Pricing; traffic management	Evaluation research	Qualitative	Transportation	Singapore
16	Hau T.D.	2006	Congestion charge	Philosophi cal paper	Qualitative	Transportmetrica	China
17	Barter P.A.	2005	road pricing	Validation research	Quantitative	Transport Policy	Singapore
18	Santos G.	2005	Congestion charge	Evaluation research	Quantitative	Transport Reviews	United Kingdom
19	Olszewski P., Xie L.	2005	road pricing	Experienc e paper	Quantitative	Transportation Research Part A: Policy and Practice	Singapore
20	Ison S., Rye T.	2005	Road Pricing; Congestion charge	Experienc e paper	Quantitative	Transport Reviews	United Kingdom
21	Parayil G., Yeo T.E.D.	2005	ERP	Philosophi cal paper	Qualitative	Prometheus (United Kingdom)	United Kingdom
22	Phang S.-Y., Toh R.S.	2004	Road Congestion; Road Pricing	Philosophi cal paper	Qualitative	Transportation Journal	United States
23	Li M.Z.F.	2002	ERP; Congestion pricing	Validation research	Quantitative	Transportation Research Part B: Methodological	Singapore
24	Goh M.	2002	ERP; Congestion management	Experienc e paper	Qualitative	Journal of Transport Geography	Singapore
25	Viegas J.M.	2001	Congestion; Urban transport	Solution proposal	Qualitative	Transport Policy	Portugal

No.	References	Year	Research Focus	Paper Type	Research Methods	Database Journal	Country
26	He X.F., Law C.L., Ling K.V.	2001	Traffic management technologies	Validation research	Qualitative	IEEE Aerospace and Electronic Systems Magazine	Singapore
27	Luk J.Y.K., Yang C.	2001	Traffic management technologies	Evaluation research	Quantitative	Journal of Advanced Transportation	Singapore
28	Ang B.W, Tan K.C	2001	Traffic congestion	Experienc e paper	Quantitative	Natural Resources Forum	Singapore
29	Stead D., Banister D.	2001	Traffic Management technologies	Validation research	Quantitative	Innovation	United Kingdom
30	Van Ewijk L.J., Van Der Spek G.A.	2000	Traffic Management Technologies	Validation research	Quantitative	IEE Proceedings: Communications	Netherlands
31	Do M.A.	2000	Traffic Management Technologies	Validation research	Quantitative	ITS Journal	Singapore
32	Seik F.T.	2000	ERP; Urban Transport	Evaluation research	Quantitative	Cities	Singapore
33	Yang H.	1999	Traffic Management Technologies	Evaluation research	Qualitative	Transportation	Hong Kong
34	Catling I., Meadow A.	1999	Traffic Management Technologies	Validation research	Quantitative	IEE Colloquium (Digest)	United Kingdom
35	Phang S.-Y., Toh R.S.	1997	ERP; Congestion pricing	Evaluation research	Quantitative	Transportation Research Part E: Logistics and Transportation Review	United States
36	Emmerink R.H.M., Nijkamp P., Rietveld P.	1995	congestion pricing	Experienc e paper	Qualitative	Environment & Planning B: Planning & Design	Netherlands
37	Bayliss D.	1994	Road Pricing	Experienc e paper	Qualitative	Economic Affairs	United Kingdom
38	Toh R.S.	1992	road congestion	Validation research	Quantitative	Logistics & Transportation Review	United Kingdom
39	Fan H.S.L., Menon A.P.G., Olszewski P.S.	1992	Travel demand management	Philosophi cal paper	Qualitative	ITE Journal	United States
40	Field B.G.	1991	Urban Transport	Philosophi cal paper	Qualitative	SAE Technical Papers	Singapore

No.	References	Year	Research Focus	Paper Type	Research Methods	Database Journal	Country
41	Do Manh Anh, Ong Jin Teong	1991	Traffic Management Technologies	Philosophical paper	Qualitative	Electronics and Communication Engineering Journal	Singapore
42	Hensher D.A.	1991	Traffic Management Technologies	Validation research	Quantitative	Transportation Research Part A: General	Australia
43	Hau T.D.	1989	Road Pricing	Solution proposal	Qualitative	Built Environment	United Kingdom
44	Borins S.F.	1988	ERP	Experience paper	Quantitative	Transportation Research Part A: General	Canada
45	Quin D.	1986	ERP	Philosophical paper	Qualitative	Australian Planner	United States
46	Dawson J.A.L.	1986	ERP	Philosophical paper	Qualitative	Traffic Engineering and Control	United Kingdom
47	Barden S.A., Runnacles T.V.	1986	ERP; Urban Transport	Philosophical paper	Qualitative	Transport Reviews	Hong Kong
48	Fong P.K.W.	1985	traffic congestion problems	Evaluation research	Qualitative	Transportation Planning and Technology	United Kingdom
49	Hills P.	1984	traffic congestion problems	Philosophical paper	Qualitative	Cities	Hong Kong
50	Wigan M.R.	1978	Traffic management	Validation research	Qualitative	Transportation Research	United Kingdom