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OPERATIONS, INFORMATION & TECHNOLOGY | RESEARCH ARTICLE

Problems and requirement analysis as a first step to connect researchers and small and medium enterprises (SMEs)

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Abstract: Small and medium enterprises (SMEs) are the main player in domestic activity in Indonesia. While running their business, they faced many problems and failed in the end. The most problem faced by SMEs is marketing (customer satisfaction, segmentation, positioning). In the other side, the research results were not fully adopted. If only researchers and SMEs can be connected, then their problems should be solved and the research result can fully be adopted by SMEs. Understanding these situations, for future needed a media to connect them by online to reach all researchers and SMEs and the first thing was to develop requirement analysis for both. Exploration of the problems faced by SMEs, the researchers will help SMEs to solve their problems and also the research results can fully adopt.

Subjects: Information/Knowledge Management; Management of Technology & Innovation; Entrepreneurship and Small Business Management; Information Technology

Keywords: SMEs; requirement analysis; problem analysis

1. Introduction
Small and medium enterprises (SMEs) are an individual business or business with legal entity that runs the activity in economy and operated in a manner lightly with the purpose to gain profit with certain limitations (Anoraga & Sudantoko, 2002). SMEs are the main

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Elfira Febriani was born in Medan, Indonesia on 15 February 1991. In 2012, Elfira graduated from Department of Agro-industrial Technology, Faculty of Agricultural Technology, Bogor Agricultural University, Indonesia. Then Elfira continued her study and finished her master graduated in 2014 in the same department. She is a lecturer in Trisakti University from 2015 until now. When still a college, she has some publications, they are Analysis of Information Quality Attribute for SME Towards Adoption of Research Result (Belitung, Indonesia: Proceeding 10th International Seminar on Industrial Engineering and Management, 2017), The Development of Technology Readiness Assessment for Commercialization Innovation and Product Development Based on Digital Business Ecosystem (Padang, Indonesia: Proceeding 9th International Seminar on Industrial Engineering and Management, 2016), and others.

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PUBLIC INTEREST STATEMENT
Small and medium enterprises (SMEs) are the main player in domestic activity in Indonesia. While running their business, they faced many problems and failed in the end. The most problem faced by SMEs are marketing (customer satisfaction, segmentation, positioning), market potential, and product development. In the other side, the research results were not fully adopted. If only researchers and SMEs can be connected, then their problems should be solved and the research result can fully adopt by SMEs. Understanding these situations, for future, they needed a media to connect them by online to reach all researchers and SMEs. To develop it, the first thing to do is develop requirement analysis for both. Exploration of the problems faced by SMEs, the researchers will help SMEs to solve their problems and also the research results can fully adopt by SMEs.

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developing force of developed marketing economics. Additionally, SMEs also has significant contribution to the regional income and state income of Indonesia.

SMEs have many problems, but they do not know how to resolve it. Sometimes, they do their own research on Google or sharing with other SMEs. SMEs need a researcher to resolve their problem. The percentage of the business length of five years is decreasing because many businesses fail in the first years (Febriani, Anggraini, & Dewobroto, 2017). Many factors have caused the business failed to survive such as the competition, low commitment to doing the business as well as financial problems.

Not only in Indonesia, about 20% of small businesses fail in their first year, and 50% of small businesses fail in their fifth year in the US (McIntyre, 2017). Lu and Beamish (Lu & Beamish, 2002) observed similar failure rates in Australia, the United Kingdom, Japan, Taiwan, and Hong Kong. Wheelen and Hunger (2012) found the high failure rate to be largely due to inform strategic planning processes and a lack of systems to keep track of the SMEs' performance.

SMEs in countries has different problems while running their business. The common problems of SMEs are about marketing. But their problem is not only about that, they faced many problems. So it is necessary to identify most of the problems faced by SMEs.

The research result (both from Universities and research institutions) has unfortunately not yet fully adopted by the community, especially the SMEs. SMEs especially in the manufacturing sector, makes a significant contribution to economic growth, yet most of the research sector has focused on large organizations (Terziovski, 2010). Therefore, it is necessary to have a link or media to facilitate the SME and researchers so that SMEs may be fully adopted research results and problem of SMEs can be solved.

To create these media based on the online system, for the first need to know requirement from both. Requirements analysis involves communication with system users to determine specific feature expectations, the solution of conflict or ambiguity as required by users or groups of users, avoidance of feature creep and documentation of all aspects in the project development process from start to finish.

Because of this problem, the purposes of this paper are present and analyze the requirement both of SMEs and researchers.

2. SMEs in Indonesia

In Indonesia, SMEs have been the main player in domestic economic activities, as they provide a large of the employee, therefore, produce a primary or secondary source of income for many rural poor households (Tambunan, 2009). In fact, SMEs are the biggest dominant form of business entities in Indonesia and represent more than 99% of the total number enterprises in Indonesia or 56.4 million units, 97% of the employee but unfortunately, only 57% of that adds value (Mourougane, 2012).

SMEs, including microenterprises, contributed 59.1% of nominal gross domestic product (GDP) in Indonesia in 2012 (Yoshino & Taghizadeh-Hesary, 2016). While 5,000 corporates contribute 38% to GDP, the contribution of 700,000 SMEs just about equals to 22%. To overcome the middle-income trap, microenterprises have to grow into small and medium-sized enterprises, increase their productivity to be able to pay higher wages, and leading to a broad middle-income class. (International Finance Corporation, 2016)

In Indonesia, the government defines micro, SMEs based on their assets and revenues according to Law No. 20/2008 shown in Table 1. An annual revenue of IDR 50 billion is approximately equal to USD 3.7 million. (Sarwono, 2015)

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Table 1. Classification of SME		
Type	Maximum assets (IDR)	Maximum revenue (IDR)
Micro	50,000,000	300,000,000
Small	500,000,000	2,500,000,000
Medium	10,000,000,000	50,000,000,000

The government classified SMEs into nine categories: (1) agriculture, livestock, forestry and fisheries, (2) electricity, gas and water supply, (3) building, (4) trade, hotel and restaurant, (5) manufacture, (6) mining, (7) transportation and communication, (8) finance, leasing and services company, and (9) services (Sarwono, 2015). The three largest sectors of SMEs in Indonesia are as follows: agriculture; a trade, hotel and restaurants; and manufacturing industry. Business fields based on the respondents in this research were trading of 42 respondents and the second highest business fields were culinary of 34 respondents.

Tambunan (2009) explains common problems of MSME (micro, small and medium enterprises) in Indonesia are Lack of working capital; Marketing difficulties; Limited access to financial resources; Lack of technological skills and management; Low productivity; Limited access to productive resources, particularly capital, technology, information and markets; still low quality of institutions and organization of cooperatives; and Lack of business networks.

From the previous research, the concern problems faced by SMEs in Indonesia is marketing (customer satisfaction, segmentation, positioning), business opportunities, product development, market potential, internet/online business, business opportunities, information technology, HR management, design (product, packaging, logo, room, building, etc.), product launching, finance, and management company (Febriani et al., 2017).

Research on SMEs about their problems and improve their business has been developed since a few years ago. Tambunan (2009) identifies several key issues for improving SME competitiveness in Indonesia, they are human resource, working capital, management and technological skills. These key factors are important to improve SME's business performance. Capó-Vicedo, Expósito-Langa, and Molina-Morales (2008) explain those are keys in improving business performance in SME cluster. Tambunan (2009) and Sefer, Savrul, and Ayd (2014) find that financial access which problem faced by SMEs is very important to SME's business performance.

Jauhari (2010) applied E-commerce as an effort to develop SMEs in Indonesia as a solution face problems in SMEs. They are the promotion, marketing, and sales of products.

Although many research has been developed for SMEs they still need researchers to solve the problems. So far there has been no link between researchers and SMEs so that researchers can find out the problems of SMEs and provide solutions up to date for them.

3. Methodology
Data collection was conducted using interview, questionnaire distribution, and observation by online. The questionnaire is the close type. Characteristics questionnaire of SME actors were multiple choices which aimed to find out the characteristics of markets and target customers.

The respondents were the owner of SMEs in Indonesia which is stay in Jakarta, Bogor, Depok, Tangerang and Bekasi from various business types. The number of respondents were 128 respondents but the 124 selected respondents said they needed research and the others said they did not need the research because the problems they faced were personal. So for this research, using 124 selected respondents that said needed research for their business because of 96.87% said they need research.

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Besides SMEs, researchers also become respondents from universities and research institutes with a total of respondents is 30 respondents for researchers. Not only SMEs, the researchers require for the research results also need to know where the problems that occur have been defined that is the research results have not been fully adopted.

The questionnaire (used questionnaire distribution by online) for SMEs were about description SMEs, the problems faced by SMEs, and information quality attributes which SMEs needed. The researcher used an interview to ask about what the researcher has been done, the expectation in the research and researchers thought about the research.

3.1. K-Means clustering

Position Clustering problem arise in many different applications, such as data mining and knowledge discovery, data compression and vector quantization, and pattern recognition and pattern classification (Tobergte & Curtis, 2013). One of the clustering method is *K*-Means, one of the simplest unsupervised learning algorithms that solve the well-known clustering problem. *K*-Means clustering is a part of data mining that used to classify most problem which happen in SMEs.

In this paper, *K*-Means algorithm which is implemented using Euclidean distance metric. Euclidean distance computes the root of square difference between coordinates of pair of objects (1). Orange software used to help compute and visualize the result of *K*-Means:

$$D(i,j) = \sqrt{(x_{1i} - x_{1j})^2 + \ldots + (x_{ki} - x_{kj})^2} \tag{1}$$

As the beginning of the data analysis process, the results of the SME questionnaires about problems they often face are grouped by using *K*-Means Clustering. *K*-Means Cluster Analysis is a non-hierarchical cluster analysis method that partition existing objects into one or more clusters or groups based on their characteristics. So the objects which have the same characteristics are grouped in the same cluster.

3.2. PIECES framework

The PIECES (Performance, Information, Economics, Control, Efficiency, and Services) framework provides an excellent outline for a problem statement. The goal is not to solve the problems, opportunities, and directives but to categorize them. Table 2 shown the explanation of PIECES (Whitten & Bentley, 2007).

Table 2. Classification of SME	
The PIECES Frameworks	**Explanation**
Performance	Performances requirement represent the performance system is required to exhibit to meet the need of users
Information	Information requirement represent the information that is pertinent to the users in terms of content, timelines, accuracy, and format.
Economy	Economy requirements represent the need for the system to reduce costs or increase profits.
Control (and service)	Control requirement represent the environment in which the system must operate, as well as, the type and degree of security must be provided.
Efficiency	Efficiency requirement represent the system's ability to produce output and minimal waste.
Service	Service requirement represent needs in order to reliable, flexible and expandable.

The results of the researcher and SMEs questionnaires about problems that they faced and the requirement of each are grouped based on PIECES category. Then It will be analyzed for alternative solutions that can currently be provided when the media (further research) can connect researchers and SMEs.

4. The results

4.1. Problems faced by the SMEs in Indonesia

Many things that SMEs need to improve their business. Based on the interview with SMEs, there are the 10 problems they faced in their business. They are marketing (customer satisfaction, segmentation, positioning), business opportunities, product development, market potential, internet/online business, business opportunities, information technology, HR management, design (product, packaging, logo, room, building, etc.), product launching, finance, and management company.

Based on these 10 things then do clustering to find out what research most wanted by SMEs to improve their business. Figure 1 is the result of clustering that has been done. First cluster (shown in purple spot) is marketing (customer satisfaction, segmentation, positioning). The second (orange spot) cluster is market potential and the third cluster (blue spot) is product development.

This result means most of problem faced by SMEs is marketing (customer satisfaction, segmentation, positioning). According to Yoshino and Taghizadeh-Hesary (2016), major challenges facing SMEs in Asia is lack of resources include of market access, market information, finance, technology, and skilled labor. It is the challenge for researchers to solve their problems.

The other countries also find the same thing, not only in Indonesia. SMEs in Turkey, faced the problems of marketing for the domestic and foreign market, finance problems, and managerial problem (Akdogan, Ozgener, Kaplan, & Coskun, 2012). Different problems in Nigeria, the problems faced by them are infrastructure, political and religious, lack of finance, managerial skills, environmental, and economy (Abeh, 2017).

SMEs give many contributions for economic growth. SMEs, including microenterprises, contributed 59.1% of nominal GDP in Indonesia in 2012 and now it is growing fastest (Yoshino & Taghizadeh-Hesary, 2016). So, they need research to improve their business.

This time SMEs does not do research very well. Although research considered important. Most of them only look and follow the trend of competitors and consumers. The easiest things to do is

Figure 1. Cluster research SMEs need.
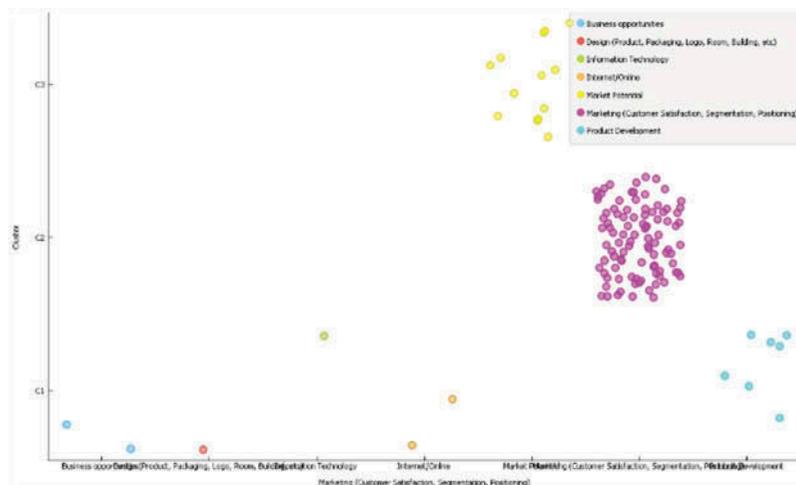
using the search engine functions like google. They did it to get instant results, although SMEs recognize simple research conducted over the internet does not provide maximum results. Another reason is that SME entrepreneurs do not need a complicated theory.

4.2. Requirements analysis SMEs and researcher

Based on the most problems faced by SMEs as seen as Figure 1, problem analysis needed. From Figure 1, SMEs need researchers to solve their problems. So they need a link or media to connect them to online. For the first step to developing it is doing requirement determination and problem analysis with PIECES framework. This framework is used to classify requirements into one of six subject areas, they are Performance, Information, Economics, Control, Efficiency, and Services. The goal of this model is to assure the system analyst and the user that the questions will be included during analysis about each of these six-essential subject as it relates to a problem domain.

The problem in Performance is problem-solving for SMEs takes a long time because of they are doing research by their self. Usually, they search their problem on Google or discuss with their college. It needed a long time. In addition, the researcher needs time to find research ideas or research place. Researchers find it difficult to get in touch with companies so it takes time to find a place which can receive research on their idea.

The information type, for all this time SMEs do not know the exact information about the research and what kind researchers can solve their problems. The same thing happens with researchers do not know the information of SMEs and the problems faced.

Economy type, costs are untraceable. The researchers spend big funds for their research but unfortunately, has not been fully adopted. Although collaboration with large companies sometimes the research results will not necessarily use.

Control (and security) type, sometimes decisions making errors are occurring in SMEs when they tried to solve a problem. Research is one of the important things so it can make good decisions. Fulfilled that decision in business is very important, where decisions can be taken based on experience and also complicated research. In addition to alternatives that available so affects the difficulty in decision making. Besides that, there is no control in SMEs while doing problem-solving stages.

Efficiency type, the effort required for SMEs to solve a problem are excessive. Beside that research usually cannot be adopted. During this time researcher must go to the company in place (location) from start offering ideas to carry out research.

Service type, sometimes problem-solving by SMEs is not accurate. Research with the only search on Google is easy to do and also does not have to spend many costs, but the results are only useful for short-term strategy.

The solutions from this problem shown in Table 3. In the performance type, SMEs and researchers will not require a long time either searching for research ideas to search location. Information about personal data both of SMEs and researchers will be transparent, problems that occur, until the progress of completion can also be known in real time. Researchers and SMEs can also minimize interaction in location because they can communicate via online.

When research has done for SMEs then there are three important quality information desired by SMEs. The three attributes of information quality required by the respondents (SMEs) are if the research is to be done then the result should be applicable to the business, the result must be able to present the required information (accurate) and information from the research result must be up to date. (Febriani et al., 2017)

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Table 3. Classification of SME		
Requirement types	**Explanation problems**	**Explanation solutions**
Performances	Problem solving for SMEs takes a long time because of they are doing research by their self. Researchers need time to search for research ideas or research sites	The system will be designed to respond to the users immediately. The researcher will not take a long time to search idea or sites. Information from the research result must be up to date
Information	SMEs do not know the exact information about the research and who the researchers can solve their problems Researchers do not know the information of SMEs and the problems that are being faced	SMEs and researchers would input the necessary information like personal data, track record research, SME's problem, etc. The system will send the recommendation who is the best researcher for their problem.
Economy	Costs are untraceable	SMEs and researcher will get the benefit while their connected. The benefit for SMEs is their problem solved and for the researcher, the result can fully adopt.
Control (and security)	Decisions making errors are occurring in SMEs when they tried to solve a problem There is no control in SMEs while doing problem-solving stages.	SMEs can control the progress research
Efficiency	Effort required for SMEs to solve problem are excessive Research that usually cannot be adopted	The system will be designed to have less user interaction in the location. SMEs can see the progress of the research by online research results can be adopted by SMEs
Service	Sometimes problem solving by SMEs is not accurate.	Every SMEs and researcher could access this media by online. The result must be able to present the required information (accurate)

For further research will continue from the requirement analysis, modeling (both data modeling and process), the system design to create a prototype. Further research will follow the system development life cycle (SDLC) stages. The prototype is a media that can connect between SMEs and researchers.

5. Conclusions

SMEs have been the main player in domestic economy activities in Indonesia, but they have a lot of problems while running their business. The problems they faced in business is marketing (customer satisfaction, segmentation, positioning), business opportunities, product development, market potential, internet/online business, business opportunities, information technology, HR management, design (product, packaging, logo, room, building, etc.), product launching, finance, and management company. From all this problem, the most of problem faced by SMEs is marketing (customer satisfaction, segmentation, positioning).

The requirement and problem analysis were done by PIECES framework. This framework is used to classify requirements both SMEs and researchers in one of six subject areas, they are Performance, Information, Economics, Control, Efficiency, and Services. The problem in performance is problem-solving for SMEs takes a long time because of they are doing research by their self and researcher needs time to find ideas or research place. For information type, SMEs do not know the exact information about the research and what kind researchers can solve their problems. The same thing happens with researchers do not know the information of SMEs and the problems faced.

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In economy type, costs are untraceable in SMEs and researchers spend big funds for research but unfortunately has not been fully adopted. In control (and security) type, sometimes decisions making errors are occurring in SMEs when they tried to solve a problem.

Efficiency type, the effort required for SMEs to solve the problem are excessive. Beside that research that usually cannot be adopted. Service type, sometimes problem-solving by SMEs is not accurate. Research with the only search on Google is easy to do and also does not have to spend many costs, but it is felt that the results of this research are only useful for short-term strategy.

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References
Abeh, O. (2017). The problems and prospects of small and medium scale enterprises (SMEs) growth and development in Nigeria: A study of selected SMEs in Delta State. *International Journal of Scientific Research in Education*, 10(103), 278–294.

Akdogan, M. S., Ozgener, S., Kaplan, M., & Coskun, A. (2012). The effects of consumer ethnocentrism and consumer animosity on the re-purchase intent: The moderating role of consumer loyalty. *EMAJ Emergency Mark Journal*, 2(1), 1–12. doi:10.5195/EMAJ.2012.15

Anoraga, P., & Sudantoko, H. (2002). *Cooperatives, entrepreneurship, and small business. Koperasi, Wirausaha, dan Usaha Kecil*. Jakarta: Penyalur Tunggal, Rineka Cipta.

Capó-Vicedo, J., Expósito-Langa, M., & Molina-Morales, F. X. (2008). Improving SMES competitiveness reinforcing interorganisational networks in industrial improving SMES competitiveness reinforcing interorganisational networks in industrial. *International Entrep Managed Journal*, 4(2), 147–169. doi:10.1007/s11365-007-0059-7

Febriani, E., Anggraini, R. D., & Dewobroto, W. S. (2017, November 07–09). Analysis of information quality attribute for SME towards adoption of research result. *Presented at the 10th ISIEM*. Belitung, Indonesia. doi:10.1088/1757-899X/277/1/012071

International Finance Corporation. (2016). Women-owned SMEs in Indonesia: A golden opportunity for local financial institutions. *World Bank*, no. March, 69.

Jauhari, J. (2010). Upaya Pengembangan Usaha Kecil Dan Menengah (Ukm) dengan Memanfaatkan E-Commerce. *Journal Sistem Information*, 2(1), 159–168.

Lu, J. W., & Beamish, P. W. (2002). The internationalization and growth of SMEs. *30th Annual ASAC Conference Winnipeg, Manitoba*, 86–96. Doi:10.1044/1059-0889(2002/er01)

McIntyre, G. (2017). What percentage of small businesses fail? (And other similar stats you need to know). [Online]. Retrieved Jan 22, 2018 from https://www.fundera.com/blog/what-percentage-of-small-businesses-fail

Mourougane, A. (2012). *Promoting SME development in Indonesia* (Vol. 995). OECD Economics Department Working Paper.

Sarwono, H. A. (2015). Business profile small and medium enterprises (SMEs). *Profil Bisnis Usaha Mikro, Kecil dan Menengah (UMKM)*.

Sefer, Ş., Savrul, M., & Ayd, O. (2014). Structure of small and medium-sized enterprises in Turkey and global competitiveness strategies. Procedia - Social and Behavioral Sciences, *150*(212), 212–221.

Tambunan, T. (2009). Development and some constraints of SME in Indonesia. *Center Industrial SME Bus Compet Studies University Trisakti*, 1(1), 1–9.

Terziovski, M. (2010). Innovation practice and its performance implications in small to medium enterprises (SMEs) in the manufacturing sector: A resource-based view. *Strategies Managed Journal*, 31(8), 892–902.

Tobergte, D. R., & Curtis, S. (2013). K-Means clustering algorithm. *Journal Chemical Information Model*, 53 (9), 1689–1699.

Wheelen, T. L., & Hunger, J. D. (2012). *Strategic management and business policy*. Pearson Prentice Hall

Whitten, J. L., & Bentley, L. D. (2007). *System analysis and design methods* (p. 765). University of California

Yoshino, N., & Taghizadeh-Hesary, F. (2016). Major challenges facing small and medium-sized enterprises in Asia and solutions for mitigating them. *ADBI Working Paper*, 564.

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