The Adoption of Critical Success Factors Theory and Resource-Based Theory to Increase Project Success

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ABSTRACT

The researchwasconductedto analyze the effects of the project resources on project success forgeothermal power plant construction projects in Indonesia. The research will provide contribution the project management area, especiallyin the effort to increase the current low project success rate in the said field.
The research method was quantitative type by using a questionnaire survey and interviews to collect the data. The critical success factors theory, "Factor" school of thought premise, the concept of grouping the project critical success factors, and the resource-based theory were appliedto develop the research model. The unit analysis was the completed power plant project. PLS-SEM was used for the data analysis and the hypothesis tests.
The study found that three project resources (foundation, support and process) increased the project success, while the fourth project resource (personnel) did not increase the project success. Personnel may increase the project success through project'scompetitive advantages. The fifth project resource (process flexibility) strengthened the effect of process on the project success.The results of this research are supported by the previous studies except for personnel. This study offers fiveproject resources, as groups of critical success factors,to be fulfilled bythe geothermal power plant construction projects project managers, to increase the project success.
The research model is strong and has predictive relevance. The result of this study cannot be applied other than for geothermal power plant construction projects inIndonesia. A larger number ofpower plant projects and respondents will increase the strength of the model.

Keywords
Construction project management, success criteria, critical success factors, foundation, support, personnel, process, flexibility, geothermal power plant.

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Introduction

Standish Group stated that only 17% of the total projects in software development in the United States were completed and satisfied the project requirements, 50% were completed with time overrun, greater costs, changed scope, and inappropriate performance, whereas the remaining 33% were canceled (Heagney 2012). About 70% of the construction projects in Saudi Arabia were completed but with a time overrun between 10% and 30% (Assaf and Al-Hejji 2006). Another study by(White and Fortune 2002) concluded that only 41% of the projects worldwide had been successfully completed.
The question arises as to why several projects are not successful. Some of the reasons are poor management and supervision in the field, unpredictable underground conditions, slow decision making, changes initiated by the project owner, and changes in the scope of work that needs to be done in Hong Kong's construction projects (Chan and Kumaraswamy 1997).
The construction of the power plant in Indonesia has been commonly contracted to the contractor in the form of a turn-key EPC (engineering, procurement, and construction) contract. The ultimate contract deliverable is the power plant unit(s) which shall deliver the agreed electricity generation output as written in the contract. For a typical flash system, the construction of a power plant has two sections in the main work scope. The first section is the steamfield above ground system (SAGS) and the second section is the power island. SAGS is the facility consisting of steam pipeline, brine/condensate pipeline, separator, scrubber, rock muffler, etc. The power island consists of a steam turbine with its generator and its essential systems.
There have been concerns raised by Indonesian geothermal power plant project practitioners on the delays and cost overruns in projects completed in Indonesia. A survey was conducted to see how they perceive the result of geothermal power plant construction projects in Indonesia. The result showed that 30% of the respondents agreed that projects were completed on schedule and 40% on budget(Sukardi 2019). This current low success rate needs to be increased.
The above studies and the survey demonstrated the challenges to achieving success in the construction projects. However, determining whether a project is successful or not is still unclear (Pinto and Slevin 1989). Several factors may affect the success of a project which researchers call themas critical success factors (Rockart 1979)(Bullen and Rockart 1981)(Rockart 1982). For projects, it was found hundreds on project critical success factors from many previous studies.These factors have been studied and proven to influence project successesin many different fieldsincluding construction projects. However, (Soderlund 2004) suggested that the "Factor" school of thought is appropriate for research and development projects.
The individual project critical success factors made project managers difficult to determine which will be applied for a project. A combination of the individual factors more predominantly affects the project success(Belassi and Tukel 1996). They grouped the project critical success factors into four groups to understand their impacts to the project success. However, their result did not explain whether and how the groups affectthe project success. Literatures on how

the groups of critical project success factors affect the project success are also limited.

In this study, five groups of individual project critical success factors were proposed, namelyproject foundation, support, personnel, process and process flexibility. The basis for thegroups naming and their contents were based on resource-based theory(Barney 1996). All of the groups are project organization resources which may affect the project success. The contents of each group was based on analysis and synthesizes of the previous studies. Specifically on flexibility, several previous studies gave different results for the effect of flexibility on project success(Andersen et al. 2006)(Shahu, Pundir, and Ganapathy 2012)(Kreiner 1995). Some researchers stated that flexibility had positive impact on project success, whereas others stated differently. Therefore, flexibility in the project process was used as a moderating variable to answer the gap.

Although research to analyze the effects of project critical success factors on project success are not new in project management field, theliterature limitation and the aboveresearch gaps are interesting areas that need to be explored and empirically tested in order to provide a possible solution to increase the project success rate for the geothermal power plant construction projects in Indonesia.

The Indonesia geothermal is very slow. The total installed capacity since 1983 is very small, namely 1,699 MW or only 5.96% in 2017 compared with the total 25.58 MW geothermal resource potential (ESDM-EBTKE 2017a)(ESDM-EBTKE 2017b). The Government of Indonesia has set an aggressive objective of 7,242 MW or 25% total installed capacity by 2025 (ESDM-EBTKE 2017a, b). This is a 5,543 MW increase for only an eight-year timeframe (2017–2025) or 693 MW per year, whereas the total installed capacity of 1,699 MW was achieved in 34 years (1983–2017) or 49 MW per year. There is a significant increase in the target per year which may not be easy to achieve. Even though there are reasons why geothermal power plant development in Indonesia is very slow, there is still no single agreement on the main contributor toward such slow development. It is believed that the delay and cost overruns during the construction of power plant projects also contribute to the overall project investment economics which ultimately affect the owner's decision on whether or not a particular geothermal development project is decided to go.

Literature Review

2.1 project management

Resources need to be provided to carry out the project management processes. At the same time, the processes are affected by project environments arising from internal and external factors, which may change throughout project performance. A project is planned according to a set of assumptions and also by considering the project environments. Assumptions are based on the needs of the client or project stakeholders which are inherently fuzzy, dynamic, and misunderstood (Kreiner 1995). These needs might change as the project progresses, and this gives rise to interim results. These effects and causes make the project performance very dynamic. The role of a project manager is to ensure that the project scope is well defined, processes are well carried out, resources are well planned, acquired, and utilized, and finally the intended outcomes are achieved. However, according to the agency theory, there is uncertainty as to whether the project manager can deliver the intended outcomes as expected. This is why a project management framework such as (PMI 2008)will assist project organization accomplishing the goals effectively.

2.2 Project Management Schools of Thought

In the effort to understand the development of research on project management, (Soderlund 2011) dividedthe research into 7 schools of thought or perspectives: Optimization, Factors, Contingency, Behavior, Governance, Relationship, and Decision.The "Factor" perspectiveis used in this research to provide basis for the five groups of individual project critical success factors which may affect the project success.

The main focus of the analysis in the "Factor" perspectivesis the success factors and project performance or results with an emphasis on investigating the project success criteria and also the success factors that lead to the success of the project. This school of thoughtstated that by determining project success criteria and project success factors, project management can be completed satisfactorily. The key questions or issues to be investigated from this perspective are what determines the success of the project.

2.3 Project Success Criteria

Project success criteria represent the measure used to estimate a success(Shokri-Ghasabeh and Kavousi-Chabok 2009). Providing benefits to owners and contractors, achieving business objectives, meeting defined objectives, meeting limits quality, producing results according to specifications that are still within budget and on time, and ensuring that all parties are happy during the project and also happy with the results are the six criteria for project success (Wateridge 1998).Fulfilling client requirements, on time, and within budget (White and Fortune 2002) are the project success criteria. Similar criteria as explained by (Zwikael 2008) thatproject shall have no schedule and no cost overruns, best performance in accordance with the requirements, and maximum level of owner satisfaction.

On the basis of the study results described above, and other studies not stated in this paper, it is concluded that time, cost, and quality criteria are the main criteria for determining the success of a project, as also mentioned by(Shokri-Ghasabeh and Kavousi-Chabok 2009). For decades, these three criteria have been commonly named as the Iron Triangle (Besteiro, Pinto, and Novaski 2015). In line with the complexity of the work and scientific development, the criteria for success were extended not only to those three criteria, but the use of the Iron Triangle, however, as a benchmark for project success has become the norm and is an established theory.

2.4 Project Critical Success Factors

The critical success factors was developed as an interview method (Rockart 1979), which was used by information

system executives to identify and define key areas of activity that executives need to know and fulfill in order to carry out their tasks successfully. The interview began with knowing the understanding of people being interviewed about the scope of the company's business, their tasks and functions, the company's goals, their objectives, and the things that need to be fulfilled to achieve the company's goals and their objectives. Critical success factor is a limited number of key activity areas, which, if fulfilled or done correctly and satisfactorily, can guarantee the competitive performance of individualsor organizations (Bullen and Rockart 1981). Critical success factors are areas that must be implemented or obtained properly to guarantee the success of a manager or an organization(Boynton and Zmud 1984). An organization will benefit from the identification and understanding of the critical success factors (Rockart 1979). The process helps managers focus on critical factors, which requires their management, forcing managers to make good measurements of these factors, enabling managers to understand the definition of each of these factors and how much it costs, preventing managers from only gathering information that is easily obtainable, and making managers understand that critical success factors can be temporary, specific for certain managers, and can change. This critical success factors concept has received very well acceptance from researchers and practitioners. This concept was implemented in several fields, including project management and also used as the basis for one of the schools of thought in project management studies(Soderlund 2011).

Authors found hundreds of project critical success factors which have been studied by previous researchers in their work. Those factors were analyzed and similar critical success factors were combinedinto one factor to come up with less than 100 factors. There has been no consensus so far among researchers on which factors influence the success of a project(Wateridge 1995).

Project foundation is the set of activities and data which provide the project organization strategic information to decide whether the project can proceed. This group represents individual project critical success factors which describes the establishment of project goals, policy and strategy(Iram, Khan, and Sherani 2016)(Munns and Bjeirmi 1996)(Pinto and Slevin 1987)(White and Fortune 2002)(Andersen et al. 2006)(Shenhar, Levy, and Dvir 1997)(Westerveld 2003), the approved project economics(Munns and Bjeirmi 1996)(Gupta, Gupta, and Agrawal 2013), the approved realistic project duration(Munns and Bjeirmi 1996)(Gupta, Gupta, and Agrawal 2013)and project cost(Allen et al. 2014)(White and Fortune 2002), the identification process of stakeholder requirements (Authors), the clearly defined scope(Allen et al. 2014)(Shokri-Ghasabeh and Kavousi-Chabok 2009)(Nasr, Diekmann, and Kuprenas 2000)(Ahmed and Kangari 1995)(Khan 2006)(Dalcher 2012), and the approved responsibility matrix(Munns and Bjeirmi 1996)(Pinto and Slevin 1987)(Allen et al. 2014).

Project support is the internal and external supports which are needed for project organization to carry out and complete the project in accordance to the agreed criteria. The group represents individual project critical success factors which describes top management support on providing the required personnel (Zwikael 2008)(Munns and Bjeirmi 1996)(Alexandrova and Ivanova 2012)(White and Fortune 2002)(Ogwueleka 2011)(Shokri-Ghasabeh and Kavousi-Chabok 2009)(Iyer and Jha 2005)(Shenhar, Levy, and Dvir 1997)(Kloppenborg, Tesch, and Manolis 2011)(Allen et al. 2014)(Bryde 2008)and the local government and local non-government organization support(Dalcher 2012)(Pinto and Slevin 1987)(Nguyen, Ogunlana, and Lan 2004)(Andersen et al. 2006)(Yamin and Sim 2016)(Iyer and Jha 2005)(Shenhar, Levy, and Dvir 1997)(Westerveld 2003).

Project personnel is the project manager and the project team members with their capabilities and motivation. The group represents individual project critical success factors which describes the project manager and project team members'work performance(Nasr, Diekmann, and Kuprenas 2000)(Turner and Muller 2005), the project manager and project team members' work ethics and attendances(Kanfer 1990)(Ahmed and Kangari 1995), the project manager and project team members' technical capabilities, and the project manager non-technical capability(Munns and Bjeirmi 1996)(Allen et al. 2014)(Alexandrova and Ivanova 2012)(Iyer and Jha 2005)(Belassi and Tukel 1996)(Pinto and Slevin 1987)(Turner and Muller 2005)(White and Fortune 2002)(Dainty, Cheng, and Moore 2005)(Shokri-Ghasabeh and Kavousi-Chabok 2009)(Iram, Khan, and Sherani 2016).

Project management process is the project phases and their activities from the initiation to the closing. The process group represents individual project critical success factors which describes the socialization program of the approved project plan (Authors), the identification of related regulations (Authors), the regulations compliance performance(Alexandrova and Ivanova 2012), effective conflicts handling(White and Fortune 2002)(Pinto and Slevin 1987), and effective control of project quality, schedule, and cost(Allen et al. 2014)(White and Fortune 2002)(Andersen et al. 2006)(Yamin and Sim 2016)(Iyer and Jha 2005).

Process flexibilityis the willingness and the capability of the project organization to handle the changes during the project execution. The group represents individual project critical success factors which describes the avoidance of making main scope changes in the mid to final project stage(Olsson 2006), the making of changes which has small impact on quality, schedule, and cost (Authors).

2.5 Resource-Based Theory

The term of resource-based theory(RBT) was introduced by Barney (Barney 1996) in 1996 based on the resource-based view concept (Wernerfelt 1984), his article on firm resources and sustained competitive advantage (Barney 1991), and many other resource-based preceding theories. RBT is a theory that explains why a company has better performance compared to other companies. RBT states that a company can achieve superior performance if it has a VRIO (valuable, rare, imperfectly imitable, and organizationally exploited) resources which are also as a source of sustained competitive advantage (Barney and Clark 2007).

Resources are defined as all assets, abilities, organizational processes, properties/attributes, information, knowledge, etc.

controlled by the company to understand and implement strategies in an effort to improve company efficiency and effectiveness (Barney 1991). The resources are divided into three categories, i.e. physical capital resources, financial capital, human capital resources, and organizational capital resources (Barney and Clark 2007).The RBT is adopted to explain the relationship between the groups of project critical success factors, as project organization resources, with project success. Company performance is an equivalent to the project organization's performance, which is the success of the project itself in terms of quality, time, and cost.

Research Method

This study is a quantitativeand explanatory research study (Creswell 2016)(Sekaran and Bougie 2013). "Factor" school of thought, project critical success factors, and RBT were used to see whether the five groups of individual factors influencedthe geothermal power plant construction project success. The hypotheses of this research were that foundation, support, personnel, and process increased project success, and process flexibility strengthened the effect of process on project success.

Foundation consisted of individual project critical success factors illustrating the strength of the basis and the reasons why the project is implemented. It had 3 indicators: formulating the project basis, making the project plan, and making the project scope. Support consisted of individual project critical success factors illustrating internal and external assistance needed by the project team to implement and complete the project. It had 3 indicators: top management, external, and project team support. Personnel consisted of individual project critical success factors illustrating the competence of project managers and team members to carry out and complete projects. It had 3 indicators: performance, motivation, and capability. Process consisted of individual project critical success factors that are required to carry out project management, from initiation, planning to closing. It had 4 indicators: making detailed project plan, regulations compliance, conflicts handling, and project control. Process flexibility consisted of individual project critical success factors that are required to enable team handling the changes throughout the project duration. It had 1 indicator which is performing the flexibility in process.

A questionnaire form was used to collect the respondents' perceptions, using a 5-point Likert scale (1. Strongly Disagree, 2. Disagree, 3. Neutral, 4. Agree, 5. Strongly Agree). The questionnaires were developed by having interviews with informants for the content validity.Avalidity testwas performed by using SPSS and has met the requirement where the corrected item-total correlation of all indicators were above 0.3. The reliability test was performed by using SPSS and has met the requirement where Alpha Cronbach of all variables were above 0.6.

The population was the completed geothermal power plant units in Indonesia which are 44 units. For data collection, the census method was used, and no samples were taken when the size of the population was less than 50(Cooper and Schindler 2003). The respondents were,at minimum, manager level,holding different job functions when involved in the projects. Face-to-face discussions were conducted with some of the respondents in order to obtain less bias and more accurate answers. One questionnaire form was intended for a specific one unit of power plant construction project. From the returned filled form, an exact number of surveyed power plants cannot be calculated since some answers did not provide the project name due to confidentiality. However, it was predicted that the returned filled questionnaire forms represented 36% of the population.

The data analysis and hypothesis tests used PLS-SEM with Warp-PLS Version 6(Kock 2019). The steps followed guidance as provided by (Hair et al. 2014)(Solimun, Fernandes, and Nurjannah 2017) which evaluates the outer model, the inner model, and the hypothesis tests.The outer model evaluation used 3 criterion: convergent validity, discriminant validity and reliability. Convergent validity test requires that the factor/outer loadings is above 0.5 and the Average Variance Extracted (AVE) is above 0.5. The evaluation has been performed and satisfied the convergent validity requirement. To satisfy the discriminant validity requirement, each of the variable's AVE must be more than the square root of AVE on the correlation of such variable with other variables. The test has been performed and met the discriminant validity requirement.The reliability test had been performed and met the requirements of Alpha Cronbach of more than 0.6 and composite reliability of equal or more than 0.7.The inner model evaluation used model fit & quality indices, R2, Q2, and f2.From the evaluation, all the requirements had been satisfactorily fulfilled where the R2 and Q2 values are 0.720 and 0.721 consecutively which indicated that the developed model is strong and has predictive relevance. The last evaluation was the hypothesis tests. The evaluation used a significance level of less than or equal to 5%. The results are shown in the Figure 1.

Findings and Discussion

4.1 Indonesian Geothermal Power Plants

The geothermal power plants construction in Indonesia began in 1983. The first 30 MW power plant to operate was KAMOJANG Unit 1 in February 1983. By the end of 2019, the total number of power plants was 44 units with a total installed capacity of 2,023 MW or 7.08%.

4.2 Results and Discussion

The hypothesis tests result is shown in Figure 1below which showed foundation, support, and process increased project success, while personnel did not increase project success.

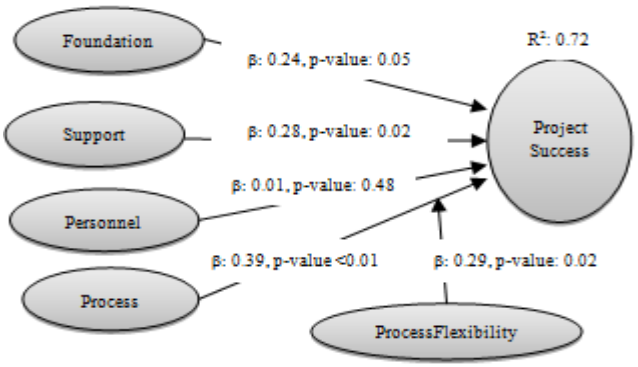

Figure 1: Hypothesis Tests Result

Firstly, project needs strong foundation to increase its success. Project organization must formulate clear project goals (Iram, Khan, and Sherani 2016)(Pinto and Slevin 1987)(White and Fortune 2002)(Andersen et al. 2006), right strategy (Westerveld 2003)and have acceptable project economics(Munns and Bjeirmi 1996)(Gupta, Gupta, and Agrawal 2013). Those will be done if the project organization forms the project organization(Munns and Bjeirmi 1996)(Iyer and Jha 2005)(Zwikael 2008)(Bryde 2008). Project organization must then make the project plan, especially the realistic schedule plan(Allen et al. 2014)(Nasr, Diekmann, and Kuprenas 2000)(White and Fortune 2002)(Pinto and Slevin 1987)(Gupta, Gupta, and Agrawal 2013), and the realistic budget plan (White and Fortune 2002)(Allen et al. 2014)(Nguyen, Ogunlana, and Lan 2004). Finally, project organization must develop a good project scope(Nasr, Diekmann, and Kuprenas 2000), clear(Shokri-Ghasabeh and Kavousi-Chabok 2009)(Nguyen, Ogunlana, and Lan 2004), well defined (Munns and Bjeirmi 1996)(Pinto and Slevin 1987),focus and not too wide(Mirzaa, Pourzolfagharb, and Shahnazaric 2013)(Khan 2006), with clear boundaries (Andersen et al. 2006), and clear responsibilities matrix (Allen et al. 2014).

In terms ofproject support, project organization must obtain strong support from top management(Munns and Bjeirmi 1996)(Alexandrova and Ivanova 2012)(White and Fortune 2002)(Shokri-Ghasabeh and Kavousi-Chabok 2009)(Iram, Khan, and Sherani 2016)(Nguyen, Ogunlana, and Lan 2004)(Ogwueleka 2011)(Shenhar, Levy, and Dvir 1997)(Zwikael 2008). Project must also get strong support from local government and local non-government organization (Yamin and Sim 2016)because they can provide political support (Pinto and Slevin 1987) andconducive environment(Iyer and Jha 2005). Their intense involvement (Nguyen, Ogunlana, and Lan 2004) will increase the project success.

In the area of project management process, a structured, good, and formal approach in project implementation is needed to increase project success(Andersen et al. 2006). Upon management approval for the project to start, any subsequent efforts for planning are also required from the early stages of the project itself (Ahmed and Kangari 1995). The formulation of project plans and project management is one of the critical success factors for the project (Munns and Bjeirmi 1996)(Pinto and Slevin 1987)(Shenhar, Levy, and Dvir 1997)(Allen et al. 2014)(Westerveld 2003)(Iram, Khan, and Sherani 2016). Project organization should also carry out the identification of any relevant regulations. Not only that, project organization needs to comply with the regulations during project performance (Alexandrova and Ivanova 2012). Project organization needs to manage and solve problems and conflicts effectively (Pinto and Slevin 1987)(White and Fortune 2002). This can be achieved with communication and interaction that is clear, effective, and intense (White and Fortune 2002)(Lindhard and Larsen 2016)(Andersen et al. 2006)(Zuppa, Olbina, and Issa 2016)(Pinto and Slevin 1988)(Iyer and Jha 2005)(Ziek and Anderson 2015)(Ziek and Anderson 2015), effective feedback (White and Fortune 2002)(Iyer and Jha 2005)(Nasr, Diekmann, and Kuprenas 2000), and the management of stakeholders (Westerveld 2003).

The execution, monitoring, and control of processes will not be effective without coordination (Pinto and Slevin 1987). To cope with the learning curve issue during execution, sharing past experiences among team members will be important (White and Fortune 2002). As part of execution and monitoring, consultation with and acceptance by clients is required to ensure that the project milestones are in accordance with the plan (Pinto and Slevin 1987), and used as a tool for managing project objectives and, at the same time, managing project risks (Ogwueleka 2011), (Shokri-Ghasabeh and Kavousi-Chabok 2009). Overall, monitoring project performance against budget, schedule, and quality is required for project success (Allen et al. 2014), and this activity will of course require control function (Shokri-Ghasabeh and Kavousi-Chabok 2009)(Shenhar, Levy, and Dvir 1997).

A structured, good, and formal process of the project will not lead to a completion if it is not well administered (Zachau 1984). If the project organization carries out the project management process properly – from making the project plan and ensuring its availability to all members of the project team, identifying and complying with relevant regulations during project implementation, managing conflicts properly, and continuously exercising control over quality, time, and cost – the success of geothermal power plant projects in Indonesia can be increased, which involves achieving quality in accordance with specifications or scope and being on time and within budget.

Secondly, this research found that personnel did not increasethe project success. This result does not support previous studies such as(Crawford 2005)(Anantatmula 2010)(Nasr, Diekmann, and Kuprenas 2000)(Ahmed and Kangari 1995)(Kanfer 1990)(Oberlender 2000)(Munns and Bjeirmi 1996)(Allen et al. 2014)(Alexandrova and Ivanova 2012)(Iyer and Jha 2005)(Turner and Muller 2005)(White and Fortune 2002)(Pinto and Slevin 1987)(Dainty, Cheng, and Moore 2005)(Shokri-Ghasabeh and Kavousi-Chabok 2009)(Iram, Khan, and Sherani 2016). This finding can be explained by resource-advantage theory of competition (RATOC) (Hunt and Morgan 1995)(Hunt 1995).

RATOC states that if a company has heterogeneous, imperfectly mobile, and unique resources, it will be able to produce comparative advantage provided thatsuch resources are able to produce superior products and at lower costs. These characteristics are similar to VRIO concept. If the company achieved the comparative advantage position in resources, it will gain a competitive advantage position and be able to produce a superior performance. In the context of

project management, superior firm performance is the success of the project itself, with criteria of meeting the planned quality, planned completion time, and planned cost. To increase the project success,project personnelmust be able to drive the project organization into a competitive advantage position by formulating and implementing the right strategy, exploiting the other resources, and managing the process efficiently and effectively. It is all the duty of the project manager and the team members, supported by the project sponsors. Otherwise, project success improvement will not be achieved.

Thirdly, this research found that process flexibility strengthened the relationship between process and project success. Even though project organization has a good plan, uncertainties and changes will always arise during project execution. These uncertainties and changes can originate from underground surface conditions, lack of water from the ground, rivers drying faster than expected, differences in estimation results and realization of quantities, potential for accelerating work by carrying out different methodologies, communication and coordination that is not in accordance with the plan, contractor performance that is not in line with expectations, responses from the community that are less positive, changes in local regulations, or the effects of nature such as abnormal rainfall that causes delays or floods, or even earthquakes.It is not advisable to stop the project if the uncertainties and changes that occur can still be controlled. To that end, application of the concept of flexibility is needed to deal with changes and uncertainties in the project environment(Kreiner 1995)(Shokri-Ghasabeh and Kavousi-Chabok 2009)(Shenhar, Levy, and Dvir 1997)(Nasr, Diekmann, and Kuprenas 2000)(White and Fortune 2002).

Conclusion and Implications

To increase its success rate, the geothermal power plant construction project needs to have strong project foundation, strong project support from top management as well as from local government and local non-government organization, as well as a clear and structured process but flexible to handle the changes with the least impact to the project success criteria. Competent project personnel are required since they may increase the project competitive advantages which leads to the improvement of the project success.

The novelty of this study is the strong research model integratingthefour theories which is able to clearly explain and predict the effects of project resources, as groups of project critical success factors,on project success for the geothermal power plant construction projects. The overall study result provides new insight to the project managers and all project stakeholders to ensure the success of the geothermal power plant construction project. A further research can be conducted to test the effect of project personnel on project success through project competitive advantages as the mediating variable.

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