A Comprehensive Stakeholder-Typology Model Based on Salience Attributes in Construction Projects

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Abstract: This article presents a comprehensive project stakeholder typology model (PSTM) based on stakeholder salience attributes (SSAs). Stakeholders are considered as one of the major pillars of construction projects and management of stakeholders is essential to effective project management in the construction industry. A literature review of stakeholder typology and management models was conducted to identify all the different SSAs that are being applied. This analysis revealed important variation in the attributes, models, and frameworks. A questionnaire survey and semistructured interviews were conducted to fulfil the research purpose. Based on a Venn-diagram analysis of data, we suggest a clear and nonoverlapping SSAs framework to be used in construction projects. We also propose a project stakeholder typology model based on SSAs. The results indicated that PSTM divides stakeholders into 15 different types based on four attributes, namely Potency, Legitimacy, Urgency, and Proximity. It is expected that the results of this study can be used by practicing professionals such as project managers when identifying, categorizing, and managing stakeholders in construction projects. **DOI: 10.1061/(ASCE)CO.1943-7862.0001684.** *© 2019 American Society of Civil Engineers.*

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Introduction

This article is about stakeholder typology in construction projects. Project stakeholders are the individuals, groups, or organizations that have a stake or interest in project activities or outputs (Rajablu et al. 2015). Therefore, stakeholders are considered as one of the major pillars of construction projects and management of stakeholders is an important issue in these projects (Dağlı 2018; Yang et al. 2009; Yu and Leung 2018).

A key initial issue in stakeholder management is identification of stakeholder attributes (Yang et al. 2016), i.e., categorization of the stakeholders based on their salience attributes to determine how to manage or communicate with the different stakeholders (Mitchell et al. 1997). Therefore, a precondition for typologizing stakeholders is to identify their salience attributes (Mitchell et al. 1997; Preble 2005).

There exist a number of models, frameworks, and methods that classifying stakeholder salience attributes (SSAs) and stakeholder typology as central (Aapaoja and Haapasalo 2014; Yu and Leung 2018). However, comparing previous studies reveals the fact that the various SSAs included in some models are not mentioned in others. After reviewing the results of these studies, we found that there are considerable differences among them; thus, they confuse those who need SSAs and stakeholder typology, especially in more complex projects. As an example of attribute difference, the Project Management Institute defined urgency as the "need for immediate attention, either time-constrained or relating to the stakeholders' high stake in the outcome" (PMI 2017, p. 513), while Aapaoja and Haapasalo (2014) and Fummey (2017) believed that "urgency can be understood as an interest of the stakeholder" without paying immediate attention to the stakeholder needs. Another research gap is that none of the typology models includes all the key attributes mentioned in the previous. In some studies, an aggregate of SSAs of several models has been used to bypass this problem. For example, Yang et al. (2014) believed Power, Legitimacy, Urgency, and Proximity are influential stakeholder attributes. The application of this approach is erroneous and does not yield clear results.

While the body of literature on stakeholder categorization is impressive, far less has been done to integrate this knowledge into a comprehensive framework. There is no model or method currently available that can help managers in construction projects to effectively identify all clear and nonoverlapping SSAs. Hence, the purpose of this article is to identify SSAs that have a clear, accurate, and nonoverlapping boundary and to develop a comprehensive project stakeholder typology model (PSTM) based on the SSAs.

The research was carried out as both a quantitative and qualitative study and it contributes to the construction management literature. First, the comprehensive literature review of stakeholder typology models offered a useful lens to understand all the different SSAs that are being applied. This analysis revealed important variation in the attributes, models, and frameworks. Second, we combine the insight from the qualitative study and knowledge about stakeholder typology to suggest a clear and nonoverlapping SSAs framework to be used in construction projects. Third, we propose a comprehensive PSTM based on SSAs.

The overall structure of the article is as follows. In the next section we review insights from the literature on SSAs and stakeholder typology models. We then present the research methodology and the process of collecting data. This is followed by the data results

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where we present the analysis using a Venn diagram, redefine SSAs, and propose a new stakeholder typology model. Finally, we discuss and conclude how this model can help in understanding and managing stakeholders in construction projects.

Stakeholder Concept

The literature on stakeholder theory and concepts clearly reveals the turbulence of scholars' opinions about stakeholder definition and typology criteria. According to Cleland (1998), stakeholders are the individuals or groups that either have a legitimate claim to some aspects of the project or they think that their claims are legitimate. Freeman (1983), Mitchell et al. (1997), and Eskerod et al. (2015) defined stakeholder as "individuals or groups that affect or are affected by the process, content, or outputs of a project." According to the PMI (2017, pp. 504–505): "Every project has stakeholders who can impact, are impacted by, or perceive that they will be affected by the work or outcomes of the project in a positive or negative way."

Stakeholder Salience Attributes

The concept of stakeholder salience was introduced by Mitchell et al. (1997) as a response to the many competing definitions of stakeholder and the lack of an agreement about who and what really counts for defining stakeholders and their salience. They proposed a new theory of stakeholder identification based on three attributes: Power, Legitimacy, and Urgency. Power refers to the ability to control resources, create dependencies, and support the interests of some group members or groups over others. Legitimacy refers to the perception or assumption that the actions of an entity are desirable, proper, or appropriate within a socially constructed system of norms, values, beliefs, and definitions. Finally, Urgency refers to the degree to which stakeholder claims call for immediate attention. This attribute determines both the dynamics of stakeholder salience and the interactions between stakeholders. Drawing from Mitchell et al. (1997), Bourne (2005) developed a model where Power, Proximity, and Urgency were the SSAs. She defined Power, Proximity, and Urgency respectively as "high capacity to formally instruct change (i.e., can have the project stopped)," "directly working in the project (e.g., team members)," and "immediate action is warranted irrespective of other work commitments." Bourne did not include Legitimacy in her model; according to Beetham (1991), Legitimacy can be explained by Power if a stakeholder is capable of establishing conformity rules, justifying the rules by reference to shared beliefs, and obtaining the consent of subordinates. In analyzing the SSAs, Yang et al. (2011a) found that empirical studies showed that practitioners thought that the attribute of Legitimacy was imprecise and difficult to operationalize, and they preferred using the attribute Proximity, which was easier to explain and put into practice.

Prior research has recognized power as an important attribute to study stakeholders. For example, Lovell (1993) and Pinto (1998) used Power as an important attribute for describing stakeholders' importance. They defined Power as "the ability to influence others and to get things done." A slightly different perspective to understand stakeholders was introduced when Jeffery (2009) focused on attributes such as stakeholder influence and interest to define discrete groups and prioritize stakeholders. He defined those respectively as "ability of stakeholders to galvanize public interest and receptivity of the public to an issue," and "the degree to which stakeholders are motivated by and mobilize around an issue." Mostafa and El-Gohary (2014) defined Influence as a function of

Interest and Power, e.g., a stakeholder that has high levels of power and interest would in turn have a high influence on a project's decisions.

Others such as Chinyio and Olomolaiye (2010, p. 89) argue that understanding the impact of stakeholders involves two dimensions: Power and Interest. They claim that the more powerful a stakeholder is, the more damage his influence might cause to the project and the more interest a stakeholder has in the project, the more active the stakeholder may be in project activities and the more uncertainties this will bring to the project. Therefore, different scholars have had different views on SSAs and their definitions.

Stakeholder Typology Models

In accordance with each group of SSAs, the scholars have provided different stakeholder typology models. A stakeholder typology model is aimed to display who really counts and what SSAs really describe and distinguish stakeholders in managers' perception for identifying, analyzing, communicating with, and managing them (Elias 2016; Mitchell et al. 2017).

In all fields of management and social science, researchers try to present the phenomenon in the form of a model or framework; because in this situation the phenomenon is more understandable (Park and Ahn 2012). Similarly, so far in the field of stakeholder management, researchers have presented several models or frameworks for various specific purposes. Table 1 shows the most well-known stakeholder typology models with their attributes.

Research Method and Data Analysis

This research study used multiple methods including a literature review, a questionnaire survey, semistructured interviews, and a Delphi method.

Fig. 1 shows the flow of overall research process that is divided into seven steps. As part of Steps 1 and 2 we performed a literature review to specify SSAs and components of each attribute. In Step 3 a combination of questionnaire survey and semistructured interviews were performed to determine the assignment degrees between each component and each attribute. In Step 4 we separated the prominent assignment degrees. In Step 5 we draw Venn diagrams for the attributes, and in Step 6 we used a Delphi method to analyze the Venn diagrams and redefine the attributes. In Step 7 we suggest new attributes for use in construction projects and propose a new project stakeholder typology model.
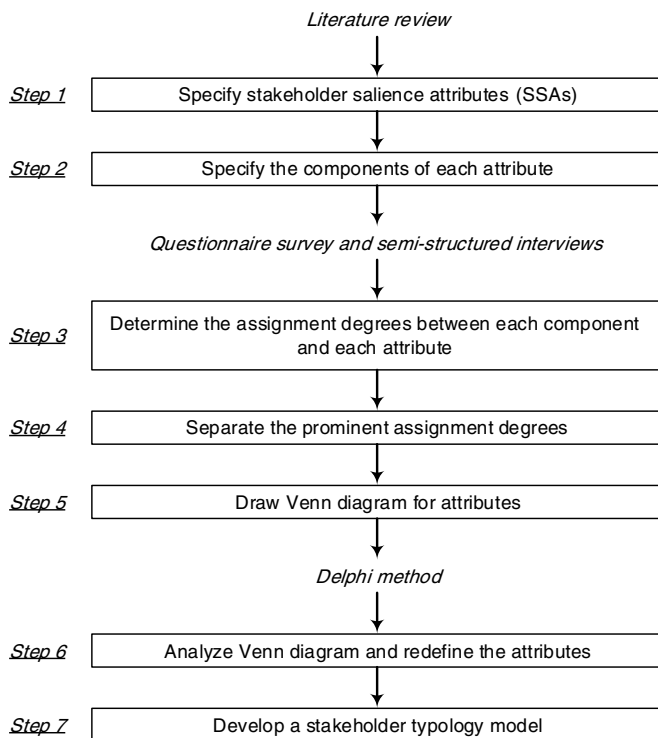
Data Collection

In order to select respondents and participants, first, we found relevant experts through the websites of journals, universities, and construction companies and corporations in Iran. After investigating their curriculum vitae (CV), we identified 92 experts with practical and educational experience in large construction projects (a project with a total budget more than $1 million) in private and public sectors. After contacting them, 74 experts agreed to participate in the information/data collection process. However, finally, only 66 experts participated in the process of collecting information and data.

Among these 66 experts, we selected 14 key persons who were subjected to the semistructured interviews and the Delphi panel method. It is sufficient for the semistructured interviews and Delphi method that 10–20 experts with high practical and educational experience participate (Kwok and Lau 2018; Yang and Shen 2014). The following criteria were used in the selection: (1) each candidate

Table 1. Stakeholder typology models

Researcher(s)	Stakeholder typology model	Description
Polonsky (1996) and Wong et al. (2005)	Relative cooperative potential/ relative competitive threat matrix	The model evaluates each stakeholder on two dimensions: their potential to (1) cooperate with the project; and (2) threaten the project. Note that each stakeholder may have both of these abilities (dimensions).
Mitchell et al. (1997) and PMI (2017, p. 513)	The three-attribute model (TAM) of stakeholder typology	They believed that stakeholder identification and salience would be determined by three attributes: Power, Legitimacy, and Urgency. In addition, these attributes have reasonable empirical and social support. Although Power and Legitimacy may fluctuate, Urgency can provide a chronological that links one event of potential interest to a specific time. Mitchell et al. (1997) argued that Urgency consists of two attributes: Time sensitivity and Criticality. They classified stakeholders based on these three attributes to seven different types: dormant, discretionary, demanding, dominant, dangerous, dependent, and definitive.
Manowong and Ogunlana (2010), Newcombe (2003), Olander and Landin (2005), and Yu and Leung (2018)	Power/interest matrix	They applied the Power/interest matrix for stakeholders' classification and identification. This model classified stakeholders into four groups based on their Power and Interest level.
Bourne (2005)	Stakeholder circle methodology	She studied the relative importance of stakeholders with the three attributes of Power, Proximity, and Urgency and introduced stakeholder circle methodology. Since then, some researchers have used Proximity instead of Legitimacy or both together (Rajablu et al. 2015; Yang et al. 2011b).
Bourne and Walker (2005) and El-Sayegh (2014)	Impact/probability of impact matrix	They believed that it is not easy to assess stakeholder Power and Interest; therefore, they proposed using Impact instead of Power on a scale. Because the level of interest determines the probability of stakeholder influencing the decisions of the project, they introduced Probability of Impact instead of Interest (Olander 2007). Ward and Chapman (2003) believed that the use of Impact leads to more success in projects because it provides an excellent method for risk assessment in construction projects.

Literature review

Step 1 — Specify stakeholder salience attributes (SSAs)

Step 2 — Specify the components of each attribute

Questionnaire survey and semi-structured interviews

Step 3 — Determine the assignment degrees between each component and each attribute

Step 4 — Separate the prominent assignment degrees

Step 5 — Draw Venn diagram for attributes

Delphi method

Step 6 — Analyze Venn diagram and redefine the attributes

Step 7 — Develop a stakeholder typology model

Fig. 1. Main research process.

Table 2. Characteristics of participants for semistructured interviews/ Delphi

Characteristic	Type	Participants
Career expertise	Project manager	6
	Project management consultant	8
Specialization field	Metro construction project	3
	Large building construction project	5
	Dam construction project	3
	Highway construction project	3
Education	Project management	9
	Construction engineering and management	5

Note: All experts were Iranian with 12–19 years' experience in large construction projects, and had a Ph.D. degree and PMP certification. They were fluent in the English language [They had at least one of these qualifications: IELTS (6.5), TOEFL (85), or MSRT (50)].

and (4) each candidate had good English language skills (because the attributes and components were in English, this criterion was essential). The other 52 experts were selected as respondents to the questionnaire survey. Tables 2 and 3 show the characteristics of participants and respondents.

Literature Review and Step 1: Specifying SSAs

A literature review was conducted to identify all SSAs used in the literature. The literature review included search in databases such as Scopus, Web of Science, Science Direct, ABI/Inform, JSTOR, and Google Scholar. The searches were limited to English language journal articles and included keywords in the title, abstract, keyword, or models.

had more than 10 years of practical experiences in large construction projects; (2) each candidate had either a master's or a Ph.D. degree in the field of project/construction management; (3) each candidate was project management professional (PMP) certified;

Table 3. Characteristics of respondents for questionnaire survey

Characteristic	Type	Respondents
Career expertise	Project manager	7
	Project management consultant	22
	Manager in project-oriented organizations in the field of construction projects	9
	Project human resources manager	14
Specialization field	Metro construction project	11
	Large building construction project	17
	Dam construction project	9
	Highway construction project	15
Education	Project management	16(M.Sc.) and 13(Ph.D.)
	Construction engineering and management	17(M.Sc.) and 6(Ph.D.)

Note: All experts were Iranian with at least 8 years' experience in large construction projects. They were fluent in the English language [They had at least one of these qualifications: IELTS (6.5), TOEFL (85), or MSRT (50)]. Also, 29 experts (56%) had PMP certification.

Table 4. Stakeholder salience attributes

Salience attribute	Source
Power	Eskerod et al. (2015), Johansen et al. (2014), Lin et al. (2018), Mitchell et al. (1997), and Mok et al. (2015)
Legitimacy	De Alwis (2016), Mitchell et al. (1997), Miles (2015), Neville et al. (2011), and Yu and Leung (2018)
Urgency	Clifton and Amran (2011), Järlström et al. (2018), Mitchell et al. (1997), Yang and Shen (2014), and Valentin et al. (2018)
Influence	Aaltonen (2011), Bourne and Walker (2006), Miles (2015), Molwus et al. (2014), Mok et al. (2017), and Mok et al. (2015)
Impact	Aapaoja and Haapasalo (2014), Yang et al. (2014), El-Sawalhi and Hammad (2015), and Clifton and Amran (2011)
Proximity	Bourne (2009), Chinyio and Olomolaiye (2010), Miles (2015), Walker et al. (2008), and Yang et al. (2011b)
Contribution	Aaltonen (2011), Aapaoja and Haapasalo (2014), Bourne (2009), Eskerod et al. (2015), Mitchell et al. (1997), Mainardes et al. (2012), and PMI (2017, p. 512)
Criticality	Aapaoja and Haapasalo (2014), Aaltonen et al. (2015), Friedman and Miles (2006, p. 95), Ribeiro Soriano et al. (2011), and Mitchell et al. (1997)
Time sensitivity	Aapaoja and Haapasalo (2014), Friedman and Miles (2006, p. 95), Kivits (2011), and Mitchell et al. (1997)
Interest	Bourne and Walker (2005), Johansen et al. (2014), Martinez and Olander (2015), Mok et al. (2015), and Yu and Leung (2018)
Support	Aaltonen (2011), Bourne and Weaver (2010), Mattingly and Greening (2002), Miles (2015), Mok et al. (2015), and Mitchell et al. (1997)

Salience indicates the degree that would affect the managers' decisions. Managers will prioritize stakeholders' competing claims based on their salience in order to respond to them faster (Järlström et al. 2018). Prioritization of project stakeholders is evaluating their relative importance (Bourne 2005). So far, extensive studies have been done to identify types of stakeholders and distinguish between them. Many theorists and researchers have persistently tried to classify and typologize a phenomenon by its constituent attributes to make it more understandable and more transparent (Niknazar and Bourgault 2017). Because SSAs are the constituent attributes of stakeholder typology, the first step is to specify SSAs.

Table 4 shows the result of the literature review, and attributes applied in previous studies, either explicitly or implicitly. The identified SSAs include Power, Impact, Influence, Support, Contribution, Legitimacy, Proximity, Urgency, Time sensitivity, Criticality, and Interest.

Step 2: Specifying the Components of Each Attribute

Components are the constituent parts of an attribute. Generally speaking, components are the smallest separable parts of an attribute, which are derived from the definitions of that attribute in the literature.

After an extensive literature review and by referring to the definitions of stakeholders and SSAs in construction projects, we identified 37 different components of SSAs used in previous studies. In Table 5 all 37 components have been listed.

Step 3: Determining the Assignment Degrees between Each Component and Each Attribute

If the components of Attribute A could not be assigned to another attribute and the components of other attributes could not be assigned to Attribute A, it is said that Attribute A has a clear and accurate boundary. In the literature, Attribute A might have an overlap with other attributes in a typology model; i.e., the components of Attribute A are shared with other attributes.

In this study, the appropriateness of assigning a component to an attribute is called the assignment degree. To determine the assignment degrees, we referred to experts. Table 6 shows rating scales for assignment degrees in this study.

In this step, we used multiple methods concurrently. We believe this research approach has increased the accuracy, validity, and reliability of our collected data (Motoyama and Mayer 2017). For this purpose, a questionnaire survey was conducted where 52 experts were asked about the assignment degree between each component and each attribute. In the questionnaire surveys, a matrix was established in which a row represents Component i and a column represents Attribute j. Then, the experts were asked to determine assignment degrees between each component and each attribute by the Likert scale data presented in Table 6. Due to a large number of questions, the questionnaires were distributed for 8 weeks to each respondent and if the experts did not respond to the questionnaire on time, the questionnaires were answered by a phone call. The numbers that are outside the parentheses in Table 7 show the average of the questionnaire method findings.

Table 5. Components of SSAs in prior studies

No.	Component	Attribute (Source)
1	Ability to assign, change, and control resources (the ability to manage resources)	Power (Chinyio and Olomolaiye 2010, pp. 3–20; Yang et al. 2011a; Yang and Shen 2014) Contribution (Chinyio and Olomolaiye 2010, pp. 24, 120) Impact (Chinyio and Olomolaiye 2010, p. 236)
2	Ability to create dependency	Power (Mitchell et al. 1997; Yang 2010, p. 158)
3	Supporting the project and its outcomes	Support (Aapaoja and Haapasalo 2014; Byrson 2004, p. 34; Chinyio and Olomolaiye 2010, p. 32; Yang 2010, pp. 12–16) Power (Byrson 2004, p. 34; Yang 2010, pp. 12–16) Contribution (Liu et al. 2013)
4	Sensitivity degree to address claims due to type of stakeholder (the importance of stakeholder claims or relationship with him)	Time sensitivity (Aapaoja and Haapasalo 2014; Magness 2008; Mitchell et al. 1997) Urgency (Elias and Cavana 2000; Valentin et al. 2018)
5	Time sensitivity degree to address the claims	Time sensitivity (Aapaoja and Haapasalo 2014; Bourne 2005, p. 57; Yang 2010, p. 25)
6	Distance between the stakeholder and the project works and activities from each other	Proximity (Chinyio and Olomolaiye 2010, p. 110; Yang 2010, p. 136)
7	Ability to reward and punish	Power (Mitchell et al. 1997; Reed et al. 2009)
8	Ability and potential to impose demands (Authority)	Power (Aapaoja and Haapasalo 2014; Chinyio and Olomolaiye 2010; PMI 2017, p. 513)
9	Ability to create restrictions or empowerment to continue and develop the project	Power (Aapaoja and Haapasalo 2014; Bourne 2005, p. 42; Chinyio and Olomolaiye 2010, p. 182; Yang et al. 2011b)
10	Ability to apply formal authority	Power (Aapaoja and Haapasalo 2014; Ackermann and Eden 2011; Bourne and Walker 2006; Yu and Leung 2018)
11	Applying wills despite resistance	Power (Aapaoja and Haapasalo 2014; Mitchell et al. 1997; Mojtahedi 2014, p. 276; Mojtahedi and Oo 2014)
12	A value that creates loyalty	Power and Influence (Bourne 2005, p. 42)
13	Proper involvement	Legitimacy (PMI 2017, p. 513)
14	Suitability of the project action patterns with the opinions and beliefs of the wider community	Legitimacy (Chinyio and Olomolaiye 2010, pp. 21–29; Magness 2008)
15	Ability to affect others satisfactorily	Power (Deng and Zhou 2010)
16	Importance of project (claims) for stakeholders	Criticality (Chinyio and Olomolaiye 2010)
17	Immediate action is warranted irrespective of other work commitments	Urgency (Bourne 2005, p. 271)
18	Ability to galvanize public interest	Influence (Abidin 2010; Gong et al. 2013; Ssegawa-Kaggwa et al. 2013)
19	Ability to influence internal or external conditions related to projects	Influence (Achterkamp and Vos 2008; Yang 2014)
20	Ability to influence without forcing	Support (Bourne 2005, p. 125; Yang et al. 2011b)
21	Ability to turn decisions into actions	Impact (Aapaoja and Haapasalo 2014, p. 90; Chinyio and Olomolaiye 2010, p. 90)
22	Ability to mobilize social and political forces	Power (Aapaoja and Haapasalo 2014; Chinyio and Olomolaiye 2010; Naderpajouh and Hastak 2014; Yang 2014)
23	Legal relationships in accordance with the norms, values, and beliefs	Legitimacy (Aapaoja and Haapasalo 2014; Yang 2014)
24	Existence of at least a contract between the stakeholder and the project	Legitimacy (Miles 2015)
25	An understanding or assumption of considerate and appropriate measures in accordance with the norms, values, beliefs, and definitions in a social system	Legitimacy (Aapaoja and Haapasalo 2014; Yang 2014)
26	Degree to which stakeholders are motivated by and mobilize around an issue	Interest (Harris 2010, pp. 6, 53)
27	Intrinsic worth in the form of profits and losses	Interest (Friedman and Miles 2006, p. 125)
28	Ability to manage effectively	Power (Hagberg 2006; Pheng and Omar 1997; Ziddah 2017)
29	Having expertise and knowledge	Power (Bourne 2005, p. 42)
30	Active involvement and participation	Influence (PMI 2017, p. 503)
31	Level of concern regarding the project outcomes	Interest (PMI 2017, p. 512)
32	Ability to influence the future of the project and respond to its strategic future	Power (Ackermann and Eden 2011; Byrson 2004; Eden and Ackerman 1998; Jones and Wicks 1999)
33	High capacity to formally instruct a change	Power (Bourne 2005, p. 57)
34	A political process to get things done	Power (Bourne 2005, p. 42; Pinto 1998)
35	Ability to create adaptive rules, justify laws, and dominate the lower social classes	Legitimacy (Yang 2014)
36	Having economic potential and ability for project advance	Power (Elias and Cavana 2000; Freeman 1983; Preble 2005)
37	Ability to change the project decisions	Influence and Power (Mostafa and El-Gohary 2014; PMI 2017, pp. 513–515)

Table 6. Rating scales for assignment degrees

X_{ij}	X_{ij} means
1	Component i does not express Attribute j
3	Component i expresses Attribute j lowly
5	Component i expresses Attribute j averagely
7	Component i expresses Attribute j well
9	Component i expresses Attribute j exactly

Note: Each element of the matrix (X_{ij}) shows the assignment degree between Component i and Attribute j.

In the second method, we conducted the semistructured interviews with 14 participants. In order to reduce the error of collected data, each semistructured interview was conducted during three sessions. After a short talk, we asked interviewees to determine the assignment degrees according to Likert scale in Table 6. The numbers inside the parentheses in Table 7 show the average of the semistructured interview method findings.

Finally, we compared the values in each element of Table 7 in order to observe the differences between the collected data from questionnaire survey and semistructured interviews for each matrix element. For this purpose, we subtracted the two values in each element of the matrix. It was found that 90.4% of the matrix elements in Table 7 have a difference less than one unit and 98.2% of

them have a difference less than two values. This confirms that the collected data have a good accuracy and validity.

Step 4: Separating the Prominent Assignment Degrees

Prominent assignment degree between a component and an attribute indicates that the presence of the component in the definition of that attribute is inevitable and must be considered based on the consensus of respondents and participants. The assignment degrees rated higher than average Likert scale (more than 5) by two methods were considered as prominent.

In this step, we separated elements higher than 5 using the outcome of both methods (Table 7). Then, we chose those elements because, in these elements, the components express attributes explicitly and exactly. The findings of this step are given in Table 8. The value of each element of Table 8 is calculated by averaging two values of the same element from Table 7.

Step 5: Drawing Venn Diagram for Attributes

Venn diagram is a tool used by mathematicians and logicians to illustrate the relationships between sets of things with some similar and some different characteristics (Habib 2015). In this study, each attribute is equivalent to a set and each component is considered as a member. Any prominent assignment degree indicates a

Table 7. Determining the prominent assignment degrees by questionnaire survey and semistructured interviews

Component	Power	Impact	Influence	Support	Urgency	Legitimacy	Proximity	Interest	Criticality	Time sensitivity	Contribution
1	6.8 (7.7)	7.3 (6.6)	7.1 (8.8)	4.3 (4.7)	1.9 (1.1)	3.6 (2.9)	1.7 (1.5)	2.1 (2.1)	3.3 (2.6)	1.6 (1.3)	5.7 (3.9)
2	7.6 (8.6)	6.4 (6.8)	8.2 (8.9)	4.1 (4.7)	2.1 (4.5)	7.2 (5.5)	2.6 (2)	2.2 (2.6)	1.9 (2.5)	1.6 (1.3)	1.3 (2.7)
3	7.3 (6.6)	6.6 (6.1)	7.6 (6.9)	8.7 (8.4)	2.4 (2)	5.1 (6.7)	1.7 (1.4)	2.2 (1.3)	2 (1.4)	1.8 (2.1)	6.6 (7.6)
4	2 (2.4)	1.7 (1.1)	2 (3.1)	2.3 (2.1)	7.7 (8)	2.8 (2)	1.5 (1.5)	1.3 (1)	7.1 (7.2)	6.6 (5.8)	2.5 (1.8)
5	1.2 (2.2)	1.7 (1.4)	2.1 (1.5)	1.2 (1.2)	6.9 (7.4)	1.4 (1.6)	1.6 (1.2)	1.5 (1.1)	6.3 (5.7)	8.7 (7.7)	1.3 (1.9)
6	1.2 (1.3)	1.2 (1.8)	1.3 (1.3)	1.2 (1.3)	2.9 (3.5)	2.8 (1.8)	8 (7.6)	2.3 (1.9)	4 (4.4)	1.8 (2.4)	4.1 (4.5)
7	7.3 (6.1)	7.7 (7)	7.1 (7.3)	6.2 (6.5)	2.6 (2.1)	5.1 (3.2)	1.6 (2.6)	2 (1.4)	1.7 (1.9)	1.4 (1.4)	2.9 (3.5)
8	8.4 (7.4)	8.5 (7.9)	8.4 (8.3)	2.8 (1.7)	1.4 (1.1)	6.1 (3.5)	2.1 (1.7)	2.3 (2)	1.1 (1.4)	1.5 (1.4)	1.7 (2.5)
9	8.9 (8.7)	6.7 (6.3)	8.3 (7.7)	5.9 (5.5)	2.6 (2.1)	6.4 (6.1)	2.2 (2.5)	1.8 (1.9)	1.4 (1.7)	1.1 (1.6)	4 (3.1)
10	8.3 (8.1)	8.2 (8.1)	8.5 (7.9)	4.9 (4.7)	1.7 (1.5)	7.8 (6.6)	1.1 (1.9)	2.1 (2.3)	1.7 (1.2)	1.4 (1.1)	1.2 (1.8)
11	8.7 (8.5)	8.1 (7.5)	7.9 (8.3)	4 (3.4)	1.2 (1.8)	5.9 (6.4)	3.1 (2.9)	2 (1.5)	1.3 (1.9)	2.6 (1.8)	1.2 (1.1)
12	6.4 (5.4)	6.6 (6.5)	6 (6.2)	5.6 (5.4)	1.1 (1.6)	8.4 (7.3)	1.9 (1.7)	2.5 (2.9)	1.1 (1.6)	1.1 (1.4)	4.2 (5)
13	2.6 (3.4)	3.5 (2.7)	1.9 (2.5)	1.3 (2.1)	6.3 (5.4)	8.5 (7.3)	3.9 (3.5)	1.3 (1.3)	6.2 (6.1)	1.1 (1.6)	3.8 (4.6)
14	3 (2.2)	1.7 (1.1)	1.1 (1.4)	1.5 (1.9)	2.3 (1.9)	8.3 (7.5)	1.1 (1.2)	1.6 (1.2)	1.4 (1.2)	1.9 (1)	1.2 (2.1)
15	8.1 (7.2)	7.5 (7.6)	8 (7.4)	6.4 (7.3)	1.3 (3.1)	5.3 (6.4)	2.1 (2.1)	2.3 (1.6)	2 (2.6)	1.7 (1.5)	3.1 (2.3)
16	1.2 (1.1)	1.7 (2.6)	1.4 (1.3)	1.2 (1.4)	7.3 (6.5)	2 (2.2)	2.5 (2.7)	1.9 (2.3)	7.4 (7.2)	6.3 (5.9)	1.6 (1.8)
17	1.8 (1.1)	1.6 (1.3)	2.8 (4.6)	1.1 (1.9)	8.5 (6.3)	1.1 (1.7)	3 (3.2)	1.8 (1.2)	6 (5.4)	8.6 (8.1)	1.7 (1.2)
18	8 (7.8)	8.6 (8.2)	7.5 (7.8)	2 (2.6)	2 (2.4)	3.3 (5.3)	4.1 (4.9)	1.1 (1.5)	1.1 (1.2)	1 (1.4)	1.6 (1.1)
19	7.8 (7.4)	6.8 (6.4)	8 (7.9)	5.6 (6.4)	1.6 (1.4)	3 (3.8)	2.9 (3.3)	2.2 (2.6)	3 (1.4)	1.2 (1.4)	2.3 (1.8)
20	8.9 (8.4)	8.3 (8.3)	8.9 (8.8)	7.1 (6.4)	2.4 (2.2)	6.4 (5.5)	1.6 (1.2)	2.1 (3.2)	3.4 (3.7)	1.5 (1.3)	7.6 (6.7)
21	7.4 (6.8)	7.1 (7.6)	7.5 (6.7)	2 (2.4)	1 (1.4)	2.9 (3.5)	5.4 (5.1)	1.6 (1.4)	2.4 (1.8)	1.1 (1.4)	3.2 (2.9)
22	8.9 (8)	8.2 (7.6)	8.1 (8.4)	3.1 (5.2)	1.6 (2.1)	7.4 (5.3)	3.1 (3.5)	1.4 (1.8)	2.1 (2.4)	1.1 (1.2)	1.1 (1.6)
23	1.2 (1.3)	1.1 (1.2)	1.6 (1.8)	1.4 (1.3)	2 (2.2)	8.8 (8.6)	3.6 (4.4)	1.4 (2.1)	1.5 (1.9)	2.4 (1.8)	1.6 (2.2)
24	1.1 (1.2)	1.2 (1.3)	2.6 (2.1)	1.3 (1.2)	2 (1.8)	8.7 (8.5)	5.8 (6.4)	1.1 (1.2)	3.3 (1.9)	2.6 (2.2)	1.9 (1.5)
25	1.1 (2)	1.6 (1.1)	2.3 (1.9)	1.8 (1.6)	1.1 (1.2)	8 (8.6)	1.6 (1.1)	2 (1.6)	1.3 (1.3)	2.8 (1.9)	1.4 (1.2)
26	6.1 (4.7)	4 (4.2)	3.8 (5.6)	3.1 (3.8)	1.4 (1.8)	7.9 (5.5)	3 (2.2)	7.7 (8.1)	2 (1.4)	1.1 (1.4)	2.7 (2.1)
27	2.3 (2)	3.4 (4)	3.8 (3.6)	2.1 (2.4)	1.5 (1.3)	8.4 (7.9)	1.6 (1.4)	7 (7.3)	1.7 (2.6)	1.4 (1.3)	3.1 (3.2)
28	6.8 (5.5)	6.5 (7)	7.1 (7.2)	5.1 (3.6)	1.7 (1.5)	1.6 (2.1)	3 (3.4)	1.3 (1.5)	1.1 (1.2)	1.1 (2.5)	2.6 (2.4)
29	7.2 (8.1)	5.6 (6.4)	6.7 (7.5)	2.5 (3.9)	3 (1.6)	2.3 (2)	3.4 (3.8)	1.3 (1)	2.9 (3.7)	1.7 (1.1)	3.6 (3.4)
30	4.1 (4.4)	5.4 (6.2)	6.2 (5.6)	5.1 (6.5)	2.9 (3.7)	1.1 (1.4)	8.3 (7.6)	1.1 (1.8)	1.8 (2.4)	1.2 (1.5)	3.9 (4.3)
31	2.6 (2.5)	3.4 (4)	1.1 (1.3)	1.8 (1.4)	8.7 (8.1)	1.1 (1.1)	2 (1.8)	6.1 (7.3)	1.4 (1.1)	6.5 (6.3)	1.2 (1)
32	7.1 (7.3)	8.4 (8.4)	7.5 (7.9)	2.1 (2.2)	3.7 (4)	2.3 (1.9)	1.5 (1.1)	2.9 (2.7)	2.9 (2.9)	1.5 (1.9)	1.4 (2.4)
33	7.7 (7)	6.3 (5.9)	8 (8.2)	5.5 (5)	2.4 (1.8)	4.2 (3.3)	1.1 (1.6)	3.5 (2.9)	2.1 (1.7)	1.1 (1.5)	2.4 (2.6)
34	7.9 (8.3)	6.1 (5.4)	6.5 (5.9)	2.9 (3.3)	1.3 (1.1)	4.3 (4.1)	2.9 (2.3)	1.1 (1.4)	1.5 (3.9)	1.1 (1.2)	3.6 (3.8)
35	5.9 (6.5)	5.8 (5.4)	7.7 (6.8)	2.1 (2.5)	1.4 (1)	8.2 (8.6)	3.7 (3.9)	1 (1.6)	1.2 (2.1)	1 (1.4)	1.7 (1.1)
36	7.8 (6.4)	5.4 (6.6)	6.5 (5.5)	2.3 (1.5)	1.2 (1.4)	1.6 (2.2)	1.2 (2.3)	1.7 (2.5)	2.2 (3.2)	1.3 (1.1)	1.9 (1.7)
37	6.7 (8.2)	8.6 (8.8)	8.1 (8.8)	5.2 (5.8)	1.5 (1)	1.5 (1.3)	2.5 (2.6)	1.4 (2.2)	1.6 (1.4)	1.7 (1.5)	2 (2.4)

Table 8. Determining the prominent assignment degrees

Component	Power	Impact	Influence	Support	Urgency	Legitimacy	Proximity	Interest	Criticality	Time sensitivity	Contribution
1	7.2	6.9	7.9	—	—	—	—	—	—	—	—
2	8.1	6.6	8.5	—	—	6.3	—	—	—	—	—
3	6.9	6.3	7.2	8.5	—	5.9	—	—	—	—	7.1
4	—	—	—	—	7.8	—	—	—	7.1	6.2	—
5	—	—	—	—	7.1	—	—	—	6	8.2	—
6	—	—	—	—	—	—	7.8	—	—	—	—
7	6.7	7.3	7.2	6.3	—	—	—	—	—	—	—
8	7.9	8.2	8.3	—	—	—	—	—	—	—	—
9	8.8	6.5	8	5.7	—	6.2	—	—	—	—	—
10	8.2	8.1	8.2	—	—	7.2	—	—	—	—	—
11	8.6	7.8	8.1	—	—	6.1	—	—	—	—	—
12	5.9	6.5	6.1	5.5	—	7.7	—	—	—	—	—
13	—	—	—	—	5.8	7.9	—	—	6.1	—	—
14	—	—	—	—	—	7.9	—	—	—	—	—
15	7.6	7.5	7.7	6.8	—	5.8	—	—	—	—	—
16	—	—	—	—	6.9	—	—	—	7.3	6.1	—
17	—	—	—	—	7.4	—	—	—	5.7	8.3	—
18	7.9	8.4	7.6	—	—	—	—	—	—	—	—
19	7.6	6.6	7.9	6	—	—	—	—	—	—	—
20	8.6	8.3	8.8	6.7	—	5.9	—	—	—	—	7.1
21	7.1	7.3	7	—	—	—	5.2	—	—	—	—
22	8.4	7.9	8.2	—	—	6.3	—	—	—	—	—
23	—	—	—	—	—	8.7	—	—	—	—	—
24	—	—	—	—	—	8.6	6.1	—	—	—	—
25	—	—	—	—	—	8.3	—	—	—	—	—
26	—	—	—	—	—	6.7	—	7.9	—	—	—
27	—	—	—	—	—	8.1	—	7.1	—	—	—
28	6.1	6.7	7.1	—	—	—	—	—	—	—	—
29	7.6	6	7.1	—	—	—	—	—	—	—	—
30	—	5.8	5.9	5.8	—	—	7.9	—	—	—	—
31	—	—	—	—	8.4	—	—	—	6.7	—	6.4
32	7.2	8.4	7.7	—	—	—	—	—	—	—	—
33	7.3	6.1	8.1	5.2	—	—	—	—	—	—	—
34	8.1	5.7	6.2	—	—	—	—	—	—	—	—
35	6.2	5.6	7.2	—	—	8.4	—	—	—	—	—
36	7.1	6	6	—	—	—	—	—	—	—	—
37	7.4	8.7	8.4	5.5	—	—	—	—	—	—	—

membership. Venn diagram is drawn according to the specified attributes, components, and prominent assignment degrees. Fig. 2 shows Venn diagrams for attributes for stakeholder typology phenomenon. The numbers are representative of the components and ovals are representative of the attributes.

Step 6: Analyzing Venn Diagram and Redefining the Attributes

As previously mentioned, the purpose of this article is to identify SSAs that have a clear, accurate, and nonoverlapping boundary and to develop a comprehensive project stakeholder typology model based on them. To achieve this goal, we performed Venn diagram analysis.

In order to analyze the Venn diagram, a Delphi method was used. The Delphi method was selected for this analysis because it offers the facilitator the opportunity to employ controls to minimize the potential impact of judgement-based biases and because this method is preferred when objective data are unavailable (Hallowell and Calhoun 2011). The Delphi method is an iterative process where the facilitators are obtaining expert opinions in several iterative rounds. Each subsequent round is developed based on the results of the previous round. The process stops when the consensus among the experts is achieved.

An important element of the Delphi method is the identification and selection of members to constitute the panel of experts (Xia et al. 2012). For the present Delphi study, we selected 14 experts that agreed to participate, all of them with high practical and educational experience. As previously mentioned, all 14 participants had a Ph.D. degree in construction/project management and a PMP certification. This level of expert experience and knowledge helped to increase the validity of the research.

In the first round Fig. 2 was described and explained for all Delphi group members. We extracted each of the overlapping states in Fig. 2, and then introduced possible solutions for each conceptual overlapping so that Delphi group would comment on them. They could modify or develop the solutions by mentioning the cause. In some cases, experts might suggest a solution except guidelines. After the first round analysis, the solutions extracted from this round were sent to the Delphi group, and we asked them to comment on the first-round solution. This work was repeated until the third round that revealed that a new solution was not proposed, which is the end of Delphi procedure.

The general solutions to resolve the conceptual overlapping at the end of the Delphi method are discussed as follows:

S_1 = Removing all shared components of attribute(s).
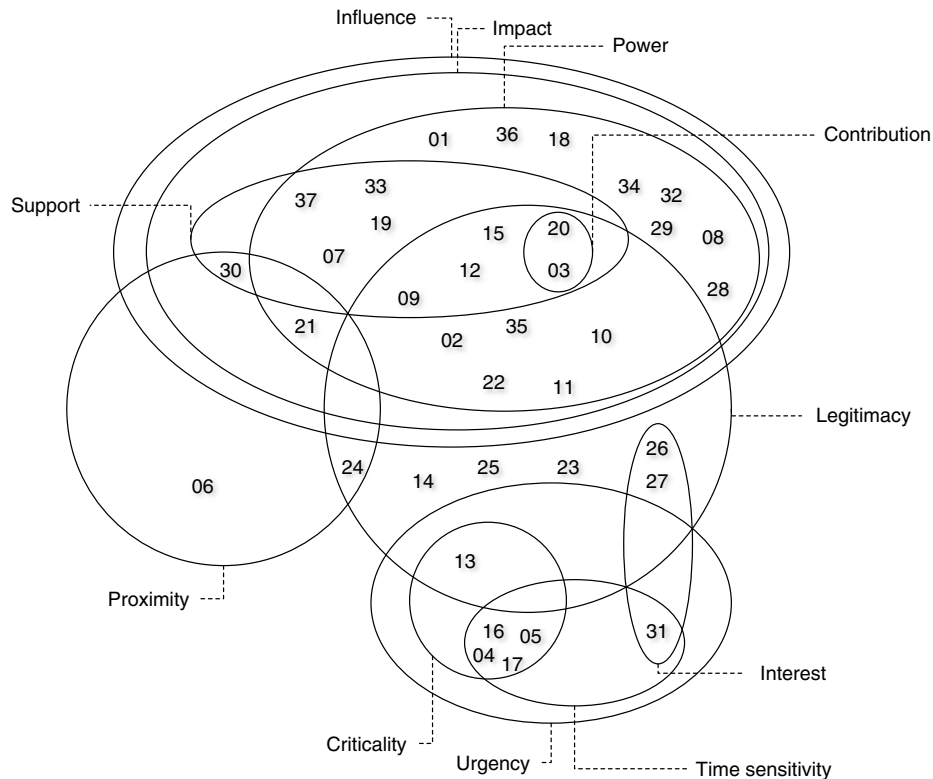
S_2 = Removing subtotal attribute(s).

Fig. 2. Venn diagram for attributes.

S_3 = Removing the shared components of the attribute(s) except one attribute; the one with more assignment degree. This solution considers all shared components as a united part of the related attribute.

S_4 = Assigning each component to an attribute that its assignment degree has a higher value. This solution considers each shared component as a united part of the other related attributes.

S_5 = Converting all attributes [or their shared component(s)] to an attribute with all components and select a suitable label that expresses them well.

After identifying the solutions, the Delphi group members were asked to specify the privilege and the reason for the superiority of each solution with a Likert scale from 1 to 9. The rounds continued until the results converged. Table 9 shows the average scores for all rounds. As Table 9 shows, due to the convergence of data in the second and third rounds, the Delphi process was terminated after the third round.

Finally, according to Table 9, the Delphi experts removed six attributes: Contribution, Support, Time sensitivity, Criticality, Interest, and Power. Also, they justified that these attributes are subsets of the broader attributes; they are defined in the heart of the broader attributes. As a result, the five attributes Influence, Impact, Legitimacy, Urgency, and Proximity remained. In the next stage, they justified that the two attributes Influence and Impact should be converted to an attribute with all components and assigned a suitable label that expresses them well. The following three criteria were used in the selection suitable labels: (1) the label should have the capacity to handle and express all components; (2) prior labels should be used as far as possible; and (3) all members of the Delphi group should reach a consensus on the selected labels of SSAs. For this purpose, we searched several dictionary websites to select a proper label for the redefined attributes. The search was performed as an exploratory process.

First, we searched the attributes to find their synonyms and definitions. For example, when we were searching the word Influence, we extracted all definitions and synonyms of this word from online dictionaries. Then we searched new synonyms (or similar concepts from definitions) of the explored concept from the first searching step. This process was repeated several times before the findings were presented to the Delphi group. Then the members of the Delphi group reached a consensus about the labels that best described the group of components. Finally, we defined Influence and Impact as Potency, namely the "capacity to be, become, or develop; potentiality; power; authority" as given by an online dictionary. In the case of other three groups of components, we also used the second rule (using prior labels) and thereby Delphi group reached a consensus about the labels.

Our findings from the Venn diagram also highlights that if a component is shared in two attributes, it should be assigned to the attribute with the highest assignment degree. For example, according to Table 8, assignment degree of component "a value that creates loyalty" is higher to Legitimacy than to Potency, therefore it should be assigned to attribute Legitimacy.

In this step, the new SSAs were redefined based on the inclusion of effective components. The results are illustrated in Table 10.

Step 7: Developing a Stakeholder Typology Model

After identifying new attributes of stakeholder salience and forming their definitions, the four attributes Potency, Legitimacy, Urgency, and Proximity were extracted. By referring to the models offered by researchers in stakeholder context, it can be understood that the attributes of the three-attribute model (TAM) are a part of the recognized attributes. From four identified attributes in this study, the three attributes of Power (in the heart of Potency),

Table 9. Delphi survey results for analyzing Venn diagram and redefining the attributes

Status	Possible solutions	First round		Second round		Third round	
		Mean	Rating	Mean	Rating	Mean	Rating
Contribution is a subset of Support	S1	1.5	4	1.1	5	1.1	5
	S2	7.9	1	8.3	1	8.2	1
	S3	5.2	3	4.8	3	4.6	3
	S4	5.6	2	3.2	4	3.3	4
	S5	5.6	2	7	2	6.8	2
Support is a subset of Influence and Impact—Power is a subset of Influence and Impact	S1	1.3	5	1.2	5	1.2	5
	S2	7.6	1	8.6	1	8.5	1
	S3	5.6	3	3.9	3	3.7	3
	S4	5.5	4	3	4	3.1	4
	S5	6.8	2	6.5	2	6.3	2
Criticality and Time sensitivity are subsets of Urgency	S1	2.1	5	1.1	5	1.2	5
	S2	8.1	1	8.7	1	8.6	1
	S3	4.7	4	3.6	3	3.4	3
	S4	5.1	3	3.5	4	3.3	4
	S5	7.3	2	6.6	2	6.6	2
Interest is a subset of union of Urgency and Legitimacy	S1	1.6	5	1.2	5	1.2	5
	S2	6.8	1	8	1	8.2	1
	S3	3.2	4	2.6	3	2.6	3
	S4	4.5	3	1.6	4	1.5	4
	S5	5.1	2	4.4	2	4.2	2
Influence and Impact are identical	S1	1	4	1.2	4	1.1	4
	S2	—	—	—	—	—	—
	S3	7.6	1	5.9	2	6.1	2
	S4	6.6	3	4.8	3	4.9	3
	S5	6.7	2	8.2	1	8.3	1
Two attributes have a/some shared component(s) (Influence/Impact with Proximity; Urgency with Legitimacy; Legitimacy with Proximity; Influence/Impact with Legitimacy)	S1	1.4	4	1.2	4	1.1	4
	S2	—	—	—	—	—	—
	S3	4.2	3	4.9	2	4.7	2
	S4	6.7	1	7.4	1	7.3	1
	S5	6.4	2	4.3	3	4.4	3

Legitimacy (in the heart of Legitimacy), and Urgency (in the heart of Urgency) are found in TAM. Therefore, TAM may offer a typology model of stakeholders in construction projects. First, the definitions of three attributes in TAM must be found and then compared with new attributes. The reason behind doing that is to develop TAM and to modify the model for construction projects if necessary.

Developing TAM Attributes

Mitchell et al. (1997) has stated several definitions from researchers and theorists; however, he did not offer a single definition of this attribute. After a careful investigation of the four attributes and all of the components in this study, it was realized that all components offered by Mitchell et al. (1997) are found in three attributes Power, Impact, and Influence. Conversely, Power is a subset of Impact and Influence and the attributes of Influence and Impact can define Power in a broader sense. Because the attribute of Potency contains both attributes of Impact and Influence, the attribute of Potency is introduced in the new model. In addition, the proposed components in TAM with adding new components to them, it can be replaced by Potency and then be expanded.

In comparison with the TAM, this attribute is wider in the new model. In addition to the components expressed by Mitchell et al. (1997), the new attribute includes other components and is introduced as Legitimacy but with a wider definition in the new model.

In comparison with the TAM, this attribute is also wider in the new model. In addition to the mentioned components, the new attribute, which includes other components, is introduced as Urgency but with a wider definition in the new model.

Project Stakeholder Typology Model

Mitchell et al. (1997) have not included the attribute of Proximity in their model for the purpose of determining the importance of stakeholders and their positions but a part of the attribute of Proximity is embedded in the context of Legitimacy in the TAM (Fig. 2). Despite the absence of Proximity in the TAM, one of the most important factors in determining the importance and typology of stakeholders is their Proximity to the project. For example, if two stakeholders exist with the same Potency, Legitimacy, and Urgency, their participation and involvement with the project become very important because it suggests that the stakeholder is more important for project success and should be prioritized over others. The definitions of attributes are as follows:

Potency: The ability and potential to influence the different aspect of internal or external conditions related to projects and its future by imposing demands (personal, political, social, etc.) regardless of whether it is legal or illegal.

Legitimacy: A worth or value that creates passion, hatred, loyalty, creates adaptive rules, justifies laws, or develops a legal relationship in accordance with the norms, values, and beliefs and definitions in a social system or beyond it in the project.

Urgency: Degree of the necessity of using immediate action irrespective of other work commitments in response to stakeholder

Table 10. New attributes for typologizing project stakeholders

No.	Component	Redefined attribute
01	Ability to assign, change, and control resources (ability to manage resources)	Potency
02	Ability to create dependency	
03	Supporting the project and its outcomes	
07	Ability to reward and punish	
08	Ability and potential to impose demands (Authority)	
09	Ability to create restrictions or empowerment to continue and develop the project	
10	Ability to apply formal authority	
11	Applying wills despite resistance	
15	Ability to affect others satisfactorily	
18	Ability to galvanize public interest	
19	Ability to influence internal or external conditions related to projects	
20	Ability to influence without forcing	
21	Ability to turn decisions into actions	
22	Ability to mobilize social and political forces	
28	Ability to manage effectively	
29	Having expertise and knowledge	
32	Ability to influence the future of the projects and respond to its strategic future	
33	High capacity to formally instruct a change	
34	A political process to get things done	
36	Having economic potential and ability for project advance	
37	Ability to change the project decisions	
12	A value that creates loyalty	Legitimacy
13	Proper involvement	
14	Suitability of the project action patterns with the opinions and beliefs of the wider community	
23	Legal relationships in accordance with the norms, values, and beliefs in a social system	
24	Existence of at least a contract between the stakeholder and the project	
25	An understanding or assumption of considerate and appropriate measures in accordance with the norms, values, beliefs, and definitions in a social system	
26	Degree to which stakeholders are motivated by and mobilize around an issue	
27	Intrinsic worth in the form of profits and losses	
35	Ability to create adaptive rules, justify laws, and dominate the lower social classes	
04	Sensitivity degree to investigate claims due to type of stakeholder (the importance of stakeholder claims or relationship with him)	Urgency
05	Time sensitivity degree to address the claims	
16	Importance of project (claims) for stakeholders	
17	Immediate action is warranted irrespective of other work commitments	
31	Level of concern regarding the project outcomes	
06	Distance between the stakeholder and the project works and activities from each other	Proximity
30	Active involvement and participation	

requests while the project (claims) and its output are important for the stakeholders and is also important for the project.

Proximity: The distance between the stakeholder and the project from each other (distance from project activities and works) to active involvement and participation.

After analyzing SSAs, a model is provided that firstly shows all the modes of existence or absence of SSAs, and secondly its visual representation closely resembles the TAM. Fig. 3 illustrates the final model. By using this model, managers can identify stakeholders clearly and accurately when meeting them. Therefore, managers
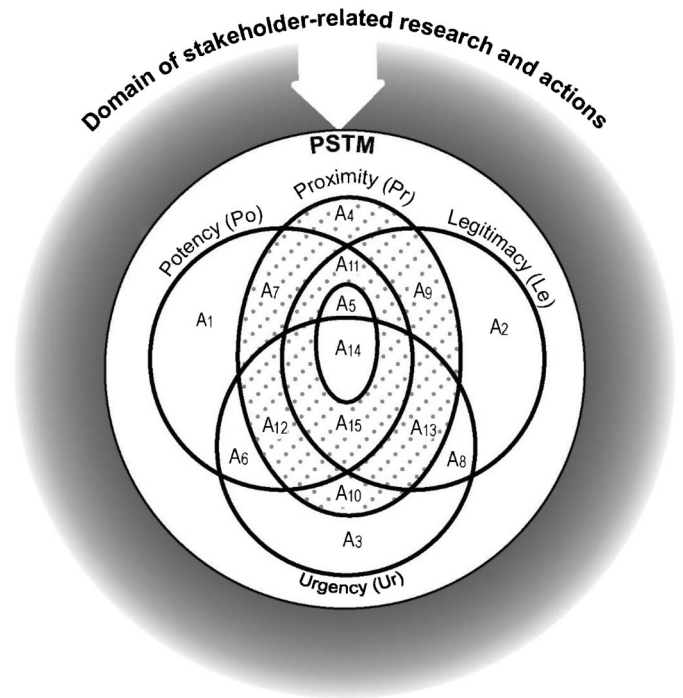
Fig. 3. Project stakeholder typology model (PSTM).

should interact with and manage stakeholders by considering Potency, Legitimacy, Urgency, and Proximity.

As the results indicated, the final model was divided into 15 areas listed in Table 11. Each area shows the type of stakeholder with regard to the possession of SSAs. To label the stakeholder types, we used a template similar to TAM.

PSTM as the Core of Stakeholder-Related Research and Actions in Construction Projects

This study offers the PSTM as the core of stakeholder-related research and actions in construction industry. In addition to the primary objectives of this article, some important results can be extracted from PSTM for stakeholder analysis, identification, and management. They are as follows:

- To analyze, identify, and manage project stakeholders, all four attributes are necessary, namely Potency, Legitimacy, Urgency, and Proximity.
- In order to prioritize stakeholders for stakeholder management, if assigning a value to the each SSA is difficult, a score can be given to each component of Table 10 and by averaging them, the score of each attribute is calculated.
- Project stakeholders can be divided into four general groups: Latent, Expectant, Definitive, and Primary. If it is assumed that all SSAs have the same weight, the priority in engagement is with Primary, Definitive, Expectant, and Latent stakeholders, respectively. Table 11 shows these groups with their considerations.
- Although PSTM is based on SSAs, nevertheless it inherently considers to the stakeholders' roles in various parties. A role is defined as the "set of rights and duties which are assigned to a person who occupies that role in a group" (Moffett and Lupu 1999). Therefore, the managers cannot specify stakeholder salience and type, unless they are aware of the stakeholder rights and duties in a group and characteristics of his

Table 11. Main stakeholders' types and their managerial considerations

Stakeholder type	No.	Area	Area name
Latent stakeholders	A_1	Po	Dormant
	A_2	Le	Discretionary
	A_3	Ur	Demanding
	A_4	Pr	Involved
Expectant stakeholders	A_5	Po + Le	Dominant
	A_6	Po + Ur	Dangerous
	A_7	Po + Pr	Terrible
	A_8	Le + Ur	Dependent
	A_9	Le + Pr	Trustworthy
	A_{10}	Ur + Pr	Frustrating
Definitive stakeholders	A_{11}	Po + Le + Pr	Potentially
	A_{12}	Po + Ur + Pr	Rebellious
	A_{13}	Le + Ur + Pr	Sensitive
	A_{14}	Po + Le + Ur	Enigmatic
Primary stakeholders	A_{15}	Po + Le + Ur + Pr	Primary
Irrelevant	—	Ø	Nonstakeholder

Note: In this article, Po, Le, Ur, and Pr are the written abbreviations of Potency, Legitimacy, Urgency, and Proximity, respectively. Latent stakeholders have only one SSA and thus are considered the least significant stakeholders. This stakeholder group needs other stakeholders. Definitive stakeholders have three SSAs and are of high importance. They will be perfect by acquiring another SSA. Expectant stakeholders have two SSAs. They either need other stakeholders or to try to achieve more SSA(s). Primary stakeholders have all the four SSAs. Attention must always be paid to these stakeholders.

group (especially for determining Legitimacy). For example, if it is assumed that A and B are two stakeholders of a project and they have different roles and they are also involved in different groups, their roles and the groups that they are involved in may impact on their Potency, Legitimacy, Proximity, and Urgency. Therefore, the effects of roles and groups are included in the PSTM. Project managers and project management teams can determine stakeholders' salience and specify their types, if they are aware of stakeholder roles in groups. In the case of determining SSAs of a person from a group, managers should be aware of stakeholder role (or consult with his group) in his group to know the role and characteristics of group and thereby typologizing stakeholders.

Discussion and Conclusion

The existence of crudity and turbulence in the literature of stakeholder analysis, identification, and management is quite obvious in construction industry. One of the most important reasons for this turbulence has been the low concentration of researchers to integrate fundamental SSAs in order to form a comprehensive framework in the related field. In other words, scholars were usually the users of the prior SSAs and have applied them to achieve their goals without evaluating them in order to define, redefine, or refine them, if necessary. This issue has been more critical when each study used several SSAs by imitating previous studies. In this situation, there were two common approaches: selecting the results from one of the previous studies (e.g., Lin et al. 2018; Mok et al. 2017) or using previous results without basic logical analysis of SSAs (e.g., Molwus et al. 2017; Rajablu et al. 2015). Therefore, the lack of consensus in using SSAs and the types of stakeholders for

analyzing, identifying, and managing them is a critical gap in previous research.

In this study, we have analyzed SSAs to create a set of comprehensive and inclusive SSAs for developing a comprehensive stakeholder typology model in construction projects. It is expected that the PSTM can be used as a global model. The reliability of the PSTM depends on two factors, namely the SSAs and the characteristics of participants/respondents. First, all 37 SSAs (Table 5) were identified from a review of English literature and can be considered as global SSAs. Furthermore, all these 37 components expressed at least one corresponding attribute in the Iranian context (Table 8). Therefore, it can be concluded that all components and attributes are meaningful in an Iranian context. Second, all the participants had international knowledge of project management (PMP certification). In addition, we tried to eliminate any cultural issues during the decision-making process when the respondents typologized the stakeholders.

The results of this analysis indicated that the attribute Contribution is a subset of the attribute Support, and should not be considered as an independent attribute for stakeholder typology. We also found that the attributes Support and Power are subsets of attributes Impact and Influence and thus should not be considered as independent attributes. Another important result was that attributes Criticality and Time sensitivity are found to be subsets of the attribute Urgency; hence, they should be removed and not be considered as independent attributes. The analysis also indicated that the attribute Interest is covered by both Legitimacy and Urgency; consequently, it should not be considered as an independent attribute. It was also found that the two attributes Influence and Impact are the same attributes. During the redefinition process we concluded that the best solution was to convert them to an attribute given the label Potency. At the end of the redefinition process we had to determine how it is possible to introduce two independent attributes without conceptual overlapping, while they have a/some shared component(s). We found that the best solution was to assign each component to the attribute that its assignment degree had a higher value. In this way, the overlapping of attributes Potency with Proximity, Potency with Legitimacy, Urgency with Legitimacy, and Legitimacy with Proximity was eliminated.

Finally, the four attributes Potency, Legitimacy, Urgency, and Proximity were identified as independent SSAs in construction projects.

The purpose of this study was to develop a project stakeholder typology model based on SSAs in order to create an appropriate understanding of stakeholders and assist researchers and managers for successful research and actions. In the past, several researchers have tried to classify stakeholders in the form of models and frameworks (e.g., Aapaoja and Haapasalo 2014; Bourne 2005; Newcombe 2003; Yang 2010; Yu and Leung 2018), but they have not focused their attention on typologizing stakeholders based on all known components of SSAs. Each of the models has at least one deficiency in introducing SSAs comprehensively and inclusively as illustrated in Fig. 2. Each of the previous models such as the relative cooperative potential/relative competitive threat matrix, power/interest model, the stakeholder circle methodology (SCM) model, TAM, and impact/probability of impact matrix include only some of the components of SSAs in the literature. PMI (2017, p. 513) has suggested TAM for large complex communities of stakeholders or where there are complex networks of relationships within the community and states that there is an adaptation of TAM that substitutes Proximity for Legitimacy, while the findings of this study illustrated that the attribute of Proximity in stakeholder circle is different with Legitimacy in TAM and their conceptual boundaries can be identified. Also, despite the attribute of

Proximity does not exist in the TAM, but an influential stakeholder may be someone who does not have Power, Legitimacy, or Urgency. For example, in a national infrastructure project such as construction projects of subway lines, the workers may have very low levels of Potency, Legitimacy, and Urgency but their Proximity is high. Therefore, if the managers ignore their Proximity in the salience, the project certainly fails. Consequently, the attribute of Proximity should definitely be added as an SSA in stakeholder typology model. A revised stakeholder typology model and framework is therefore required.

This article presented a comprehensive project stakeholder typology model that contains all four attributes (Potency, Legitimacy, Urgency, and Proximity) and their components can be used for managing stakeholders in construction projects. The suggested PSTM has been constructed from 15 areas, each representing a different type of stakeholder. Stakeholders in each area of the model have common properties and salience, so it helps researchers, engineers, and managers allocate a specific engagement strategy for all of the stakeholders in a specific area.

Therefore, the present model is a development of previous models and can be replaced instead of them as a comprehensive model for project stakeholders' typology. The reason is that we have applied all attributes from literature to analyze and redefine the complete and nonoverlapping SSAs, and therefore PSTM specifies different types of stakeholders more accurate and in more details.

Future Research

Several proposals for future research are relevant based on the concerns of the current study. First, we suggest that specification of the SSA should be studied further. In addition to the literature review, empirical and analytical descriptions could be useful to identify other unknown possible attributes involved. Second, it is also our view that further research should study how to calculate the assignment degree between each component and each attribute, for example by using fuzzy theory. Third, future research can also take into account the practical use of PSTM and we suggest a survey and expert interviews on PSTM utilization. Finally, we suggest that the model and framework should be tested in other settings, e.g., projects from other industries than construction, to identify whether this would lead to the same results. It is only by cross-industry data analysis that a more robust model and framework can be developed.

Data Availability Statement

Data generated or analyzed during the study are available from the corresponding author by request. Information about the *Journal*'s data-sharing policy can be found here: http://ascelibrary.org/doi/10.1061/(ASCE)CO.1943-7862.0001263.

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