Research Article

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Identifying Innovative Reliable Criteria Governing the Selection of Infrastructures Construction Project Delivery Systems

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Abstract: No doubt that the most vital issues to achieve a great success project are the choice of best suitable project delivery methods. According to the experience of project management staff, the delivery of the project is chosen. However, that leads to similar repetitive issues, for example, exceeding the cost of the project and exceeding the project's schedule, and that's what many projects face. It is difficult to develop the management of the recurring issues of the project because there is no awareness of delivery methods. The efficiency of project implementation is greatly affected by selecting the appropriate delivery method. Fuzzy data at early stages of construction projects leads to the fuzzy decision of selection a suitable type to deliver the project contract. In this study, the main purpose was to determine the comprehensive criteria that significantly influence the selection of infrastructures construction project delivery systems. These criteria will aid decision making process more comprehensive and effective innovation tool to choose the reliable Infrastructures Project Delivery System.

Keywords: Project Delivery Systems (PDS), Infrastructures Projects, Collected Criteria, Simos' Procedure, Ranking Methods

1 Introduction

There is rapid development in infrastructure projects in the Middle East, it shows through the establishment of mega projects in the future. for example, the Dubai (International exposition) in 2020 and the Fifa (World Cup) in

Qatar) in 2022. The great growth in the expansion of infrastructure projects and Reduce project planning time, makes it difficult for the government to make the right decisions, particularly in terms of the chosen delivery system [1]. It is known that one of the most important criterion the success of the project is the appropriate choice of contractual project delivery system [2]. The choice of delivery of the project depends on the objectives of the owner and the requirements of the project [3]. Infrastructure projects are expensive to build, operate, and maintain. The project usually long term, thus the expense of any choices is weak, unexpected errors can lead to a huge negative impact that can last for generations. In the same sense, mega infrastructure planners are oftentimes delayed delivery, more than the budget, and it fails to realize the desired goal. Because of its importance for the growth in the future, the public sector is on the rise in request novel and improved (infrastructure) project delivery system. In the mature Governments and mature Market, economies are investigating innovative methods of infrastructure (project delivery systems) to great investments in infrastructure projects to face the high requirements for the expansion and development of cities. However, governments confront complications in securing funds and attracting investors to develop such capabilities needed. Confronting and mastering these challenges requires the perfect choice and development of infrastructure projects (delivery methods) [4].

The Project delivery systems not only realize the liabilities of (Parties implicated) in the project but also, effect in stages of the project design, the procurement and the project construction [5]. One of the vital criteria in infrastructure project success, project delivery system has an important impact on project time, project cost and project quality [6–8]. Thus selecting a suitable project delivery system will explicitly influence and project performance progressed [9, 10].

Traditional PDS, it found that one of the most commonly used ways to deliver public projects is the Design Bid Build [11, 12]. The design-bid-build method, the owner assigns the designer the completion of the design of the

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project before the implementation stage. Contractors will be awarded at the lowest cost then will construction these projects. Because of this separation, this method has several weaknesses that outcome a lot of recurrent (claims) result and disagreement among participants. So the cost of the project and schedule exceeded. Building systems also require more coordination among project stakeholders. Accordingly, these concerns; it created the need for other alternative methods. For instance, there are alternative ways to deliver the project such as the design_build and the construction _manager _at_risk. One alternative method is for the owner to employ (a project manager) to help him in the evaluation of accurate project cost estimates, project schedule, review designer plans for construction, obtain and negotiate bids, and coordinate various aspects of work [13]. Traditional PDS used in the general construction sectors have many constraints [14, 15]. Thus, many alternative project delivery methods have been presented to beat these constraints. However, the reaffirmation was depended on special stages of delivery methods and it lacks the general and complete refinement of delivery methods. Integrated Project Delivery [IPD] has newly arisen as a method with the possibility of the renaissance in the delivery systems. It differs from other alternatives because it concentrated on comprehensive optimization and merge operations. In spit of its possibility, IPD application in the early stages. This type of delivery system is used by extremely few projects [16].

It is worth noting the many research groups have related studies implemented on the criteria that influence project delivery using various project delivery systems [17–20]. However, the experimental analysis current is based on the criteria impacting project evaluation by the fundamental focus on owner's advantage, the project feature, the contractor's advantage and external environment of the project [6, 12, 20, 21]. Accordingly, This study indicates that the most reliable key criteria in the selection of project delivery systems. The main purpose of this study to intro-

duce and compile all previous research on criteria affecting PDS selection on infrastructure projects. Preceded by such a comprehensive review, in this paper described the research methodology of our questionnaire survey based on the degree of importance and ranking weights criteria. The final list of key criteria in PDS decision-making is obtained, summarizes and endorsed as research contributions and key findings of our study.

2 Literature review

Regarding infrastructure projects, innovation dynamics have various methods of project delivery systems [22, 23], it is found that delivery systems of management contracting, “design-build and ways of partnerships for different sectors are varied [24] have improved in integration with more cooperative approaches, such as partnering [25, 26], integrated project delivery [27], and alliances alliancing [28, 29]. Various methods can be used in selecting PDS. However, to choose the delivery system, the choice must be logical, It depends on the Advantages and disadvantages of delivery methods. Additionally, it must give any criteria for choosing a possible delivery system, weight to engineering sense and judgment, because of this choice based on (the engineering information, judgment, and previous owner experience) [30].

Selecting a suitable project delivery system made project high performance [31]. The establish a global set of criteria for selecting the project delivery system, it attracts more investigator for more research studies [18]. Many scientists have proposed special criteria for selecting project delivery systems. there are finally **twenty-six** research papers and thesis dissertations selected. Table 1 shows the Project Delivery System selection (PDSs) criteria identified in the previous studies.

Figure 1: Frequency distribution plot of influencing criteria.

In Figure 1, the column indicates the digit of times Criteria found in previous studies from 1 to 26 and row indicates the criteria from criteria number 1 to criteria number 28.

Table 1: Criteria identified in the previous studies.

Criteria	Literature																									
	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
Project objectives Category																										
Cr.1-Project cost.	✓	✓	✓	✓	✓	✓	✓	✓					✓	✓	✓			✓					✓	✓		✓
Cr.2-Project schedule.	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Cr.3-Project quality.	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓			✓	✓	✓			✓	✓		
Cr.4-Safety.		✓																					✓			
Cr.5-Contract/business, optimize return.		✓																								
Project characteristics Category																										
Cr.6-Project size.	✓		✓				✓										✓	✓		✓		✓		✓		✓
Cr.7-Project confidentiality.		✓			✓	✓																				
Cr.8-Ability to define the project scope.	✓	✓			✓	✓	✓			✓						✓		✓	✓	✓	✓					✓
Cr.9-Project complex.	✓	✓	✓		✓	✓		✓		✓		✓		✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓
Cr.10-Project flexibility.	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓		✓	✓			✓	✓		✓	✓				
Cr.11-Project location.		✓	✓																							
Cr.12-early availability of materials and equipment																					✓					
Cr.13-Conforms with user's expectations.																								✓		
Owner's Characteristics Category																										
Cr.14-Owner's preferences for responsibility & involvement	✓		✓		✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓			✓				
Cr.15-Owner's preferences for control.		✓	✓			✓	✓																			
Cr.16-Owner's experience.			✓			✓	✓																		✓	✓
Cr.17-Owner's staff qualifications.	✓				✓	✓				✓		✓						✓				✓			✓	✓
Cr.18-Owner's ability to finance.			✓		✓		✓																		✓	✓
Cr.19-Owner's preferences for risk control and allocation.	✓	✓	✓		✓			✓				✓		✓	✓	✓	✓		✓		✓	✓			✓	✓
Cr.20-Owner and contractor management awareness.	✓		✓																							
Cr.21- Owner's available personnel.												✓														
Cr.22-Special training preference by owner.																									✓	
Cr.23- The owner wants to use his (equipment and material).																	✓									
External Environment Category																										
Cr.24-Market competitiveness.	✓					✓		✓		✓		✓		✓	✓		✓	✓	✓	✓						
Cr.25-Innovation constructability.					✓	✓	✓										✓			✓					✓	
Regional Category																										
Cr.26-Security constraints & political impact.			✓		✓	✓																			✓	
Cr.27-Availability of experienced contractors and capacity.	✓		✓		✓													✓	✓	✓						
Cr.28-Availability of resources.		✓			✓																					

Where: resources [a to z] : [references No.]

a: [32], b: [33], c: [34], d: [35], e: [36], f: [37], g: [38], h: [39], i: [40], j: [41], k: [42], l: [43], m: [8], n: [44], o: [45], p: [6], q: [17], r: [12], s: [21], t: [46], u: [5], v: [47], w: [48], x: [49], y: [30], z: [50]

2.1 Criteria identification

Reviewing a lot of literary efforts to define criteria about choosing delivery methods, the preliminary list includes (twenty-eight) criteria belonging to five main categories as listed in Table 2: namely project objectives Category, project characteristics Category, Owner's Characteristics Category, External Environment Category, and Regional Category. There are a total of twenty-eight selection crite-

ria that could be presented to decision-makers to make an informed and comprehensive decision.

3 Research methodology

In the first step, an initial questionnaire was performed to cover twenty - eight criteria depend on several works of literature after studied with many experts to find the sample

Table 2: Initial criteria List.

Categories	Criteria	Criteria description
Project Objectives Category.	Cr.1	Cost for Completing project.
	Cr.2	Time for completing schedule project.
	Cr.3	An express the quality of the project.
	Cr.4	Ensures safety in (design and construction)
	Cr.5	Increased return.
Project Characteristics Category.	Cr.6	Is depending on the budget of the project (special or traditional project).
	Cr.7	Is protecting the confidentiality of the project document.
	Cr.8	Is clarity of the project scope?
	Cr.9	Represents the expectation of a major change in construction.
	Cr.10	Represents the possibility of changing the design at the time of the project implementation.
	Cr.11	Easy access to site and availability services.
	Cr.12	Availability of materials and equipment at an early stage of the project.
	Cr.13	The project achieves all the requirements expected for the user.
Owner's Characteristics Category.	Cr.14	Owner's ability to participate and responsibility clarity.
	Cr.15	The owner has great control over the project.
	Cr.16	The owner's experience in design, Construction.
	Cr.17	Strength of the owner's staff to the administration of the construction process.
	Cr.18	The owner's financial ability to expand on the project.
	Cr.19	The owner control and identifies the risks that can occur.
	Cr.20	The owner and Contractor are a high degree of management ability.
	Cr.21	The staff is available to the owner.
	Cr.22	Effect of Special training preference by owner.
	Cr.23	Owner's preference to use both the materials and equipment he owns.
External Environment Category.	Cr.24	Expresses the competitive market degree for the project as well as the availability of contractors.
	Cr.25	Using construction knowledge and encourage innovation.
Regional Category.	Cr.26	Regulatory actions, the degree of the national importance of the project, Foreign-funded project.
	Cr.27	Contractor's experience and Technical, financial ability
	Cr.28	Availability of resources that will be used in the execution of the project.

Figure 2: Methodology flowcharts.

size of research. In the second step, the survey data was processed, Then followed by the test of reliability. In the third step, if the survey data succeed in a reliability test, Then it is sent to a stage of Simos' procedure to obtain the global weight for each criterion. Finally, analyzing the results, the specific process is shown in Figure 2.

3.1 Survey Instrument

3.1.1 First Questionnaire survey

The twenty-eight criteria, it was obtained from research a large collection of literature, it was designed in the questionnaire It depends on three major sections; the first Section contains respondent's data, while the second section is the main element of a questionnaire. Also, they are included in a list of relevant criteria of importance. The third section contains the list of additional information that an expert can add. Obtaining methodology by ex-

pert responses, There's evaluation of the degree of significance related to any criteria is based on a range [1–5], that matches with “Very Low Importance” - “Very High Importance”. To meet a number of a prepared sample volume for choice the significant criterions, expert responses to the survey were collected. A Sample of consultants, contractors, and owners have been contacted for getting their responses. Based on findings and expert review, the questionnaire survey was reviewed and completed to data collection.

3.1.1.1 Collecting Questionnaire

For collecting the questionnaire, a questionnaire survey is designed to respond via a web link, field questionnaire survey and the interviews were applied. Sources of survey samples shown in Figure 3. The questionnaire was sent to 60 experts by e-mail, including owners, contractors, and consultants. Among all of these, twenty recipients of the questionnaire did not respond to emails, and ten questionnaires with clear errors (for example, commonly answer as the same choice, or missing answers, among others); overall of eighteen questionnaire survey answers were to completed and it returned with a 30% response rate. Also, fifteen questionnaires were distributed to graduate students during their studies. Of these, eight questionnaires were deleted for incompleteness. Also, conducted several interviews and obtained five correct questionnaires. Finally, thirty correct questionnaires were obtained.

Figure 3: Sources of survey project samples.

3.1.1.2 Description of the questionnaire Survey

Out of thirty questionnaires, percentage of the experts participants in the questionnaire was : (1) 53.33% owners, (2) 33.33% consultants, (3) 16.67% contractors, as shown in Figure 4.

Table 3 shows the statistical analysis of respondents in terms of their practical experience in thirty questionnaires.

Table 3: Years of practical experience for respondents.

Position	Practical experience [years]				Summation
	less than 5	From 5 to 10	From 10 to 15	more than 15	
OWNER	2	4	7	3	16
CONSULTANT	0	2	6	2	10
CONTRACTOR	0	1	2	1	4

Figure 4: Survey respondents' roles.

3.1.1.3 Sample size design calculations

The number of questionnaires required was calculated according to the number and specialties of engineers in the Egyptian guild of engineers. Based on the equation (1), the total number we want is calculated.

$$N = \frac{\left\{ \left[\frac{z_{\alpha}}{2} \right]^2 \times P \times [1 - P] \right\}}{d^2} \quad [51] \quad (1)$$

Where: the size of a sample is (N), by using $\left(\frac{z_{\alpha}}{2} \right)$ statistical value equal 1.645, (P) will be used as a percentage of the target population, and (d) will be used as a percentage 10% for the acceptable error.

The number of targeted owners is 5430 (Armed Forces Engineering Authority= 1180, Suez Canal Authority=370, Ministry of housing=1380, Ministry of Electricity=2500), and a total owner of 182,000, so the number (N) for the owner is equal 7.82. For a sample consultant of 1000 and a total consultant of 30,000, so the number for consultants becomes 8.71. For a sample contractor of 1200 and

a total contractor of 182,000, so (N) for the contractor is equal 1.77, to increase questionnaire accuracy. Therefore, decided that raise expert sample to become instead for more accuracy. Accord to the questionnaire survey notes, it was found that 16 respondents for owners, 10 respondents for consultants, and 4 respondents for contractors.

3.1.1.4 First survey outcome

Based on the outcome calculated in this paper, Criteria that were weak or have no effect were excluded from the group according to statistic analysis. Criteria for average values below or equal to 3.0 have been deleted from the group. It is worth noting that it has been excluded six criteria from the total (twenty-eight-criteria), and therefore makes up the reliability group Consists of (22 criterions) which shown at (Table 2), these criteria have been excluded, Contract/business (Optimize return) (C5). Project Objective category has one eliminated criterion, and the eliminated criteria are the early availability of materials and equipment (C12). And Conforms with user's expectations (C13) Project Characteristics category, have two eliminated criteria and Owner Characteristics Category, have three eliminated criteria. Owner desires the use of its resources (C21), Owner's available personnel (C22) and Special training preference by owner (C23), Most of the deleted criteria were in this category. While the external environ-

Figure 5: Mean Values for each criterion.

ment category, the regional Category have no eliminated criterion. The standard error for all criteria less than 0.2.

As illustrated in Figure 5 within the Project Objectives category, Project quality (C3) and Project Safety (C4) is the most significant criterion, while, the least significant is Project Cost (C1). Concerning the Project Characteristic category, Project Size (C6) is the most significant criterion, while, the least significant is Project Complex (C9). Regarding the Owner's Characteristics category, the Owner's ability to finances the project(C18) is the most significant criterion, while, the least significant is the Owner's Experience (C16). Concerning the external environment category, Innovation / Constructability (C25) is the most significant criterion, while, the least significant is Market Competitive-

ness (C24). Concerning the Regional category, the Availability of experienced contractors and Capacity (C27) is the most significant criterion, while, the least significant is the Availability of resources (C28). Figure 5, illustrates the Mean Values for each criterion, Which range from 3.7 to 4.1.

3.2 Reliability grade Analysis

Data reliability must be (tested) before using the data into account. (Reliability) is representing the accuracy of the measurement, (Cronbach's) alpha-criterion will be used as a (reliability) indicator. The alpha criterion is ranged be-

Table 4: Data of (the grade of reliability & alpha criterion) [adopted from 54].

Reliability	Cronbach's criterion [α]
Untrustworthy	Cronbach's criterion less than or equal to .3
Hardely [reliable]	.3 $\leq$ Alpha criterion <.4
[Reliable]	.4 $\leq$ Alpha criterion <.5
Very [reliable]	.5 $\leq$ Alpha criterion <.9
Quite [reliable]	Alpha criterion more than or equal to 0.9

Table 5: Total. [Statistics of criteria].

Criteria	[Scale means] [deleed item]	[Scale variance] [deleed item]	[Corrected item]	[α] [deleed item]
C1	81.7000	61.183	0.227	0.793
C2	81.2333	59.909	0.346	0.785
C3	80.9667	60.861	0.350	0.785
C4	80.9667	64.171	0.060	0.800
C5	80.9000	62.369	0.313	0.787
C6	81.4667	58.947	0.463	0.779
C7	81.0667	59.306	0.489	0.778
C8	81.5667	57.840	0.540	0.774
C9	81.3667	59.620	0.402	0.782
C10	81.3333	57.678	0.570	0.773
C11	81.3000	56.907	0.612	0.770
C12	81.3667	65.551	-0.059-	0.811
C13	81.0667	59.582	0.383	0.783
C14	80.7667	60.530	0.403	0.783
C15	81.7667	60.806	0.304	0.787
C16	81.4333	58.806	0.407	0.781
C17	81.5667	56.668	0.636	0.768
C18	81.6667	65.264	-0.18-	0.802
C19	81.4000	61.628	0.187	0.796
C20	81.0333	61.482	0.234	0.792
C21	81.0000	58.207	0.496	0.776
C22	81.5667	60.461	0.353	0.785

tween 0 to 1, the nearer to [1] means greater accuracy. To perform a reliable analysis of the questionnaire data the program was used (SPSS 25.0). In the reliability test, internal consistency has been applied to variables and calculate the Cronbach's α criterion of variables [52]. As a measure of reliability assessment of criterions, the alfa - criterion must be higher than (0.70) [53]. Table 4, presented the data shown (the grade of alpha-criterion & reliability) [54].

Questionnaire data is entered into SPSS 25.0 for reliability testing. By using statistical analysis of the outputs. The alpha criterion for analysis of questionnaires using data is 0.793 more than 0.70, which proves that twenty – two criteria are very qualified, the Table 5 shows excluding some elements, It's not going to improve significantly the Cronbach criterion [α], This means the information is [very reliable], and will be utilized in the future tests.

3.3 Second questionnaire

3.3.1 Description of Simo's procedure

The idea of the Simo's procedure is based on linking each criterion to the card of playing, and all the respondents have to do is arrange these cards. For many white cards (n), it represents many criteria.

Then, it is asking the user to rank these criteria from the least significant to most significant [arranged in ascending]. Depending on the user's opinion. If the criteria are the same important takes the same rank [51].

Table 6: Simo's Normalization Procedure.

Criteria	No. of Criterion	[Rank]	Non [normalized weight]	[Normalized weight]	Total [normalized weight]	Global weight
C1	1	3	3	$(3/13)*100=23$	23	0.0506
C2.	1	2	2	$(2/13)*100=15$	15	0.033
C3.	1	4	4	$(4/13)*100=31$	31	0.0682
C4	1	4	4	$(4/13)*100=31$	31	0.0682
Sum	4	13			100	0.22
C5	1	6	6	$(6/25)*100=24$	24	0.0672
C6	1	3	3	$(3/25)*100=12$	12	0.0336
C7	1	5	5	$(5/25)*100=20$	20	0.056
C8	1	4	4	$(4/25)*100=16$	16	0.0448
C9	1	5	5	$(5/25)*100=20$	20	0.056
C10	1	2	2	$(2/25)*100=8$	8	0.0224
Sum	6	25			100	0.28
C11	1	6	6	$(6/28)*100=21$	21	0.0462
C12	1	3	3	$(3/28)*100=11$	11	0.0242
C13	1	5	5	$(5/28)*100=18$	18	0.0396
C14	1	7	7	$(7/28)*100=25$	25	0.055
C15	1	1	1	$(1/28)*100=4$	4	0.0088
C16	1	2	2	$(2/28)*100=7$	7	0.0154
C17	1	4	4	$(4/28)*100=14$	14	0.0308
Sum	7	28			100	0.22
C18	1	1	1	$(1/3)*100=33.3$	33	0.0363
C19	1	2	2	$(2/3)*100=66.7$	67	0.0737
Sum	2	3			100	0.11
C20	2	3 3	3	$(3/11)*2*100=55$	55	0.0935
C21	1	3	3	$(3/11)*100=27$	27	0.0459
C22	1	2	2	$(2/11)*100=18$	18	0.0306
Sum	3	11			100	0.17

Table 7: Categories Estimated global Weights.

(A) Project Objective category	1	4	4	$(4/18)*100=22$	22
(B) Project characteristics category	1	5	5	$(5/18)*100=28$	28
(C) Owner characteristics category	1	4	4	$(4/18)*100=22$	22
(D) External Environment category	1	2	2	$(2/18)*100=11$	11
€ Regional category	1	3	3	$(3/18)*100=17$	17
Sum	5	18			100

3.3.2 Second Questionnaire

The questionnaire includes twenty-two criterions. Evaluating the criteria affecting s (PDSs) of infrastructure projects is the main objective of this survey, By applying the two-stage Simos' procedure. At the first step, responses of experts are collected, which are the order of the criteria. In the second stage, for each criterion, both normalized weights and global weights are calculated [55]. The responses were collected from 19 experts and based on their ranking of criteria the [non – normalized weight], [normalized weight], and [global weight] of each criterion were calculated as illustrated by Table 6, global weight it is calculated, for each criterion which is the product of multiplying the normal weight of the criteria in the normal weight of the main category that belongs to this criteria, Table 7 shows the global weight for each main category.

3.3.3 Second Questionnaire Results

Figure 6 depicts the distribution of the global weight percentage amongst the different main categories. Categories are 22% for Project objective category, 28% for Project characteristics category, 22% for Owner characteristics category, 11% for External environment category, and 17% for

Regional category. Global weight distribution for each criterion showed in Figure 7.

Figure 6: Distribution of global weight percentage amongst the different main Categories.

4 Conclusions

The project delivery systems are generally selected based on the experiences of decision-makers. However, in this comprehensive study, twenty-eight criteria were obtained that influence decision-making in selecting the type of project delivery systems. As evaluating the criteria affecting s (PDSs) of infrastructure projects is the main objective of this study, By applying the two-stage Simos' procedure. These criteria were generated through discussions with experts, and very comprehensive detailed review of the literature review influencing infrastructures construc-

Figure 7: Global weight for each criterion.

tion projects in Egypt. Five main categories were identified, 1- Project objective category; 2- Project characteristics category; 3-Owner characteristics; 4-External environmental category; and 5- Regional category. “These categories were turned out that the most important decision-making criteria for selection project delivery system in this study results depicts the distribution of the global weight percentage amongst the different main categories. Categories are 22% for Project objective category, 28% for Project characteristics category, 22% for Owner characteristics category, 11% for External environment category, and 17% for Regional category. Based on a research sample generated from the two questionnaires, to determine the most influential criteria on the choice of the [PDS]. Our findings generated final list of twenty - two important criterions. Also in addition generated ranked criteria weights using Simo’s approach implemented the decision making settings for selection best infrastructures [PDS] to achieve the desired goals.

5 Future directions and enhancements

As mentioned before to the author’s published work [61] based on this current paper, the authors should capture the simulation and the entire experiment of the model in terms of implementing it into the system initialization, parameter input, parameter output and system operation, this warrants a collaborative study in a separate report. Given this fact, examining the suitability of this model as well as its validation steps in different circumstances. It is worth noting the final upgrades of model would need to be addressed based on the identified specific barriers within the validation stage. This upgrade and enhancement of the model will be for better accessibility of the model findings to be utilized. In summary, any early validation work on a project won’t be successful in the meantime as this will require group process and intellectual efforts, as well as the application of a range of specific procedures and criteria. As the current work is at the proof of concept stage, such comparison is warranted in our future work in a separate and detailed study focusing on that.

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