

# A Review on Critical Success Factors of Sustainable Retrofitting Implementation

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## Abstract

Sustainable retrofitting has been one of the alternate solutions to mitigate greenhouse gas emissions and climate change. However, it is apparent that limited existing buildings are being sustainably retrofitted and the reason lies within the influential forces which contribute to the failure of the sustainable retrofitting project. Thus, this study aims investigate the current literature based on critical success factors (CSFs) for sustainable retrofitting and to identify any gap that might exists. Journals were searched using the key words identified from the preliminary literature review. Successive round of article abstract reviews resulted in 59 articles being selected for compilation purpose. The CSF constructs were then identified using content analysis and inductive coding approach. Critical analysis of the literature revealed gaps in the literature. The most significant findings was the lack of research on CSFs for sustainable retrofitting from the stakeholders' perspective. This research provides a comprehensive compilation of all previously identified CSFs for project purpose.

*Keywords:* Sustainable retrofitting; CSFs; stakeholders' perspectives; content analysis; inductive coding approach

## Abstrak

Membaikpulih mampan merupakan salah satu penyelesaian alternatif bagi mengurangkan pelepasan gas rumah hijau dan perubahan iklim. Walau bagaimanapun, ia adalah jelas bahawa bangunan sedia ada yang sedang dipasang secara mampan adalah sangat terhad dan antara sebab utama keadaan ini terjadi ialah disebabkan oleh faktor-faktor yang menyumbang kepada kegagalan projek retrofitting yang mampan. Kajian ini adalah untuk mengkaji literatur semasa berkaitan dengan faktor kejayaan kritikal (FKK) bagi mengubah suai mampan bangunan sedia ada dan juga bagi mengenal pasti jurang yang mungkin wujud. Jurnal-jurnal berkaitan diperolehi melalui kata kunci yang dikenal pasti daripada kajian literature terdahulu. 59 artikel dikenal pasti hasil daripada kajian yang lebih mendalam berasaskan abstrak artikel untuk tujuan kompilasi. Konstruk FKK dikenalpasti melalui analisis kandungan dan juga melalui pendekatan induktif pengkodan. Hasil kajian kritikal literature menyebabkan pengenalpastian jurang dalam literature. Penemuan yang paling signifikan daripada kajian ini adalah kekurangan kajian berkenaan dengan FKK untuk mengubah suai bangunan sedia ada berdasarkan kepada perspektif pihak berkepentingan. Kajian ini menghasilkan satu kompilasi yang komprehensif bagi FKK projek yang dikenal pasti.

*Kata kunci:* Membaikpulih mampan; FKK; perspektif pihak berkepentingan; analisis kandungan; pendekatan induktif pengkodan

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## 1.0 INTRODUCTION

The building sector is by far one of the largest sources of greenhouse gas emissions around the world. An estimates by the American Institute of Architects (AIA), suggests that nearly 50% of all greenhouse gas emissions are generated by buildings

and their construction in terms of the energy used in the production of materials, transportation of materials from production factories to construction site as well as energy used in running and operating buildings. Additionally, according the USGBC, existing buildings are accountable for 72% of electricity consumption, 40% of raw material usage, 39% of

energy use, 35% carbon dioxide emissions, 30% waste output and 14% potable water consumption.<sup>1</sup> Hence, buildings are estimated to account for approximately half of all annual energy and greenhouse gas emissions. These numbers are enough to demonstrate that there is indeed a huge negative impact of buildings on the environment. Hence, one prospective solution is to make certain that the design, construction and maintenance of the built environment is sustainably developed.<sup>2</sup> Indeed, there is a strong business case for sustainable building.

Whilst there is growing recognition that sustainable buildings outperform conventional buildings in term of a variety of environmental, social and economic indicators<sup>3</sup>, sustainable buildings represent the next phase of buildings. The reality is that, the vast stock of existing buildings which make up the bulk of the market are not sustainably built. The growing support for sustainable building practices and the current development of new sustainable building construction are not enough to reverse this cycle. Consequently, according to Miller and Buys, if the challenge of climate change is to be successfully addressed, these vast stocks of existing buildings need to be retrofitted.<sup>3</sup> Since, the ratio of existing buildings to new sustainable construction is overwhelming, sustainable retrofitting of existing buildings could be the logical solution to reduce the environmental effects sooner.<sup>4</sup> Therefore, the enormous challenge in sustainable building is not to construct a minority of highly sustainable buildings, so much as to raise the sustainability of the entire stock of buildings in active use. Generally, when all building types are measured, the major single source of greenhouse gas emissions in buildings comes from commercial buildings, and therefore the focus for making significant reductions of emissions lies within this group.<sup>5</sup> According to Menassa and Baer, stakeholders are concerned with raising the sustainability of their existing buildings from social, environmental, economic and technical perspectives.<sup>6</sup> In fact, policy making bodies have recognized the need for increased building retrofitting<sup>7</sup> as a means of achieving sustainability in the built environment.

However, despite of all these facts, the question is how much progress are actually done in regards to “sustainable retrofitting”? Unfortunately, even with the growing concerns of stakeholders over environmental, social and economic aspects, sustainable retrofitting is not winning its place at the forefront as hoped for.<sup>4</sup> Existing buildings are continued to be retrofitted at a very low rate.<sup>8</sup> The limited response of the commercial property markets to the sustainability is well recorded.<sup>9-11</sup> For instance, according to Olgay & Seruto, existing commercial building stock is currently being retrofitted at a rate of approximately 2.2% per year only.<sup>8</sup>

A significant proportion of the existing building stock is owned by institutional investors who are unconvinced by the need to improve their stock and pass the running costs to tenants. Additionally, according to Wilkinson, research has proven that particular building stakeholders are less likely to retrofit and authorities need to consider ways to initiate stakeholders towards sustainable retrofitting.<sup>12</sup> Reasons given tend to be based around the circle of blame and the lack of business case for sustainable retrofitting.<sup>13</sup> Indeed, according to Cadman, the major barrier that obstructs the development of sustainable existing buildings is the circle of blame.<sup>14</sup> Further review of literature revealed several barriers that inhibit building stakeholders especially owners from making reasonable and effective decisions to sustainable retrofit their existing buildings. Therefore, a substantial gap in research currently exists in the area of commercial buildings and the means of persuading stakeholders towards sustainable retrofitting existing buildings.<sup>5</sup>

Furthermore, according to Menassa and Baer, even though there is significant demand for sustainable buildings, sustainable building retrofit projects are still not widely pursued.<sup>6</sup> Indeed, few studies have explored the technical, economic and environmental implications of existing building sustainable retrofits.<sup>15-22</sup> Additionally, a review on recent literature shows very few studies have been conducted on what motivates public and private building owners to pursue green and sustainable building design initiatives.<sup>6</sup> Yudelso identified multiple reasons why building owners and operators are interested in energy efficient and sustainably retrofitted buildings.<sup>23</sup> Where else, Fuerst and McAllister outlined the rationale to pursue sustainable building design. Nonetheless, no attention has been devoted in identifying success factors from stakeholders’ perspective towards implementing sustainable retrofitting in existing commercial buildings.<sup>24</sup>

Therefore, this research aims at identifying the success factors towards sustainable retrofitting based on the problems that inhibit stakeholders from sustainably retrofit their existing commercial buildings so that progress can be made on sustainable retrofitting. However, since it is not practically viable to discuss all the problems to identify the success factors contributing to successful sustainable retrofitting implementation, one alternate solution is through investment in Critical Success Factors (CSFs). Furthermore, as suggested by Bullen and Rockart, one of the five sources of identifying CSF are based on the problems.<sup>25</sup>

CSF was first developed by Rockart.<sup>25</sup> CSFs are the limited number of areas in which results, if they are satisfactory will ensure successful competitive performance for the organization.<sup>25</sup> CSFs are also known as the few key areas where ‘things must go right’ for the business to flourish, areas of activity that should receive constant and careful attention from management, and also areas in which good performance is necessary to ensure attainment of goals.<sup>25</sup> The identification of CSF is important for the policy makers to increase the rate of sustainable retrofitting implementation in existing commercial buildings. Indeed, a critical review of publication related to sustainable retrofitting revealed, there has been lack of comprehensive and dedicated study on the CSFs for sustainable retrofitting carried out by previous researchers.

Based on the results of a comprehensive compilation of construction project success factors, this paper seeks to present a new agenda to further research on critical success factors for sustainable retrofitting from stakeholders’ perspective. The following section will explain the research methodology chosen for the compilation of success factors. Next will be the summary of the CSF categories and concepts and finally the critical analysis of the CSF literature

## ■ 2.0 RESEARCH METHODOLOGY

### 2.1 CSF Compilation

Comprehensive literature review involves an extensive note taking of any possible references to CSFs, based on the conceptual analysis approach. Since, as mentioned previously, there has been lack of studies on the CSFs for sustainable retrofitting, therefore, CSFs in this context is defined as reference to any condition or element that is deemed necessary for project implementation in any industry. For the purpose of coding the identified factors, relevant articles containing reference to CSFs were analyzed in depth. This part of the analysis involved differentiating and combining the data collected.<sup>26</sup> Emphasis was placed on the meaning of the words

and not on the words itself. Hence, all the identified CSFs will be sorted in like categories regardless of its description. This will be done using inductive coding technique. According to Strauss and Corbin, open coding is the part of analysis that pertains specifically to the naming and categorizing of phenomena through close examination of data.<sup>27</sup> During open coding, the data are broken down into discrete parts, closely examined, compared for similarities and differences, and questions are asked about the phenomena as reflected in the data.<sup>27</sup>

The methodology part also involved the technique of preparing qualitative data category cards as described by Strauss and Corbin.<sup>27</sup> Coded constructs were recorded as they appeared in individual journal articles based on bibliographic software program. Then, the frequencies of each noted constructs will be recorded.

As the aim of this study is to understand in depth the various CSFs identified by researchers from various field, therefore appropriate approach for analysis was content analysis. Content analysis is the most common technique when analyzing texts.<sup>28</sup> Silverman suggests that a good coding scheme would reflect a search for ‘uncategorized activities’ so that they could be counted for, in a manner similar to searching for abnormal cases.<sup>28</sup> Therefore, this analysis also searched for references to success factors without identifying so. Thus, some of the search terms did not always use “success” and “critical success factors” to select articles.

## 2.2 Data Collection Procedures

The data collection method for the CSF compilation followed the eight category of coding steps offered by Carley.<sup>29</sup>

Step 1: *decide the level of analysis*. This is a decision making stage of determining whether to search for a single word or phrases. Furthermore, according to Berg, determining the level of choosing the sample and the units of analysis are the first step of content analysis.<sup>30</sup> Therefore, for the purpose of this research, the level of analysis involves the entire journal articles.

The data collection phase for literature review involved an in depth search of many major journals including but not limited to, as outlined below:

- Business Process Management Journal
- Sustainable Cities and Society
- Property Management
- Structural Survey
- Journal of Corporate Real Estate
- Energy Policy
- Journal of Civil Engineering and Management
- Journal of Construction Engineering and Management
- International Journal of Project Management
- International Journal of Strategic Property Management
- Journal of Sustainable Real Estate
- Construction Management and Economics
- Engineering Construction and Architectural Management

Other than the above, the following databases also were searched; Emerald, Web of Science, Science Direct, Taylor and Francis Online, Scopus and Wiley Online Library. Collectively, these databases include hundreds of journals according to the field.

The search terms and conditions for selecting the articles from search results were outlined in Table 1 below. Furthermore, the keywords for the search were based on the keywords used by the authors of relevant articles identified from

preliminary literature review. Also, the articles were selected from journals that were peer-reviewed or scholarly.

However, the actual selection of the articles was based on the researcher’s decision after reading the article abstract and title. Articles will be further review if contain any information indicating CSFs.

**Table 1** Search terms: journals and database

Searched: citation, abstract and title	
Individual Journal Searches	Database Searches
Critical success factors for sustainable retrofitting	Critical success factors “AND” sustainable retrofitting
Critical success factors for sustainability	Critical success factors “AND” sustainability
Critical success factors for sustainable development	Critical success factors “AND” sustainable development
Success factors for sustainable retrofitting	Sustainable retrofitting “AND” successful implementation
Sustainable retrofitting success factors	Sustainable retrofitting “AND” success
Sustainable retrofitting Critical success factors	Sustainability “AND” success  Sustainable retrofitting  Sustainability  Sustainable development  Critical success factors

Step 2: *decide how many steps to code for*. This stage involves the decision whether to code for a specific pre-determined set of concepts or to allow for a more interactive coding approach. Interactive coding approach was selected as it would allow for enclosure of all identified CSFs.

Step 3: *decide whether to code for existence or frequency of a concept*. At this stage, the coding was based on the frequency of the concept.

Step 4: *decide on how you will distinguish among concepts*. At this stage, decision will be made on whether to code the concept exactly as they appear or to be recorded in some altered or collapsed form. Therefore, in this research, any words that gives the same meaning will be categorized under the same constructs.

Step 5: *develop rules for coding your text*. It is necessary to develop a set of translations rules that could be applied throughout the coding process, to ensure consistency and internal validity of coding. Hence, the following translation rules were developed and applied:

- All articles were read for the first time and priority was given on identifying possible success factors. At this point, the categories were not confirmed yet. In defining the success factors, Williams and Ramaprasad offered four degrees of criticality: factors linked to success by a known causal mechanism; factors necessary and sufficient for success; factors necessary for success; and factors associated with success.<sup>31</sup> However, for compilation purpose, factors considered both necessary for and associated with success were included.

- In order to determine any similarity in concepts, the articles were re-read and similar concepts were placed in like categories.
- A thorough review of the concepts and examination of categories were done again to determine possibility of collapsing or establishing additional categories.
- The constructs terms will be determined based on the review of the concepts, after finalizing the categories. The terms might be from one of the coded terms or an entirely new term.

Step 6: *decide what to do with “irrelevant” information.* This stage decides with the information in the text that was not coded. Since, literature compilation deals with grouping all the concepts considered success factors, therefore, coding were only based on the aspects that clearly states possible success factors.

Step 7: *code the texts.* In this stage, a manual technique was used for coding process. The translation rules in step 5 were tracked.

Step 8: *analyze your results.* This stage involves in reviewing the constructs based on frequency as well as critical evaluation of the CSF approach.

### 3.0 CSF LITERATURE COMPILATION

#### 3.1 Discovering Categories

A total of 100 articles were reviewed and 59 were considered to contain success factors applicable to project success. The first stage involves grouping similar concepts into like categories. After completion of this stage and successive round of collapsing several categories, the final possible CSFs are 9.

#### 3.2 Naming Categories

The names for each category were selected based on the ability to understand the concept. For most of the cases, the selected name category was based on the terminology frequently used in the literature. Table 2 lists the 9 categories of critical success factors and the frequency of each CSF.

**Table 2** Frequency analysis of CSFs in literature

CSF Category	Number of Instances Cited in Literature
Project Management	59
Interactive Processes	51
Project Related Factor	50
Human Related Factor	49
External Factors	12
Contractual Arrangements	8
Knowledge and Innovation of Sustainable Development	4
Project Procedures	2
Implementation of Sustainable Development Strategy	1

#### 3.3 Understanding the CSF Categories and Their Concepts

The identified CSFs were described in detail of its concepts below.

*Project Management.* This construct refers to the ongoing management of the implementation plan. Therefore, it involves, allocation of responsibilities to various players, definition of milestones and critical paths, training and human resource planning, and finally the determination of measures of success.

*Interactive Processes.* According to Larson, project success may be better assured when the owner and contractor firm work jointly as a team with recognized general objectives and definite procedures for mutual problem solving.<sup>32</sup> Correspondingly, such relationships should be extended to include all project participants. Therefore, the interactive processes become vital in assisting effective coordination throughout the project lifespan.<sup>33</sup> Communication refers to the adequacy of communication channels, both formal and informal, and their effectiveness in providing timely, sufficient information to the suitable project participants. Project planning concerns the importance of developing comprehensive plans over the entire project lifecycle.<sup>37</sup> Monitoring deals with examining and reporting (feedback) on actual performance against expected progress. Finally, control involved taking action to outline future events with the aim of accomplishing what has been originally planned.<sup>38</sup>

*Project Related Factor.* Project related factor has been proposed as a useful predictor for construction time.<sup>39</sup> Furthermore, the significance of project related factor for project success has been also mentioned by many researchers.<sup>32</sup> The indicators used to measure this factor are realistic schedule, innovations, materials and equipments, supervision, profitability, risk, adequate fund/ resources.

*Human Related Factors.* Chua *et al.*, define human related factors as the key players, including project manager, client, contractor, consultants, subcontractor, supplier and manufacturer.<sup>32</sup> Walker considered influence of client and clients' representative as a significant factor on construction time performance. A construction project requires team spirit, therefore team building is important among different parties.<sup>39</sup> According to Hassan, the crucial element for successful completion of a project is the team effort by all parties to a contract.<sup>40</sup>

*External Factors.* Various researchers support 'environment' as a factor affecting the project success.<sup>32,41-45</sup> Furthermore, researchers described 'environemnt' as all external influences on the project, including social, political and technical. Nevertheless, according to Gudiene *et al.*, external factor were found to be the least important factor among all the identified success factors.<sup>46</sup>

*Contractual Arrangements.* Indicators under this construct only focus on the major considerations that lead to project success. For instance, according to Hwang and Lim, the identification of risk and its equitable allocation and adequacy of plans and specifications dictate both the content and type of the contract used.<sup>47</sup> Chua *et al.*, stated that regardless of the contract type, the scope must be founded upon clear objectives and realistic obligations.<sup>32</sup> Project performance may also be improved with contractual motivations. The factors identified from the contractual arrangement aspects are realistic obligations/ clear objectives, risk identification and allocation, adequacy of plans and specifications, formal dispute resolution process, motivation/ incentives, saving shares and task allocation.

*Knowledge and Innovation of Sustainable Development.* The indicators under this construct are learning

from own past experience and past history, learning from best practice and experience of other workgroup, review failure and solving them, accurate measurement and verification and awareness to sustainable development theory. According to Xu *et al.*, highlighting and promoting awareness to the concept of sustainability could make a project success with sustainable development principles in planning, designing and building retrofits.<sup>48</sup>

**Project Procedures.** A number of researchers identified the importance of project procedures related factors.<sup>49-52</sup> Dissanayaka and Kumaraswamy, defined the scope of procurement as the structure within which construction is brought about, acquired or obtained.<sup>50</sup> Therefore, two attribute are used to determine this factor; they are procurement method (selection of the organization for the design and construction of the project) and tendering method (procedures adopted for the selection of the project team and in particular the main contractor).<sup>53</sup>

**Implementation of Sustainable Development Strategy** Implementation of sustainable development strategy contains indicators such as sustainable development strategy planning, available technology, control mechanism of sustainable development strategy and policy support. In order to achieve sustainable development, sustainable development principles should be taken as a strategy to organize these projects.<sup>54</sup> According to Xu *et al.*, strategy management for sustainable project is an instrument to assure sustainable objectives of project through sustainable development strategies planning and control mechanism.<sup>54</sup> Retrofit technologies reveal new equipment, new energy resources, new energy audit technologies and new technologies of improvement measures.<sup>54</sup> Xu *et al.*, also added that the major obstacle of energy efficiency improvement in existing buildings is lack of policy incentives.<sup>54</sup>

#### 4.0 ANALYSIS OF SUSTAINABLE RETROFITTING IMPLEMENTATION LITERATURE

As mentioned earlier, sustainable retrofitting is measured as one of the foremost approaches in achieving sustainability in the built environment to mitigate global warming and climate change. However, many researches on CSFs for project were based on the construction projects and the maintenance of the existing buildings. The previous section provided a compilation of range of success factors that are frequently cited in literature. There was an additional analysis carried out that able to identify obvious gap in literature to date. As a result, the most critical gap found was no in depth research in the coverage of CSFs for sustainable retrofitting was studied. Furthermore, another noteworthy review revealed the need to initiate sustainable retrofitting by the stakeholders. Since, the decision on sustainable retrofitting lies within the building stakeholders.<sup>6</sup>

The first gap identified through literature was no studies conducted regarding sustainably retrofitting existing commercial buildings. However, numerous list of CSFs for construction projects have been introduced by various researchers.<sup>54</sup> For instance, Chua *et al.*, arranged the CSFs for construction project into four major aspects, namely, project characteristics, contractual arrangements, project participants and interactive processes.<sup>32</sup> Belassi and Tukel, also have grouped the CSFs into four areas based on seven different lists of CSFs identified from literature.<sup>55</sup> The four areas was factors related to the projects, factors related to the project manager and the team members, factors related to the organizations and factors related to the external environment. Additionally, Hwang and Lim have

derived 32 success factors and also have grouped them into four major aspects.<sup>56</sup>

On the other hand, Chua *et al.*, identified project success factors based on seven major journals from the construction field.<sup>32</sup> Then classified the factors into five major groups namely, project related factors, project procedures, project management actions, human related factors and external environment. Saqib *et al.*, also classified success factors into 7 major groups, namely, project management factors, procurement related factors, design team related factors, contractors related factors, business and environment related factors.<sup>57</sup>

However, Enshassi *et al.*, have identified 63 factors related to project performance and have classified them into ten major groups, which are cost factors, time factors, quality factors, productivity factors, client satisfaction factors, regular and community satisfaction factors, people factors, health and safety factors, innovation and learning factors and environmental factors.<sup>58</sup>

Giudene *et al.*, have identified 71 project success factors and classified them into seven major groups, namely external factors, institutional factors, project related factors, project management related factors, project manager related factors, client related factors and contractor related factors.<sup>59</sup> Al-Tmeemy *et al.*, have identified 13 success criteria for building projects and have classified them into 3 major components, known as project management success, product success and market success.<sup>60</sup>

As most of the researchers identified a list of CSF categories, researchers such as Chan and Yu and Chan and Suen have only emphasized contractual arrangement as the major factors for construction project success.<sup>61,62</sup> Where else, Davies and Chan (2001) point out partnership as the key ingredients for performance success. However, most researchers in previous studies have categorized the CSFs based on a similar principles categories.<sup>63</sup> And other researchers such as Toor and Ogunlana and Fortune and white identified a more comprehensive coverage of CSFs.<sup>63,64</sup>

Based on the previous paragraphs, while there seem to be a large body of information on CSFs for construction projects purpose, a literature search turned up very little regarding the success factors for sustainable retrofitting. Sanvido and Riggs have identified 10 success factors in their report on retrofit project management submitted to the Construction Industry Institute.<sup>65</sup> The factors identified was project team characteristics, team member characteristics, contracting, information management, planning and communications, time management, space management, management of working environment and resource/support. The identified success factors were merely to manage a retrofit projects. Another researcher, Xu *et al.*, have identified 21 success factors for EPC for sustainable building energy efficiency retrofit (BEER) of Hotel Buildings in China.<sup>52</sup> Xu *et al.*, have grouped the success factors into six major categories namely, project organization process, EPC project financing for hotel retrofit, knowledge and innovation of EPC, sustainable development and measurement and verification, implementation of sustainable development strategy, contracting and external economic environment.<sup>52</sup> Therefore, it is clear that there has been no research conducted to produce a collection of CSFs for sustainable retrofitting of existing commercial buildings.

The second gap identified from literature review was the need to identify CSFs for sustainable retrofitting based on the stakeholders' perspectives. Since, as mentioned earlier, stakeholders are encouraged to enable operations towards sustainable retrofitting of existing buildings<sup>65</sup>, the identification of the success factors should be based on the stakeholders' need

in order to initiate sustainable retrofitting. Furthermore, according to Lapinski *et al.*, implementing sustainable retrofitting involves a significant amount of planning and communication with stakeholders.<sup>66</sup> In fact, according to Geoghegan and Dulewicz, Shahhosseini and Sebt, Yang *et al.*, and Zavadskas *et al.*, stakeholder factors plays a significant role in determining the success of a project.<sup>25,67-69</sup>

Additionally, previous researches on the CSFs for construction projects were also focused on the stakeholders. For instance, Chua *et al.*, Hwang and Lim, have included factors related to construction projects based on the project participants.<sup>32,70</sup> Where else, the critical success factors identified by Belassi and Tukel involved factors related to project manager and team members.<sup>71</sup> Saqib *et al.*, have identified success factors for construction projects by including factors related to client, design team and contractors.<sup>72</sup> Also, Gudiene *et al.*, have identified success factors for projects based on factors related to team members, project manager, client and contractor. Indeed, Nah *et al.*, have identified the necessary to study the apparent importance of success factors from stakeholders' perspectives. Therefore, the need to identify CSFs for sustainable retrofitting from stakeholders' perspective is considered significant.

## 5.0 CONCLUDING THOUGHTS AND DIRECTIONS FOR FUTURE RESEARCH

Research on sustainable retrofitting and critical success factors can be a vital step towards enhancing chances of sustainable retrofitting implementation in existing buildings. A review of the CSFs literature reveals that in many cases CSFs are presented for construction project in general and the identified factors were based in the review of already published literature. Therefore, duplication occurs in the frequency analysis on the success factors. Indeed, there is little or no research on CSFs for sustainable retrofitting of existing commercial buildings based on previous literature.

Furthermore, thorough review of previous literature, study revealed that CSFs should be developed based on stakeholders' perspectives. Since, according to Menassa and Baer, a decision on whether a building should undergo sustainable retrofitting need to be agreed by the building stakeholders.<sup>6</sup> Furthermore, as mentioned earlier, review of literature also revealed that there are several barriers that inhibit building stakeholders from making sustainable retrofitting decision.<sup>6</sup> This supported by the research conducted by Wilkinson who have concluded that building stakeholders are the one less likely to retrofit existing buildings.<sup>12</sup> Therefore, existing building stakeholders can help direct the choice of sustainable retrofits to be implemented in the existing buildings, if the success factors identified based on the problems that inhibit sustainable retrofitting.

In view of the limitations of the previous literature and based on the suggestions from other researchers, there is a need to focus future research efforts on the study of CSFs for sustainable retrofitting as they apply to the perspectives of the stakeholders.

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