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Green Building Incentives: A review

Abstract

Green building incentives are important to promoting green building. However, it lacks a systematic review of existing knowledge. This paper aims to elicit the common themes in studies on green building incentives through a systematic review. It is found that the common research areas in the studies on green building incentives are incentive categorisation, its effectiveness of promoting green building development, criticism of current green incentive implementation, and strategies for improving green building incentives. Green building incentives are categorised into external and internal ones. The external incentive is a forced choice whereby beneficiaries are required to fulfil specified conditions or requirements before benefitting. The internal incentive allows beneficiaries to be incentivised out of volition as a result of the appeal of the benefits of green buildings. The external incentives, which are largely provided by the government is divided into financial and non-financial incentives. It is found that owners are more incentivised by non-financial incentives. In terms of effectiveness, the review finds that, both external and internal ones are important instruments for promoting green building, although it is not clear which one is more effective. Furthermore, the review uncovered the criticisms of external green building incentives. The criticisms mainly focus on the shortcomings in the manner of administering the incentives by the government to the owners. The strategies for improving green building incentives were also found in the review. The major emphasis of the strategies is the need for the government to redirect their approach to providing incentives so that owners can be more attracted and encouraged to pursue green building. It could be seen that the string that connects the four research areas of green building incentive is the government. This signifies the importance of the government on issues regarding green building incentives. Consequently, the government is implicated by the findings of this study. Also the findings gave-off a research area that could expand the knowledge of green building incentive.

Keywords: *Green building incentives, government, internal, external, review, extrinsic, intrinsic*

1. Introduction

Global resources are being used up at an alarming rate through Man's over exploitation [1-4], and the result is not just increasing greenhouse gas emission, which is altering the global climate for worse, but also collapsing fisheries, diminishing forest cover and depleting fresh water systems and natural resources [1]. To a large extent, the construction industry has been responsible for this environmental degradation [2, 5-8], especially given its high rate of energy consumption [1, 9, 10]. Acknowledging that construction activity will always involve, to some extent, adverse environmental implications [11], green building has been advocated and promoted as a guiding paradigm to development in the building sector [5, 12, 13]. It is the construction sector's response to enacting sustainable development [4, 14-16].

Green building is the practice of creating structures and using processes that are responsible and resource-efficient throughout a building's life-cycle from siting to design, construction, operation, maintenance, and renovation [9, 14, 15]. During design and construction, green buildings use recycled materials, less water, less energy, and resource efficient techniques; incorporate water sensitive design and minimize vulnerability to flooding; minimize polluting emissions to water, air and soil and minimize noise and light pollution [6, 11-13, 17, 18], thereby minimising adverse impact on the environment [6]. Consequently, this environmental-friendly construction process implicates socially and economically. Socially, green buildings improve the living and working environment for people [19]. Economically, green buildings offer life cycle cost savings to owners or occupiers [20]. Also, they are leased or sold at a faster rate, offering the possibility of greater profits [21]. In essence, green building is environmentally, economically and socially advantageous [20, 22, 23].

In light of the environmental, social and economic advantages of green buildings, incentives are required to drive the adoption of green buildings by stakeholders in the building sector [20, 23]. Generally, incentives can be defined as something that influences people to act in certain ways [101]. Emerton [100] described incentives as specific inducements designed and implemented to influence or motivate people to act in a certain way. As a motivation, incentives compel people to actually incorporate green building techniques on their projects in the building sector [32]. In the building sector, the implementation of green building involves many stakeholders such as designers, constructors, consultants and project owners [99]. However the influence of project owners is greater due to their position as key decision makers [47]. Hence, the issue of incentives for green building projects is largely focused on project owners (see [29, 52, 72]).

The subject of incentives for green buildings is covered under different topics in the literature. The subject of incentives for green building projects has been described in respect of how it incentivises beneficiaries, especially project owners. One way is that beneficiaries are handed a forced choice of meeting specified green building related condition or requirement so as to benefit from this incentive. Usually, the government is responsible for administering this type of incentive, and it is termed external incentive [22, 25-29, 30]. Another way is through the appeal of the benefits of green buildings which provokes the interest of stakeholders to adopt green building practices. Through this way, it is regarded

that project owners are incentivised to adopt green building internally, or out of personal conviction or volition. Despite their differences, it is agreed among researchers that both are capable of stimulating the adoption of green buildings [31-33, 34, 37].

Another topic is the effectiveness of the incentives for green building. Some studies argued for the effectiveness of government incentives (29, 31, 38). Others argued for the effectiveness of the internal incentives [39-40]. Other topics include the criticisms of; and strategies for improving government incentives. Incentive for green building is an important subject because it is an instrument that can ultimately drive the sustainable development of the building sector [105]. It is therefore important to articulate the various topics on the subject in the literature.

Past related review include Zuo and Zhao [4]'s critique of studies on green building. In the review, the various approaches to achieve green buildings were identified as one of the major research themes, but there was no comprehensive description of incentives as instrument for driving the adoption of green building. Similarly, Circo [15]'s review only describes the use of mandates and incentives to encourage green building in the private sector in the US. Consequently the review argues for a systematic review of studies on green building incentives so as to sum up available studies on the subject area. Thus this paper conducts a systematic review of studies on green building incentives. Systematically reviewing published articles on a subject avails the idea of what is known and not known about the subject matter [41], thereby stimulating inspirations for future research [42]. The outcome of the review will not only reveal research implications with the potential to expand the knowledge area, but also provide information for the government on how to administer incentives more effectively.

2. Research Methodology

2.1 Search strategy

This search follows a systematic review process, as shown in Figure 1. First, electronic searches of relevant publications on green building incentives were conducted in September, 2014 in large databases such as Google Scholar and Scopus [43, 44]. The studies of interest, or inclusion criteria were published works focusing on green building incentives, either completely or partially. With the appropriate Boolean operator, keywords search, such as *Green building incentives, sustainability incentives, and sustainability incentives and sustainable building* returned 530 publications. All of them were downloaded into *Endnote*. Second, titles and abstracts of these publications were examined, which allowed the authors to make initial judgement about suitability for inclusion of publications ([45, 46]). It was found that majority of the publications contained at least one of the keywords. After checking titles and abstracts, and excluding duplicated publications, 175 publications were remaining. The final step was the content review of the remaining publications. Publications were checked whether they solely or partially focused on green building incentives. Majority of the articles do not meet the inclusion criteria, and only 65 publications, either entirely (20) or partially (45) focusing on green building incentive were finally selected. As shown in Table 1, there were 54 Journal articles, 6 conference articles, 4 theses and 1 textbook.

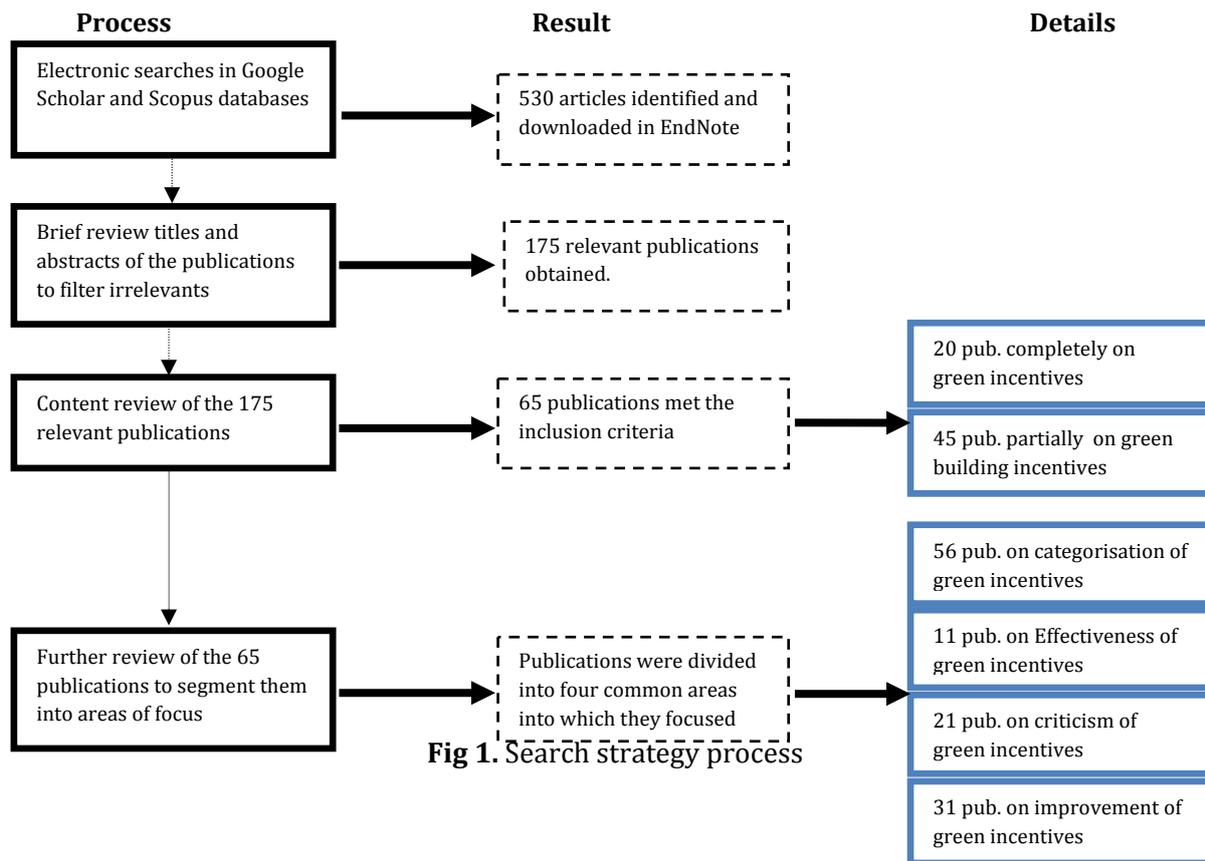


Fig 1. Search strategy process

Based on a further in-depth review, it was found that these 65 publications focused on four research areas (Fig 1). The first area is the categorisation of green building incentives. A total of 56 publications made explicit description of the categories of incentives and the distinction between them. These publications also made significant emphasis on the role of the government in different jurisdictions in providing green building incentives. The second area relates to the effectiveness of green building incentives. 11 publications provide empirical evidences in different locations on the effectiveness of incentives towards promoting green buildings among owners. The third one focuses on criticisms of green building incentives. 21 publications described the shortcomings in the manner of administering incentives, which invariably discourages, or have the potential to discourage green building among owners. The last area covers 31 studies which recommend strategies for improving green building incentives towards green building among owners. In the next section, the research areas are briefly introduced, followed by the description of the findings of each research areas.

Table 1. Summary of selected articles

Type of Publication	Inclusion criteria		Number
	Focused solely on green building incentives	Green building incentives as part of larger scope research	
Journal articles	15	39	54
Conference papers	3	3	6
Theses	2	2	4
Textbook	0	1	1
Total	20	45	65

3. Findings

4. Research themes in green building incentives

In the following section, the four identified research areas are described, including categorisation, effectiveness, criticisms, and strategies for improvement of green building incentives. Each research area is briefly introduced, and findings are presented in sub-themes., where insights and reasons into current practices are provided, in most cases, examples are provided to buttress the findings. Table 2, shows the exact number of studies on each sub-theme.

4.1 Categorisation of green building incentives: External and Internal

4.1.1 External incentives: incentives provided by the government

The differentiating characteristic of external incentive is its specificity of conditions or requirements that must be fulfilled by beneficiaries or subscribers. In a sense, this is also because external incentives are provided by the government – who must ensure that due process is followed in providing incentives to encourage the adoption of green building projects. In other words, the beneficiaries or subscribers are handed a forced choice of meeting a specified green building related condition or requirement so as to benefit from government incentives.

For the beneficiaries or subscribers, especially the project owners, the adoption of green building project as a result of government incentives connotes an extrinsic motivation. In self-determination theory (SDT), extrinsic motivation explains the phenomenon whereby an action is carried out by a person or group of persons because of a separable outcome or external end such as rewards, punishments, deadlines etc. [106-107]. Also this separable outcome or end is usually external to the activity performed or action taking [108]. This phenomenon is also called controlling motivation where people act with the intention of obtaining a desired consequence or avoiding an undesired one, so they are energized into action only when the action is instrumental to those ends [109].

The government has an important and leading role in promoting green building development [28, 47, 48]. There is a growing awareness of the construction sector's potential to positively affect the environment through green building [49]. As the largest owner in construction, the government has a significant

influence and opportunity to realize this potential [15]. For instance in China, the government is constructing green buildings through several policies and specific plans [3]. However, for other important stakeholders, especially the private sector, green building projects often appear to lack financial feasibility [50]. In other words, initial cost is a barrier hindering the private sector in green building development [22, 48, 51-54].

Also under the current macro-economic environment, most private clients need a payback period of between seven and twenty years [3, 29] and it is difficult to convince them to inject the extra investment involved [4] while the potential of the resulting green building premium to offset its high initial cost at all is still being debated, and remains inconclusive [22, 24, 49, 55, 56]. This dissuades many private owners from voluntarily adopting green construction practices [29]. Thus to relieve the cost impediment, incentives are offered by the government as 'carrots' to drive private sector change [50, 57]. Carrots or incentives such as subsidy or reward are provided to overcome economic barriers [22, 58-60]. In sum, the government's green building incentives are provided as encouragement [29, 55, 61-63], and to mitigate the financial inadequacies of owners and other stakeholders.

However, stricter mandates, the "sticks," are also used where the carrots, "incentives", are neither sufficient nor efficient [50]. As Gordon and Plunkett [64] observe, green practice is well on the way to becoming mandatory for all construction projects, rather than a socially conscious, idealistic option. In other words, green or sustainable building may cease to be an environmental or commercial business option but rather an unavoidable requirement [62].

This is because green building is becoming the only acceptable way to build [51]. Therefore, it is anticipated that in the short term future government incentives will be provided solely for willing green building owners, while those deemed to be laggard and resistant will be faced with regulations and the negative consequences of non-compliance [61, 65] in a true dual carrot-and-stick system to generate green construction [29].

External incentives, otherwise provided by the government involve some forms of direct financial investment or are cost-free (non-financial) [66, 67].

- *Financial incentives*

Financial incentives include direct grants, tax incentives, rebates and discounted development application fees [47, 58, 68, 69]. These incentives are monetary in nature, that is, they result in financial gains for beneficiaries, and also the most common green building incentives provided by the government [55, 67, 70]. Take the tax incentive for example, owners of green buildings are offered tax deductions or totally exempted from tax payment [62, 71]. It is a popular financial incentive provided by the government [29, 50, 66, 72, 73] especially in the U.S. [74]. Notably, tax could also be levied as a punitive measure for unsustainable practices [71], which means tax incentive offers the advantage of either being applied positively or negatively. In Tinker et al.[75]'s study, positive and negative financial incentives are the major drivers in the decisions owners make concerning the incorporation of environmental friendly

features in their homes. In 2010, the government of Malaysia announced its Green Technology Financing Scheme (GTFS), a soft loan incentive to attract innovators and users of green technology. As a result of this incentive, there has been an increasing trend of companies building green [47], with the rate of green building certification in Malaysia rising from just 1 to 137 between 2009 and 2013 [26]. Also, Hendricks and Calkins [76]s' study indicate that incentives such as development bonuses and grants have increased the likelihood of Chicago and Indianapolis building owners and architects installing green features such as green roofs (roof gardens) [77].

- *Non-financial incentives*

Non-financial incentives include **Floor-to-Area density (FAR)** [50, 68, 69, 78], technical assistance, expedited permitting, business planning assistance, marketing assistance, regulatory relief, guarantee programs, and dedicated green management teams in building and planning departments [22]. In administering the non-financial incentive, the government normally grants the owners the right or additional rights that are beyond the normally allowable when certain conditions are fulfilled. For instance, expedited permitting enable owners who incorporate green building materials into a proposed development to get their plans and permits more quickly from the local jurisdiction [72]. The FAR incentive allows the owners to construct more building area than allowed by the usual zoning. An example is the Green Mark Gross Floor Area incentives scheme in Singapore where owners who achieve the highest Green Mark Platinum or Green Mark Gold Plus rating are granted an additional floor area up to 2% of the total gross floor area of the project [29]. Though this is a non-financial incentive, owners may recoup some or all of their expenditure on green development through the increased rentable/saleable space resulting from FAR bonuses [22, 25, 66]. Thus non-financial incentives are also financially rewarding.

It is also found that non-financial incentives such as expedited permitting or technical assistance, save owners' time by mitigating risk and process issues [22, 25, 31, 66]. This is even more significant because in project delivery, time is crucial, especially in getting the project ready for marketing or occupation. When time is significantly reduced, it leads to project cost reduction for the owner [25]. Additionally, non-financial incentives are flexible and can be designed to fit local conditions [22]. As expected, governments mostly favour the provision of non-financial incentives because no direct costs are involved [25].

4.1.2 *Internal green building incentives*

The government alone cannot bring about a green building revolution [15], therefore it is important to emphasise the internal incentives as complement. Internal incentives manifest as an appeal to the goodwill of stakeholders, including project owners, and as a result provoke their unforced interest in adopting green building practices. Notably, green buildings have some unique benefits such as resource use efficiency, increased marketability, enhanced societal reputation etc. [99], which appeal to the goodwill of stakeholders, thereby provoking their interests. In situations where people are poised to act out of sense of volition, personal endorsement and feeling of choice, it is regarded as intrinsic motivation

[106]. Unlike the external incentives which are forced choice, internal incentives arise from the person's feelings or connection about the activity [107]. In other words, internal incentives are unforced, neither are they provided externally by any entity. The types of internal incentives are as follows:

- *Human well-being related incentives*

As Zuo and Zhao [4] pointed out, human beings stay in buildings for a considerable amount of time, which makes it reasonable to expect that they prefer a high level of comfort in buildings. Therefore, comfort becomes an internal incentive for building occupants. Also as green buildings promote human well-being in terms of healthy environment and community [79]; high employee productivity and low absenteeism of workers [24, 49], these benefits are affective on humans, thereby turning green buildings into major attractions for project owners ([3, 51, 80]). Especially the commercial green buildings owners, it implies fewer tenant turnovers, low vacancy rate and **uninterrupted returns on their investment** [52]. Also **green building serves to benefit the corporate business because there is a strong relationship between employee productivity and return on investment** [26]. **As a result of the positive influence of green buildings on human aspects such as health and productivity, project owners are encouraged intrinsically or internally to adopt green building practices.** [62]. **The human well-being related incentives are more reinforcing in the development of educational green building projects. In order to achieve intellectual progress in educational facilities, project owners are encouraged to develop** green building projects to provide comfort for staffs, students and researchers (see [35]).

- *Market demand related incentives*

The literature reports that green buildings have higher market demand, willingness to pay [29, 55, 63, 81] and rental values than conventional buildings [52, 82]. In fact, the report of McGraw-Hill Construction revealed that market demand for green buildings has experienced increased growth [102]. In response, project owners are encouraged to develop **green buildings**[3, 34, 47, 49, 52, 63, 72, 83]. **The appeal of the market prospects of green buildings is persuasive for project owners, especially the owner developers, who believe in profit making from investments on projects. Also literature findings revealed that it is in the interest of owners to prosper from their businesses, including green building business. Hence the personal connection of project owners to profiting incentivises them to engage in the profitable** business of green building development (see [103, 104]).

- *Gratifying incentives*

The achievement of green building by owners is recognised in myriad of ways. The common ways to majority of societies are the recognition through awards and green certification through assessment systems [47, 55]. To owners, these are gratifying as it leads to a feeling of gratification since their image and reputation are increased [47]. It is also reported that the recognition of green building achievement, especially the certification, provides an avenue for improving competitive advantages [74]. For instance, the Green Builder logo of the Austin Green Building Program, Texas, US, helps participants differentiate themselves from their competitors [75]. Also in the US, it has become a competition in the Real Estate

industry on the level of LEED certification achieved for a new project [46], where, for example, LEED Platinum projects are well differentiated and prided by the owners than LEED Silver projects [84, 85]. Therefore, recognition of green building achievement is not only gratifying and encouraging for project owners to develop green buildings, but also provides a basis for competition.

- *Altruistic incentives*

Another internal incentive driving green building is the pro-environmental beliefs that are based on altruistic or personal moral norms and values [16, 31]. As Aliagha et al. [26] explained, owners' interest in green building may not be wholly due to the ascertained benefits involved such as energy and cost savings, but because of the altruistic belief that climate change and its effects on people and the environment are real and they can act to reduce these effects. Gou et al. [29] reiterate this assertion, arguing that owners are unlikely to be significantly motivated to build green simply by reduced energy costs. Their vision for building sustainably is to reduce carbon emissions, contribute to energy efficiency, and educate the public of sustainable building technologies and practices [95]. In another parlance, this means simply "doing the right thing" which, in the construction industry context, implies sustainable construction, or green building (e.g. [81]). As Mulligan et al. point out, the business owners, non-profit organizations and educational institutions that are the innovators in the sustainability market build green to 'do the right thing' for the public and lead the market. That is, in quest for balanced outcomes, stakeholders are incentivised by the responsibility to meet the need for environmental protection without neglecting social and economic aspects too [97]. In short, human beliefs, especially when skewed in favour of environmental protection, are important internal incentive for green building.

- *Persuasion and inspirational incentives*

Persuasion based on prevailing conditions, as well as inspiration derived from exemplary leadership are both internal incentives promoting green building [32]. For example, owners in Arizona, US, were persuaded into green building because of the extremely high energy costs [32]. In terms of inspiration from exemplary leadership, owners in different categories or spheres are inspired into green building when there are champions to promote them. For instance, in the US, the federal, state and city governments are leading by example by being committed to building LEED-certified or LEED-equivalent buildings [57, 83]. In Malaysia, the government has demonstrated its commitment and leadership by turning four of its iconic buildings (i.e. Kuala Lumpur Securities Commission building, the Diamond Building, Putrajaya, Green Technology and Water, and LOE Energy Office Building GreenTech Malaysia) into green buildings [26]. Similarly, the first LEED certified building in China is the eight story government office of the Ministry of Science and Technology in Beijing, completed in 2004 [48]. In sum, the presence of a persuasive influence and unfavourable circumstances are potent internal incentives for green building.

Table 2 cont'd: Summary of publications on green building incentives

References	External incentive		Internal incentive					Effectiveness of incentives	Criticisms				Strategies				
	F	NF	HR	DR	GI	AI	PI		ATT	LE	LM	NF	IP	LI	FI	MS	IA
DuBose, Bosch [32]							✓										
Nelms, Russell [57]							✓										
Butler [83]							✓										
Liu, Low [48]							✓		✓								
Sentman, Del Percio [50]								✓				✓					
Qian, Chan [86]								✓					✓				
Azizi and Sakina [34]								✓			✓						
Webert [87]									✓								
DeLaPaz [88]										✓							
Perkins and McDonagh [25]							✓			✓							
Ghodrati, Samari [89]											✓						
Ji, Hong [53]											✓						
Roodman, Lenssen [90]												✓					
Zuo and Zhao [4]												✓	✓				
Song and Feniosky [91]												✓					
Wang, Foliente [59]													✓				
Pippin [92]													✓				
Li, Yang [3]															✓		
Zimmerman [61]															✓		
Menassa and Baer [93]															✓		
Baer [94]															✓		
Gaosheng and Yingpu [30]							✓									✓	
Anning [35]																✓	
Mulligan, Mollaoglu-Korkmaz [95]																✓	
Yudelson Work [60]							✓										
Sauer and Siddiqi [96]							✓										
Retzlaff [85]					✓												
Zainul Abidin [16]																✓	
Abidin and Powmya [97]																✓	
Total	16	10	9	6	7	4	4	11	11	3	3	4	6	8	3	7	7

F-financial incentive; NF-non-financial incentive; HR-human well-being related incentive; DR-demand related incentive; GR-gratifying incentive; AI-altruistic incentive; PI-persuasion and inspirational incentive; ATT-attachment of incentive to certification; LE-lack of enforceability mechanism; LM-lack of mechanism to determine the optimum level of incentive; NF-non-transferability of incentive; IP-increased private sector participation; LI-localising incentive; FI-focusing incentives on the long term; MS-mitigating split-incentive; IA-increasing the awareness of incentive

4.2 Effectiveness of green building incentives

Another important research area on green building incentives is their effectiveness in terms of encouraging owners into green building. Different incentives have been employed in different locations to promote green building among owners (see [15, 22]), and therefore the findings of studies that investigated their effectiveness are reported in this section.

Green building continues to grow at a rapid rate in the US [60, 98], which is largely due to encouragements such as incentives [54, 60]. In the US, there are different incentives, consequently, three studies [24, 31, 96] provide a deeper understanding of their effectiveness in an empirical research. Sauer and Siddiqi [96] compare the impact of three different incentives (financial and administrative incentives, and density bonus) provided at the county level on the production rates of Leadership in Energy and Environmental Design (LEED)-certified multi-unit residential buildings in the U.S to know which leads to the greater adoption of green building. The findings reveal that density bonus (i.e., zoning ordinances), which allow projects to achieve a higher unit density, lead to the production of more LEED certified multi-unit residential buildings. It is interesting to find that administrative incentives e.g. expedited permitting, has a more significant impact on the adoption of green building by owners than financial incentives, such as tax credits [24, 31]. Taken together, it could be seen that non-financial incentives are more effective at encouraging green building development in the US. This corroborates another study which found that monetary supports have not effectively promoted green building [31].

In a case study of 20 owners in Hong Kong, 11 considered the environmental responsibility and company's commitment to sustainability to be the two main incentives for green building [29]. Both incentives are internal, and their effectiveness is because owners in Hong Kong favour market prestige [30]. It is not different in China where Li et al. [3]'s study reveals that the increase in green building among owners is due to some internal incentives such as environmental values and beliefs, and reputation.

4.3 Criticisms of green building incentives

The incentives provided by the government (i.e. the external category) have been criticised, mainly concerning the manner in which the incentives are administered. These criticisms are described in this section.

4.3.1 Attachment of incentives to green building certification

The first major criticism is related to the attachment of green building incentives to green building certification [73]. For instance in the US, many local and state governments have tied their incentive programs to LEED certification, an approach that has some drawbacks [69, 82]. An example is Washington, D.C., where both public and private projects are required to comply with the LEED rating system [62] to qualify for FAR incentives. Other areas such as Nashville, Tennessee, Arlington, Virginia, and Sunnyvale, California, also offer an increase in FAR to projects that achieve various levels of LEED

certification [50]. In Singapore, the Green Mark Incentive Scheme offers financial allowances of S\$3 to S\$6 per square metre for all buildings qualified for Gold and Platinum certification Awards respectively [29].

The first drawback with this arrangement is that it is predicated on a third-party rating system, which may be biased or even inequitable [69]. Also, compliance with certification e.g. LEED, is arduous and costly, and the cost is not offset by the rewards offered by the government [49, 69, 86, 88]. According to Azizi and Sakina [34], the estimates of the soft costs in obtaining LEED certification range roughly from USD\$40,000 to USD\$200,000, depending on the size of project involved. In Australia, for example, the cost of achieving Green Building Council of Australia (GBCA) Green 5 Star and 6 Star ratings increases the cost of green building [4]. The Malaysian green building rating system, the Green Building Index (GBI) (Samari et al., 2013), attracts such incidental costs as registration fees, GBI facilitator and consultancy costs (Aliagha et al., 2013). These costs are not included as additional capital expenditure incurred to obtain the GBI certification, and thus, they are excluded from tax incentives. Further, another major difficulty of the certification conditions in case of LEED, is related to obtaining hard-to-find materials or creating cutting-edge designs [69]. This is corroborated in a Chinese LEED project experience where the participants reported that meeting crucial LEED requirements was the largest barrier they encountered in the early stage of green building project development after high fabrication. [48]. Drawing on all these, the goal of the incentives provided by the government is often nullified by the high cost and efforts of the attached certification condition [86].

For the second drawback, it is argued that for an incentive to be an effective encouragement or enticement, recipients must be able to factor it in their financial planning, which occurs at the beginning of the project. However, the certification of buildings with rating systems such as LEED is made upon completion of construction, making it uncertain if the project will be eligible for the incentive [69]. Depending on the owner's risk attitude, this drawback has a negative implication on the decision to build green [34]. It could be seen that the manner in which green building incentives are administered, especially in relation to green building certification discourages green building.

4.3.2 *Lack of enforceability mechanism*

Another significant administrative criticism of green building incentives is the lack of enforceability in case of default [87]. That is, if an incentivised green building project falls short of green building requirements, there are no effective mechanisms for recovering the resources invested [69]. Also, when incentives are provided, there are no standard procedures to ensure that requirements are delivered. According to Ghodrati et al.[89], financial green building incentives are considered to be a high cost contribution by government sponsors, especially in developing economies where the green building market is largely undeveloped. In green building, it is likely that the level of greenness will not be attained, either by commission or omission. Thus due to the lack of enforceability mechanism, either in developed or less developed country, hence the resources invested in providing the incentives amount to waste. In short, this criticism has implication on the fiscal reputation of governments [66]. It is even more

discrediting that government resources are left to fate with the lack of mechanism for ensuring that incentives provided are utilised in the required manner.

4.3.3 Lack of mechanism to determine the optimum level of incentives

Analogous to the problem of lack of enforceability is the lack of a mechanism to determine the optimal level of green building incentives required [73]. When the incentive is too small, it cannot achieve the desired results, and when too large will result in a waste of resources therefore being an unnecessary drain on government finances [85]. Thus it remains a challenge for the government to adequately match the perceived value of the incentive to the perceived increase in cost associated with green building [73]. Consequently, mismatches between incentives and perceived cost are hampering the effectiveness of some incentive programs [25, 73], which is limiting the amount of green building work being carried out [13].

4.3.4 Non-transferability of incentives

The non-transferability conditions attached to green building incentives, particularly tax-related incentives can stifle demand. For instance in Malaysia, only the owner who secures GBI certification and commences business or occupation of the GBI building qualifies for GBI income tax incentives [26]. Thus buyers or lessees of certified green buildings cannot qualify for GBI income tax incentives, discouraging demand for non-owner occupiers [89]. Similar condition is the lack of proportional upgrade in the value of financial incentives to reflect improvement in the greenness of green building. In fact, for different levels of certification, tax incentives in Malaysia make no distinction. Therefore the current tax incentives are less attractive to the public and private sectors in Malaysia [26]. Though less discussed in the literature, other related administrative criticisms include the non-uniformity and instability of the tax incentives [34], and lack of a clear set of criteria for granting appropriate financial incentives to new green building [53].

4.4 Strategies for improving green building incentives

To improve the effectiveness of incentives in promoting green building, strategies have been suggested in various studies.

4.4.1 Increasing private sector contribution

It could be seen that the government is more involved in providing incentives (financial and non-financial) than the private sector. However, it has been pointed out that the private sector also has significant roles, even as much as the government, in providing incentives for green building [90]. Examples of the private sector participation in providing incentives for green building have been reported. Roodman and Lenssen [90] report that some financial institutions give preferential lending rates for the construction of green buildings. Some private sector water and electricity supply utilities offer rebates on payments in water and energy efficient buildings. Also, the insurance industry has provided non-financial incentives [91], and played a powerful role in communicating the benefits of green

building [66] through the communication of benefits such as healthier living to beneficiaries or stakeholders (e.g. [4]). Despite these, the private sector still lags behind the government in terms of providing incentives to encourage the adoption of green buildings [22, 48, 66, 91]. It is suggested that the private sector take the initiative, in a leading role, in providing incentives towards green building given the drive of the private sector, especially in developed economies. This is even more important in face of dwindling governments resources globally [48].

4.4.2 Localising incentives

In the studies on green building incentives, there is a consensus that the incentives should be matched with local prevailing conditions in economic and environmental regards. Environmentally, as stated by Choi [22], green building incentives are generally most effective at the local level where they can be designed to meet local or regional environmental needs and standards. **This is why** green buildings in different countries are designed and built according to local climatic conditions and to suit local requirements [4]. Matching green building incentives with local prevailing conditions stimulate their attractiveness and effectiveness, especially if the incentives can be varied in scope and implementation (flexibility) in different jurisdictions [59]. Economically, Qian et al.[86]'s analogy, from the owners' point of view, illuminates the fact that green building incentives from the government are less effective during an economic upturn than in a downturn. This is because property sells well during an economic upturn and owners care less about introducing green features as a means of attracting buyers. The reverse is the case during an economic downturn. This implies the need to give recourse to the prevailing local economic situations before providing incentives for green building. De Blaauw and McDonagh [70] concur with this view, stressing that any financial incentive must operate within the wider context of local and national policy frameworks, including economic policies. As a result, especially in the national setting, it is prescribed that individual country should tailor incentives for promoting green construction based on its own social, financial and political situations [89, 92]. Failures and resources wastage occur when local prevailing conditions are not given sufficient consideration when providing incentives to encourage the adoption of green building(e.g. [73]).

4.4.3 Focusing incentives on the long term

The idea of green building, especially when compared with conventional building, is the tendency to be beneficial in the long rather than the short run [3]. That is why the proponents of green building adopt a life cycle costing approach to justify the thorny initial cost problem [61]. Therefore, it is often reiterated that green building incentives should also be accorded a long-term view. Some studies (e.g. [22, 66]) criticise existing green building incentives as being basically short sighted. For instance, tax abatements are usually offered as temporary, short-term incentives [66]. However, as many large projects take several years to complete, owners may not be able to reap the same financial benefits from the abatement since it may no longer be available when the project is finished [66]. In Qian et al.[86]'s study the majority of respondents agree that the greatest concern in the green building market regarding a new incentive is if it is stable and long lasting. Therefore, incentives should be designed for the long term. A way to achieve

this is to design them flexibly. For instance, incremental tax rebates is offered during the design process, handover, one year after handover, and three years after handover if corresponding requirements are met, etc. [66]. This would encourage all stakeholders to build and operate green. In sum, designing green building incentives for the long term, rather than the short term, is more effective towards promoting green building.

4.4.4 *Mitigating split-incentives*

There are many stakeholders with vested interest in green building including owners, tenants, building operators and designers [93]. However, the incentives for green building differ for different stakeholders [31, 66]. In the literature, it is referred to as split incentives, which has unfortunately pervaded the demand and the supply side of green building procurement (e.g. [3, 31, 61, 93, 94]). It leads to a situation where the demand and the supply side of green building procurement have different incentives, or motivations for green building. For instance, in the supply side of green building procurement, the owner might be motivated to sustainably retrofit so as to reduce life cycle costs and increase return on the investment, while on the demand side, the tenant, or lessee may be interested in other incentives such as lower rent or increased employee productivity [93]. Thus, throughout the building life cycle, the owner or lessor feel they are paying for the improvements to the building while the tenants are reaping most of the benefits [29, 94]. Because of this, owners are less persuaded into green building [29]. This split situation, or incentive incongruence is also evident in external incentives. Take the New York property tax relief for green building owners for example, unless the owner is a long term owner-occupier, the relief accrues to the post development owner and/or their tenants as the tax relief is applied year by year [25]. Therefore it is necessary to focus efforts towards balancing the incentives, especially the internal incentives, of both the demand and supply sides of green building procurement. For external incentives, it is best to incorporate a variety of techniques that will target a wide spectrum of stakeholders (e.g. builders, owners and operators) [66]. In short, mitigating split-incentive improves the performance of green building incentives, and by extension, green building.

4.4.5 *Increasing the awareness of incentives*

The awareness, or knowledge of green building incentives, externally or internally, is related to how much it will promote green building [30, 35]. Such awareness prompts owners to subscribe to the incentives, if external, or embrace it, if internal, both encouraging green building. However, it is a recurring topic in the literature that owners are unaware of green building incentives, both the internal and external (e.g. [29, 31, 92, 95]). In the developed countries, information about incentives is usually made available on dedicated online platforms. For instance, the Database of State Incentives for Renewables & Efficiency (DSIRE) is a database containing information of over 24,000 available green building incentives in the US [78]. It thus points to the need for improved awareness of green building incentives among owners. Besides, well-diffused information about green building incentives is beneficial to the individual and the community [22, 31].

5. Conclusions, recommendations and future research

This paper undertakes a systematic review of studies of green building incentives. It reveals that there are two major categories of green building incentives, namely external and internal incentives. The external and internal incentives are different in their manner of motivation. The external incentive, which is extrinsic in nature, specifies conditions or requirements which that must be fulfilled by beneficiaries before benefitting. In other words, the external incentive is a forced choice for project owners, and other stakeholders who are potential beneficiaries. This is partly due to the major source of external incentives - the government, who has to follow due process in providing incentives to encourage the adoption of green building projects. External incentives, however, consist of financial and non-financial ones.

On the other hand, the internal incentives are intrinsic in nature, which manifests as an appeal to the good will of stakeholders, especially project owners, and thus provokes their unforced interest in adopting green building practices. In short, specificity of conditions before benefiting from internal incentive does not apply. Instead, project owners and other stakeholders alike adopt green building projects out of volition. The identified internal incentives include the human wellbeing related, market demand, gratifying, altruistic and persuasion and inspirational incentives.

In terms of effectiveness, it is a confirmation that incentives, both external and internal ones are important instruments for promoting green building, although it is not clear which one is more effective. Additionally owners are more incentivised into green building by the non-financial incentives than the financial incentives. Also evidence from the review suggests that the government is moving in the direction of regulating green building as against incentivising it. The review uncovers some criticisms of green building incentives, mainly on external ones. They include the attachment of green building incentives to certification, lack of enforceability mechanism, and lack of mechanism to determine the optimum level of incentives required. Notably, these criticisms are significant because their manifestations discourage green building among owners, while it also leads to imprudence on the part of the government. Owners are discouraged by the accompanying costs of meeting the conditions for benefiting from incentives. In particular, the commercial building owners are confronted with low demand because the incentives that encouraged them into green building are not transferrable to buyers or lessees.

The strategies for improving green building incentives were also elicited from the review. Similar to the criticisms, the strategies largely concern the external incentives. One strategy, the private sector participation, emphasises on collaboration between the government and the private sector. Other strategies such as localising green building incentives require the government to redirect their approach to providing incentives so that owners can be more attracted and encouraged to pursue green building.

The findings of this review provide a number of implications for the government. As the largest provider of external incentives, there is need for the government to adopt newer strategies that will make incentives provided to be more encouraging to the owners. Also, the government needs to address the gaps in the manner in which she administers incentives to the owners so as to sustain the reasons for

providing the incentives in the first place, and to prevent loss of resources by the government themselves. The government should also seek to collaborate with the private sector in promoting green building. Evidence points to limited private sector participation, therefore, a collaborative effort by the government and private sector is significant towards promoting green building.

This review gave off important research opportunities in future. It is important to uncover the effectiveness of incentives in other countries given that findings on the effectiveness of incentives in this review is largely skewed to US and parts of Asia. In Europe, many parts of Asia and South Africa, green building practices have strongly developed, and the use of incentives to promote green building practices has advanced. It will be useful to know the effectiveness of incentives as instruments for promoting green building practices. This will also inform the generalizability of the effectiveness of incentives as instruments for driving green building projects. Also because incentives incur huge investment, especially government incentives, it is important appraise their effectiveness to justify continuing investment.

The criticisms of; and strategies for improving government incentives are largely directed at external incentives in this review. The reason is that the manifestation of internal incentives on green buildings is psychological – an area which is still growing in the literature. Nonetheless, many psychological and behavioural studies have been carried out on the related subject of energy efficiency but not green buildings in specific. It will be worthwhile to borrow some of the ideas to robustly address the criticism of; and strategies for improving internal incentive on green buildings.

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