Regulations Enforcement Mechanisms for Sustainable Housing Projects

Dr. Sawsan Rasheed Mohammed
Assistant Professor
Department of Civil Engineering
Engineering College- Baghdad University
Email: sawsan_2@yahoo.com

Ibtisam Abduljabbar Abdulridha
Ph.D Student-Principal Senior Engineer
Ministry of Construction and Housing
Email: Ibtisam3_5@yahoo.com

ABSTRUCT

Regulations are one of the instruments that governments used to achieve objectives of their policies. Sustainable projects often face compliance problems when working to meet the applicable regulations. The challenge for governments is to develop and apply enforcement mechanisms that achieve the best possible outcomes by achieving the highest possible levels of compliance. The aim of this paper is to identify the most effective mechanisms that can be used to develop a framework for the regulations enforcement for the applications of sustainable housing projects. Accordingly, this paper reviews the common classification of building regulations and enforcement steering mechanisms, in addition to the related international tools of sustainable housing development. The researchers developed a questionnaire included proposals for legislation within five main themes: materials, energy efficiency, water efficiency, health and safety as well as management of residential complexes during the occupation and maintenance phase. Findings represented the highly importance and top preference of incentive mechanism for enhancing sustainable housing regulations. Furthermore, in the theme of health and safety is within the authority of the institution that set these regulations to be imposed on providers and developers of housing. While the results of both energy efficiency and management of housing complexes indicate that legislation be obligated through centralized Act and not as an institutional, so any institution must impose these legislations on housing developers.

Key words: regulations, enforcement, sustainable housing, mandatory regulation, incentives.

آليات انفاذ ضوابط مشاريع السكن المستدام

د. سوسن رشيد محمد
استاذ مساعد
قسم الهندسة المدنية
كلية الهندسة-جامعة بغداد

ابتسام عبد الجبار عبد الرضا
طالبة دكتوراه
رئيس مهندسين اقدم
وزارة الاعمار والاسكان

الخلاصة

تعتبر التشريعات واحدة من الأدوات المستخدمة من الحكومات لتحقيق أهداف السياسات التي تضعها. وكثيراً ما تصادف المشاريع المستدامة مشاكل التنظيم والامتثال للقوانين في تلبية اللوائح بشكل أوسع. ان التحدي الذي تواجهه الحكومات هو تطوير وتطبيق آليات انفاذ التشريعات التي تحقق أفضل النتائج الممكنة من خلال تحقيق أعلى المستويات الممكنة من المطابقة. يهدف البحث الى تحديد الآليات الأكثر فاعلية التي يمكن استخدامها لوضع إطار لإنفاذ اللوائح لتطبيقات المشاريع الإسكانية المستدامة. يستعرض البحث مختلف انواع انظمة البناء وآليات الانفاذ فضلاً عن الأدوات العالمية الخاصة بالإسكان المستدام. طور الباحثون استبياناً شمل مقترحات لتشريعات ضمن خمسة محاور رئيسية هي: المواد وكفاءة الطاقة وكفاءة استخدام المياه والصحة والسلامة، فضلا عن إدارة المجمعات السكنية خلال مرحلة الاشغال والصيانة. تمثلت النتائج باهمية آلية التحفيز كأحد انواع التشريعات المعززة لنشر تطبيقات السكن الميسر حيث كانت الاعلى تفضيلاً. كما لوحظ في محور الصحة والسلامة حيث يقع ضمن سلطة المؤسسة التي تضع هذه تفرض على مقدمي ومطوري الإسكان. في حين أشرت نتائج كل من محوري كفاءة الطاقة وإدارة المجمعات السكنية أن تكون بشكل تشريع ملزم من خلال قانون مركزي، لذلك يجب على المؤسسات أن تفرض هذه التشريعات على مطوري الإسكان.

الكلمات المفتاحية: التشريعات، الانفاذ، الاسكان المستدام، التشريعات الملزمة، التحفيز.

1. INTRODUCTION

Over all centuries, the governments have developed regulations and rules to control buildings work to save and maintain life safety and quality from the common social and economic issues. The development of regulations is important to achieve the new requirements for applications such as sustainable objectives. This is because of the need for new considerations and changes.

The previous housing policies in Iraq which expanded from the fifteenth of last decay were almost as partial solutions other than effective housing policies lead to retreat the housing sector other than the quality of life, and not being harmony with the stress of population growth because of deceleration of construction industry caused from Iraq conditions that lead to housing deficit. Nowadays, Iraq is considered a developing country but heading towards sustainability development; this will accelerate all sectors move towards sustainability. Concerning housing sustainability, The Agenda No. 21 for Environment and Development of the United Nations Conference **UNCED, 1992**, identified a number of program areas for promoting sustainable human settlement development, including providing access to safe and healthy shelter.

Challenges stand against implementing sustainability within housing projects in Iraq lie in economical, institutional, technical and socio-cultural barriers. Lack of sustainability concerning regulations and lack of enforcement are challenges with higher impact. Ensuring effective compliance with regulations is an important factor in creating a well-functioning society and trust in government. As many issues for housing development, sustainability should be tackled from a regulations perspective. To promote sustainability within housing projects, it is often necessary to experiment with new initiatives and programs that break out of standard patterns.

2. CLASSIFICATION OF BUIDLING REGULATION INSTRUMENTS

First of all, the researchers has to define the deferent instruments for regulating the building industry through the most common terms related to the subject of buildings which they are:

1. Acts: The act is a regulatory document that enacted by Congressional approval to make it a mandatory provision. In Iraq, the first Act was enacted for buildings works is the System of Roads and Buildings (SRB) No. 35 of year 1935 and was amended in 1964. **A1., 1964**
2. Building Regulations: Building regulation is characterized as an instrument utilized by a national or local government organization to direct building implementations through an arrangement of articulations of satisfactory least prerequisites. In Iraq, there are the building regulations that issued by the Morality of Baghdad, in addition to the Comprehensive plan of Baghdad. **A2., 2007**
3. Building Standards: Standards are created by an expansive scope of public or private institutions, however not by legislation bodies or by their agents. Standards for the most part manage how things have to be carried out and perform as "best perform". There are various types of standards **Bukowski, e al., 2001**: calculation or test technique standards; product or system determination standards; and performance statement standards, including client needs or goals.
4. Guiding Rules: Guiding rules are tools regulate building works but without scores and ratings. The design guidelines set up a typical understanding of design principles and need to be integrated with the design process.
5. Assessments: Assessments may be utilized during the design phase of construction project less than building guidelines. Life cycle assessment (LCA) is one technique for assessment. It used in assessing the ecological impacts of systems, processes and products during entire life-cycle of them **Sonnemann, et al., 2003**.

6. Rating Systems: The rating system is considered the most market-oriented tool; it aims to assure the affirmation and public acknowledgment of prevalent building performance and design.
7. Code of Practice: Building codes build up the least measures for construction projects aiming to health and safety regards. For housing sector in Iraq, there is the Code of Practice of Pole Service-Report Two which is adopted for approval awarded for design documents of housing projects. **A3., 1983**.

3. REGULATIONS ENFORCEMENT SYSTEMS

It is very essential to the viability of any building regulatory framework that it ought to work to fulfill compliances with related acts and regulations either were prescriptive or performance based regulations. This would be built up by enforcement and compliance systems, which are necessary to get a building license for any construction works. It is the request for a license from the authorities which is the municipality that sets the system of compliance. In order to get a building license, plans have to be submitted that will reviewed and approved before issuing the license. This is regularly where various building practitioners and individuals communicate with the regulatory authorities in regards to the regulations and its necessities. There are different types of regulations that commonly in use, which illustrated in the following sections that are ordered according to their degree of centralized control from government.

3.1 Command-and-control regulation

This type of regulation is made for non-acceptable actions so it commands the working sectors or people by "not to do a specific action". So the government enacts a law for this command to make that action illegal. Enforcing this law will be by delegating authorities to impose fines to those who break the law. For examples, a law enacted for the allowed maximum levels of pollution emissions. **Cole,** and **Grossman, 1999**. The researchers supposed that is the control system used by the government.

3.2 Incentive-based regulation

An incentive is any approach, rule, evaluating instrument or strategy that looks to alter the conduct of people or organizations by changing the marginal expenses or marginal advantages associated with specific choices and exercises, through the essential idea of punishments for bad behavior such as polluting, or rewards for good action **Cambini,** and **Rondi, 2010**. An example, regulations of land use may include incentives for developers to provide affordable housing; in such a case, the localities must ensure that those who will benefit from the incentives, only the once that will fulfill or exceed the criteria of the particular sustainable housing. Incentives should be considered for specific terms, i.e. developers ought to be punished on the off chance that they neglect to maintain their end of the contract and do not meet the necessities of sustainable housing requirements **Kumar, 2015**.

3.3 Performance-based regulation (PBR)

This regulation is a type of incentive-based regulation when incentives are tied to enhancements in facility performance, price lessening and improving service quality. Performance-based regulation (PBR) intends to advance sharing of advantage between the facility and the customers. The utility will advantage from incentives and lower costs that prompt to higher and better profit on investments. While the customers get advantage from lower prices and improved service. PBR is additionally more dependent on external standards of performance and less touchy to organization particular activities. For example, PBR may enhance plant usage,

diminish operation and maintenance costs and enhance system reliability **Bukowski,** and **Rackliffe, 2001**.

3.4 Market regulations

There is a scope of market-based regulations, which can be utilized to manage activities. These regulations can demonstrate finance effective and lead to control and decrease the regulatory interference in everyday operation of business. The researchers find that this type can be used to promote the applications of sustainable construction by establishing such as the international tools for sustainable rating systems.

Monetary measures, for example, the utilization of taxes and subsides are also generally utilized market-based instruments. Taxes are regularly forced on destructive activities to make them moderately more costly. While, subsides can be utilized to support generation or utilization of activities or products which are viewed as attractive **Hepburn, 2009**.

3.5 Self-regulation

This regulation is characterized as relying substantially on the goodwill and cooperation of individual firms for their compliance. It regularly appears as a business or an exchange affiliation developing, monitoring and enforcing its own guidelines of performance **Sinclair, 1997**. There can be some oversight on the regulation by the government. Deferent industries used to have self-regulatory systems to govern industry practices, such as health care, nuclear power, higher education, and professional sports. **Gunningham, 1998**.

Heijden, 2007 found that because of critic on both command and control system and self regulations, and due to thoughts that private sector being more effective than government legislative sector, a solid concentrate on the possibility of self-regulation appears to have ascended from the 1970's.

4. SUSTAINABLE HOUSING REGULATIONS

Regulatory systems and codes concerning the sustainability objectives are significant in advancing support for sustainability to be integrated within practices of building projects **Luce, 2010**. As a result of the fragmented manner of construction projects with the various involved stakeholders and actors, regulations may consider as the main conceivable way for projects activities to continue **Häkkinen** and **Belloni, 2011.** Following sections review kinds of sustainability regulation tools for housing in particular.

4.1 Sustainable Building Instruments

Sustainable building instruments come in a wide assortment of advancing formats; each format achieves diverse objectives and makes distinctive impacts **Carmody, et al., 2009**. **Table 1** shows the international tools related to sustainable housing projects. Instruments reviewed in this paper come into five fundamental classes: building codes, standards, assessments, rating systems, guidelines,

In Some cases, guidelines of sustainable building are composed as recommendations or advise to help engineers, developers, and planners to design and construct the sustainable buildings. In other cases, governments and its different institutions may utilize these guidelines as obligatory methods. For example, The Sustainable Building Guidelines of Minnesota in United States is a case of a guideline that is obligatory for all buildings developed by financing from the state government **Carmody, et al., 2009**. This is to aim to guarantee that state money is utilized rationally to design buildings that are energy efficient, long lasting, and with few loads as could be expected on local infrastructure, e.g. roads and storm sewers.

4.2 Types of Indicators

Commonly, there are two types of sustainability indicators: prescriptive indicators and performance indicators. These both types have favorable circumstances. Indicators are typically used to determine the action or performance objective that must be met to fulfill a specific standard of work. Otherwise, there is an imperative distinction amongst prescriptive and performance indicators as discussed below.

4.2.1 Prescriptive Indicators

These indicators are used to determine specific arrangements for actions that must be made to fulfill the criteria. These arrangements are picked in advance by the institution that built up any of the deferent instruments i.e. guideline, assessment, or the rating system. Then these actions be prescribed and must be finished as composed. Since the indicator is not tied to a measurement, the ultimate result of a prescriptive indicator will not be known **Carmody, et al., 2009**. Contractors prefer prescriptive type since this type outline a progression of actions which are simple to follow. Similarly, organizations working with rating acknowledge prescriptive indicators because they are not difficult to enforce.

4.2.2 Performance Indicators

This type of indicators is used to measure the result of an arrangement of actions which is not prescribed. With these indicators, designers and specialists will choose how the required outcomes will be accomplished. Likewise, the performance indicator decides how the outcome will be measured. There are significant advantages of these indicators. First, these indicators maximize the flexibility designers need to accomplish objectives of sustainable building. In spite of that advantage, performance indicators necessitate extra work to measure the performance of accomplished works. Additionally, they compel designers and specialists to measure the outcomes of the choices they make. This helps them comprehend which choices really work to enhance performance.

In case of post-occupancy monitoring activities, performance indicators will be used to constrain building owners and occupants to measure environmental impacts of their actions. This can prompt improvement to behavior and procedures to enhance a building's performance. Additionally, these indicators can aid to measure compliance with centralized regulations such as energy use, levels of pollution. **Carmody, et al., 2009** found that most of building researchers have mostly agreed that performance indicators are the best method to achieve objectives of sustainability.

4.3 Regulation Enforcement Instruments

The shortage of correct instrument could be a barrier for the sustainable building practices. Different forms of instruments are getting used for steering the sustainable buildings projects. These forms include obligatory laws, incentives and voluntary actions. Accordingly, in order to enhance application of sustainability within building projects, it is important to find the right instruments and systems for enforcing the regulations whatever the type of them.

4.3.1 Obligatory regulations

In this form, the project will be more averse to be opposed by the regulatory institutions since requirements are considered previously, **Robichaud** and **Anantatmula, 2011**. The regulations may have either positive or negative consequences on an action. In the primary phase of

sustainable building development, regulations have to enforce the base required performance and this will definitely be effective to accomplish the outcomes **Häkkinen** and **Belloni, 2011**.

4.3.2 Incentives

Incentives are as motivation method to encourage people or institutions to do something, for example as tax diminishment which can impact positively the developers' desire to accomplish sustainability targets. As sustainability needs both regulations and innovations in the future as more in the housing development projects, incentives can persuade innovations and make requests for alternatives. As an example, in USA, several states enacted their own legislation to develop and implement LEED based tax discount incentives to create green building initiatives, by allowing property tax discount at a local level, as financial incentives that will be founded on accomplishing LEED accreditation **Prum, 2009**. As per this proposed enactment, a private client, who wants to develop a new building with LEED accreditation, he will get tax discount for up to 12 years.

The risk of Incentive programs is that they deviates markets and present need to comparison opportunities for developers. These programs require solid enforcement and checking by government powers. Such incentives additionally should be organized with clear points of reference and conditions and commitments, to necessitate the release of the incentives. In this manner, implementation the incentives should be actualized with great care.

For sustainable housing projects, right adjust is required between the cost and the value picked up by the developer. Development of sustainable housing may be postponed in case incentive is not satisfied. Incentive programs are also subject to be not active leading that developers may develop less-quality houses.

4.3.3 Voluntary activities

Voluntary activities are, for example, the green accreditations from various rating systems such as LEED system. **Häkkinen** and **Belloni, 2011**concluded that voluntary approach has not brought about huge changes, therefore, normative regulations are required. In the case of regulations that support the voluntary activities, they would be useful to enhance application of sustainable construction.

5 BUILDING THE ENFORCEMNT REGULATION FRAMEWORK

Regulators need to implement rules and instructions by delivering what they aim from concerning institutions and people, through providing guidance or any deferent forms of direction to achieve enforcement. They often enforce regulations through inspections and approved all stages outputs of design to assess whether development accords with regulations. There are two levels of influences required to be considered when planning for enforcing regulations; one of them is concerning the behavior of people, and the other will be required to influence the actions and activities of institutions when delivering their works related to housing projects.

For the aim of this paper concerning developing an enforcement steering mechanism for sustainable housing regulations, the researchers framed the following steps:

1. Identifying the scope of the regulations needed to be implemented for sustainable housing projects in Iraq;
2. Develop a questionnaire to test the themes needed to stimulate a framework for enforcement mechanisms. Those will be illustrated in section 5.2;
3. Discussing the results to advance recommendations for the aim of this paper

5.1 Regulations of Sustainable Housing

For the scope of this paper, the researchers concluded and extracted, from literature survey, five main domains which are crucial for sustainability within housing projects: Materials, Energy efficiency, Water efficiency and Health and safety. These domains are to be decided during the stage of planning and design of the project. In addition to the management domain which will be needed after completion of previous phase, i.e. the phase of occupation and maintenance. These domains are as shown in **Table 2**. The proposed regulations within those domains have to be decided how to be obligated. So the researchers appointed three main levels of obligation: Centralized regulations, institutional and guiding rules.

Additionally, the researchers developed incentives regulations for private investors to be used when developing sustainable housing projects as illustrated in **Table 3**; this is to examine how incentives would be viable to enforce sustainability practices for housing.

5.2 Developing the Questionnaire

The researchers used the questionnaire as an instrument considers the experience of professionals to examine the themes of the paper. Three questions were developed for three cores important for developing the intended framework for regulation enforcement mechanism. Questions and scale of evaluation are shown in **Table 4**. Themes of question 1 and question 3 were rated using the fifth scale of measurement, while for question 2, three types of obligation were proposed for each regulation of sustainable housing which determined in **Table 2**.

The questionnaire was delivered to professionals across all Iraq by using the technique of Google Drive to prepare and distribute the questionnaire and to receive the replied responses. Those professionals were choosing according to their sector of work, experience in housing sector, qualifications, and various disciplines ranging from planners, designers, managers, consultants, academics, legal and economists in addition to private investors. The researchers distributed the questionnaire to 44 professionals, but only 41 responses were replied, this is considered the sample size. Initially the questionnaire asked for the background profile of the professionals as shown in **Fig. 1,** which illustrates the working sectors ranging between public and private, and No. of experience years ranging from 16 years to more than 30 years which account for more than 52% of the total sample size of responses. While the qualifications ranged from Ph.D which accounts 35.50% of the sample size, in addition to MSc. accounts 24.85% and BSc. of 39.64%.

5.3 Discussion the Results of the Questionnaire

5.3.1 Testing the Reliability

It is known that the smallest acceptable value for Cronbach's alpha coefficient is (0.6) and the best value ranging from (0.7 to 0.9) while the higher value than (0.90) supposed to be the better but do not reach the correct value of (1) **A4., 2013.** Values of the reliability coefficients for the three questions are positive with maximum limit of (0.930) and the minimum limit of (0.644) as shown in **Table 5**.

5.3.2 Results of Question (1)

As noted from **Fig. 2** and **Fig. 3**, that the professionals are more satisfied with incentive and performance based systems to apply sustainable housing applications with some control required from government, and also they find that less control through self regulation and market control systems may be used for some types of regulations. These two types also gained some satisfaction from professionals with value of arithmetic mean exceeded (3.40) that means the "high" satisfaction.

5.3.3 Results of Question (2**)**
Values and symbols were given to the three levels of obligation, to examine the trends of responds for the regulations as follow:
"1" = (C) Central regulations
"2" = (I) Institutional regulations
"3" = (G) Guiding rules

The aim of this question is to test the considerations that researchers appointed for the three suggested levels to obligate the regulations of the five themes mentioned in **Table 2**. These considerations are:
1) All items will be implemented after the stage of development and construction of the housing project need to be legislated as centralized regulations.
2) Items that will be decided through the phase of development and construction will be either institutional-based regulations or design guiding rules. They will be obligated by the institution that gives the license for the project when these items are able to be implemented by the developers but these developers may not desire to implement them because of the possible related costs. Otherwise these items will be as guiding rules to the developers to implement them in the way they desire but have to accomplish the end targets.
3) Final evaluation for the level of regulations enforcement depended on the comparison between the researchers' considerations and the results from the questionnaire statistical analysis; this is because of discrete scale of the three levels of evaluation.

Tables 6a, b, c, d and e show the results of themes of the second question. The researchers noted that the centralized regulations were appointed by the professionals for actions that considered out of the authority of the institutions to control these actions and enforce them, i.e. these actions are interrelated to special named institutions must take action to regulate them.

For the non compatible final results with researchers' considerations, the researchers concluded that these regulations required to be included within the authority of the related institutions, as illustrated below for each proposed regulation:

- MR2- Recyclable and re-usable materials for a specific portion from total materials: the researchers supposed that this item need to be legislating as centralized regulations because it needs more obligations to be executed. As per, this will lead to establish stations for recycling and reusing of building materials and components. While the results shows the favor type of obligation is that regulation be as guiding rules for designers and this will not persuade the developers to implement this item because of non available required infrastructure for this item to be realized, and because of non interest and awareness of the important of recycling and reusing for sustainability. Accordingly, the researchers suggested that this item will be as guiding rule and to be studied for long term mandatory legislation in the future.
- MR4- Cavity external walls, double glazing, low emission glass and heat isolated materials: according to the professionals, this item required to be obligated for housing developer by an institution, while the researchers appointed this item to be as guiding rules. The recommendation is that this item be as institutional obligated or as guiding rule as per the project orientation and briefing.
- MR5- standard material and product sizes and unified window shapes and sizes for easy replace when need to maintenance: professionals indicated this item to be as guiding rules, while the researchers indicated it to be obligated by the institution. So, the researchers suggested that this

item firstly has to be as guiding rules with term that it will be obligated by institutions in the later time and not to stay as guiding rules.

- MR7: low shining concrete or materials with reflecting factor used for car parking surfaces to reduce the heat island: the result is as same as MR4. This item recommended to be obligated by institutions.
- For themes of energy efficiency, water efficiency and health and safety, the results are compatible for both researchers' consideration and results of the questionnaire.
- For themes of Occupation and Maintenance Management, only one item has conflict result which is the OMR3: Create programs for residents to engage them in the programs of utilizing and/or maintaining water and energy; the professionals indicated this item would be obligated as per institutions, while the other two items; OMR1 and OMR2 were indicated as centralized obligated.

5.3.4 Results of Question (3**)**

As noted from **Fig. 4**, the professionals highly encourage using incentive regulations for investors to promote the applications of sustainable housing. The three items: IR1, IR2 and IR3 concerning using the vacant and contaminated lands and enhancing mixed use zoning for housing within commercial buildings scored more than 4.20 which indicate "very high satisfaction" from the respondents. While the results of the other three regulations: IR4, IR5 and IR6 concerning rainwater tank and recycling techniques for grey water, floating zone and brownfield sites, also indicated high score which is higher than 3.40, leading to conclusion that the respondents are with high satisfaction with promoting incentives for these regulations but need more binding terms when contracting.

6 CONCLUSIONS

From the literature review of this paper and the results of the practical work, the researchers concluded that to promote sustainability practices within housing projects, it is necessary to establish programs and mechanisms out of the ordinary model. Enforcement mechanism should be standing on the concept of not treat all regulated issues in a uniform method. Based on that, differentiation should be based on the overall actions of the regulated issue. That means the enforcement approach would base on the status of the housing project and its briefing.

Furthermore, they concluded that incentive regulations can be determined and controlled by the authorized bodies. Also moving toward performance-based regulation (PBR) is highly recommended to be adopted in the reforming regulations of sustainable housing, but with using the four types of enforcement levels to promote the sustainable practices: centralized; institutional and guiding rules, in addition to incentive regulations. For some regulations, it is as per a locality to decide how would like to obligate them within contracts with developers to fulfilling their vision.

Also the researchers found that to create programs for residents to engage them in the programs of utilizing and/or maintaining water and energy need to be centralized obligated, so the researchers recommended that this item firstly be obligated as an institution decides to, with condition that it will be legislated centralized in the long term strategy.

Another recommendation is that the government has to promote actions to be as supported activities for establishing an enforcement mechanism for sustainable housing projects through maximizing the awareness of practitioners who either work within the regulatory bodies or the private sectors who work in developing housing projects in addition to the households that will be the users of the sustainable housing projects.

REFRENCES

- Bukowski, R, Hirano, Y., and Rackliffe, T., 2001, *Standards Linkages to a Performance-Based Regulatory Framework*, Proceedings CIB World Congress, Wellington, NZ, CIB 2001
- Cambini, C. and Rondi, L., 2010, *Incentive regulation and investment: evidence from European energy utilities*, Journal of Regulatory Economics, Volume 38
- Carmody, J., Weber, W. and Jacobson, R., 2009, *Design guidelines for Sustainable housing*, Center for Sustainable Building Research (CSBR), Korea
- Cole, Daniel H. and Grossman, Peter Z., 1999, *When Is Command-and-Control Efficient? Institutions, Technology, and the Comparative Efficiency of Alternative Regulatory Regimes for Environmental Protection*, Articles by Maurer Faculty, Indiana University, Paper 590
- Gunningham, N., 1998, *Smart Regulation. Designing Environmental Policy*, Clarendon Press, Oxford
- Häkkinen, T., & Belloni, K., 2011, Barriers and drivers for sustainable building. Building Research & Information, 39(3), 239-255.
- Heijden, J., 2007, *Enforcement of Building Regulations: From Public Regulation to Self regulation; A Theoretical Approach*, International Conference for Sustainable Urban Areas, 2007, Rotterdam
- Hepburn, G., 2009, *Alternatives To Traditional Regulation*, OECD report for the OECD Regulatory Policy Division
- Kumar, Tej K., 2015, *Mandatory Versus Incentive-Based State Zoning Reform Policies for Affordable Housing in the United States: A Comparative Assessment*, Journal of Housing Policy Debate, V. 25
- Luce, Z., 2010, *Project Management and Sustainability*, Retrieved 11th October
- Sinclair, D., 1997, *Self-Regulation versus Command and Control? Beyond False Dichotomies*, Law & Policy Journal, Vol. 19, No. 4
- Prum, D., 2009, *Creating State Incentives for Commercial Green Buildings: Did the Nevada Experience Set an Example or Alter the Approach of Other Jurisdictions?*, William & Mary Environmental Law and Policy Review /vol34/iss1
- Robichaud, L. B., & Anantatmula, V., 2011, *Greening project management practices for sustainable construction*, *Journal of Management in Engineering*
- Sonnemann, G.; Castells, F.; Schuhmacher, M., 2003, *Integrated Life-Cycle and Risk Assessment for Industrial Processes*, Lewis Publishers: Boca Raton, USA
- UNCED, 1992, The Agenda No. 21 of the United Nations for Environment and Development Conference.

المصادر العربية

A1., 1964: وزارة الداخلية في العهد الملكي، *نظام الطرق والابنية رقم 44 لسنة 1935، معدل في 1964*، العراق

A2., 2007: امانة بغداد، 2007، *مجموعة الضوابط التخطيطية للبناء وتقسيم الاراضي في مدينة بغداد*، العراق

A3., 1983: مؤسسة بول سيرفس البولونية، 1983، معايير الاسكان الحضري ووالريفي، المؤسسة العامة للاسكان السابقة، العراق

A4., 2013: عبد المجيد، احمد عودة، 2013، *كتاب مفاهيم التقييم والقياس والاداء*، كلية التدريب، الرياض

ABBREVIATIONS

PBR= performance based regulations
CAC= command and control
ER= energy efficiency regulations
HSR = health and safety regulations
MR = materials regulations
OMR= occupation and maintenance regulations
Q = question
Sys = system of enforcement
S.D = standard deviation
WR = water efficiency regulations

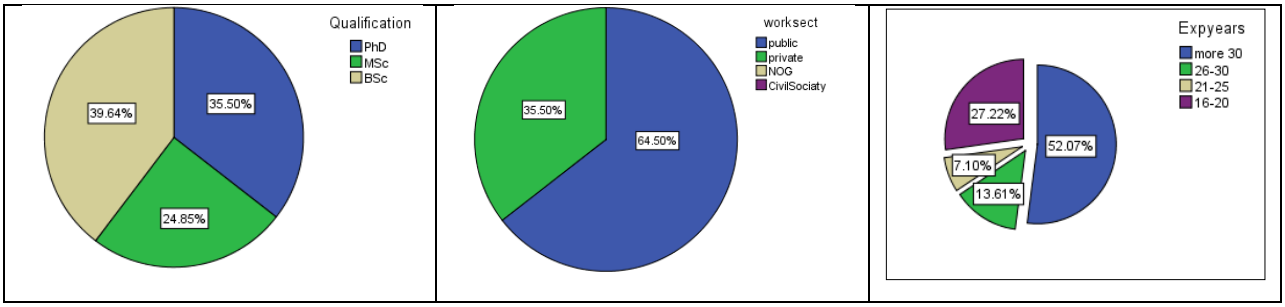

Figure 1. Qualifications and work place of the respondents, **Researchers**.

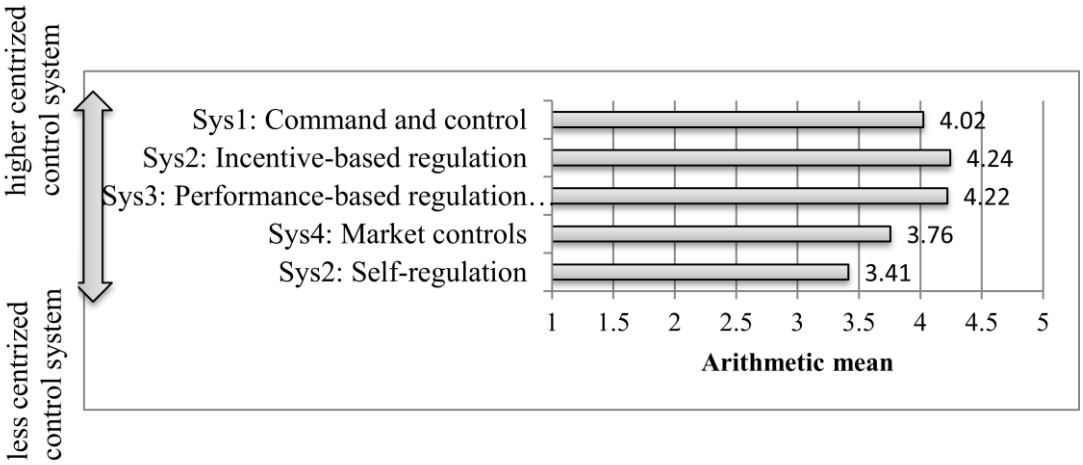

Figure 2. Descriptive analysis for respondent's evaluation of supposed regulations enforcement systems, **Researchers**.

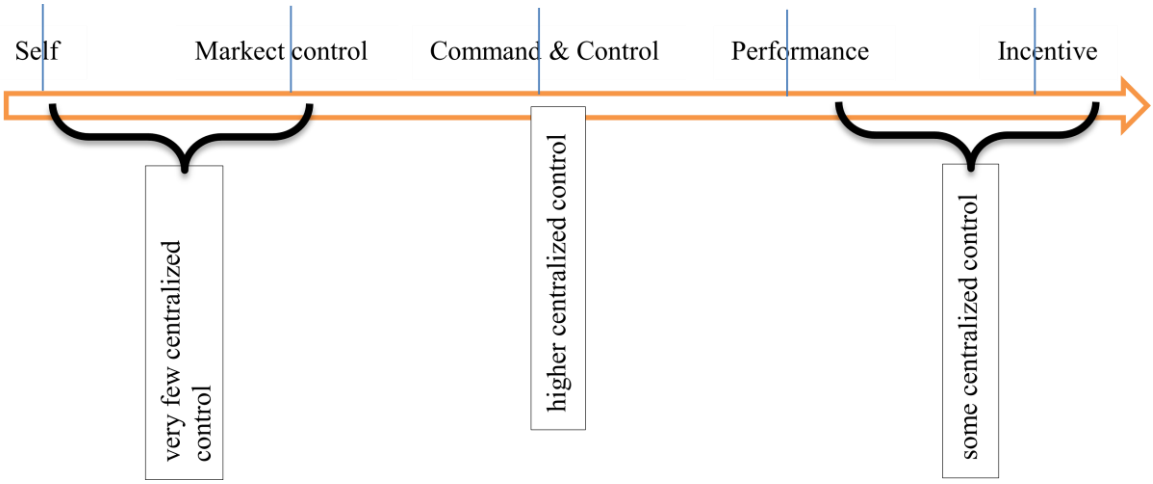

Figure 3. Spectrum of satisfaction with degree of centralized control by regulations, **Researchers**.

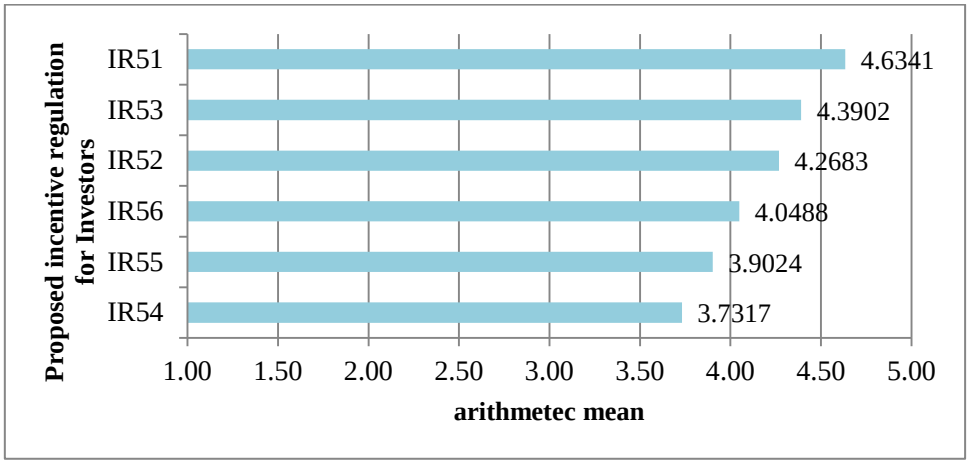

Figure 4. Descriptive analysis for respondent's evaluation of proposed incentive themes for regulations for housing investors, **Researchers**.

Table 1. Indicators in the international tools for sustainable housing development ,Researchers depend on, **Carmody, et al., 2009**.

		International tools for sustainable housing development													
		LEED for Neighborhoods	LEED for Homes	CASBEE-Homes	HK--BEAM	GBCS -MUNRBs	Green Globes	Austin Energy Green Building	Passive Haus	NABERS - Homes	Living Building Challenge	UK Code for Sustainable Home	MN B3 Guidelines	SB-tool	SBAT llite
Year		2007	2008	2002	1996	2002	2004	1992	1996	2005	2006	2007	2004	1997	1997
Country		USA	USA	Japan	Hong Kong	Korea	USA	USA	Germany	Australia	USA	United Kingdom	USA	Canada	South Africa
Formats	Building Code											●			
	Standard						●								
	Assessment								●	●	●		●	●	
	Rating	●	●	●	●	●	●	●		●		●		●	●
	Guideline										●		●	●	
Performance Indicators	Bio - diversity	√	√	√	√	√	√	√			√	√	√		
	Land use	√	√		√	√	√	√			√	√	√		√
	Heat island effect	√	√	√	√		√						√		
	Vehicle miles travelled	√	√		√	√	√	√				√	√		√
	Energy use – total building	√	√		√	√	√	√	√	√	√	√	√	√	
	Energy use – HVAC		√	√			√	√	√						√
	Energy use – others		√	√	√		√	√				√	√	√	√
	Energy use – renewable	√	√	√	√	√	√	√					√	√	√
	Water use – building	√	√	√	√	√	√	√		√	√	√	√	√	√
	Water use – landscape	√	√	√	√	√	√	√		√	√	√	√		√
	Waste water				√	√	√				√		√		√
	Storm water	√	√	√	√	√	√				√	√	√		√
	Solid waste	√	√	√	√	√	√	√			√	√	√		√
	Light pollution	√			√		√	√					√		
	Sound pollution			√	√	√									
	Carbon footprint				√		√			√	√	√	√	√	√
	Human health IEQ	√	√	√	√	√	√	√			√	√	√		√

Table 2. The proposed regulations within the five domains for sustainable housing, **Researchers**.

Main domains	Proposed Regulations
Materials Enact a standardized national code to promote using:	**MR1**: local building materials for a specific portion from total materials
	MR2: recyclable and reusable materials with for a specific portion from total materials
	MR3: low volatile organic compound (VOC) building materials
	MR4: Cavity external walls, double glazing, low emission glass and heat isolated materials
	MR5: standard material and product sizes and unified window shapes and sizes for easy replace when need to maintenance
	MR6: energy saving construction materials for a specific portion from total materials
	MR7: low shining concrete or materials with reflecting factor used for car parking surfaces to reduce the heat island
Energy Efficiency	**ER1:** Determine a portion of the total electric power needed to whole housing project to be generated from renewable energy recourses
	ER2: Using Solar system for water heating
	ER3: Installing energy efficient appliances for heating, cooling, cooking, lighting and ventilation
	ER4: A specific percentage of total dwelling units must be oriented correctly
Water Efficiency	**WR1:** Water recycling based strategies: rain water storage and re-use, and Gray water re-use and recycling system
	WR2: installing water efficiency appliances and fittings
	WR3: Impose strict levies and penalties for the quantity of used water by specify the upper limit for the permitted quantity of water
	WR4: establish limits for out-door water use
Health and Safety	**HSR1:** make the main living areas of the dwelling unit away from roads and car parking to avoid exposure to car fumes
	HSR2: Enhancing using fire network System and design for escaping roots
	HSR3: Using materials and building components of a non- combustible and flammable content in order to reduce the risk of the rapid spread of fire and toxic gases inside the house
	HSR4: Using smart appliances such as: Combustion appliances (venting Measures), Indoor contaminant control, Moisture Control devices and Occupant controls/ease of use (CO Monitors installed in each unit
	HSR5: Using hard or natural barriers and trees to avoid and eliminate the outside noises
Occupation and Maintenance Management	**OMR1**: Establish housing association in order to set and conduct a long term Programs for housing and facilities maintenance and management within the housing development or district.
	OMR2: set and conduct a waste management plan for the housing development
	OMR3: Create programs for residents to engage them in the programs of utilizing and/or maintaining water and energy.

Table 3. Incentives regulations for private investors, **Researchers**.

	Proposed Incentives regulations for investors
IR1	**Vacant lands:** Reduce costs and facilitate the approvals and licenses for investors for the purpose of developing vacant land within the urban fabric assigned for residential use to establish affordable housing but must be with sustainability applications for energy, water and materials using efficiency.
IR2	**Contaminated lands:** Granting subsidies for the rehabilitation of contaminated lots for housing complex projects with sustainable practices
IR3	**Inclusionary Zoning-Mixed Use:** allow apartments over stores to create powerful incentives for private developers and investors to produce more affordable housing but with sustainable practices.
IR4	**Brownfield sites**: Using land with existing infrastructure more effectively: reducing the need to invest in costly new infrastructure expansion, lowers land and service costs thereby contributing to housing affordability and sustainability
IR5	**Floating zone:** Identifying specific regions and lands to apply specific floating legislation previously agreed that differ from what is stipulated in the general regulations such as density, number of floors, elevations, coverage ratios, setbacks and subdivisions and others, to create a motivational environment for investors to set up projects with sustainable applications for affordable housing
IR6	**Rainwater tank and recycling techniques for grey water:** Developers are entitled to an amount as remission on their development contribution for approved installation of rainwater tanks, and using recycling for grey water to encourage the wise and sustainable reuse of water resource.

Table 4. Themes and scale of evaluating the themes of the questionnaire.

Questions	Theme	Scale
Q1	Enforcement systems mentioned in Section 3	Rated from 1 to 5, where (1) represents the "not satisfy" and (5) represents the highest satisfaction. The calculated scale to represent the results are: - Not satisfy: 1.00 - 1.80 - Little: 1.81 – 2.60 - Medium: 2.61 – 3.40 - high: 3.41 – 4.20 - Very high: 4.21 – 5.00
Q2	Proposed regulations for five themes: 1)Materials, 2)Energy efficiency, 3)Water efficiency, 4)Health and safety, and the 5)management	three main levels of obligation: • Centralized regulations; • institutional; • guidelines

Q3	Proposed incentive regulations for housing private investors	Rated from 1 to 5, where (1) represents the "not satisfy with viability of the proposal" and (5) represents the highest satisfaction. The calculated scale to represent the results are: - Not satisfy: 1.00 - 1.80 - Little: 1.81 – 2.60 - Medium: 2.61 – 3.40 - high: 3.41 – 4.20 - Very high: 4.21 – 5.00

Table 5. Reliability statistics test for the main themes of the questionnaire using Cronbach's Alpha as internal consistency.

Question	Number of items of the question	Standard lower bound	Actual values	Assessment
Q1	5	0.60	0.644	Pass
Q2	33	0.60	0.930	Pass
Q3	10	0.60	0.729	Pass

Table 6a. Results for the theme of Materials.

Proposed Regulations	Supposed mandatory level by researchers	Centralized regulations (C)	Institutional /sectoral regulations (I)	Guiding rules (G)	Mean	S. D	assess
MR1	Centralized	15	13	13	1.95	.835	Centralized
MR2	Centralized	12	11	18	2.15	.853	Guidelines
MR3	Centralized	19	12	10	1.78	.822	Centralized
MR4	Guidelines	11	20	10	1.98	.724	Institutional
MR5	Institutional	4	16	21	2.41	.670	Guidelines
MR6	Guidelines	8	13	20	2.29	.782	Guidelines
MR7	Guidelines	12	17	12	2.00	.775	Institutional

Table 6b. Results for the theme of Energy efficiency.

Proposed Regulations	Supposed mandatory level by researchers	Centralized regulations (C)	Institutional /sectoral regulations (I)	Guiding rules (G)	Mean	S. D.	assess
ER1	Centralized	13	21	7	1.85	.691	Centralized
ER2	Centralized	15	15	11	1.90	.800	Centralized
ER3	Centralized	15	14	12	1.93	.818	Centralized
ER4	Guidelines	6	18	17	2.27	.708	Guidelines

Table 6c. Results for the theme of Water efficiency.

Proposed Regulations	Supposed mandatory level by researchers	Centralized regulations (C)	Institutional/sectoral regulations (I)	Guiding rules (G)	Mean	S. D.	assess
WR1	Institutional	11	21	9	1.95	.705	Institutional
WR2	Centralized	11	18	12	2.02	.758	Institutional
WR3	Centralized	21	11	9	1.71	.814	Centralized
WR4	Centralized	10	20	11	2.02	.724	Institutional

Table 6d. Results for the theme of Health and safety.

Proposed Regulations	Supposed mandatory level by researchers	Centralized regulations (C)	Institutional/sectoral regulations (I)	Guiding rules (G)	Mean	S. D.	assess
HSR1	Guidelines	14	14	13	1.98	.821	Institutional
HSR2	Centralized	20	16	5	1.63	.698	Centralized
HSR3	Centralized	15	15	11	1.90	.800	Centralized
HSR4	Guidelines	10	17	14	2.10	.768	Institutional
HSR5	Guidelines	10	16	15	2.12	.781	Institutional

Table 6e. Results for the theme of Occupation and maintenance management.

Proposed Regulations	Supposed mandatory level by researchers	Centralized regulations (C)	Institutional/sectoral regulations (I)	Guiding rules (G)	Mean	S. D.	assess
OMR1	Centralized	18	20	3	1.63	.623	Centralized
OMR2	Centralized	18	19	4	1.66	.656	Centralized
OMR3	Centralized	11	17	13	2.05	.773	Institutional