

Impact of Quality Management on Defects and Energy Performance of Buildings

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ABSTRACT

Construction industry plays an important role in the development of any country. The development of construction industry depends on the quality of construction project. Quality is one of the critical factors in the success of construction projects. Improvement in the quality of construction projects is linked with quality management in the project life cycle. Although quality management at every stage of project life cycle is important but the quality management at the execution (construction) stage contributes significantly on final quality outcome of construction projects. The aim of this project is reducing energy and ensure thermal comfort. The project also includes the data measurement (energy, temperature), analyze the losses due to quality defect in quality management (using FLC) and suggests some proactive measures for the improvement of quality in execution phase of construction projects.

KEYWORDS: energy efficiency, construction defects, quality management, FUZZY logic controller (FLC).

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I. INTRODUCTION

In modern society, air conditioners are commonly found in homes, but most of the energy will be losses due to the construction defects that are like a discontinuity of insulation layer, gaps in the vapor/air barriers. As such, any innovations that can be reduce energy losses in buildings.

This paper investigates how quality management systems in the INDIA construction sector, focusing on energy performance aspects. This also assesses how quality management system enhancements could be applied to reduce energy demand. The strategy it uses is a five-step improvement process:

define, measure, analyze, improve and control (FLC). Fuzzy logic controller is more intense, focused and detailed than any other quality improvement techniques. and also used to analyze the data.

A. 2. Fuzzy logic controller

FLC involves receiving input signal and converting the signal into fuzzy variable (fuzzifier). The fuzzy control rules relate the input fuzzy variables to an output fuzzy variable which is called fuzzy associative memory (FAM), and defuzzifying to obtain crisp values to operate the system (defuzzifier). In this FLC, there are two fuzzy input variables and one output fuzzy variable.

II. SPSS SOFTWARE

The software name originally stood for **Statistical Package for the Social Sciences (SPSS)**, reflecting the original market, although the software is now popular in other fields as well, including the health sciences and marketing. This is used for ranking data.

III. METHODOLOGY

In this project, apply the fuzzy logic controller. To evaluate a knowledge base, expressed in terms of relevant fuzzy inference values and an appropriate inference engine to solve a problem. It controls the essential controllers. FLC is a continuous improvement methodology by using fuzzyfier. For implementation of FLC method to improve the quality of products and analyze the fuzzyfier (Define, Measure, Analyze, Improve, Control). Then SPSS is used for ranking data.

Define: The system, the voice of the customer and their requirements, and the project goals, specifically.

Measure: Key aspects of the current process and collect relevant data.

Analyze: The data to investigate and verify the losses of energy. Seek out root cause of the defect under investigation.

Improve: The current process based upon data analysis using management techniques

Control: The future state process to ensure that any deviations from the target are corrected before they result in defects.

IV. SCOPE AND OBJECTIVE

The objective of this paper is to study various literatures about quality management using Fuzzy and identify the key parameters that affect the quality in construction and to reduce the energy defects in construction.

The Scope of this paper includes:

- To study the basic theory of Fuzzy, its principles, methodology and various tools.
- To suggest a substitute method or remedial measures based on the project.

V. LITERATURE REVIEW

A literature review is a detailed report of information obtained from the literature that are related to our topic of study. The review describe, summarize, evaluate and clarify this literature. It gives a base for the research and helps in

determining the nature of the study. This section represents the review of literature collected from various journals and articles that are most relevant to the study.

1. Critical factors affecting quality performance in construction projects : k.n.jha,k.c.iyer (2006)

A preliminary survey identified 55 attributes responsible to impact quality performance of the projects. Out of these 55 attributes, 28 – referred to as success attributes in the study, whereas the presence of 22 – referred to as failure attributes.

The results of the study prove to be closer to Juran's philosophy that middle management (project manager and his team in this case) play a more important role in most stages of the project, although the top management's role becomes more significant in further enhancing the level of quality when the existing level is already high.

2. Quality performance on successful project, asce journal of construction engineering and management : ledbetter, w. b. (1994)

Ledbetter has developed a quality performance management system (QPMS) that tracks labor costs in three main categories: normal work, quality management work (prevention and appraisal), and rework (deviation correction). He has assumed the cost of quality to be the sum total of quality management and rework. He finds QPMS to be useful in promoting awareness and improving the understanding of the quality process in addition to facilitating communication, reducing the overall cost of quality, and directing the management to the areas where quality improvements could be made.

3. Impact of defects on energy performance in building : joao Alencastro, Alba Fuertes, Andrew Fox, Pieter de Wilde (2017)

This study set out to investigate how quality management systems related to energy performance of buildings are defined and implemented in social housing project in the UK. The analysis of evidence collected from number Housing Association case studies suggests that in the majority of the projects, the deployed quality management procedure focused on visual quality issues, allowing defects with the potential to impair the thermal performance of the dwelling to remain uncorrected.

4. Benefits and challenges of energy efficient social housing : Trivess Moorea, Larissa Nicholls, Yolande Strengers, Cecily Maller, Ralph Horne (2017) This paper presents a multi method (interview, cost-benefit analysis, technical

monitoring) longitudinal evaluation of ten social housing dwelling in

Horsham (victoriya, Australiya), including four low energy and six control houses. Occupants of the low improved thermal comfort purchased 45-65% less electricity, had improved thermal comfort, health and social outcomes. The paper concludes by providing discussion to help guide similar projects in the future to more sustainable outcomes.

5. Energy efficient refurbishment towards nearly zero energy houses, for the mediterranean region : D.K.Serghides, S.Dimitriou, M.C.Katafygiotou & M.Michaelidou (2015)

The study was carried out in order to determine the overall economic viability of the refurbishment on an old Single Family House towards a nearly Zero Energy Building, and to evaluate the effectiveness of the energy conservation measures related to the upgrading of the energy performance of the envelope, in terms of energy savings and cost effectiveness. The results indicate that the refurbishment of an old Single Family House into a nearly Zero Energy Building, Therefore, the cost effectiveness of the different refurbishment measures on the building envelope and the high amounts of energy produced from PV systems must be taken into consideration for the definition of the nearly zero energy buildings in Cyprus and redirect it into a more flexible and cost effective choice.

6. Summer discomfort reduction by direct evaporative cooling in southern mediterranean areas : Chiesaa, Nora Hubermanb, David Pearlmutterb, Mario Grossoa 2016

The present study analyses the effect of direct evaporative cooling (DEC) in reducing the number of discomfort hours in the area of Southern Europe and the Mediterranean. A total of 20 urban locations were selected in order to cover different climate conditions in the chosen area. Cooling degree hours and virtual climatic discomfort hours were calculated for the entire set of locations. A psychometric analysis was carried out and comfort boundaries identified for helping designers in considering DEC and night ventilation suitability from the early design phases (e.g. building programming).

7. Potential energy savings and environmental impact by implementing energy efficiency standard for household refrigerators in china : Wei Lu (2006)

This paper first describes the standard briefly. It develops a mathematic model to evaluate the potential energy savings and environmental impacts of the standard. The estimated results indicate implementing the standard will save large energy, as well as benefit greatly to environment. Thus, it is very necessary to implement energy efficiency standard for refrigerators in China.

8. Impact of building regulations on indian hill towns : Ashwani Kumar 2015

This study attempts to highlight various issues of existing development pattern and existing building regulations of hill towns along with various factors responsible for building regulations. Various impacts of building regulations on urban environment of hill towns are also highlighted in this study.

9. Using intelligent building energy management system for the integration of several systems to one overall monitoring and management system : Sotiris

Papantoniou, Stefano Mangili, Ivan Mangialenti (2016)

This research concludes that the developed and proposed iBEMS can assist significantly in the overview and control of all the sub-systems connected to it. It has been presented the overview of the whole building and the various subsystems. The solution solves the issue of intercommunication between various sub-systems since all the information are Collected on the higher level and are distributed in all the required stations.

10. A new methodology for the selective measurement of building performance and safety : Littlewood, J. R Alam, M a. Goodhew, 2016

This paper evaluates the present evidence of smoke spread due to problems in compartmentation and also reviews different test methods which can be employed to identify these problems during construction stages. Since 2010, evidence has emerged that the rapid spread of smoke occurs in and between UK buildings, including The paper also reviews different tests that can be employed as part of in construction testing (iCT) methodology to identify the potential defects in fire compartmentation, and fire stops such as cavity barriers in buildings. fire compartmentation, and fire stops such as cavity barriers in buildings.

11. Measuring the potential of zonal space heating controls to reduce energy use in

UK homes: the case of un-furbished 1930s dwellings: Arash Beizae, David

Allinson¹, Kevin J. Lomas, Ehab Foda³, Dennis L. Loveday 2014

This paper presents, what is believed to be, the first controlled comparative study of zonal heating control (ZC) systems in UK houses. Such systems have the potential to reduce the fuel used for space heating, which accounts for 66% of all energy use in the UK residential sector. Further studies in the matched pair homes are suggested to enable the effects on energy savings of different occupancy and heating schedules to be investigated. Further work, using a dynamic thermal model calibrated against the measured data, will enable the energy saving potential of zonal controls to be explored more fully.

12. Cool, translucent natural envelope: thermal-optics characteristics experimental assessment and thermal-energy and day lighting analysis : Federica Rossoa, Anna Laura Pisello^{b,c}, Franco Cotana^{b,c}, Marco Ferreroa 2016

Innovative construction elements are increasingly studied to improve the energy performance of new and existing buildings, to satisfy global regulations and societal needs. In this view, optimizing buildings energy efficiency and sustainability are crucial aspects, given their high energy saving potential with respect to the other sectors characterizing human activities. Natural materials are often preferred to artificial materials, thanks to their more sustainable production and to the reduced content of harmful substances.

13. Energy 10 performance on building energy efficiency in Jordan : Mahmoud S.

Awad, 2 Anwar Al-Mofleh 2012

This paper examines building energy efficiency parameter in order to improve efficient of construction projects as well as looking into making the building more energy efficient. Buildings considered one of the largest consumers of energy. In the developing countries huge number of new buildings is constructed yearly. One of the major barriers for better building energy efficiency is the lack of aiding tools during the primary design stage. A major barrier during design process of building has been the difficulty in finding the available suitable programs.

14. Energy performance of fuzzy logic controllers in smart buildings:

1) Ali Baniyounes, Yazeed Ghadi, Ayman Abu Baker (2019)

This article presents simulation study on using fuzzy logic based controllers in order to determine building's occupancy level and hence its effect on energy usage. The projected results of energy savings then is used to determine and investigate the proposed fuzzy logic based control system environmental and economic aspects. The proposed system energy performance are measured based on the system occupancy density level, Daylight utilization and natural ambient air and humidity. Results showed that system will save 14% of total energy demand at 50 % of occupancy level compared to total energy demand at full occupancy level (100% occupancy level) and also it is able to save 24% of total energy demand at 25 % of occupancy level compared to full occupancy level energy demand (100% occupancy level).

15. Potential of Saving Energy Using Advanced Fuzzy Logic Controllers in Smart Buildings in Subtropical Climates in Australia:

Yazeed Yasin Ghadi¹, M.G. Rasul², M.M.K. Khan

Subtropical Regions in Australia are associated with high demand for air conditioning throughout the long Summer which leads to a high energy consumption and consequently high greenhouse gas (GHG) emissions which has a high negative impact on the environment. Using conventional controllers in Building Management Systems (BMS) whose functions are based on ON/OFF, temperature control and in some cases humidity control is not the ultimate solution to save energy. The reason behind the above fact is that, conventional controllers do not take into account real time events such as the number of occupants, indoor air quality (IAQ), natural light illuminations and etc dislike Fuzzy logic based controllers. In the last decade there is a high interest in researching Fuzzy logic based controllers as they have the ability to save energy while maintaining indoor comfort level. In this article a general review on Fuzzy logic based controllers is presented, focusing on the role of technology in saving energy, and its potential in subtropical Central Queensland, Australia.

16. A fuzzy-based building automation control system: optimizing the level of energy performance and comfort in an office space by taking advantage of building automation systems and solar energy: luigi martirano

Building automation systems (BASs) are the key to improving the energy performance of buildings as

well as the occupants' comfort. There is a need to build a knowledge base on the matter and to grow suitable algorithms for a smart management of intelligent buildings. Therefore, fuzzy logic is a valuable candidate for developing robust algorithms. The scope of this article is to validate a fuzzylogic approach with the ability to optimize the level of energy performance and comfort in an office space by taking advantage of BASs and solar energy. In BASs, dynamic elements, e.g., dynamic facade and luminaires, can exploit daylight and solar gain based on the condition that well-programmed integrated multicriteria decision-making methods are used. In this article, a virtual model of a smart office room (SOR) equipped with dynamic shading, lighting, and an airconditioning control system was studied, and four different scenarios were considered: control versus no control, economy versus comfort mode, fluorescent versus light-emitting diode (LED), and dimming versus switching. Both economy and comfort mode showed a better energy performance than the noncontrolled scenarios. In conclusion, the proposed model is a valuable tool for optimizing comfort features and energy demand.

VI. CONCLUSION

This paper considers that wide literature and knowledge about Fuzzy method was obtainable and gives a wide idea of foregoing practices and techniques used in construction industry and researches carried across the world. Fuzzy concept is new to construction industry but is being used to find losses of energy and it is also possible to use it in construction industry. The SPSS software also used for ranking data. This research is carried out to show various techniques and more research work is required in this field. In this paper, I have studied several journal papers about quality management using Fuzzy in residential construction. Thus, it is concluded that fuzzy logic controller is used to reduce the quality defects in construction and also the energy losses.

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