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Critical Success Factors for Post Occupancy Evaluation of Building Performance: A Literature Analysis

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Abstract

This paper aims to identify the critical success factors (CSFs) for post occupancy evaluation (POE) of building performance based on literature review. Failures in carrying out POE and achieving the goal of its implementation have been recognised as one of the difficulties in managing POE projects. Despite the numerous studies on POE, the CSFs for POE as a successful project have not been investigated. This leads to a knowledge gap of what are the CSFs that contributes to the success of POE of building performance. Employing NVIVO and content analysis on 63 selected articles, 13 POE critical success factors and 32 sub-factors have been identified. The outcome of this paper will provide detailed review on the need for the development of CSFs for POE of building performance.

Keywords: Critical success factors (CSFs); post occupancy evaluation (POE); NVIVO; content analysis

Abstrak

Tujuan kajian ini dijalankan adalah untuk mengenal pasti faktor-faktor kejayaan kritikal (CSF) bagi penilaian pasca menduduki (POE) untuk prestasi bangunan. Kegagalan dalam menjalankan POE serta mencapai matlamat pelaksanaannya telah dikenalpasti sebagai salah satu halangan dalam menguruskan projek-projek POE. Walaupun terdapat banyak kajian mengenai POE yang telah dijalankan, CSF bagi POE sebagai projek yang berjaya tidak pernah dikaji. Ini membawa kepada jurang pengetahuan, apakah CSF yang menyumbang kepada kejayaan POE bangunan. Dengan menggunakan NVIVO dan analisis kandungan terhadap 63 artikel terpilih, 13 faktor-faktor kejayaan kritial POE dan 32 sub faktor telah dikenalpasti. Hasil kajian ini akan memberikan rujukan terperinci mengenai keperluan untuk pembangunan CSF untuk POE bagi prestasi bangunan.

Kata kunci: Faktor kejayaan kritikal (CSF); penilaian pasca menduduki (POE); NVIVO; analisis kandungan

1.0 INTRODUCTION AND BACKGROUND

The significance of integrating sustainability into building performance has been emphasised in recent years. Globally, there are growing efforts to undertake building performance evaluation studies with the intention to meet sustainability challenges (Mastor and Ibrahim, 2010). This leads to the upbringing of Post Occupancy Evaluation (POE); "the process of systematically evaluating the extent to which a facility, once occupied for a period of time, meets the intended organisational goals and user-occupant needs" (Preiser *et al*., 1988). POE has played a significant role in the building performance evaluation literature since works began in the United Kingdom in the 1960s (Becker and Sims, 1990; Kooymans and Haylock, 2006) POEs have been conducted periodically across the public and private sectors (Cohen, Standeven, Bordass and Leaman, 1999; Fowler, MacRae, Stern, Harrison and Gerteis, 1999; Friesen, Trojan and Suter, 2008; Kennon, Bauer and Parshall, 1988; Kotaka and Manildo, 1999; Lackney and Zaifen, 2005; Zagreus, Huizenga, Arens and Lehrer, 2004) especially on building facilities that are 'critical' and functioning as the integral part of the business (Then, 2005).

The success of building design cannot be confirmed without POE (Izran, 2011). According to Manning (1987); cited in Ng and Zainal (2012), there are three main purposes for conducting building performance evaluation:

i) to learn how the existing buildings perform through the amalgamation of opinions of building users and professionals.
ii) to assess the possible consequences of design options and their impact on performance.

iii) to determine the extent to which the performance of the completed building meets the initial target performance specified in the building stage.

POE of building performance is vitally needed to ensure that building performance of government and public buildings and facilities is sustained (Nawawi and Khalil, 2008). Although the importance of POE has been recognised by many, obstacles still exist in its widespread adoption. The success of a project depends on a combination of many events and interactions, planned or unplanned, over the life of a facility, with changing participants and processes in a constantly changing environment (Rohaniyati Salleh, 2009). While numerous studies are bound on the barriers and solutions, benefits and costs, techniques and process, there have been no POE studies encountered on what are the CSFs that need to be considered and concentrated on post occupancy evaluation of building performance. Table 1 and Table 2 show the latest studies on POE and CSFs. As can be seen, these studies do not relate to the CSFs for POE. A survey conducted by Neo (2013) has discovered that international POE experts acknowledge the absence of studies on CSFs for POE and further emphasise the importance of CSFs for POE projects.

Table 1 Review of previous POE based studies

Author (s)	Issues Addressed
Aqlima (2012)	Factors thwarting the implementation of Post Occupancy Evaluation in Malaysia
Energy Design Resources (2010)	Challenges facing the widespread adoption of POE
Taylor, Littlewood, Geens, Counsell and Pettifor (2010)	Drivers and barriers for POE
Zimring (2010)	How to conduct a successful FPE
Hadjri and Crozier (2009)	Post-occupancy Evaluation: purpose, benefits and barriers
Riley Moody and Pitt (2009)	Inhibitors of the POE process

Table 2 Review of previous CSFs based studies

Author (s)	Issues Addressed
Olbrich, Pöppelbuß, and Niehaves (2012)	CSFs for business intelligence
Reyes-Alcázar, Torres-Olivera, Núñez-García and Almuedo-Paz (2012)	CSFs for quality assurance in healthcare organizations
Xaymoungkhoun, Bhuasiri, Rho, Zo and Kim (2012)	CSFs of e-learning in developing countries
Nasir and Sahibuddin (2011)	CSFs for software projects
Yu and Kwon (2011)	CSFs for urban regeneration projects in Korea

According to Rockart (1979), critical success factors are "the limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organisation, and should receive constant and careful attention from the management". The correlation between CSFs and project success has long been recognised. The effectiveness of project delivery has been attributed to consideration on CSF studies. According to Yasin and Egbu (2010), as part of the strategic planning process in the Facilities Management industry specifically in conducting performance evaluation of building performance, the identification of CSFs is essential. This is in alignment with the statement by Bullen and Rockart (1981) wherein CSFs are recognised as a necessary input to the strategic planning process.

Understanding on the CSFs for performance evaluation of building performance forms a strong foundation when carrying out POE projects (Yasin and Egbu, 2010). Therefore, a structured approach was devised and applied to systematically review the factors that lead to the success of POE of building performance; the driving research question being **'What are the factors that influence the success of POE of building performance?'**

2.0 RESEARCH METHOD

This paper is specifically devoted to search and review the literature on the factors that contribute to the success of POE of building performance. The primary data was generated through qualitative content analysis. Content analysis is considered a scholarly methodology in the humanities by which texts are studied as to authorship, authenticity, or meaning (Joubish and Khurram, 2011). It is often used as "a research technique to objectively and systematically describe the content of communication

Qualitative content analysis was applied for reviewing published material related to POE CSFs. Based on the method used by Miskon *et al*. (2011) and Levy and Ellis (2006), a three-stage method was employed to extract, analyse and report the literature-based findings. The first stage involved identifying the articles to be included in this review. The second stage involved designing and executing detailed rules of conduct that prescribed how to capture and analyse the literature. The third stage entailed synthesising the analysed details and deriving the research findings.

As the first step of the content analysis, all articles published in the leading POE journals, academic conferences and books were collected. The POE journals included in the search consists of *Facilities, Building Research and Information, Journal of Building Appraisal, International Journal of Construction Management, Journal of Facilities Management, International Journal of Management Science and Engineering Management,* and *International Journal of Architectural Research***.** The literature sample comprises English-speaking journals, peer-reviewed papers; proceedings from academic conferences and books on factors that influence the success of POE of building performance, covering the twenty four-year-period from 1990 to 2014. For compiling the literature sample, a literature search was carried out, based on a pair of keywords "success factors", "success elements", "critical success factors" and "key success factors", to be jointly found in tile, keywords or abstract. The structure keywords search was conducted in major databases subscribed by the UTM library: *Emerald, Sage Journals, Wiley, Scopus, Proquest, Springer* and *Taylor & Francis*. Through these processes, a total of 63 qualitative research articles related to POE CSFs were identified (henceforth, these 63 papers are referred as the 'primary' set of papers).

NVIVO 9.0 was used to code and analyse the literature in a single repository. NVIVO had previously been effectively employed in this way by Miskon *et al.* (2011), Bandara (2006), and Bandara *et al*. (2011). A detailed rule of conduct was devised to store, code and analyse the extracted papers in the NVIVO database. All 63 articles were saved and arranged as 'documents' and 'nodes'.

Two levels of coding were involved in the analysis. The key areas of interest (the critical success factors and sub-factors for POE) were plotted at a high level in two main tree-level nodes in NVIVO. This is in alignment with the specification of

the first rule of conduct. The tree-level node represents a logical location within NVIVO. This allows one to plot and store the content that are logically grouped together, during the coding process. Based on the rule of conduct, each paper was manually scanned in NVIVO to inductively identify the key area of interest (the critical success factors and sub-factors of POE). The coding process was carried out by mapping relevant sentences/ statements to the nodes. Any suggestion of a benefit either implicit or explicit was mapped to the 'Critical Success Factors' node. A similar process was carried out for the 'Sub-factors'.

The result from the first analysis (the coded content) was scrutinised to inductively derive actual critical success factors. To group the statements that described similar factors, sub-folders were created. This process led to the identification of a set of critical success factors and sub-factors from the coded literature. The overall research findings are discussed in the next section.

3.0 DATA ANALYSIS AND FINDINGS

Content analysis was carried out to identify the factors that influence the success of POE of building performance. Table 3 presents the factors identified through this effort. In order to ensure that the list of factors was comprehensive, the factors that were only cited once were also considered in the list.

Table 3 Summary of results from content analysis

Critical Success Factors / Sub-factors	Number of coding references	Number of sources	List of sources
CSF 1: Resources	60	15	SCI-Network (2012), Zimring (2010), CEFPI (2007), Palm (2007), British Council for Offices (2007), Scottish Executive (2006), Hewitt, Higgins, Heatherly and Turner (2005), Bordass and Leaman (2005), McDougall, Kelly, Hinks and Bititci (2002), Vischer (2001), Federal Facilities Council (2001), Bordass, Leaman and Ruyssevelt (2001), Cooper (2001), Eley (2001), and Zimmerman and Martin (2001)
Sub-factor 1: Cost	129	14	SCI-Network (2012), Aqlima (2012), Izran (2012), Zimring (2010), Riley *et al.* (2009), CEFPI (2007), Palm (2007), Keen Engineering (2006), Bordass and Leaman (2005), McDougall et *al.* (2002), Vischer (2001), Bordass *et al.* (2001), Cooper (2001), and Zimmerman and Martin (2001)
Sub-factor 2: Time	72	8	SCI-Network (2012), Aqlima (2012), Izran (2012), Zimring (2010), Riley *et al.* (2009), CEFPI (2007), Vischer (2001), and Eley (2001)
Sub-factor 3: Manpower	7	5	Zimring (2010), Riley *et al.* (2009), Scottish Executive (2006), Federal Facilities Council (2001), and Zimring (2001)
CSF 2: Participation and Commitment	28	10	SCI-Network (2012), Aqlima (2012), Izran (2012), Scottish Executive (2006), Bordass, Leaman and Eley (2006), Leaman (2003), Jaunzens, Cohen, Watson and Picton (2002), Federal Facilities Council (2001), Cooper (2001), Zimring (2001)
Sub-factor 4: Who should carry out	18	7	Aqlima (2012), Izran (2012), British Council for Offices (2007), Scottish Executive (2006), Leaman (2003), Facilities Council (2001), and Zimring (2001)
Sub-factor 5: Who should be involved	12	4	SCI-Network (2012), Scottish Executive (2006), Bordass *et al.* (2006), and Federal Facilities Council (2001)
Su-factor 6: Enthusiasm from all participants	1	1	Jaunzens *et al.* (2002)
CSF 3: Leadership	10	3	Balogun (2008), Scottish Executive (2006), and Lam (2005)
Sub-factor 7: Qualities Of process leader	2	1	Lam (2005)
Sub-factor 8: EQ competencies for process leader	6	3	Obradovic, Jovanovic, Petrovic, Mihic and Mitrovic (2013), Lam (2005), and Trabun (2002)
Sub-factor 9: Interpersonal skills of process leader	8	4	Scottish Executive (2006), Lam (2005), Davis, Skube, Hellervik, Gebelein and Sheard (1992), and Bolton (1986)
CSF 4: Skills	25	9	Aqlima (2012), Izran (2012), Zimring (2010), Vischer (2001), Energy Design Resources (2010), Zimring and Rashidi (2008), Stevenson (2008), Zuriati (2005), and Federal Facilities Council (2001)
Sub-factor 10: Technical skills	32	9	Aqlima (2012), Izran (2012), Zimring (2010), Energy Design Resources (2010), Zimring and Rashidi (2008), Stevenson (2008), Zuriati (2005) Vischer (2001), and Federal Facilities Council (2001)
Sub-factor 11: Logistical skills	2	2	Zimring (2010), and Energy Design Resources (2010)
SF 5: Education and Attitude	18	11	Aqlima (2012), Izran (2012), SCI-Network (2012), Riley *et al.* (2009), Palm (2007), Bordass and Leaman (2005), McLennan (2004), Jaunzens, Grigg, Watson and Picton (2003), Jaunzens *et al.* (2002), Cooper (2001), and Zimmerman and Martin (2001)
Sub-factor 12: Training in building performance evaluation	5	3	Aqlima (2012), Izran (2012), and Bordass and Leaman (2005)

Critical Success Factors / Sub-factors	Number of coding references	Number of sources	List of sources
Sub-factor 13: Prepare to accept negative feedback	15	11	Aqlima (2012), Izran (2012), SCI-Network (2012), Riley *et al.* (2009), Palm (2007), Bordass and Leaman (2005), McLennan (2004), Jaunzens *et al.* (2003), Jaunzens *et al.* (2002), Cooper (2001), and Zimmerman and Martin (2001)
Sub-factor 14: Enthusiasm from building practitioners	2	2	Bordass and Leaman (2005), Lam (2005)
CSF 6: Ownership	52	15	Aqlima (2012), Izran (2012), Riley *et al.* (2009), Hadjri and Crozier (2009), Palm (2007), British Council for Offices (2007), Brooks and Viccars (2006), Bordass and Leaman (2005), Jaunzens *et al.* (2003), McDougall *et al.* (2002), Vischer (2001), Bordass *et al.* (2001), Cooper (2001), Eley (2001), and Zimmerman and Martin (2001)
Sub-factor 15: Who should carry out	8	4	British Council for Offices (2007), Scottish Executive (2006), Leaman (2003), and McDougall *et al.* (2002)
Sub-factor 16: Who should pay	24	13	Aqlima (2012), Izran (2012), SCI-Network (2012), Riley *et al.* (2009), Hadjri and Croizer (2009), Palm (2007), Bordass and Leaman (2005), McDougall *et al.* (2002), Vischer (2001), Bordass *et al.* (2001), Cooper (2001), Eley (2001), and Zimmerman and Martin (2001)
CSF 7: Indicators and Benchmarks	17	10	Aqlima (2012), Izran (2012), Izran (2011), Kooymans and Haylock (2006), Brooks and Viccars (2006), Vischer (2001), Zimmerman and Martin (2001), Kincaid (1994), Becker (1990), and Becker and Sims (1990)
Sub-factor 17: Agreed and standard definition	9	8	Hadjri and Croizer (2009), Kooymans and Haylock (2006), Brooks and Viccars (2006), Bordass and Leaman (2005), Jaunzens *et al.* (2003), Eley (2001), Zimmerman and Martin (2001), and Kincaid (1994)
Sub-factor 18: What criteria and parameters to be used	7	6	Aqlima (2012), Izran (2012), Kooymans and Haylock (2006), Brooks and Viccars (2006), Zimmerman and Martin (2001), and Kincaid (1994)
CSF 8: Managing POE Information	12	10	Aqlima (2012), Izran (2012), Leaman, Stevenson and Bordass (2010), Palm (2007), Scottish Executive (2006), Vandenberg (2006), Leaman (2004), Vischer (2001), Federal Facilities Council (2001), and Zimring (2001)
Sub-factor 19: Complexity of managing information	14	3	Aqlima (2012), Izran (2012), and Vischer (2001)
Sub-factor 20: Prepare to accept negative feedback	11	8	Aqlima (2012), Leaman *et al.* (2010), Palm (2007), Scottish Executive (2006), Vandenberg (2006), Leaman (2004), Facilities Council (2001), and Zimring (2001)
CSF 9: Top Management Support	16	8	Zimring (2010), Palm (2007), Leaman (2003), Jaunzens *et al*. (2003), Federal Facilities Council (2001), Eley (2001), Zimring (2001), and Heerwagen (2001)
Sub-factor 21: Commitment from top management	4	3	Palm (2007), Leaman (2003), and Vischer (2001)
Sub-factor 22: Funding has to be available	6	4	Jaunzens *et al*. (2003), Federal Facilities Council (2001), Eley (2001), and Zimring (2001)
CSF 10: Knowledge	19	10	Izran (2012), Kooymans and Haylock (2006), Brooks and Viccars (2006), Bordass and Leaman (2005), Zuriati (2005), McDougall *et al.* (2002), Vischer (2001), Zimmerman and Martin (2001), Kincaid (1994), and Becker (1990)
Sub-factor 23: What feedback techniques available	8	6	Izran (2012), Palm (2007), Bordass and Leaman (2005), Zuriati (2005), McDougall *et al.* (2002), and Eley (2001)
Sub-factor 24: How the technique should be used	6	6	Izran (2012), Palm (2007), Bordass and Leaman (2005), Zuriati (2005), McDougall *et al.* (2002), and Eley (2001)
Sub-factor 25: How the results should be used	6	6	Izran (2012), Palm (2007), Bordass and Leaman (2005), Zuriati (2005), McDougall *et al.* (2002), and Eley (2001)
Sub-factor 26: What criteria and parameters to be used	9	7	Izran (2012), Kooymans and Haylock (2006), Brooks and Viccars (2006), Preiser *et al.* (1988), Kincaid (1994), Douglas (1994) and Becker (1990)
CSF 11: POE Methods	7	5	Brooks and Viccars (2006), van der Voordt and van Wegen (2005), Preiser and Vischer (2004), Eley (2001), and Cohen *et al*. (1999)
Sub-factor 27: Data collection methods	13	11	Brooks and Viccars (2006), Carthey (2006), van der Voordt and van Wegen (2005), Preiser and Vischer (2004), Jaunzens *et al.* (2002), Groat and Wang (2002), Eley (2001), Bordass and Leaman (2001), Cohen *et al.* (1999), Vos and Dewulf (1999), Baird, Gray, Isaacs, Kemohan and McIndoe (1996)

Critical Success Factors / Sub-factors	Number of coding references	Number of sources	List of sources
Sub-factor 28: Standardisation in POE methods	3	2	Queensland Department of Housing and Public Works (2012), Carthey (2006)
Sub-factor 29: Combination of POE methods	2	2	Zimmerman and Martin (2001), and Jaunzens *et al.* (2002)
CSF 12: POE Process	10	7	Mastor and Ibrahim (2010), Meir, Garb, Jiao and Cicelsky (2009), Vandenberg (2006), Scottish Executive (2006), Keen Engineering (2006), Vischer (2001), Federal Facilities Council (2001)
Sub-factors30: What process model to be used	7	5	Mastor and Ibrahim (2010), Meir *et al.* (2009), Vandenberg (2006), Vischer (2001), Federal Facilities Council (2001)
CSF 13: Provide Access to Knowledge	11	8	Okolie (2011), Zimring (2010), Palm (2007), Leaman (2004), Leaman (2003), Vischer (2001), Federal Facilities Council (2001), and Zimring (2001)
Sub-factor 31: Distribute information	9	7	Okolie (2011), Zimring (2010), Palm (2007), Leaman (2003), Vischer (2001), Federal Facilities Council (2001), and Zimring (2001)
Sub-factor 32: Create POE database	10	5	Mastor and Ibrahim (2010), van der Voordt and van Wegen (2005), Vischer (2001), Federal Facilities Council (2001), and Zimring (2001)

■4.0 DISCUSSION

There are 13 CSFs and 32 sub-factors for POE of building performance identified from this study. The CSFs and its relevance sub-factors are briefly discussed in the following sub-sections.

4.1 Resources

POE of building performance is not as simple as conducting a user satisfaction survey. Rather it is a complex undertaking that requires a vast amount of resources. Identifying the resources available to carry out POE, matching data collection and analysis activities to the available time and budget has become one of the challenges for building practitioners (British Council for Offices, 2007; Vischer, 2001). The success of POE is more related to the availability of resources including money (cost), time and manpower within the organisation. It also includes a variety of stakeholders over a long period, and requires simultaneous attention to a wide variety of technical and non-technical issues.

4.2 Participation and Commitment

Participation and long term commitment from all key participants are important. However, in practice, POE has been regarded as insignificant by building practitioners due to time constraints and tight construction schedule (Vischer, 2001). They are also reluctant to carry out evaluation since POE is not part of the standard facility or building delivery process and there is no provision in the legislation for POE [40]. Thus, POE is treated as merely an option since they believe that they do not receive any benefit from the investment on POE.

4.3 Leadership

Leadership is one of the critical factors that have to be fulfilled for a successful POE (Scottish Executive, 2006). People are complex. Leading people is a daunting task. The success of a building project does not depend on how many professionals are involved, but on how well these people relate to one another, and how well they work together towards a shared vision of an integrated product (Obradovic *et al.*, 2013). A good leader can get things done by focusing on the effort of a group of people toward a common goal and enabling them to work as a team (The PMBOK, 2008). POE project without positive leadership may under-perform, under-utilise team members, fall short of project goals, quality performance and productivity.

4.4 Skills

Lack of skills was considered as a major factor in restricting the success of POE (Vischer, 2001; Zimring and Rashidi, 2008; Stevenson, 2009]. The skills required to perform user feedback studies is diverse. Building performance evaluation has become more complex than ever as today's building have become more complex (Izran, 2011). Building practitioners have to possess a wide range of skills in order to undertake a successful POE study (Vischer, 2001; Stevenson, 2008). However, it is rare for the in-house staffs to possess a broad range of technical and logistical skills, as well as mastering in-depth knowledge to direct, evaluate, manage and translate POE data into workable information for decision making.

4.5 Managing POE Information

POE of building performance is not an easy task; rather it is a complex mix of technical and non-technical process. In the practical world of building design, construction, and management, most organisations have no established system for knowing what to evaluate, how to process, direct, and act on the information they receive from POE (Vischer, 2001). This may cause the information to not go anywhere either to the upper-level management, design team or public, which in turn leads to POE failures.

4.6 Ownership

Numerous building scholars and POE references recognise ownership as a critical factor that POE project team has to clarify for achieving project success (Izran, 2011; Zimmerman and Martin, 2001; Jaunzens *et al.*, 2003; Brooks and Viccars, 2006). The main question is who is to take the ownership? Professionals such as architects, building designers, engineers

and facilities or property managers are likely to deflect the ownership for POE because they refuse to become liable for any new problems or costs associated with POE (Riley *et al*,. 2009). From the client's point of view, they refuse to take POE ownership due to the concern of the negative results that might be generated from the POE activities that will reduce their asset value (Riley *et al*., 2009; Brooks and Viccars, 2006). The project team on the other hand will be reluctant to reduce their profit by paying for an evaluation of the building.

4.7 Indicators and Benchmarks

Unclear indicators and accompanying benchmarks for determining the requirements for a well-functioning building cause the failure of POE to achieve its optimum benefits. Though numerous literature and studies on POE are available, there is a still a gap on what is the reliable and agreed definition of a good building (Zimmerman and Martin, 2001), what are the actual building performance criteria, as well as the parameters that need to be considered in POE of building performance (Kooymans and Haylock, 2006; Izran, 2011; Brooks and Viccars, 2006; Kincaid, 1994; Becker, 1990).

POE is also perceived as an evaluation method that is only customised to the specific circumstances of the building and its occupants (the aspects of evaluation are tailored for a specific building only) (Izran, 2012). This means, POE does not permit performance comparison with other buildings, with other sectors of the industry, which causes POE results to rarely become part of a systematic database. To ensure POE success, POE programmes should be standardised across the industry to provide compatible results that can be compared to give indications of improvement.

4.8 Education/ Culture and Attitude

Unlike other industries, the construction industry has not developed a culture of critical examination and evaluation for the buildings they delivered (Carthey, 2006). This is due to the fact that practitioners are not trained in building performance evaluation and are not paid to carry out the evaluation process (Bordass and Leaman, 2005; Izran, 2012; Riley *et al*., 2009). Cooper (2001) in Riley *et al.* (2009) also stated that, in the early 1990s the concept of POE was nearly removed from the curriculum of architecture because of the lack of regard for POE within the real estate industry. Zimmerman and Martin (2001) in Riley *et al.* (2009) further noted that the "ignorance is bliss" mentality exists within the practitioners in the construction industry and it is totally in contrast with concepts such as POE. Building owners on the other hand refuse to conduct POE which they fear would extract shortcomings and reveal the weaknesses of the building, which may lead to the tenants moving out from the building (Izran, 2012). Building owners often assume that the POE activities will reduce their asset value (Vischer, 2001; Brooks and Viccars, 2006).

4.9 Top Management Support

Support from the top/ senior management is one of the vital factors that have to be fulfilled for a successful POE (Zimring, 2010; Palm, 2007; Federal Facilities Council, 2001; Bordass, Leaman and Eley, 2006; Heerwagen, 2001). Support and commitment from the senior management is important and is required throughout the implementation in order to provide and allocate sufficient resources (Federal Facilities Council, 2001; Eley, 2001; Zimring, 2001; Zimring and Rashidi, 2008). Support also motivates the team to work harder in creating new ideas to expedite the processes and to face obstacles such as resistance to change.

4.10 Knowledge

Knowledge on POE is a fundamental aspect for POE to be undertaken successfully (Kooymans and Haylock, 2006; Izran, 2011; Vischer, 2001; Zuriati, 2005; Brooks and Viccars, 2006; Kincaid, 1994; Becker, 1990). POE has been around for more than 50 years and there are numerous materials (journals, research works, etc.) on POE. However, the level of knowledge among the practitioners on how to carry out POE is extremely low. It is of great regret to see developing countries such as Malaysia still struggling to foster the knowledge on how to systematically learn from building occupants (Izran, 2011). The study conducted by Zuriati (2005) shows that building practitioners in the Malaysian construction industry have little knowledge on POE. Palm (2007) similarly found that building practitioners in the Swedish real-estate sector possess limited knowledge on POE. The lack of knowledge on what to be evaluated, feedback techniques to apply, how the techniques should be applied, how the results should be used, are recognised as deficiencies that in turn affect the success of POE.

4.11 POE Methods

To ensure POE success, the methods employed need to be standardized. Existing methods and those that are benchmarked against established methods should be applied where possible (Cohen *et al*., 1999). Standardisation in the data collection methodology (including the selection of data collection instrument), data analysis and the reporting is necessary to ensure the result is consistent (Queensland Department of Housing and Public Works, 2012; Carthery, 2006). Jaunzens *et al.* (2002) have also suggested that the most accurate evaluation can usually be gained from employing existing techniques in effective combinations. A sizeable number of data-collection strategies and techniques have been developed, including questionnaire, walkthrough observations, mapping of activities and behaviors, interviews, focus groups, visual selection and perception (Bair *et al.*, 1996; Vos and Dewulf, 1999; Bordass and Leaman, 2001; Groat and Wang, 2002; Preiser and Vischer, 2004; van der Voordt and van Wegen, 2005)

4.12 POE Process

The importance of POE process used in carrying out POE cannot be underestimated (Vischer, 2001; Zimring, 2001). Lessons learned from past real life successful POE projects indicate that a standardised POE process is important to ensure effective flow of feedback (Mastor and Ibrahim, 2010). However, most POE projects fail to achieve the potential benefits of POE due to the lack of standardised and established process (Federal Facilities Council, 2001; Vandenberg, 2006; Meir *et al.*, 2009). In order for POE to be successful, each step of the project should be managed efficiently and effectively. Correspondingly, managing the POE process has become a challenge for building practitioners as it requires extensive financial, human resources and is time sensitive. As with any venture, a POE project requires thorough understanding of what is to be achieved and why it should be executed. Careful planning and meticulous considerations on who to carry out the survey, required data and data collection techniques, respondents to be targeted, time to be completed, and what to do

with the information are essential for the success of the project, all of course considered within approved budget (Izran, 2011).

4.13 Provide Access to Knowledge

The information obtained from POE studies can be used avoid repeating mistakes and improve future building design (Federal Facilities Council, 2001). Unfortunately, the feedback is not well used because most designers and builders tend to be territorial in defending their perceived areas of expertise. Once the project has been completed, the designers and builders simply move on to the next project without learning from the buildings they have delivered (Leaman, 2004). Ideally, feedback and knowledge gained from POE projects provide the necessary information for good briefing, which in turn contributes to high building performance and overall organisational effectiveness (Okolie, 2011). Thus, a POE database is needed which will allow the information to be accessed by different parties (Vischer, 2001).

5.0 CONCLUSION AND FUTURE REMARKS

This paper has presented the results of the qualitative content analysis on CSFs for POE of building performance. Within the context of recent literatures on POE, 13 POE CSFs have been discovered with 32 sub-factors distributed unevenly.

This study did not only identify the CSFs and their sub-factors for POE, but also determined the coding references for each of the CSFs and their sub-factors from the literatures. 'Resources', 'Ownership' and 'Participation and Commitment' top the table scoring coding references (see Table 3) which directly indicates that these factors have significant impact on the success of POE projects. Probing further, it has also been discovered that various researchers (Riley *et al*., 2009; British Council for Offices, 2007; Jaunzens *et al.*, 2003; Bordass *et al*., 2001; Cooper, 2001) acknowledge the direct relationship among 'Resources', 'Ownership' as well as 'Participation and Commitment'. The reluctance to take ownership and participate in POE among the stakeholders can be attributed directly to lack of funding and commitment from the top management.

The question about money (resources) is something that always comes at the top of everyone's list when asked why they do not do more POE. POE has been neglected by building practitioners due to budget constraints/ lack of funds (Zimring and Rashidi, 2008; Bordass *et al.*, 2006).However, the root of the problem here is not about the cost of carrying out POE, but the uncertainty of who is responsible for commissioning and paying for POE as well as who is professionally responsible to conduct POE (Riley *et al.*, 2009; Palm, 2007; Cooper, 2001; Vischer, 2001).

The construction industry in Malaysia needs to focus on the factors that are critically important for POE to produce its optimum benefits. The findings in this paper suggest that Resources', 'Ownership' and 'Participation and Commitment' are the factors that demand attention if POE projects are to be successful, thus promote a healthy performance management culture of our buildings through post occupancy evaluation. The failure of POE projects in the past that inevitably led to the disregard for POE by the construction industry may cease to persist if the CSFs and their sub-factors for POE are considered in future POE projects.

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