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EDITORIAL

Welcome to Volume 7 Issue 1 of the Journal of Quantity Surveying & Construction Business.

In this Issue there are 4 papers. The first paper discusses online and distant learning in construction programmes, the second and third papers relate to construction management and co-operatives as housing providers respectively and the fourth and final paper reports on a study on conservation and restoration of historical textiles. The diversity, albeit within the knowledge areas of quantity surveying and construction business, reflect the interest of authors and readers on works published by the Journal.

The first paper by Sharifah Mazlina Syed Khuzzan Alhabshi and Bingu Inirige reports on a study on assessment strategy in online and distant learning (DL) in construction programmes. The author presents a summary of findings on method of delivery, method of interaction, method of assessment, problems faced by learners and recommendations on improving co-learners interaction within a DL setting.

The second paper by Hamzah Abdul-Rahman, Wang Chen and Jeffrey Yap Boon Hui reviewed literature on design changes and rework and their impact to project performance, the latter in terms of time and cost overruns. Their study showed that on the one hand design changes are among the key reasons leading to time and cost overruns but on the other hand published works on the subject in the Malaysian context failed to recognize the presence of such a relationship. The authors highlighted the significance of the relationship between design changes and rework and the consequential impact to project performance and proposed an analytical framework for use in future studies.

The third paper by Nadiya Adnan, Hasniyati Hamzah, Muhd Nasir Daud and Yasmin Mohd Adnan conducted an empirical study on the current issues and challenges faced by Malaysian housing co-operatives in undertaking housing development. Their study was motivated by the rapidly diminishing number of co-operatives that develop houses in Malaysia since the late 1980s as opposed to co-
operatives in other countries. They found out that the Malaysian co-
operatives face management, operational and funding issues. The
authors proposed an alternative model that could be used by co-
operatives in effort to address their current predicament.

The fourth and final paper in this Issue reports on a historical
and scientific study on a historical textile from a palace’s collection.
In the paper, the authors described the techniques they used in
identifying the materials and contents for the textile and the
subsequent method to restore and preserve it. They highlighted that
“using inadequate and inaccurate methods of restoration and
conservation can cause more damage than good to a material
heritage…”

In this issue, the Editors would like to express their gratitude
to the members of the Editorial Board that have decided to move on
and warmly welcome the new members.

As always, the Editors are very grateful to all for their continuous
support.

Professor Sr. Dr. Khairuddin Abdul Rashid
Professor Dr. Christopher Nigel Preece
Editors
IMPROVING CO-LEARNER INTERACTIONS THROUGH WEB-BASED ONLINE ASSESSMENTS WITHIN DISTANCE LEARNING SETTINGS: CASE STUDIES

FINDINGS FROM THE BUILT ENVIRONMENT

Sharifah Mazlina Syed Khuzzan Alhabshi\textsuperscript{1} and Bingu Ingirige\textsuperscript{2}

ABSTRACT

Distance Learning (DL) is an educational model in which the student and instructor are separated by time and space is currently the fastest growing model of domestic and international education which has come into prominence during the last two decades of the 20\textsuperscript{th} century. One of the major influencing factors for achieving intended learning outcomes in a programme is the assessment strategy adopted. Tutors in DL programmes have adopted various methods of assessments that could broadly be described as formative and summative assessments. A well documented formative and summative feedback for learners, especially early on in a course, will facilitate in their learning and provides opportunities for students to gain insight into their understanding of the course content. However, learners often express their need for a more empowerment within their modules to enhance their active involvement and interactions within the programmes.

This paper firstly looks into the literature; with respect to assessments within DL settings and set out the overall methodology of the paper. Then, through a survey of eight construction courses offering DL within five identified universities in the UK, the currently used web-based online assessment tools within the DL settings were identified. This paper also includes other issues within the area in improving the co-learner interactions within the DL, i.e. factors and barriers in improving co-learner interactions, gaps and flaws within the available tools, etc. The result and conclusion derived from this paper will recommend guidelines in improving co-

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learner interactions within DL settings through ‘effective’ use of web-based online assessment tools.

**Keywords:** Distance Learning (DL), co-learner interactions, web-based online assessments

**INTRODUCTION**

Advances in information technology (IT) is continually evolving; opening up additional channels for today’s higher education (Chen et al, 2001), i.e. distance education technologies. Distance education technologies have become more prominent during the last decade of the 20th century (Ingirige et al, 2005). Moreover, Chen et al (2001) noted that the application of IT has allowed universities to deliver multimedia course contents and enable students to communicate with their instructors and fellow students in both synchronous and asynchronous formats; hence making distance learning (DL) possible. DL, an educational model in which the student and the instructor are separated by time and space, is considered the current fastest growing model of domestic and international education (Poley, 2000).

In the domain of higher education (HE) in the construction industry, DL has become a major source by which many HE institutes conduct their courses, particularly at postgraduate level. The new developments in technology have impacted the overall delivery process of the DL in construction programmes. It has been considered that one of the major influencing factors for achieving the intended learning outcomes of these programmes within an overall information and communication technology (ICT) enabled delivery process is the assessment strategy adopted. Assessment is considered a crucial issue in teaching and learning at all levels of education. One of the most important challenges facing educators is to devise and successfully implement new assessment strategies for their use in the twenty first century classroom (Kilpatrick, 1993; Niss, 1993), as assessments can be considered as a significant way of interaction and providing feedback from the instructor to the learner and a medium for the co-learners to interact with each other (Syed Khuzzan and Ingirige, 2008). Hence, due to the significance of this area, a study was conducted to improve the interactions of co-
learners through web-based online assessments tools within DL settings.

**METHODOLOGY**

The research methodology approach adopted for this paper embraces the distillation of core research material gathered from a detailed literature review. The literature review encompassed concepts and issues surrounding DL and web-based online assessment tools used within the DL setting. Eight DL programmes in total were looked into from the five identified universities within the UK and were used as case studies to achieve the following objectives:

i) To identify the delivery methods currently implemented within the DL settings;
ii) To identify the methods of assessment currently implemented within DL;
iii) To identify the available web-based online assessment tools to be used within DL;
iv) Identify gaps within the available tools and their capabilities in improving co-learner interactions;
v) Identify barriers in improving co-learner interactions within DL;

Interviews were conducted with the DL tutors from the case studies identified in achieving the above-mentioned objectives. The result and conclusion from this paper will be used to recommend the way forward in order to improve co-learner interactions within DL settings.

**RESEARCH PROBLEM**

Learners often express their need for more empowerment within some of their modules to enhance their active engagement. With all types of learning, including online learning, it is useful for students to receive constructive, timely and relevant feedback on their progress even within DL settings. Therefore, a mix of computer marked and tutor marked essays could be adopted for summative assessments. Online marked assessment is sometimes constrained by the medium in which it is operating. Computer marked assessments
alone are not appropriate for marking or giving feedback on assignments such as essays or projects that require more than the mere production of knowledge (Dede, 1996). With the increase of DL programmes being offered there has been a corresponding increase in both synchronous and asynchronous mechanisms being developed to facilitate these assessments (Dede, 1996; Wilson and Whitelock, 1997).

Despite addressing the needs of the programme in developing a regime of assessment strategies, most online learning communities within a DL setting expresses a feel of isolation (Syed-Khuzzan and Ingiringe, 2008). According to Ortiz-Rodriguez et al., (2005) and Stein et al., (2005), interaction between student peers is important to give satisfaction in online learning. When interaction produces a sense of community the result may be an environment in which learning is facilitated (Lee et al., 2006). In addition, according to Brown (2001), the need for interaction is more likely important when new online students have experience with DL; whereby they have to learn the technology and therefore tend to spend more time working in isolation (Brown, 2001).

Assessment is considered as an indispensable part of teaching and learning (Govindasamy, 2002). It can also be considered as a way of interaction and providing feedback from the co-learner (e.g. instructor) to the learner. However, the types of assessment methods used within a DL setting and the barriers in the form of resource constraints, sometimes affect the provision of pedagogic requirements such as maintaining appropriate co-learner interactions within DL programmes. In this respect, it is not only important to find out the types of web-based online assessment tools available; but also to identify the gaps within the tools, and how best it can be used to improve co-learner interactions within a DL setting – of which is the core reason of this research.

DISTANT LEARNING: DEFINITIONS AND CHARACTERISTICS

Several definitions have been cited for the term DL; among others; Majdalany and Guiney (1999) define DL as “instruction and learning practice utilising technology and involving students and teachers who are separated by time and space”. Jonassen (1992) defines DL as the volitional control of learning by the student rather
than the distant instructor, while Perraton (1988) and Verduin and Clark (1991) define it as the separation of the teacher and the learner in space and/or time during at least a majority of the instructional process.

Hall and Snider (2000) characterised DL with three criteria; (i) a geographical distance that separates the communication between the trainer and the participant, (ii) the communication is two-way and interactive, and (iii) some form of technology is used to facilitate the learning process. Keramiyige et al (2006) supported this view by considering the two significant characteristics of DL; which is (i) the distance between the tutor and the learner (either geographically or timely) and (ii) the learner centred learning mechanisms as opposed to the teacher centred learning in a traditional classroom based learning environment.

The additional characteristics of DL that has been discussed by Keegan (1986) include:

- The influence of an educational organisation both in planning and preparation of learning materials and in the provision of student support services; which distinguishes DL from the private study and teach-you programme;
- The use of technical media, print, audio, video or computer to unite teaching and learner and carry the content of the course;
- The provision of a two-way communication so that the learner may benefit or even initiate dialogue; a characteristic which distinguishes DL from the other uses of technology in education; and
- The quasi-permanent separation of the learning group throughout the length of the learning so that people are usually taught as individuals and not as groups, with the possibility of occasional meeting for both didactic and socialisation purposes.

In addition to the definitions provided previously, many terms have also been used in relation to distance education. The following terms are defined in Table 1 (Du Mont, 2002):
Table 1 Definitions of Terms (Du Mont, 2002)

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
<th>Source</th>
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<tr>
<td>Asynchronous learning</td>
<td>“A type of learning in which learners and instructors use computers to exchange messages, engage in dialogue and access resources” at any time and any place.</td>
<td>Commonwealth of Learning (2000) and Schocken (2001).</td>
</tr>
<tr>
<td>Distance education</td>
<td>“Planned learning that normally occurs in a different place from teaching and as a result requires special techniques of course design, special instructional techniques and special instructional techniques, and special method of communication by electronic and other technology, as well as special organisational and administrative arrangements.”</td>
<td>Moore and Kearsley (1996)</td>
</tr>
<tr>
<td>Distance learning</td>
<td>“Instructional and learning practice utilising technology and involving students and teachers who are separated by time and space.”</td>
<td>Majdalany and Guiney (1999)</td>
</tr>
<tr>
<td>Distributed learning</td>
<td>“Learning environment [which] exists among a dispersed student population, is structured according to learner needs, and tends to integrate traditional institutional functions (e.g. classroom and library)….through both synchronous and asynchronous communication.”</td>
<td>Oblinger and Maruyama (1996)</td>
</tr>
<tr>
<td>e-Learning</td>
<td>“Can be a subset of distributed learning. Relies on digital content, experiences through a technology interface, and is network-enabled. Collaboration is a desirable feature of e-Learning…”</td>
<td>Lundy, Harris, Igou and Zastrocky (2002)</td>
</tr>
<tr>
<td>Open learning</td>
<td>“An arrangement in which learners work primarily from self-instruction, completing courses structured around specially prepared, printed teaching materials, supplemented with face-to-face tutorials and examinations.”</td>
<td>William, Paprock and Covington (1999)</td>
</tr>
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According to Du Mont (2002), definitions of DL exist which emphasise the process of educational and structure. Sherry (1996) noted that the terms “distance education” or “distance learning” have been applied interchangeably by many different researchers to a great variety of programmes, providers, audiences and media. Berge (1998) however note that there is a difference between the term
‘distance education’ and ‘distance learning’. According to Berge (1998), distance education is seen as the formal process of DL, with information being broad in scope; e.g. college courses. DL however is seen as the acquisition of knowledge and skills through mediated information and instruction, encompassing all technologies and other forms of learning at a distance. In addition, Gotschall (2000) described DL as a broadcast of lectures to distant locations, usually through video presentations.

**DISTANCE LEARNING: INTERACTIVITY AND FEEDBACK**

Butler and Winne (1995) define feedback as information that a learner receives about his or her learning processes and learning outcomes. Interaction is best described by function of exchange, highly related to pedagogy. Some of the examples of where interaction can take place are through the following activities: discussion, collaboration, peer-to-peer learning, group work, peer review, feedback, teaming and mentoring. In addition, the frequent feedbacks coming from the said activities might be useful to the learners, and considered as an essential contribution towards effective learning (Reiser and Dick, 1996). Interaction is routinely cited as a requirement for quality and effectiveness in a DL setting (Cooper, 2003; Gunawardena and Zittle, 1997; Meyer, 2003; Moore, 1989; Whatley and Bell, 2003).

According to Ley (1999), an instructor in a traditional classroom can more easily interact with students by easily giving simple knowledge of result feedback with more complex feedback as students require or demand. In DL environments, most distance instructors lack the logistical support or the technology to return papers and answer questions during the same session. Proper planning for adequate and useful feedback through web-based online assessments can lessen the DL instructor’s feedback burden, hence, improving co-learner interactions within the DL settings. Moreover, Ley (1999) mentioned that without a ‘suitable’ feedback system in place, distance students engage in learning under the handicap of inadequate or no feedback at all. In traditional distance education settings, learners are often left to go through the process of learning in isolation with very little contact with tutors and peers, thus are confined to basic, 'static' interaction with material delivered through
one-way media in the form of printed text, audio cassettes and/or video (Karaliotas, 1998). Furthermore, according to Karaliotas (1998), with the advent of new media and technologies, the use of affordable and well integrated two-way communication is now possible in distance learning, which in turn enables dynamic interactions.

Moore (1989) states that interactions take place in the learning environment in three ways; e.g. (i) learner with contents, (ii) learner with other co-learners and (iii) learner with instructors. This particular research concentrates more on the interactivity between learners with other co-learners in a DL setting. Karaliotas (1998) mentioned that DL environments offer plenty of opportunities for interaction with other learners, far more likely to be productive and complete than in traditional HE learning environments as they are independent of time and place due to their asynchronous nature, and more in line with the learning to learn process as they can be highly motivated and goal oriented. Interaction with other co-learners takes place within collaborative activities, in threads of sociable exchanges, or philosophical and self-searching discussions.

Learners’ abilities to interact with the instructor, the peers, and the content can affect their performance in DL. Acker and McCain (1993) mentioned that "interaction is central to the social expectations of education in the broadest sense and is in itself a primary goal of the larger educational process and that feedback between learner and teacher is necessary for education to develop and improve" (p. 11). Online interactions take into consideration the characteristics of the learners as well as the communication technology. The interactive features of the current computer-mediated communication (CMC) systems, such as two-way video and instant feedback, have provided more options for learner interactions. Moreover, Gunawardena et al (1998, pp. 141) have interpreted interaction as “the process through which negotiation of meaning and co-creation of knowledge occurs in a constructivist learning environment”. Wagner (1998) however argues that interaction can serve as a means to an end of enhancing learning and performance. Learner interactions require planning and structure in order to achieve the goal of active learning. According to Rohfeld and Hiemstra (1995), tasks such as debates, guest lecturers/discussants, polling, brainstorming, or student moderated discussions via CMC networks can help to increase student
interactions for learning. The principles of student-centered discussion accord the students the responsibilities of facilitating online conversations. When the activities and tasks become an integral part of the learning process, learner interactions can be conducive to learning (Chou, 2000). This is where this research emphasises that web-based online assessment would be able to help enhance co-learners interactions within a DL setting.

ASSESSMENT

Assessment basically supports the learning approach a student adopts. According to Marcus (2006), a varied combination of assessment activities provides sufficient opportunity for the student to demonstrate learning, while several assessment options allow learners to respond to different evaluation strategies. The choice of assessment methods is an important decision in instructional design (Stephen et al., 2007). This is especially more important in a DL programme, in which students often focus heavily on formal assessment requirements. In addition, assessment choices should support intended learning outcomes and also consistent with the desired learning approaches (Stephen et al., 2007).

To most learners and teachers, the term ‘assessment’ is traditionally associated with the concept of tests, grades, reports, and standards (Bartley, 2006). The body of literature has revealed that there is an assessment movement in education, which has been evolving through cycles of reform and expansion (Herman et al., 1991; Kulieke et al., 1990; Lazerson et al., 2000; National Research Council, 2001). Assessment has also been defined broadly, to include all activities that teachers and learners undertake to get information that can be used diagnostically to alter teaching and learning (Liang and Kim, 2004). The core to this definition is the notion of systematic process of gathering and interpreting information, in order to provide feedback (Bartley, 2006). Mac Alpine (2002) noted that assessment can also be described as a form of communication involving a number and variety of sources, such as:

I. assessments may be directed to the learners, as a form of feedback on their learning;
II. assessments may be directed to teachers, as a form of feedback on their teaching;
III. assessments may be directed to the curriculum designer as a form of feedback towards the curriculum;
IV. assessments may be directed to the administrator as a form of feedback on the use of resources; and,
V. assessments may be directed to the employers as a form of feedback on the quality of applicants.

WEB-BASED ONLINE ASSESSMENTS IN THE ONLINE LEARNING ENVIRONMENT

Mason (1998) discussed the phenomenon of the online learning environment (in the context of this research is DL) for learning in relation to the three main elements of asynchronous group and individual messaging, access to course materials, and real time (synchronous) interactive events. One of the important considerations for effective online assessments is to ensure that the tool incorporates these elements, fits the mode of delivery, and legitimately measures the desired outcome. It has been identified that one of the main advantages of using assessment software over manually assessing performance is primarily the savings in cost and time (Dowsing et al., 2000; Weisburgh, 2003). Online assessment is a method of using the Internet to deliver, analyse, and report exam content; and when appropriately used, it can enhance the efficiency of online learning (Bergstrom and Lopes, 2003).

Assessments in general can be classified into three broad categories, according to their general use (Bergstrom et al., 2006). They can be used prior to, during, and following learning (Swearingen, 2004), and classified as follows:

I. Diagnostic assessment
II. Formative assessment
III. Summative assessment

*Diagnostic assessment* identifies learners’ strengths and weaknesses, and can be used to identify specific personality characteristics or traits (e.g. motivation for success, personality type, etc.), or allow individuals to self-assess their ability to complete a task or demonstrate knowledge of a particular subject area.
Formative assessments take place during the learning process. Formative assessments involve the delivery of multiple-choice or short quizzes administered at the end of a textbook chapter, learning module, or other learning benchmark in a course or training programme. Feedback is usually provided during or following the delivery of these assessments, and opportunities for self-remediation may also be available.

Summative assessments frequently take place in the middle or end of a learning or evaluation programme and can be used for grading, certification, and high stakes evaluation. Summative certification, licensure and some cognitive ability tests are administered with the purpose of identifying the best candidates to be awarded some form of credential.

The majority of assessments used in the online learning environment are in the asynchronous environment, where the assessment is completed in delayed time, and outside the present of an instructor (Bourne et al., 1997; Mason, 1998; Morley, 2000). The online asynchronous tools may involve alternating interactions between instructors and individual learners or entire groups through computer conferencing software and modem or network connections (Brem, 2002; Morley, 2000). In this context, the assessments can take many different forms, from traditional examinations of written assignments, case studies, research projects, and multiple choice examinations, to alternative measures such as portfolios, learner diaries, or journals to assess higher order abilities (Bourne et al., 1997; Morley, 2000; Muirhead, 2002).

Synchronous assessment models also play an important role within the DL process because dishonesty is minimised and the instructor has continual management of the testing environment (Morley, 2000). Online synchronous assessments may be mediated by two-way interactive conferencing systems with telephone connections (Morley, 2000; Palloff and Pratt, 1999). An example of a typical exam format involves asking learners one question at a time, similar to oral examinations requiring learners to type in answers within a limited time frame (Kouki and Wright, 2005). According to Morley (2000), accreditation agencies prefer this method of synchronous testing because the instructor has significant interaction with the remote learners during examination.
A great deal now has been written which confirms that assessment is the key to learning in traditional settings (Ramsden, 1992). In all forms of DL contexts today, print-based, mediated via video or teleconferencing or supplement by computer-based communications; assessment tasks can be seen as the active components of study (O’Reilly and Newton, 2008). Assignments provide learners with opportunities to discover whether or not they understand, if they are able to perform competently and demonstrate what they have learnt in their studies. In a DL context, not only assessments have been identified as a performance measure, it has also been identified as means and ways to encourage co-learners interactions within a DL environment (O’Reilly and Morgan, 1999). Online learners should take the advantage of the opportunities to interact, to form social networks that are contributing to a learning network.

DISADVANTAGES AND ADVANTAGES OF WEB-BASED ONLINE ASSESSMENT

Some drawbacks have been identified to offering assessments online (Bergstrom et al., 2006). Many educators feel challenged by the tasks and costs of producing high-end coursework delivered with reliable technology to learners, and may be unequipped to meet the level of standard required. In the face of market pressure to offer DL and e-Learning courses, it can be very difficult to ensure that learners receive the same kind of protections obtained in traditional classrooms or training facilities with regard to certain types of assessments, particularly high stakes assessments. In addition, another drawback that has been identified in using Web-Based online assessments is on the issue of support. Within this context, it has been identified expensive and time consuming to provide round-the-clock support to learners who are now learning and testing at all hours. Many educators feel that the face-to-face, iterative interaction with students is an important part of the learning process. Whilst it is said that learners get immediate feedback on some of the web-based online assessments available, educators do not always get the feedback of what topics learners find confusing or not clear. This is when the appropriateness and meaningfulness of the feedback becomes an issue, as it is as important as the assessment itself.
Furthermore, another factor contributing to the disadvantages of web-based online assessments is the loss of connectivity. Learners utilising online courses and assessment should therefore be provided with reliable Internet connectivity. Assessments must be designed so that loss of connectivity does not result in loss of data, so that tests can be restarted at the exact point of interruption. In addition, learners who perceive themselves as being I.T. illiterate may find online assessment as a disadvantage. Extensive preparation and support may be required when introducing learners to these forms of education and testing (Naglieri et al., 2004).

Despite the disadvantages that web-based online assessments contribute; there are also advantages of using web-based online assessments, especially for busy adult learners. With respect to busy adult learners, online assessments can be considered to be useful and suitable as it is made available 24 hours a day, seven days a week from any computer with access to the Internet. Furthermore, in a traditional paper-and-pencil testing and assessment programme, examinees normally receive their scores and interpretive reports after a certain period of time taking the assessment. With online assessments, learners often receive feedback within a few seconds after completion (this classic scenario is for a multiple choice question (MCQ) type of assessment). Web-based online assessment lends itself to a pedagogical approach to learning in which assessment is integrated with learning processes. In the current scenario, online assessments enable instructors to obtain feedback on the performance of a student; as well as to evaluate the effectiveness of the e-Learning environment. In many ways, web-based online assessment, like online teaching, is still very much in its embryonic state. Today, the most common online assessment strategies involve the use of computer communications as simply a transfer medium to submit and comment upon assigned work such as essays, submit and compile portfolios, and deliver traditional paper-and-pencil tests in a computer testing environment (i.e. MCQ). As mechanisms for learning paradigms change, assessments delivery methods would also change within time.
WEB-BASED ONLINE ASSESSMENT TOOLS AVAILABLE FOR DL

Educators usually spend a lot of time in creating assessments to measure students’ knowledge and comprehension. Listed below are some of the identified web-based online assessment tools available, and the advantages it offers in order to provide feed-back and improve co-learner interactions (Ley, 1999):

- **Discussion board participation**
  According to Savage (1999), students seem to perform better when the discussion boards (or asynchronous communication) are required, where participation is ‘rewarded’ by a grade. This incentive of a grade brings a higher level of participation to the discussion, where students engage in dialogue begun by the instructor but often taking off on its own soon after (Greenlaw and DeLoach, 2003). Moreover, students then become co-constructors of the materials, examine alternative viewpoints and reach a consensus on a topic together (Greenlaw and DeLoach, 2003). Hence, discussion board participations can be seen as a mechanism in improving the interactions between co-learners within the DL settings.

- **Online quizzes**
  Online quizzes enables the instructor to regularly assess student understanding of the materials presented (Martyn, 2003), thus keeping the instructor on track of the students’ performance.

- **Electronic paper and project submissions**
  Paper and project submissions can be performed using the Digital Drop Box, or file sharing. By submitting the paper electronically, students do not have to make physical contact with a particular location in order to submit, and, there is less chance of the instructor losing the paper (Ley, 1999). In addition, an electronic receipt is automatically generated when the instructor receives the submission, enabling accurate records to be kept of who submitted the assignment and when (Thomas et al, 2002).
• **Reading outside of the assigned textbook (including hyperlinks and electronic formatted documents)**

By posting hyperlinks to sources of information, and labelling them as required or recommended, the instructor can share these sources of information with students very quickly and easily at any point during the course (Horton, 2000; Palloff and Pratt, 2001). This therefore also encourages discussions and interactions between co-learners on the topics and information shared by the instructor.

The internet also offers helpful resources that can be used to reduce the time it takes to create rubrics for projects, experiments, portfolios, and other performance-based items. There are also online resources to generate traditional, formative and summative assessments such as True/False and multiple choice questions.

**CASE STUDIES FINDINGS**

Based on the case studies conducted on seven DL Masters programme and one undergraduate programme within the five identified universities within the UK, the findings have been summarised and shown in Table 2.
Table 2 Summary of Case Study Findings

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Case Study 1</th>
<th>Case Study 2</th>
<th>Case Study 3</th>
<th>Case Study 4</th>
<th>Case Study 5</th>
<th>Case Study 6</th>
<th>Case Study 7</th>
<th>Case Study 8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Method of Delivery</strong></td>
<td>Lectures through Horizonwi-mba</td>
<td>Lectures delivered via the Internet</td>
<td>Face-to-case teaching session</td>
<td>Classroom setting conducted through summer schools</td>
<td>Face-to-face teaching session</td>
<td>Taught via the Internet</td>
<td>Taught via the Internet</td>
<td>Lectures delivered face-to-face</td>
</tr>
<tr>
<td></td>
<td>Face-to-face teaching session</td>
<td>Winter school – attendance compulsory</td>
<td></td>
<td>Conduct tutorials and practical works</td>
<td></td>
<td></td>
<td></td>
<td>Tutorial sessions</td>
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</tr>
<tr>
<td><strong>2. Method of Interaction</strong></td>
<td>Via email</td>
<td>Online tutorials, group discussions and email</td>
<td>Email</td>
<td>Face-to-face</td>
<td>Tutor support through online tutorials, discussions and individual communication (via email)</td>
<td>Tutor support via online tutorials, email</td>
<td>Tutor support via online tutorials, email</td>
<td>Face-to-face</td>
</tr>
<tr>
<td></td>
<td>Using audio and visual modes between tutor and learners</td>
<td>Threaded group discussion board</td>
<td>Chat rooms</td>
<td>Email</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Discussion forums/board for learners to interact</td>
<td>Student common room</td>
<td>Discussion forums</td>
<td></td>
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</tr>
<tr>
<td><strong>3. Method of Assessment</strong></td>
<td>Written coursework submitted via email</td>
<td>Learning activities</td>
<td>Formative – self assessed learning activities</td>
<td>Mostly summative</td>
<td>Balance of both summative and formative</td>
<td>No use of specific web-based online assessment tool</td>
<td>Summative assessment submitted via email</td>
<td>A balance of formative and summative</td>
</tr>
<tr>
<td></td>
<td>Dissertation</td>
<td>Formative feedback</td>
<td>Summative – written coursework</td>
<td>Written coursework submitted through school office</td>
<td>Essay/ written coursework</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No use of web-based</td>
<td>Electronic paper and project</td>
<td>Summative – written coursework</td>
<td>Submitted via</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>


## Improving Co-Learner Interactions through Web-Based Online Assessments within Distance Learning Settings: Case Studies Findings from the Built Environment
Sharifah Mazlina Syed Khuzzan Alhabshi and Bingu Ingirige

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Case Study 1</th>
<th>Case Study 2</th>
<th>Case Study 3</th>
<th>Case Study 4</th>
<th>Case Study 5</th>
<th>Case Study 6</th>
<th>Case Study 7</th>
<th>Case Study 8</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>online assessment tool</td>
<td>submission • dissertation • No use of specific web-based online assessment tool</td>
<td>submitted to school office • Dissertation • No use of specific web-based online assessment tool</td>
<td>• Practical session • Final examination • Dissertation • No use of specific web-based online assessment tool</td>
<td>email • Formative assessment conducted through learning activities within learners through group discussions • No use of specific web-based online assessment tool</td>
<td>was held to encourage learners to interact using ‘skype’ • No use of specific web-based online assessment tool</td>
<td></td>
<td>presentations • Feedback from tutors to learners – a special session is conducted • Summative assessment – individual coursework • Dissertation • No use of specific web-based online assessment tool – not appropriate for MSc level</td>
</tr>
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</tr>
<tr>
<td>4. Problems faced by learners within DL setting (complaints made by learners)</td>
<td>• Late feedback from instructors • Lack of interaction between co-learners</td>
<td>• None stated</td>
<td>• Time constraint • Geographical constraint • Lack of participation of other learners – contributing towards learners</td>
<td>• Lack of interactions between co-learners – learners rely more on co-workers</td>
<td>• Complexities of working alone based on different times and location – causing stress • Lack of technical support – leading to</td>
<td>• Not a DL setting</td>
<td>• Communication barriers caused by the nature of the learners taking the programme – busy working learners • Packed schedule</td>
<td>• Technology shy • Learners feel isolated</td>
</tr>
<tr>
<td>Criteria</td>
<td>Case Study 1</td>
<td>Case Study 2</td>
<td>Case Study 3</td>
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<tr>
<td>5. Suggestion to improve co-learners interactions within a DL setting</td>
<td>• To increase group work assessment in order to encourage interactions and discussions between learners and co-learners</td>
<td>• Support more interactions and discussions</td>
<td>• Encourage discussions and interaction through student common room</td>
<td>• Put more practice on group works - constraint: 'free-rider' among team members</td>
<td>• To have online tutorial sessions rather than individual works - encourage peer-to-peer discussion</td>
<td>• To still conduct face-to-face lectures to encourage learners</td>
<td>• To provide 'appropriate' technology support</td>
<td>• Learners should meet and interact with other co-learners</td>
</tr>
<tr>
<td>Criteria</td>
<td>Case Study 1</td>
<td>Case Study 2</td>
<td>Case Study 3</td>
<td>Case Study 4</td>
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<td>Case Study 7</td>
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<tr>
<td>through discussion boards, chatrooms – perhaps as part of the formative assessment</td>
<td>• Having ‘group-clusters’ within area of interests.</td>
<td></td>
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<tr>
<td><em><strong>Criteria</strong></em></td>
<td>Case Study 1</td>
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- Improving Co-Learner Interactions through Web-Based Online Assessments within Distance Learning Settings: Case Studies Findings from the Built Environment

Sharifah Mazlina Syed Khuzzan Alhabshi and Bingu Ingirige
DISCUSSION AND FINDINGS

Table 2 shows the summary of findings for all the case studies conducted within this research. The summary of findings was narrowed down into five main criteria, i.e.: (i) method of delivery, (ii) method of interaction, (iii) method of assessment, (iv) problems faced by learners within DL setting, and (v) suggestions to improve co-learners’ interactions within a DL setting.

From Table 2, it can be seen that there was a mix of method of delivery within the case studies conducted, i.e. some lectures were delivered face-to-face (through summer school sessions), and some were delivered and taught online with the support of the Internet. The common method of interaction was through the use of emails and online tutorial support, as well as discussion boards and chat rooms. The case studies implemented both a mixture of summative and formative assessments methods. The common summative assessments identified were written coursework, project paper and dissertation. The written coursework and project paper were usually submitted via email or straight through the school office. The formative assessment method practised by most of the case studies is through learning activities with other co-learners. However, it can be concluded that almost all of the case studies conducted did not implement a specific web-based online assessment tools within the assessment method to be used in the MSc and BSc programme. This might be due to the problems that have been raised by some of the course instructors within the case studies, whereby the course instructors felt that an MSc programme should implement a much more critical, complex, and detailed written coursework. The web-based online assessment tool is said to be more suitable for undergraduates’ level.

Some of the problems that were being faced by the learners within a DL setting are identified as: the lack of interaction between co-learners within the programme, as well as late feedback obtained from the instructor on any enquiries or assessments taken. The learners also found it difficult to work in isolation based upon the geographical and time constraint being faced by the learners enrolled in a DL setting. Almost all the case studies were in the perception that in order to improve co-learners’ interaction within a DL setting, a face-to-face lecture should also be conducted within the period of study. This would give learners the opportunity to get-together and interact with other learners within the programme. This conforms to
the findings from the literature review that many educators feel that the face-to-face iterative interaction with learners is an important part of the learning process (Bergstrom et al., 2006). More group works assessments were recommended as an initiative to encourage co-learners’ interactions, although extra care should be addressed to minimise the threat of ‘free-riders’ among group members. Programme instructors should also ensure that there is sufficient technology support for learners, so that learners do not feel isolated and stressed due to the nature of the DL setting. This further conforms the finding from literature as highlighted by Naglieri et al., (2004) that learners have different technology abilities. Learners who perceive themselves as being I.T. illiterate may find online assessments within the DL setting as an advantage. In addition, one of the recommendations made by the instructors within the case studies were to develop ‘group-clusters’ within learners’ area of interest, to encourage learners of the same ‘circle’ would interact more within the discussion boards and chat rooms provided.

CONCLUSION AND WAY FORWARD

Findings from the case studies revealed that most of the DL programmes deliver lecture materials in accessible format which comprise text, diagrams and drawings (for which descriptor alternatives are available) and video presentations (for which audio and text captioning are available) through online environments such as the “Horizonwimba” and ‘Elluminate Bridge’. The delivery methods currently used within the programmes are both synchronous and asynchronous. The result from this research identifies that there is a lacking in the implementation of specific web-based assessments tools within the DL settings, since none of the case studies have actually implemented a specific web-based online assessment tool as an assessment mechanism. However, the aid of technology is used within the assessment method implemented, i.e. most of the submission of coursework and project papers was done via email. However, the use of web-based online assessment tools is not denied as a way forward towards a paradigm shift in DL community as a means to encourage co-learners’ interactions (O’Reilly and Morgan, 1999).

Based on the in-depth literature, web-based assessments tools have been found to help improve co-learners’ interactions
within DL settings. Most DL programmes have just gone for the traditional assessment method, which is the written coursework due to lack of emphasis on co-learners’ interactions when deciding on the method of assessment to be implemented. The findings from the case studies highlighted the following recommendations in general to improve co-learners’ interactions within a DL setting with the aid of online assessments methods:

- More group works/ assessments are recommended to encourage co-learners to interact more. However, being in a Masters level, the assessments should be more complex, detailed, and critical; hence, close attention should be given to learners in avoiding ‘free-riders’ within team members.
- More support and encouragements should be given to learners through discussion boards, emails, and chat rooms in order to encourage learners’ interactions.
- I.T. support should also be taken into ‘proper’ consideration to attract ‘matured’ learners, or learners who are not comfortable with the use of technology as a medium of interaction within co-learners.
- Having ‘group-clusters’ within areas of interest to encourage learners within the same level of interest so that chat rooms and discussion boards can be catered to address learners’ personalised interests.

The highlighted recommendations should be used as a way forward for all DL setting programmes so that web-based online assessment tools could really be used in order to improve co-learner interactions.

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Education, Division of Behavioral and Social Sciences and Education. Washington, DC: National Academy Press.


ABSTRACT

Design changes and rework are inevitable in construction projects. Even though papers published in major journals have acknowledged design changes as a significant factor inhibiting construction project performance, there seems to be a limited studies in this domain to systematically synthesizing preceding studies. This paper reviewed papers published in peer-reviewed journals and conference proceedings in the construction management field. The objectives are to analyze the relationship of design changes and the consequent rework, to recognize their resulting impacts on project performance and to provide insights for directing further studies in Malaysian context. The findings indicate that design changes are identified as important causing factors to project delay and cost overruns. Similar results were found for studies done in both developed and developing countries round the world because construction projects commonly share key characteristics. On the contrary, preceding studies done in Malaysia that were published in the top-tier construction management journals failed to recognize design changes as a major cause of project schedule and cost overruns. Therefore, suggestions for future research are recognizing design changes as a major cause of schedule and cost overruns in construction project in Malaysia, identifying factors stimulating design changes and the ability to predict the resulting impacts on project performance. Thus, the analytical framework for future study is presented.

Keywords: Design changes, rework, construction industry, project performance, overruns, Malaysia

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INTRODUCTION

Performance of construction project is much impacted by design changes (Olawale & Sun, 2010), yet research in this field is limited, especially in Malaysia’s context. The most prominent concern related to design changes that happened in Malaysia is the construction of Kuala Lumpur International Airport 2 or known as KLIA2. The initial target date for opening is September 2011 but was later moved several times and finally completed in May 2014. The construction cost ballooned from the initial RM 1.7 billion to RM 4 billion was due to the new design concept for KLIA2 (Ng, 2015; Ghazali, 2015). This is one example that shows time and cost overruns caused by design changes are a serious issue in Malaysian construction industry. To date, there appears to be a lacking of attention paid to the need for summarizing what has already been presented in the literature. Reasons for cost and schedule increases arising from design changes are not formally studied (Chang, 2002). Hence, amplify the need of a systematic review of existing literature in this domain. This study can assist researchers in gaining an in-depth understanding of previous research efforts on this topic and in exploring directions for future research.

OVERVIEW OF DESIGN CHANGES IN CONSTRUCTION PROJECTS

In this section, the author discusses on the definitions of design changes and rework in construction projects in order to give a proper understanding of the terms used. Several keywords from past studies are highlighted and synthesized to provide the author’s deduction on the summary of definitions available.

Definition of Design Changes

A design change is defined as any change in the design or construction of a project after the contract is awarded and signed. Such changes are related not only to matters in accordance with the provision of the contract but also changes to the work conditions (Burati et al., 1992). Similarly, Akinsola et al. (1997) noted that these changes are any additions, omissions or adjustments made to
the original scope of work after a contract is awarded. It may cause an adjustment to the contract price or contract time, and it occurs regularly on construction projects (Ibbs, 2012). Likewise, Park (2003) defined that construction changes refer to work state, processes or methods that differ from the original construction plan or specification and usually resulted from different in work quality and conditions, scope changes or uncertainties that make construction dynamic and unstable. Table 1 exhibits the keywords used in the definition of design changes by past studies.

<table>
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<tbody>
<tr>
<td>Changes in design / construction (addition / omission)</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>After award of contract and signed</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Affects contract provision (affect on scope)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Affects work conditions</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Adjustment to contract price / contract time</td>
<td></td>
<td></td>
<td>✓</td>
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<tr>
<td>Occurs regularly</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Make construction dynamic and unstable</td>
<td></td>
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<td>✓</td>
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</table>

The author synthesize the definition of design changes as regular additions, omissions and adjustments to both design and construction of work in a construction project that occurs after the award of contract which affects the contract provisions and work conditions that make construction dynamic and unstable.

**Definition of Rework**

Rework was defined as the unnecessary effort of re-doing a process or activity that was incorrectly implemented at the first time (Love, Smith, & Li, 1999; Love, 2002). Another study by Hwang et al. (2009) revealed that terms such as non-conformances, quality deviation, quality failures and defects have been seen as synonymous with rework. Rework has become one of the most collective concerns in construction projects. Rework can be described as unneeded effort of redoing an activity or operation that
was enforced in a wrong way from the beginning (Love & Li, 2000). According to Palaneeswaran (2006), most of rework cases arises from changes, damages, defects, errors, omissions and other non-conformances. Table 2 exhibits the keywords used in the definition of rework by past studies.

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Unnecessary effort of redoing a process of work</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unneeded effort of redoing an activity</td>
<td></td>
<td>√</td>
<td></td>
</tr>
<tr>
<td>Incorrectly implemented at the first time</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wrong way from the beginning</td>
<td></td>
<td>√</td>
<td></td>
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<tr>
<td>Arising from changes</td>
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<td></td>
<td>√</td>
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</tbody>
</table>

As this study focuses on the rework arising from design changes, the author will exclude rework due to non-conformances to quality or specification. Thus, rework due to design changes can be summarised as unnecessary efforts of redoing a process of work or activity due to incorrect implementation at the beginning that arise from design changes.

**RESEARCH METHODOLOGY**

Fink (1998, p.3) defined literature review as “a systematic, explicit and reproducible method for identifying, evaluating and interpreting the existing body of recorded work”. For that reason, Cooper (2010) highlighted literature review as the development of connections between related research works which aims to recognize the recent achievement in a specific field and emphasize significant concerns to be answered. Due to the large number of information available, delimitation to establish the boundary of study is essential (Chen et al., 2015). In this study, the criteria considered to delimit the literature are:
1. Only papers in peer-reviewed English academic journals are selected for review
2. Only papers in peer-reviewed English conference proceedings are selected for review
3. Non-published Master and PhD thesis are eliminated

Three major academic databases: EBSCO, Proquest and Scopus were searched for relevant publications. The keywords identified to be used in the literature search are: design changes, rework, change management, construction industry, delay, cost overrun, project performance. Notwithstanding using keywords, some retrieved papers appear to be less relevant. As a result, the author applied the two stages filtering process adopted by Mok et al. (2015) in their literature review published in one of the top project management journal. Firstly, papers which do not contain the aforementioned keywords in their titles and abstracts were immediately screened out. Secondly, the contents of each paper found were quickly screened through to distinguish the relevancy where extraneous papers were excluded. Finally, the literature was organised through a literature map (Creswell, 2014). Figure 1 portrays the research framework for this study.
RESULTS OF LITERATURE REVIEW

The following section discusses the findings from literature review on design changes, consequent rework due to design changes and the impacts to project’s time and cost performance. This section concludes by identifying the knowledge gap in Malaysian context and the dire need to manage design change dynamics. The analytical research framework is then formulated as the starting point for further analysis.
Synthesis of Design Changes Studies

Change is a necessary fact of a project. A design change is a form of change that will deviate the way the work was planned, budgeted or scheduled. Almost all building projects undergo various degrees of design changes through the project lifecycle. Changes in construction projects are inevitable in most construction projects to correct or modify original design or scope of work (Alnuaimi et al., 2010). Design changes in building projects are common (Mohamad et al., 2012) where in many circumstances, these changes lead to excessive claims and disputes (Howick et al., 2009). Therefore, complex and dynamic nature of construction project poses uncertainties and risks (Zhao et al., 2010). Changes usually occur at any stage of a project due various causes from different sources and have considerable impacts (Motawa, Anumba, Lee, & Peña-Mora, 2007). Naoum (1994) emphasized that lack of timely and effective communication, lack of integration, uncertainty, a changing environment and increasing project complexity are the drivers of project change. Additionally, these changes in project can cause substantial adjustment to the contract duration, time, total direct and indirect cost or both (Ibbs, Lee, & Li, 1998). The sooner the changes are identified and resolved, the lesser impact it will have on the project. According to Hwang and Low (2012), conflict over project changes can be minimized when the problem is found at the earlier phase of the project. Therefore, one of project management best practices is to implement design change management to construction projects.

Almost all building projects undergo various degrees of design changes through the project lifecycle. According to a study by Ogunlana, Promkuntong and Jearkjirm (1996), construction owners are the major cause of change order due to changing plans in line with the changing economic climate, to meet customer demands or for making marketing reasons. According to Orangi et al. (2011), design changes is identified as the major root cause of the Victoria-based Australian pipeline projects. Williams, Eden, Ackermann, & Tait (1995) also reported that design changes and delays in design approval would have caused delay to the project. Olawale and Sun (2015) suggest having an agreed price with the client that will be used for variations and ensuring the programme and cost estimate are updated as the design evolves as good practices for project control. Several other studies have also shown that design changes
are mostly caused by clients (Hamzah et al., 2012; Love, Frani, & Edwards, 2004; Memon, Rahman, Faris, & Hasan, 2014; Yu, 1996). Design change often results from these terms: quality deviation, non-conformance, quality failure, defects or mistakes (Burati et al., 1992). Design changes need to be constantly monitored to avoid escalation (Olawale & Sun, 2015). Even though design changes are widely accepted by the practitioners in the construction industry, however, its effect on project performance is undesirable. Overruns in project schedule and project cost are key principles for a successful project that adversely impacted by design changes (Chan & Kumaraswamy, 1996; Frimpong et al., 2003).

Given the large volume of published work, there was a need to set a limit to the scope of the review. This study was chosen to focus on causing factors of design changes, because a good understanding of causes is a prerequisite for modelling the dynamics of design changes. It is also important to identify the different causing factors of design changes in construction project before looking into the impact of design changes to project lifecycle performance. Design changes can be originated from several factors that are related to the construction project. Various causing factors have been identified by many researchers in different regions which will be discussed. Memon et al. (2014) divided the causes of delay into two broad categories: excusable delays and non-excusable delays. Excusable delays were more orientated to the client or consultant causes, while the non-excusable delays were related to the contractor. Design change in particular was described as a cause in excusable delays.

Love et al. (2002) stated that project changes can occur due to the influences of both internal and external elements. The internal elements include project, organizational and stakeholder related issues where the external elements consist of natural unforeseeable circumstances, government intervention, economy or legal issues. Love et al. (2002) describe how changes and their actions or effects which are known as dynamics can impact the project management systems. Wu, Hsieh, and Cheng (2005) divided the causes of design changes into external such as political or economic, natural environment and third party factors, and internal factors such as owner or design consultant factors. Andi and Minato (2003) stated that defective design originates from the owner, design company and workplace.
Sun and Meng (2009) conducted a comprehensive and systematic overview to fill the knowledge gap by reviewing and synthesising existing literature on project change causes and effects in order to develop two taxonomies for change causes and change effects in construction projects. Alagbari, Kadir, Salim, and Ernawati (2007) reported that there are two kinds of cause for delay in construction projects which are external causes and internal causes. In this study, the causing factors are divided into internal factors and external factors. The internal factors comprise of (1) Client-related; (2) Design-related; (3) Project-related and (4) Contractor-related while external factor is (5) Government policy-related.

Critical Appraisal of Preceding Rework Studies

According to Love, Mandal, and Li (1999), rework is waste due to its non-value adding activities that takes time, resources or require storage and do not add value to the final output. Therefore, rework is known as non-value adding symptoms that affect the productivity and performance in construction projects. Ledbetter (1994) categorized rework into four reasons which are owner change, designer change or error, contractor change or error and supplier change or error and the reasons can appear in design, construction or even start-up stages. A major contributor of rework is design changes (Han et al. 2013). Love (2002) revealed that design change orders resulting in rework can account for as much as 50% of project cost overrun. Similarly, a study by Burati et al. (1992) found that 79% of rework costs arising in industrial engineering projects were the result of design changes, errors and omissions. In essence, rework results in higher costs due to additional cost of re-doing or re-designing an activity or process within the construction project (Love et al., 1999).

Rework is one of the prevalent cause of loss of project productivity (Cooper & Reichelt, 2010) and has a considerable impact on project performance (Park & Peña-Mora, 2003). A study by Love et al. (2002) has identified rework as a significant factor that contributes to cost increases and schedule delays in construction projects. When rework increases, the project costs and time is likely to increase which eventually lead to claims and disputes (Love, Wang, Sing, & Tiong, 2012). The case study projects by Love &
Sohal (2003) in Australia found out that rework costs ranges from 2.4% to 3.15% of their contract value where changes initiated by client was identified as one of the primary causes of rework. Similarly, Senaratne and Sexton (2009) noted that rework due to unplanned changes can cost 10% to 15% of contract value. Rework has become an endemic feature of the procurement process in construction that invariably leads to time and cost overruns in projects (Josephson et al., 2002). Past studies have also indicated that significant rework in construction is due to design changes (Love et al., 1999; Love, Mandal, Smith, & Georgiou, 2000; Love, Edwards, & Irani, 2008; Sommerville, 2007). According to Li and Taylor (2014), rework in construction development project can significantly degrade project cost and schedule performance. These frequent design-related rework generate costly ripple effects that create delay and disruption to the project life cycle performance which eventually lead to cost overruns and schedule delays.

Much research studies have attempted to identify the root causes of rework and its negative impact on project performance (Hwang et al., 2009; Love et al., 1999; Love et al., 2004; Palaneeswaran, 2006; Thyssen, Emmitt, Bonke, & Kirk-Christoffersen, 2010; Palaneeswaran et al., 2014). Recent study by Hwang and Yang (2014) identified a gap in knowledge on identification of the impacts due to rework on schedule performance and highlighted the need to establish the relationship between rework and schedule performance.

**Impact of Design Changes on Project Performance**

Nearly all projects go through assorted changes from the design stage right through to construction. These various changes have considerable impacts during the lifecycle of a project, which may be minor or major according to the result of the change. However, the impacts are always being underestimated by construction practitioners (Olawale & Sun, 2010). Design changes in construction projects will inevitably lead to cost overrun or schedule delay (El-Razek, Bassioni, & Mobarak, 1995; Kaming, Olomolaiye, Holt, & Harris, 1997; Le-Hoai, Lee, & Lee, 2008; Owalabi et al., 2014). Overruns in project schedule and project cost are key principles for a successful project that adversely impacted by design changes (Chan & Kumaraswamy, 1996; Frimpong et al., 2003).
A study by Cox, Morris, Rogerson and Jared (1999) revealed that design changes often have a major impact on the client objectives in construction projects where the cost associated with post contract award design changes typically amount about 5% to 8% of the contract value. Another study by Chang (2002) reported that cost increased on average of 24.8% and schedule increased on an average of 69% based on four sampled projects in California as a result of design changes. Chang, Shih, and Choo (2011) reported that design changes has resulted in an increased in redesign cost of 2.1% to 21.5% and on average 8.5% of the construction change cost. Similarly, a study by Burati et al. (1992) found that 79% of rework costs arising in industrial engineering projects were the result of design changes, errors and omissions. Williams, Eden, Ackermann and Tait (1995) also reported that design changes and delays in design approval would have caused delay to the project. Undoubtedly, design changes are on-going problems that continue to raise concerns in the construction industry. Project changes have obvious impacts on the construction process, not only on the project’s schedule and cost but also on the project’s performance, e.g. labour efficiency (Hanna et al., 1999). Several studies on causes of delays and cost overruns in construction projects have highlighted design changes as major contributing factor. Kaming et al. (1997) studied influencing factors on thirty one high-rise project in Indonesia and found that design changes is one of the most important factors causing time overrun. This claim is further supported by studies of Apolot, Alinaitwe, & Tindiwensi (2013) in Uganda, Rosenfeld (2013) in Israel, Yang, Chu, & Huang (2013) in Taiwan, Ijaola & Iyagba (2012) in Nigeria, Alnuaimi et al. (2010) in Oman, Le-Hoai et al. (2008) in Vietnam, Assaf & Al-Hejji (2006) in Saudi Arabia, Sweis, Sweis, Hammad, & Shboul (2008) in Jordan, Kartam, Al-Daihani, & Al-Bahar (2000) in Kuwait, and Ogunlana et al. (1996) in Thailand. The findings from previous studies in several parts of the world are consistent that design changes impose significant detrimental effects to time and cost performance of construction project. However, the author failed to recognize any published research from Malaysia that supports this proposition.
Lack of Studies Done In Malaysian Context

In order to weigh up the studies done in Malaysia, six top-tier construction management journals were selected: *Construction Management and Economics* (CME), *Journal of Construction Engineering and Management* (JCEM), *Engineering Construction and Architectural Management* (ECAM), *Journal of Management in Engineering* (JME), *International Journal of Project Management* (IJPM) and *Building Research and Information* (BRI). These target journals were identified by Chau (1997) as the leading construction journals. For this reason, the selected papers for this study are of high merit and reliable (Tang et al., 2010). Nonetheless, limited research was available on causes and effects of delay in building construction in Malaysia (Abdul-Rahman et al., 2008) with only two (2) noteworthy papers discovered: Sambasivan & Yau (2007) and Alaghbari et al. (2007). The major factors of delay in Malaysian construction projects are shown in Table 3.

Table 3 Top-ten causes of delay in Malaysian construction projects
(Source: Adapted from Sambasivan & Yau, 2007; Alaghbari et al., 2007)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Improper planning</td>
<td>Financial difficulties and economic problems</td>
<td></td>
</tr>
<tr>
<td>2 Site management</td>
<td>Financial problems</td>
<td></td>
</tr>
<tr>
<td>3 Inadequate contractor experience</td>
<td>Supervision too late and slowness in making decisions</td>
<td></td>
</tr>
<tr>
<td>4 Finance and payments of completed work</td>
<td>Slow to give instructions</td>
<td></td>
</tr>
<tr>
<td>5 Subcontractors</td>
<td>Lack of materials on market</td>
<td></td>
</tr>
<tr>
<td>6 Shortage of material</td>
<td>Poor site management</td>
<td></td>
</tr>
<tr>
<td>7 Labour supply</td>
<td>Materials shortages on site</td>
<td></td>
</tr>
<tr>
<td>8 Equipment availability and failure</td>
<td>Construction mistakes and defective works</td>
<td></td>
</tr>
<tr>
<td>9 Lack of communication between parties</td>
<td>Delay in delivery of materials to site</td>
<td></td>
</tr>
<tr>
<td>10 Mistakes during construction stage</td>
<td>Slowness in making decisions</td>
<td></td>
</tr>
</tbody>
</table>

Gap in Knowledge

Apparently, these literatures fail to recognize design changes as one of the contributing factors and therefore, not included in the questionnaire surveys conducted. As a result, the findings were not aligned with other studies around the world where design changes
were listed as an imperative cause of schedule and cost overruns (Mansfield et al., 1994; Kaming et al., 1997; Assaf & Al-Hejji, 2006; Chang, 2002; Lee et al., 2005; Ogunlana et al., 1996; Al-Momani, 2000; Kartam et al., 2000). In addition, construction projects worldwide commonly share some key characteristics (Olawale & Sun 2010). Construction practitioners in Malaysia deliberately put forward design changes as a major concern (Abdul-Rahman et al., 2006). A recent study by Shehu et al. (2014) conducted 359 samples of a questionnaire survey of Malaysian quantity-surveying consultants and reported that an alarming 55% of projects in Malaysia suffer from cost overruns. Therefore, the ability to predict the probabilities of occurrence (Abdul-Rahman et al. 2006) is essential to mitigate overruns and possible disputes due to design changes and rework. This observation provides the underlying motivation for future studies to fill the gap in knowledge on the major causes of schedule and cost overruns in Malaysian construction projects and validate design changes as one of the major contributing factors. Moreover, the above studies are over 7 years old and there is a need for more up-to-date investigation to reflect the current concern. Therefore, studies on the causing factors of design changes are essential in order to understand the reasons of the changes and potentially reduce the imposing impacts on project performance in terms of schedule and cost management. It is essential to minimise the disruptive effects of change (Bower, 2000).

Many papers have been written about design changes, but few documents focus on the impacts of design changes on the project lifecycle performance. Hence, future studies are requisite to capture the dynamics of design changes and systematically assess their impacts to facilitate effective construction project management.

The Need to Manage Design Change Dynamics

Good understanding of causes and effects is always a requirement for successful construction project management (Sun & Meng, 2009). Design changes may well contribute to rework (Han et al., 2013) which directly degrade project progress and cause disruptions (Park & Peña-Mora, 2003; Cooper & Reichelt, 2010). As a result, whenever design changes occur, immediate attention is imperative so as to plan for apposite actions and responses (Love et al., 2002). Thus, if the problem is recognized at the earlier phase of the project,
the impact it will have on project performance (time and cost) can be effectively inhibited (Hwang & Low, 2012). In view of that, construction project delay and cost overruns can ultimately be well mitigated.

ANALYTICAL FRAMEWORK FOR FUTURE STUDY

Figure 2 depicts the analytical framework of the future research work.
The analytical framework of the future study will instigate with the identification of knowledge deficiencies within existing studies of building construction projects in Malaysia and the current issues focused on in this literature review. The primary research aim is to recognize design changes as a key factor of project schedule and cost overruns. The future study ensues to establish the dynamics of design changes that influence project progress and causes
disruptions. With an exploratory sequential mixed methodology research approach (Creswell, 2014), qualitative data will be collected through semi-structured interviews and subsequently with quantitative data collection via questionnaire survey will be used to identify causes, relationship and consequences of design changes to project performance (time and cost). A conceptual causal loop model of design changes will then be developed for the use in building construction projects.

CONCLUSIONS AND RECOMMENDATIONS

The review undertaken in this paper appraises the impacts of design changes to project performance in terms of schedule and cost overruns. The relationship of design changes and the consequent rework is identified. Previous research has been carrying out on identifying the significant factors causing project schedule and cost overruns, mitigation of project delay and control of project variations. Design changes caused rework in construction projects while rework is the prevalence cause of loss in productivity. These frequent design-related rework generate costly ripple effects that create delay and disruption to the project life cycle performance which eventually lead to cost overruns and schedule delays. However, this literature review found out that there is scarcity of studies that focus on linking design changes and rework in construction projects which justify the need for systematically synthesizing preceding studies in this domain. In order to mitigate the detrimental impacts of design changes, the dynamics that influences design changes need to be identified and attended to appropriately. Despite construction projects differ in size, duration and complexity, several common features can be established. Nevertheless preceding studies done in Malaysian context on construction delays and cost overruns that were published in the top-tier construction management journals fell short to recognize design changes as a major cause of delays and cost overruns in construction projects. This finding is not aligned to other studies done worldwide although construction projects unanimously do demonstrate considerable similarities. For this reason, insights have been provided to offer further research directions to address the gap in literature primarily in Malaysian context. In view that schedule and cost overruns remain as a primary concern for Malaysian public and
private construction projects; there is a critical need to recognize the prevalent factors that tend to distress project performance and recommend ways to mitigate this pervasive issue. Therefore, managing the root causes with clear understanding of the types of design changes and factors influencing the occurrence of these changes at various times in the project with the resulting impacts are fundamental to achieving success in the delivery of construction project management. Hence, the problems need to be addressed as early as possible or immediately upon detection. The relationship and consequences of design changes must to be established. Moreover, the ability to predict the impacts of design changes on project performance at the early phase of the project is essential in order to deal with future claims and disputes arising from these unanticipated delay and disruptions to the project performance.

REFERENCES


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Impacts of Design Changes on Construction Project Performance: Insights from a Literature Review
Hamzah Abdul Rahman, Wan Chong and Jeffrey Yap Boon Hui


MALAYSIAN HOUSING CO-OPERATIVES: PERFORMANCE, PROBLEMS AND FUTURE PATH

Nadiya Adnan1, Hasniyati Hamzah2, Mohd Nasir Daud3 and Yasmin Mohd Adnan4

ABSTRACT

Housing co-operatives used to be one of main housing providers in Malaysia. Nonetheless, their eminence as a housing provider has rapidly diminished since the late 1980s, as evidenced by number of houses developed by them. Seeing that housing co-operatives in other countries have grown in stature and have succeeded in providing significant amount of housing for the people, it is worthwhile to examine why Malaysia housing co-operatives have been lagging behind. This paper aims to reveal current issues and challenges faced by Malaysian housing co-operatives in undertaking housing development. A qualitative approach driven by semi-structured interviews was adopted in obtaining information related to the barriers faced by Malaysian housing co-operatives. Findings revealed that there exist prevalent management, operational and funding issues among Malaysian housing co-operatives. Being part of a research into alternative housing tenure for Malaysia, this paper points out the inherent weaknesses within the current housing co-operative structure and proposes the “re-invention” of housing co-operatives in providing proper and adequate housing for their members. A new form of housing co-operatives for Malaysia is proposed, but the highlighted weaknesses need to be addressed before the potentials can be harnessed.

Keywords: Housing co-operatives, performance, intermediate tenure, innovation

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4 Lecturer, Department of Estate Management, Faculty of Built Environment, University of Malaya
INTRODUCTION

Housing is a basic human need that has been high on the agenda of policymakers, the focus being adequate affordable housing for the population. Other than the public and private sector, the co-operative movement was once a main housing provider in Malaysia. In general, co-operatives are involved in housing besides banking and finance, consumer, industrial and construction. Originally, the housing co-operative was conceived based on socialist principles, i.e. to improve the living conditions of people by offering access to affordable housing, which is an alternative to the market housing. As time progresses, housing co-operatives throughout the world have evolved in terms of function and operation to reflect changes in the socio-economy, although the basic social bias remains. To date, co-operative housing is a significant type of housing tenure in Western countries such as Sweden, Norway, the United Kingdom and the United States, whilst housing co-operatives become an important third provider of housing besides public and private developers.

According to the Malaysia Co-operative Societies Commission (2014), housing co-operatives in Malaysia play the dual role of developing and constructing housing projects for their members. Most of the projects are focused on low and medium cost housing, with prices about 20%-30% cheaper than the market price. Cheah (1986) stated that Malaysian housing co-operatives were once popular as an alternative to conventional or market housing that involved high housing loan charges. These reasons led to the firm support for housing co-operatives during their early years, as seen in their 13.7% contribution to the total housing units constructed in the First Malaysia Plan (Rahim, Bakar, & Abdullah, 1991). This performance was not sustained in the following years. Subsequent Malaysia Plans reported small contributions from housing co-operatives, ranging from 0.84% to 2.67%. After the Eighth Malaysia Plan, the housing contribution of housing co-operatives was not reported, a reflection of the marked decline of Malaysian housing co-operatives as a housing provider.

On the other hand, seeing that housing co-operative in other countries play an important role in housing provision, it is worthwhile to examine the recent decline of Malaysia housing co-operatives. A review of Malaysian housing literature indicated that there has been no recent study on housing co-operatives except the study that was carried out by Salleh & Bujang in 2008. This paper
forms part of a larger research into the feasibility of introducing an alternative housing tenure besides home ownership and renting among the Gen Y in Malaysia, by piggybacking on the current housing co-operative structure. This paper aims to reveal issues and challenges faced by Malaysian housing co-operatives in undertaking housing development. A qualitative approach frames the study, with key informant interviews being the main method of data collection. The findings point out the inherent weaknesses within the current housing co-operative structure. We conclude by proposing the “re-invention” of Malaysian housing co-operatives based on the established model of housing co-operatives in other countries.

LITERATURE REVIEW

The Co-Operative Movement in General

Currently, the co-operatives system can be found in various economic activities including transportation, businesses, housing, consumerism and so forth. The layman definition of a co-operative is any activity that involves a group of people who operate with a similar objective. The co-operative movement has been around for over 200 years and has been instrumental in providing significant services which would otherwise be unattainable (Das, Palai, & Das, 2006). According to the International Co-operative Alliance (2015), the earliest modern co-operative movement was established in 1844 when the Rochdale Pioneers founded the Co-operative Movement in Lancashire, England. The main purpose of that particular co-operative was to provide an affordable alternative to poor-quality and adulterated food and sundry provisions, using any surplus to benefit the community. Since then, the co-operative movement has developed rapidly, spreading throughout the world in a myriad of economic sectors.

Nevertheless, the co-operative movement has their own issues and problems. For example co-operatives have existed in India for 100 years but despite the rapid growth in the co-operative movement, Das et al. (2006) cited problems of government interference, mismanagement and manipulation, lack of awareness among the people, restricted coverage due to inadequate size of co-operative and limited function in terms of single purpose co-
operators. These issues have also plagued co-operatives in most countries, including Malaysia.

Housing Co-Operatives throughout the World

The economic liberalization policies of early 1990s across the globe had reduced the scope of public housing and enhanced the role of private housing market (Ganapati, 2010). However, the withdrawal of public housing developers and the inability of private housing developers in fulfilling all housing demands has led to the involvement of third sector organisations such as housing co-operatives. This new development has become the focus of attention among the policymakers, scholars and community activist both in developed and developing countries. The housing co-operative is seen as a good mechanism in the provision of affordable housing since it is believed to be able to minimise speculation (Saegert & Benitez, 2005).

Co-operatives housing members do not receive a deed to their housing unit, and thus do not own the property (Mallin, 1990). The members only own a share towards the house, becoming part of the shareholders in the corporation, with the corporation owning the title to the property. However, members can enjoy all occupational benefits as long as they obey the corporation rules. The members have a right to a long-term lease which is up to 99 years called “occupancy agreement” or “propriety lease” to the unit (Mallin, 1990).

Table 1 shows the types of housing co-operatives available in other countries. It can be seen that there are a few models available to be implemented by housing co-operatives, depending on the local institutional needs and conditions. According to the (Northcountry Cooperative Development Fund, 2012), housing co-operatives may be divided into market rate co-operative, limited equity housing co-operative, leasing co-operative, mutual housing co-operation and senior-housing co-operative.

<table>
<thead>
<tr>
<th>Types of Housing Co-operative</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market rate co-operative</td>
<td>The co-operative sells shares at full market value in original sale and allow future units sales at the market price. The market price is alike conventional real estate</td>
</tr>
</tbody>
</table>
Malaysian Housing Co-Operatives: Performance, Problems and Future Path
Nadiya Adnan, Hasniyati Hamzah, Mohd Nasir Daud and Yasmin Mohd Adnan

As shown in Table 2, the presence of housing co-operatives can be observed in various countries with different levels of involvement in the national housing provision. The country where housing co-operatives has been a substantial provider of housing is Sweden, whereby about one fifths of the total housing supply came from co-operatives. It should be noted that housing co-operatives were only introduced in Sweden about 40 years ago. Additionally, if the absolute number of co-operative housing was considered rather than proportion against the total housing stock, Germany have produced well over 2 million co-operatives housing, which is almost half of the total housing stock of Malaysia.

<table>
<thead>
<tr>
<th>Types of Housing Co-operative</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>whereas the unit’s sale price is determined by the market, allowing for potential accumulation (or loss) of equity by the members</td>
<td></td>
</tr>
<tr>
<td>Limited equity housing co-operative</td>
<td>The co-operative in which residents buy a low-cost share of the ownership of a building but are limited on the return from resale value of the housing (Graves, 2011).</td>
</tr>
<tr>
<td>Leasing co-operative</td>
<td>The property is leased by the investor on a long term basis, sometimes with an option to buy. The property is operated by the residents as a co-operative.</td>
</tr>
<tr>
<td>Mutual housing association</td>
<td>Non-profit corporation set up to develop, own and operate housing. The residents of the housing own and control the association.</td>
</tr>
<tr>
<td>Senior housing co-operative</td>
<td>A co-operative that has designed and service features appropriate to senior residents.</td>
</tr>
</tbody>
</table>

(Source: Northcountry Cooperative Development Fund (2012))

<table>
<thead>
<tr>
<th>Country</th>
<th>Date of establishment</th>
<th>No of housing co-operative units</th>
<th>Total housing stock</th>
<th>Percentage of housing co-operative units against total housing stock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>1895</td>
<td>368,000</td>
<td>4,200,000</td>
<td>8.76%</td>
</tr>
<tr>
<td>Egypt</td>
<td>1908</td>
<td>500,000</td>
<td>12,200,000</td>
<td>4.10%</td>
</tr>
<tr>
<td>France</td>
<td>20th century</td>
<td>300,000</td>
<td>31,264,000</td>
<td>1.00%</td>
</tr>
<tr>
<td>Germany</td>
<td>19th century</td>
<td>2,180,000</td>
<td>40,136,000</td>
<td>5.43%</td>
</tr>
<tr>
<td>Italy</td>
<td>Mid 19th century</td>
<td>672,000</td>
<td>30,038,200</td>
<td>2.24%</td>
</tr>
<tr>
<td>Portugal</td>
<td>After WW2</td>
<td>180,000</td>
<td>5,880,000</td>
<td>3.06%</td>
</tr>
<tr>
<td>Sweden</td>
<td>1970s</td>
<td>997,969</td>
<td>4,508,000</td>
<td>22.13%</td>
</tr>
</tbody>
</table>

(Source: Own analysis)
The History of Malaysian Housing Co-Operatives

In post-independence Malaysia, there was scarcity of accommodation in urban area due to the changes in socio-economic activities and urban pattern as a result of rural-urban migration (Newcombe, 1956). The widespread demand for tea money (bribe) to obtain a house, escalation of house prices and the high cost of borrowing with short repayment term triggered the growth of Malaysian housing co-operatives (Cheah, 1986). In 1949, two housing co-operatives were registered i.e. Teluk Anson English School Teachers’ Housing Co-operative and the Kuala Lumpur Housing Co-operative. The number of housing co-operatives increased from two pioneer co-operatives in 1949, to 30 in 1957 and 66 in 1967 (Rahim et al., 1991).

The expansion of Malaysian housing co-operatives in the 1950s may be attributed to good institutional support. Firstly, the Federation of Co-operative Housing Societies and the Housing Trust were formed to control and co-ordinate the housing co-operatives in terms of technical assistance, advice and also finance to the co-operatives (Rahim et al., 1991). Moreover, most of the members of housing co-operatives were also members of the Thrift and Loan Societies that provide credit and finance for their co-operative purchases (Rahim et al., 1991). In 1958, the Co-operative Central Bank (CCB) was established, which further availed resources from the Thrift and Loan Societies to the housing co-operatives and effectively provided more housing loans to members (Rahim et al., 1991). Subsequently, CCB became an essential element for housing co-operatives as a source of funding. The government also played an important role in fostering the growth of housing co-operatives in terms of development fund assistance and providing supply of development land.

From the 1970s to mid-1980s, housing co-operative began to decline in number, but still attracted new members due to their improved organisational structure based on government support, such as the government’s assistance in building 12,500 houses at an estimated cost of RM933 million (Rahim et al., 1991). However, in the mid-1980s, the government limited the new membership of housing co-operative due to prevalent issues such as housing co-operative’s inability to complete housing projects. Additionally, this period saw CCB having serious financial difficulty which impeded credit facilities to its customers.
Current Situation of Malaysian Housing Co-Operatives

At present, Malaysian co-operatives are involved in many economic functions such as banking and finance, housing, consumerism, industrial, construction and others. Although once co-operative developers were one of the main housing providers in Malaysia, their importance has declined since the mid-1980s. According to Hassan as cited in Rahim et al. (1991), initially the co-operatives built houses only for the members of co-operative but eventually offered their houses to the public. Generally, however, current housing co-operatives undertake development of housing schemes for their members (Malaysia Co-operative Societies Commision, 2014). According to Salleh & Bujang (2008), all Malaysian citizens are eligible to register as member of co-operatives. In order to become a member, the person must be 18 years old or 12 years old for certain matters in a co-operative and is a resident, has employment or owns land within the co-operative area.

As mentioned above, Malaysian housing co-operatives failed to contribute significantly to the total housing supply under each Malaysia Plan. Table 3 shows the percentage of completed housing units by co-operatives to waver between slightly under 1% to about 3% from 1971 to 2009 against total completion.

<table>
<thead>
<tr>
<th>Malaysia Plan (MP)</th>
<th>Target units for housing co-operatives</th>
<th>Completed units of housing co-operatives</th>
<th>Achievement of housing cooperatives (Completed/Target)</th>
<th>Actual Contribution to Total Overall Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>2MP (1971-1975)</td>
<td>N/A</td>
<td>3,585</td>
<td>N/A</td>
<td>0.97%</td>
</tr>
<tr>
<td>3MP (1976-1980)</td>
<td>12,000</td>
<td>4,120</td>
<td>34.3%</td>
<td>0.64%</td>
</tr>
<tr>
<td>4MP (1981-1985)</td>
<td>25,260</td>
<td>4,570</td>
<td>18.1%</td>
<td>0.90%</td>
</tr>
<tr>
<td>5MP (1986-1990)</td>
<td>12,500</td>
<td>7,483</td>
<td>59.9%</td>
<td>2.43%</td>
</tr>
<tr>
<td>6MP (1991-1995)</td>
<td>12,600</td>
<td>11,305</td>
<td>89.7%</td>
<td>1.72%</td>
</tr>
<tr>
<td>7MP (1996-2000)</td>
<td>15,000</td>
<td>13,703</td>
<td>91.4%</td>
<td>1.57%</td>
</tr>
<tr>
<td>8MP (2001-2005)</td>
<td>14,000</td>
<td>23,151</td>
<td>165.4%</td>
<td>2.67%</td>
</tr>
</tbody>
</table>
Based on the Interim Statistic Report (2014) as shown in Table 4 below, the current number of co-operative societies involved in housing development stands at 202 compared to 180 in 2013. However, the increase in the number of housing co-operatives did not lead to more houses being built by co-operative developers. Notably, the number of housing co-operative members is fairly substantial i.e. 154,253 (2% of total co-operative members) with a total asset of RM1,044,890 (3.1%). This shows that housing co-operatives are still active in Malaysia, albeit lesser in degree from the 1960s and 1970s.

<table>
<thead>
<tr>
<th>Functions</th>
<th>No. of cooperatives</th>
<th>Members</th>
<th>Shares/Fees (RM Million)</th>
<th>Asset (RM Million)</th>
<th>Earning (RM/Million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banking</td>
<td>2</td>
<td>1,000,750</td>
<td>3,320.99</td>
<td>87,848.95</td>
<td>2,893.45</td>
</tr>
<tr>
<td>Credit</td>
<td>596</td>
<td>1,357,897</td>
<td>5,580.55</td>
<td>11,269.76</td>
<td>905.44</td>
</tr>
<tr>
<td>Agricultural-Adult</td>
<td>2,439</td>
<td>738,810</td>
<td>602.54</td>
<td>2,383.82</td>
<td>511.67</td>
</tr>
<tr>
<td>Agricultural-School</td>
<td>6</td>
<td>446</td>
<td>0.02</td>
<td>0.06</td>
<td>0.03</td>
</tr>
<tr>
<td>Housing</td>
<td>202</td>
<td>154,253</td>
<td>211.56</td>
<td>1,044.89</td>
<td>546.85</td>
</tr>
<tr>
<td>Industrial</td>
<td>235</td>
<td>16,605</td>
<td>10.66</td>
<td>75.87</td>
<td>23.18</td>
</tr>
<tr>
<td>Consumerism-Adult</td>
<td>2,514</td>
<td>600,112</td>
<td>301.32</td>
<td>1,344.54</td>
<td>524.82</td>
</tr>
<tr>
<td>Consumerism-School</td>
<td>2,295</td>
<td>2,127,397</td>
<td>22.96</td>
<td>257.88</td>
<td>227.25</td>
</tr>
<tr>
<td>Construction</td>
<td>185</td>
<td>132,576</td>
<td>52.13</td>
<td>419.35</td>
<td>42.09</td>
</tr>
<tr>
<td>Transportation</td>
<td>450</td>
<td>147,377</td>
<td>66.30</td>
<td>300.62</td>
<td>483.65</td>
</tr>
<tr>
<td>Services</td>
<td>2,526</td>
<td>920,807</td>
<td>3,171.40</td>
<td>7,632.41</td>
<td>11,242.03</td>
</tr>
<tr>
<td>Total</td>
<td>11,450</td>
<td>7,197,030</td>
<td>13,340</td>
<td>112,578</td>
<td>17,400</td>
</tr>
</tbody>
</table>

(Source: Interim Statistic Report (2014))
Table 5 shows a few examples of active housing co-operatives that are still active in Malaysia. The active co-operatives located in the Greater KL area became the subject of this paper.

Table 5 Selected Active Housing Co-Operatives in Peninsular Malaysia

<table>
<thead>
<tr>
<th>No.</th>
<th>Name of Housing Co-operative</th>
<th>State</th>
<th>Date Established</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Koperasi Tunas Muda Sungai Ara Berhad</td>
<td>Penang</td>
<td>1966</td>
</tr>
<tr>
<td>2.</td>
<td>Koperasi Perumahan Malaysia Berhad</td>
<td>Selangor</td>
<td>1989</td>
</tr>
<tr>
<td>6.</td>
<td>Koperasi Guru Melayu Kelantan Berhad</td>
<td>Kelantan</td>
<td>1940</td>
</tr>
<tr>
<td>7.</td>
<td>Koperasi Perumahan Melayu Perak Berhad</td>
<td>Perak</td>
<td>1953</td>
</tr>
</tbody>
</table>

(Source: Own analysis)

In Malaysia, the housing co-operatives had contributed 13.7% from the total housing units constructed in the First Malaysia Plan (Rahim et al., 1991). Most of the housing projects by co-operative developers focus on the low and medium cost housing. However, the contribution of housing co-operatives has continuously declined since then, with 0.97% in the Second Malaysian Plan period and 0.64% in the Third Malaysian Plan period. In the next Malaysia Plans, the trends of housing co-operatives distributions showed fluctuation i.e. Fourth Malaysian Plan (0.90%), Fifth Malaysian Plan (2.43%), Sixth Malaysian Plan (1.72%), Seventh Malaysia Plan (1.57%) and Eighth Malaysia Plan (2.67%) Although there was a slight improvement in the Eighth Malaysia Plan, the improvement did not have a significant overall impact on the Malaysian housing market and the performance of housing co-operatives ceased to be reported altogether from the Ninth Malaysia Plan.

Figure 1 below is the typical model for existing Malaysian housing co-operatives as summed from the literature review. This model indicates the develop- for-outright-sale operation of Malaysian developers, a characteristic of market-rate co-operatives. Although the houses developed by co-operatives is sold around 20%- 30% cheaper than the market price for its members (Salleh & Bujang, 2008), there are no restrictions to the re-sale price. Members are also free to sell their units at market price in the future. There are a few ways to obtain land for housing co-operatives, including through land alienation by the state authority and through purchase
of private land (Salleh & Bujang, 2008). As such, the Malaysian housing co-operatives are not much different from market developers in terms of operations.

![Figure 1 Existing Housing Co-Operative Model in Malaysia](Source: Own analysis)

The provision of housing by housing co-operatives has become less substantial due to several factors. According to Rahim et al. (1991), housing co-operatives have suffered poor track record due to several factors, including difficulty in obtaining cheap land, difficulties in getting suitably located land, difficulty in getting finance, management problems as the co-operatives administration is based on part time basis, lack of expertise in building as well as high cost of infrastructure in housing project. Similarly, Salleh and Bujang (2008) found similar problems in the Johor State Land Development Co-operative Limited Kluang (KOPKETA) housing development projects, comprising financing problems, administrative problems and insufficient experienced staff to decide on and implement housing development activities.

**METHODOLOGY**

A review of Malaysian housing literature indicated that there has been no recent study on housing co-operatives, the latest being Salleh & Bujang (2008). Based on the premise that Malaysian housing co-operatives could attain similar achievements as their
counterparts in other countries, this paper endeavours to reveal issues and challenges faced by Malaysia housing co-operatives in undertaking housing development before proceeding to “re-imagine” the role of Malaysian housing co-operatives based on the established model of housing co-operatives in the abovementioned countries.

A qualitative approach frames the study, with key informant interviews undertaken to examine the issues and challenges in housing development by housing co-operatives. Using purposive sampling, three personnel from different housing co-operatives around Kuala Lumpur were selected as interviewees. The selected housing co-operatives that have been chosen for this research were Koperasi Perumahan Angkatan Tentera Malaysia Berhad (KPATMB), Koperasi Perumahan Sentul Pasar Berhad (KPSPB) and also Koperasi Perumahan Malaysia Berhad (KPMB). All of these housing co-operatives are located in Klang Valley area. The main aim of the interviews was to reveal current issues and problems experienced by these selected housing co-operatives.

Details of the interviewees are provided in Table 6.

Table 6 Details of the Interviewees

<table>
<thead>
<tr>
<th>Interviewee</th>
<th>Position</th>
<th>No. of years of working experience</th>
<th>Organization level</th>
<th>No. of housing development completed by organisation</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Chief Executive Officer</td>
<td>19 years</td>
<td>National</td>
<td>3</td>
<td>Wangsa Maju, Kuala Lumpur</td>
</tr>
<tr>
<td>B</td>
<td>Executive Officer</td>
<td>5 years</td>
<td>Local</td>
<td>3</td>
<td>Sentul Pasar, Kuala Lumpur</td>
</tr>
<tr>
<td>C</td>
<td>General Manager</td>
<td>21 years</td>
<td>National</td>
<td>2</td>
<td>Puchong, Selangor</td>
</tr>
</tbody>
</table>

Although the number of interviewees seemed small, the interviewees fulfilled the five requirement of an ‘ideal’ key informant as stated by Tremblay (1989, cited in Marshall, 1996). The five characteristics are role in community, knowledge, willingness, communicability and impartiality. Thus, the small number of interviewees were not seen as compromising the quality of interview data obtained. The findings by both Salleh and Bujang
(2008) and Rahim et al. (1991) were used as the basic premise to guide the key informant interviews. Trigger questions were asked on Site, Finance, Management and Expertise; these pre-determined major themes were extracted from the two main references. After the initial trigger questions, probing and follow-up questions were asked to further explore in detail any issues that were revealed.

Interviews were then transcribed. The qualitative data was manually coded using open, axial and selective coding. The implementation of open coding was guided by an inductive approach in examining the current issues and challenges faced by housing co-operatives, whereby themes and sub-themes were generated from the open coding. Axial coding then eliminated overlapping sub-themes by linking and collapsing similar sub-themes. Finally, the selective coding process identified the significant sub-themes to be reported in this paper.

**FINDINGS AND DISCUSSION**

The main and sub themes are summarised in a fishbone diagram (Figure 2). The themes, sub-themes and sample quotations are provided in the Appendix.

![Figure 2 Summary of Issues Faced by Housing Co-Operatives](image-url)
The findings revealed the inherent weakness in the structure of housing co-operatives, which led to their lukewarm performance since 1980s. The scarcity of land and high demand for housing in Malaysia, especially in major cities have caused the price of residential land to keep increasing over the years. This has caused the attainment of affordable and suitable sites beyond the reach of the housing co-operatives, as previously mentioned in Rahim et al. (1991). The difficulties in obtaining affordable and suitable sites could cause housing co-operatives to develop in less expensive locations, which unfortunately suffer from poor locations in terms of lack of social amenities and infrastructure. Additionally, poor locations could affect in the saleability of the new units. Thus, the overall profitability of the project and housing co-operative business performance may also be affected.

In any housing development, the funding aspect can determine the final outcome of the project. The problem of insufficient capital has been described as a very serious issue among Malaysian housing co-operatives (Rahim et al., 1991), and was found to still be a significant impediment among interviewees’ organisations. The existing structure of Malaysian housing co-operatives entails the reliance on shares and subscriptions paid by their members, funding by the Malaysia Co-operative Societies Commission (MCSC) or funding from third parties, including financial institutions for project funding. The housing co-operative membership has suffered in the 1990s due to the government’s concern about the poor track records of housing co-operatives in delivering housing units on time on quality. The government’s tighter control over co-operative activities and less liberal funding support to housing co-operatives have suppressed membership and led to low subscriptions. In turn, housing co-operatives have had to resort to finance facilities from commercial banks and financial institutions. In getting funding from financial institutions, housing co-operatives have to compete with private developers. Inevitably, the less experienced and less market-oriented housing co-operatives would be looked upon less favourably compared to the more experienced and more market-savvy private developers.

Although site and finance pose a substantial challenge to housing development ventures by co-operative developers, more serious issues can be attributed to the inherent flaw in the structure of co-operative housing provision. As stated by Salleh and Bujang (2008), co-operatives can be defined as “an organisation which is
owned, financed and managed by its members with the aim to enhance social economic situation and fulfil the requirements of the members”. From this definition, it can be seen that the administration matters are controlled by the members of the co-operatives themselves. The lead in a housing co-operative lies with its Board of Directors. However, the interviews revealed that the Board of Directors of a housing co-operative may comprise people from different backgrounds with different motivations and values. Interviewees indicated how the diversity in socio-economic backgrounds can complicate the management of housing co-operatives, resulting in lengthy negotiations among board members during the decision-making process that can result in delays in the housing project. Additionally, the Board members of co-operative undertake administration on a part-time basis, whereas any housing project requires a full commitment and effort to ensure its smooth running. Such part-time administration could negatively impact development activities, which in practice have been known to deviate from the original plan due to various internal and external factors. The election of a member into the Board of Directors of a housing co-operative indicates a certain level of trust and belief in the skillset possessed by the member. Although that is the assumption made by other members, oftentimes members of the Board of Directors display deficiency in the required skill, knowledge and experience. Among others, the ability in decision-making, planning, loan arrangement, implementation and monitoring could be missing from Board members. Additionally, the Board of Directors may change during the annual general meeting, further affecting the project flow.

The administration and management of housing development activities require a particular set of technical, legal, procedural and financial knowledge in housing development to successfully complete the project. Due to the lack of expertise, oftentimes the housing co-operatives have to enter into joint venture with another developer to undertake the housing project. The interviews indicated how the lack of expertise among Malaysian housing co-operative’s top personnel had affected the development activities. Due to this insufficiency, the housing co-operatives have to appoint other developers to execute the housing project. In some cases, the partner developers caused further problems to the housing co-operatives by abandoning the project before completion. According to the interviews, such unsuccessful partnerships could ultimately lead to
the failure to deliver houses on time to housing co-operative members and loss of reputation of the housing co-operatives.

CONCLUSION AND RECOMMENDATIONS

In this paper, the poor performance of housing co-operatives have been shown to be attributed to their organisational structure. Ironically, the main cause of the problem could be attributed to the basic principles of the co-operative movement – among others - voluntary and open membership and democratic member control, which result in insufficient skill, experience and knowledge required in housing development. Housing development is a major economic activity that requires a specific skillset that may not be available among the elected Board of Directors on the co-operative. Such deficiency may result in outsourcing the expertise and entering into unsuitable joint venture partners.

All the three housing co-operatives in the study were facing the same problems, including obtaining affordable and suitable sites and acquiring project funding. Strong leadership from the Board of Directors seemed to be lacking due to insufficient knowledge and background in property development and the election system of Board members. From the statistical data provided, housing co-operatives have not managed to bounce back to their glory days which saw the co-operatives contributing double digits to the housing supply in the country.

To stay relevant in the future, there needs to be a paradigm shift in the function and operation of housing co-operatives. Looking at the current performance of Malaysian housing co-operatives, the time has come for a ‘re-invention’ of the housing co-operatives. A brave leap is needed in the mindset of current co-operative leaders in order to survive in the current housing market condition. In providing guidance to the future direction of housing co-operatives, consideration must be given to the original spirit of co-operatives. Co-operatives were established to provide an alternative to the conventional market system, whereby the members would strive to ethically and honestly improve the collective well-being of other members. The current structure of co-operative housing provision in Malaysia seems to have lost the original direction, whereby the housing co-operative is no longer distinguishable from the private developer. Malaysian housing co-operative may want to re-look the
current develop-for-outright-sale model which has proven to be problematic and venture into other co-operative housing models, such as the Limited Equity Housing Co-operative (LEHC).

If implemented, LEHC will present a new dimension to Malaysian housing co-operatives. Taking into account the existing institutional arrangements in Malaysia, Figure 3 represents the proposed LEHC for Malaysia that incorporates the pre-existing institutional framework. In contrast to a typical LEHC, Malaysian LEHCs will be controlled by the MCSC to reflect the current housing co-operative structure in Malaysia. In most countries, the members of a typical LEHC are the sole controllers of LEHC as they own shares in the LEHC that carry voting right. In contrast, the proposed Malaysian LEHC is not only controlled by its members but also is supervised by the MCSC. The supervision by MCSC may ensure a proper governance by Board members, who may be hampered by their lack of skill, experience and knowledge in housing provision. As such, the current organizational shortcomings that have hampered the performance of housing co-operatives can be rectified in the new proposed LEHC. Further study into the finance and legal aspects of the proposed LEHC is necessary to provide a more complete outlook of the new structure of co-operative housing provision. Nonetheless, there is a good prospect for the proposed LEHC to transform the present under-performing Malaysian housing co-operatives into a formidable provider of alternative housing.
ACKNOWLEDGEMENTS

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REFERENCES


## APPENDIX: THEMES, SUB-THEMES AND SAMPLE QUOTATIONS

<table>
<thead>
<tr>
<th>Theme</th>
<th>Sub-theme</th>
<th>Sample quotations</th>
</tr>
</thead>
</table>
| Site  | • Land scarcity  
        • High land prices  
        • Unstrategic location | “There are a lot of problems faced by us in obtaining affordable and suitable land. Eventually, in order to get the affordable land, we have to choose land that is far from the town. In fact, at the beginning the land chosen was not suitable for housing development” *(Interviewee A)*  
“...before this has a lot of problems in getting suitable lands. For example, the land located in the middle of town is more expensive compared to outskirt areas. Therefore, we have a lot of problems to get the money to pay.” *(Interviewee B)*  
“It is very hard to get affordable land... If the co-operatives are supported by government then it should be okay. But, if co-operatives have to stand by themselves, for example, seeking viable land, it is next to impossible” *(Interviewee C)* |
| Finance | • Difficult MCSC funding  
        • Limited members  
        • Limited commercial institutions funding  
        • Limited membership fee | “.......we can make a loan from the bank but it depends on the reputation of the housing co-operative. Other than that, the capital is supplied by Malaysia Co-operative Societies Commission (MCSC) through the “Kumpulan Wang Amanah Pembangunan Koperasi”. However, it is for limited amounts. Maybe for a small scale project it could be considered” *(Interviewee A)*  
“It is very difficult to get the funding from the MCSC. When we apply, it takes almost a year to deal with them. The forms of government funding assistance is not the problem. However, there is a problem in the aspect of implementation. The way they handle should be improved. For example, the government already gave about RM200 million to MCSC. But when we applied for RM10 million, it was very difficult to get it. There were no strong reasons given why they rejected our application and when we...” |


<table>
<thead>
<tr>
<th>Theme</th>
<th>Sub-theme</th>
<th>Sample quotations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management</td>
<td>• Complicated decision-making process</td>
<td>“In management aspect, we have a problem in decision-making. In this co-operative, we used to have about 16-20 board of directors. So, when there are a lot of people that have to sit down to come out with one final decision, it is really difficult and it is next to impossible. But now there are only 6 left after we made a change on the by-laws and we got no problem when have to come out with a decision. When we execute a housing project, we need a long time to manage everything, more than 2 years and at least 3 to 5 years to complete it. When board of directors have to change, it may cause difficulty to the project. For example, when the chairman changes, he may not agree with the certain things and this situation can affect the flow of the project.” (Interviewee C)</td>
</tr>
<tr>
<td></td>
<td>• Admin problems</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Senior members’ resistance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Member’s apathy</td>
<td></td>
</tr>
<tr>
<td>Expertise</td>
<td>• Need for joint venture</td>
<td>“We have to look for the developer as we have no expertise among the members. This is also a main problem of housing co-operatives in Malaysia...the abandoned project faced by our co-operative is not about the inadequate fund supply. But, it is because of the developer ran away, gone bankrupt and left the project incomplete.” (Interviewee B)</td>
</tr>
<tr>
<td></td>
<td>• Outsourcing costs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Partner abandonment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Late delivery</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Loss of reputation</td>
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</tr>
</tbody>
</table>
TECHNICAL STUDY ON CONSERVATION AND RESTORATION OF NIavarAN PALACE’S EMBROIDERED PATEH

Mina Janpourtaher¹ and Mandana Barkeshli²

ABSTRACT

A historical and scientific analysis was carried out on a historical textile from Sahebgharanieh Niavaran Palace’s collection. The examination shows that the sample under study is embroidered in Pateh technique. It belongs to Iran, dated around late 18th Century, from Qajar dynasty period. To conserve and restore the textile sample under study, the material technology on its fiber, weave and motif were identified. The scientific analysis shows that the fiber is made of wool, with Twill weave technique, decorated with embroidered fiber made of silk. With the help of SEM-EDX method of analysis it is detected that the fabric contains a great value of silver and gilt scythes using metallic thread with delicate silk yarns. Motifs used in the fabric are of paisley leaf with decorative motifs of plant and animal embroidered beautifully. The Fabric was graphically documented by microscopic and macroscopic methods and its degree of damage was assessed. This leads to the implementation of conservation, restoration and display techniques, which was carried out in the textile division of Sahebgharanieh Niavaran Palace Museum. It will be discussed in detail later in the paper. The paper employs scientific analysis and SEM-EDX method to analyze the historical textile. The major aim and objective of the study is to know the materials and contents from which the textile is made in order to know the best restoration and preservation method that may be applied in preserving and conserving the historical textile and the likes of it.

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Keywords: embroidery, Pateh, Qajar Dynasty, Metal Thread, SEM-EDX.

INTRODUCTION

Textile art and industry is one of the oldest human arts that Iran has in the history of art (Yavari, 2009). Many textiles product of various materials, such as cotton, wool and silk woven into the fabric, have their history and samples in the ancient Iran. One such example is embroidered and needlework art.

In Qajar period, most of the Iranian needlework art, which was the relic of the past, came to life. Most of them remaining in most parts of Iran art works depict the Renaissance period in Qajar dynasty (Esfandyari, 1992). This drew more attention to the decorative arts, as embroidery and chain embroidery on colourful fabric were commonly used with braid yarn, the stitching features of which did not exist in any other period.

The certain elegance and beauty of the embroidery comes from Iranian tradition designs, such as paisley and the tree of life motifs. This pattern is one of the most common of Iranian motifs (Hakimian, 2005); the most common in all kinds of hand-woven and sewn materials in the olden days.

Historic and artistic survey

The embroidered, or chain embroidered, in a sort of Iranian embroidery, covers the greater part of the whole field, which is coloured woolen, silk yarns or rarely Scythes thread (Sedigh, 1992).

The studied sample is a woven panel (Pateh chain embroidered with Scythes thread and Metal thread) of the 19th century’s Decorative Arts Museum of Kerman. It was transferred to Niavaran Palace and maintained in Sahebgharanieh warehouse with inventory number 186.

The fabric on the four sides is enclosed with black tape and connected to the frame with nail and glue. It is framed without support at the rear side. The background was not seamless, and the fabric pieces were put together, just like a puzzle, to come on board.

Surveys, as well as interviews, conducted reveal that this fabric had another usage in the past. The pieces were put together, characterized and fixed with the symmetric pattern. The fabric was
decorated with the sterilization pattern of animals, plants and arabesques (Eslimi) motifs together and created a beautiful combination.

The fabric contains three main parts, namely: 1) original layer fabric: red worsted (red wool fabric); 2) margin fabric: black worsted; and 3) embroidered part that includes needlework with natural fibres and brocade Scythes thread.

The margin fabric is connected to the frame using adhesive tapes. Nails are also used in all parts of the frame to make it firmer. The sewing technique used on the fabric includes, but not limited to, a) connecting natural fibres with the original fabric layer using embroidery; and b) creating braid yarn (metallic yarn) around the silk fibres, and connecting it to the support layer of the fabric using silk thread. Detail of this can be found in the diagram below.

Diagram 1 Different parts of the woven textile under investigation

Methods:

There are various ways and methods used in restoring and conserving this kind of material. Before the restoration and conservation, there are also few steps needed in successfully preserving such a material. In this particular case, the following steps were taken to identify and technically study the material:

1- Pictures of the different parts of the fabric were produced into macro and micro in the loop;
2- The sampling from each of the macro and micro parts were taken;
3- Fibres were identified using optical microscopy;
4- The metal fibres were identified SEM-EDX;
5- The woof and warp were similarly identified;
6- The fabric texture design was reviewed; and
7- The motifs used on the fabric were accurately reviewed.

Identification of the fibers used in the fabric

Due to lack of fiber samples, fiber identification was done using microscopy (Houck, 2009). Some samples were also carried out by burning. Thus, it is revealed that wool fibres were used to support the margin fabric and the silk fibres of the brocade. The wool fibres were coloured with natural dyes.

Metallic yarn used in the fabric is braided and placed on the fabric surface as outstanding form. In some parts of the fabric surface, metal corrosion and blur, caused by corrosion of metal, are visible.

To exactly identify the metal thread, SEM-EDX was used. It is revealed that the silver is coated by gold, which is approximately 80 percent, and the thickness of metal layer is 20 microns. Silk yarn is used on the metal thread, with a yellow silk thread, to artistically reduce or control the damage.

Chart 1 SEM analysis
Study of the texture and yarn twist

The margin, the support layer fabrics weave design and the twist of fibres used was determined using microscopic survey. Twill weave was found, and the twist of margin fibre is Z while the twist of support fabric and brocade is S.

Pathology of the fabric

A scrutiny of the fabric material shows that some damages have been effected on the fabric. Some of the damages include, but not limited to, the:

- Traces (effects) of dust, grime and pussy;
- Acidification of the fabric, especially the marginal part;
- Physical, chemical and biological rupture;
- Disruption of natural fibres;
- Stretching and opening of the metal fibres;
- Blurring of the metal fibres used on fabric;
- Separation of the natural fibres;
- Biological damage;
- Previous improper restoration; and
- Inappropriate display style, i.e. displaying textile using improper wood and organic adhesive.

**Damage Drawing**

Linear design of margin and support layer fabrics:

- The past improper restoration
- Tear the background fabric
- Mechanical rupture
- Biological rupture
- Chemical tear
- Fibre stretching (Opening warp and weft)
- Acidification and shedding Margin Fabric
Darkness and tearing scythes thread
Shortage parts of scythes yarn

Pollution damage caused by purulent, dust, penetration of corrosion and biological contamination on the fabric:

Figure 4 Pollution damages of the textile
Tear damage of the fibres stretch due to harmful physical, chemical and biological causes, improper restoration and sewing compactness. There are many sewing, which have effected mechanical stress to the support layer fabric. The sewing made holes and tears on the fabric, where the wool fibres are loosened.

The major damage to the margin fabric is laxity and tears due to chemical and physical agents. The use of glue to affirm the fabric to the frame also causes acidic precipitation in the presence of the nails used.
Metal thread damage

Damages done onto the scythes thread of this fabric are of two types, namely, physical-mechanical and physical-chemical, which includes oxidation layer. Previous improper maintenance and poor storage caused displacement and metal threads breakage. As a result, the fibres inside the metal thread were torn and disintegrated. Due to mechanical factors, such as tension and torsion, the metal tape contains spaces and the yarn in central thread is shown, and thus the middle thread is bowed out.
Steps of preservation and restoration

In order to clean up and restore the fabric, the following steps are taken:

1) The solvent test (using toluene, acetone and water) was employed in separating the fibre from frame;
2) The fabric surface was cleaned using vacuum cleaner;
3) pH was measured. The fabric pH in the support layer was five and the margin was four. It was quite acidic;
4) The seams of fabric’s support layer were strengthened using mesh fabric;
5) The front and back of the fabric were washed using water, ethanol and detergent;
6) The front and back of the fabric were dried using cold winds of dryer;
7) The support layer was separated;
8) The margin fabrics were strengthened using tissue paper, HV adhesive and iron heating. In this method end of trusteeship was done and marginal fabric was carefully preserved;
9) The metal was cleaned using ethanol and whisk brush;
10) The ruptured area was restored and the lack area was filled with appropriate coloured thread. (This innovative method was chosen after considering the strength of the fabric);
11) The metallic yarn was restored and connected to the background through the sew method; and
12) The fabric was inserted on canvas covered with a non-acidic paper to store and display.

The figures below show the systematic process.
Figure 7 Separating the fabric from the frame with solvent and mechanical method.

Figure 8 Steps of washing and drying the fabric.
Figure 9 Strengthening and restoration of the margin fabric.
The restoration of support layer and embroidered decoration

In order to strengthen the destroyed area, the support layer was dipped in a prepared adhesive. It was then placed on the affected site, and fixed with iron heat.

In this study, a new method was used in restoring, and filling the lack area of, the fabric. Dyed thread proportional with the color of fabric’s warp and weft was used. It was done using HV adhesive and sewing method in view of the strength of fabric in rupture area.

Figure 10 Lack of background fabric and embroidered decoration

Figure 11 Preparing the support silk fabric.

Figure 12 Covering silk fabric with HV adhesive

Figure 13 Putting silk fabric on rupture area

Figure 14 Connecting Silk fabric with iron heat
Support the background with silk fabric

To restore the background layer accordance, the fabric was safely placed and the metallic thread was placed in the appropriate area. The yarn was then put in the warp and weft of the shortage was resolved.

Connecting metal thread to background

Metal thread in the lack area
Figure 18 Fill up the background with thread.

Figure 19 Reconstruction and restoration of the background

Figure 20 Restoration of embroidered pattern with sewing method

Sewing method was used for restoration of embroidered decoration with considering strengthens of the fabric.

Figure 21 After restoration
For restoration of decorative brocade first, the metal strip was prepared in coordination with the form of metal used in the fabric.

**Figure 22** Covering background fabrik with HV adhesive  
**Figure 23** Putting metal thread in the lack area  
**Figure 24** Connecting metal thread with sewing method  
**Figure 25** Before restoration  
**Figure 26** After restoration
CONCLUSION

Studies conducted on the Niavaran Palace’s embroidered *Pateh* show that the fabric, because it has natural silk fibre and it is adjacent to the metallic silver gilt, is unique, hence requires careful conservation and restoration. This study shows that using inadequate and inaccurate methods of restoration and conservation can cause more damage than good to a material heritage, just as it has done on the Niavaran palace’s embroidered pateh. It is also evident that exposing artifacts to dirty and untidy exposure can cause a lot of harm to both the physical, chemical and mechanical parts of the artifacts. Thus, the restoration and preservation of such a kind of heritage should be carefully and professionally carried out. Therefore, after accurate survey, examination and identification of the fabric in question, the most reliable method of conservation and restoration, using scientific analysis and SEM-EDX, was applied.

Figure 27 The woven after restoration
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NOTES FOR CONTRIBUTORS

GENERAL

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