Participatory Action Research as a Methodology to Identify Multiple Roles Requirements

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ABSTRACT

This paper proposed Participatory Action Research (PAR) as a methodology to identify multiple roles requirement where users are differentiated by their knowledge domains. User requirement for an enterprise system comprises of explicit and tacit knowledge of a business model. Enterprise systems are information systems that allow companies to integrate information across operations on a company-wide basis. Multiple roles involves in development of information system increases the complexity of users’ requirements coming from diverse knowledge domains due to the cross functional business processes in an organization. Therefore complexity of enterprise wide application includes dealing with variety of stakeholders from heterogeneous discipline. The differences exist because of these roles are from difference domain, on which the requirements may differ in term of contexts, demands and language of communication. The construction environment is a case study known to have multiple roles from diverse knowledge domains. The PAR methodology was conducted to capture the business process and capture the requirements among multiple roles from various knowledge domains. As a result of this case study PAR has identified requirements based on explicit and tacit knowledge of the stakeholders. Conclusively PAR is argued to be more accurate and comprehensive to manage cross functional and multiple roles requirements.

Keywords: Participatory Action Research (PAR), enterprise system, multiple roles, construction, methodology, requirement engineering, tacit knowledge, explicit knowledge

I INTRODUCTION

Enterprise system allows various companies to integrate information across operations on company-wide basis. Consequently, multiple stakeholders from various knowledge domains will be involved due to the cross functional business processes in an organization. However, identification of user requirement is crucial for analysts, on which the requirements may differ in term of contexts, demands and language of communication \cite{17}. User requirement for an enterprise system comprises of explicit and tacit knowledge of a business model. Explicit knowledge is knowledge that can be recorded and learned, can be written down, encoded, explained or understood. Howbeit, tacit knowledge which popularly known as ‘we know more than we can tell’, is a knowledge that is personal and contextual and not easily written down, formalized or aggregated \cite{4}. Since many of the explicit knowledge are stored and documented, thus requirements for this type might not be at the risk. Anyhow for tacit knowledge, stakeholders with their expertise tend to fail to describe their understanding of expertise to the working outside people. In order to capture the tacit knowledge, some solutions can be considered is the need of close personal interaction and trust, through practical experience or ‘learning by doing’. Colman (2006) has addressed the multiple roles phenomenon by developing an adaptive design framework \cite{17}, however acquiring requirement from business process with embedded tacit knowledge has not been focused. This proposing methodology of PAR tends to capture both explicit and tacit knowledge of a business model from various knowledge domains where researcher is working alongside with stakeholders ideally as a practical learner and enter the expert system to gain experience from expertise who act as a mentor. This paper also highlighted the literatures for PAR, description about PAR methodology and result after implementing PAR into the case study of Malaysian construction company where it involved with multiple stakeholders from various knowledge domains.

II EVOLUTION OF PAR

Participatory Action Research (PAR) is an approach that originally proposed by an American psychologist, Kurt Lewin in the mid-1940s. Though, in some literature mentioned that the origins of action research are unclear, authors such as \cite{9}\cite{16}\cite{7} stated that action research originated with Kurt Lewin \cite{12}. McKernan also states that
there is evidence of the use of action research by a number of social reformists prior to Lewin, such as Collier in 1945, Lippitt and Radke in 1946 and Corey in 1953 [12]. At the early age of PAR exist in this world, Lewin named it as the Action Research. After several years, action research has gone through some evolution until Borda and Rahman (1970) came out with the importance of researchers to participate alongside with the participant in their research. Then, Action Research is known as Participatory Action Research [1]. Action research is described by Lewin as a proceeding in a spiral of steps, which each of the steps composed of planning, action and the evaluation of the result of action [10]. Lewin argued that in order to understand and change certain social practices, social scientists have to include practitioners from the real social world in all phases of inquiry [12]. Early 20th century, Antonio Gramsci argues that all people are intellectuals and philophers. He defined it as “organic intellectuals” where people who take their local knowledge from life experiences, and use that knowledge to address changes and problems in society [5]. The idea that PAR researchers are really co-learners and researchers with the people they meet in the research process promotes the validity that all people are intellectuals who develop intricate philosophies through lived experience[13]. Supported by Greenwood (1993), PAR needs the full collaborators with the members of organizations in studying and transforming those organizations. It is an ongoing organizational learning process, a research approach that emphasizes co-learning, participation and organizational transformation [6].

PAR seeks to explicitly study something in order to change and improve the research study even though it does not start out with a precise idea. Whilst participation is important as involvement between participant and researcher can reduce confusion or lack of agreement regarding the direction and purpose of the inquiry for whom and for what, improves the chances of asking the right questions, collecting the data and implementing changes. Wadsworth added with that participation, action and research are not separate in practice; it must come together into the research process [15]. In 2007, Paul Chatterton, Duncan Fuller and Paul Routledge defined PAR as an approach that about jointly producing knowledge with others to produce critical interpretations and readings of the world, which are accessible, understandable to all those involved and actionable [3]. While Reason and Bradbury (2011) defined PAR as democratic process which concerned with developing practical knowing in the pursuit of worthwhile human purposes, grounded in a participatory worldview and bringing together action and reflection, theory and practice, in participation with others in the pursuit of practical solutions to issues of pressing concern to people, and more generally the flourishing of individual persons and communities [14].

III DESCRIPTION OF PAR METHODOLOGY TO IDENTIFY MULTIPLE ROLES REQUIREMENTS

PAR is an approach that consists of 4 initial phases which are plan, act, observe and reflect. PAR phases are in cyclical process where a researcher can has more than one cycle in one research study, which solely depending on research questions and aims of the research. This approach gives freedom to researcher to start at any phase, and number of cycles depends on the research [6]. The process is dynamic, constantly evolving one. The unique of PAR approach is that researcher participates alongside with the stakeholders who act as the participants in a research and their opinions are value to the researcher instead of the conventional approach where a researcher is doing a research about the stakeholder. In short, ideally a researcher act as a practical learner while stakeholders act as a mentor, those who expertise in their domains. Figure 1 illustrates the four (4) phases in PAR approach.
A. **Phase 1: Plan**
PAR phases are in cyclical and for this research started at planning phase. At this phase, there are four (4) main activities involve which are:

1. Answer key questions
2. 9 steps research in action checklist
3. Choosing appropriate method approach
4. Approval from client

B. **Phase 2: Act**
Initially this second phase of PAR involves with four (4) main activities which are:

1. Construction of map – environment navigation
2. Observing participants day-to-day activities
3. Identify participant problems
4. Permission to interview available person

C. **Phase 3: Observe**
Observation is critical part in practice PAR onto client side. There are several observation techniques need to consider and properly chosen by researcher, depending on their situation. As this research has to look into construction business process, this research studied several observation techniques includes socio-metric analysis, record sheet, procedural analysis and interaction process analysis. These techniques are useful to identify the relationship between diverse construction players which cross department in construction environment. Socio-metric analysis provides the idea to draw a graphic that communicates dynamically what is going on. See Figure 2. There is an interaction between admin and quantity surveyor, the interaction exist to both parties. Indicate in two vertical bar (|) and arrow in both direction. While quality assurance officer and quality control staff and quantity surveyor has minimum interaction, indicates in single vertical bar (|) and single direction of arrow.

Record sheets or checklist is used to gather data and maintain records, such as observation schedules, analyses of actions and pictorial representations of action. Result from this record can determine the relationship among stakeholder, those who responded and contributed the most in organization. This is useful for researcher to grab an opportunity to seek information from the significant players in organization. See Table 1.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Number of Interactions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr CM</td>
<td></td>
</tr>
<tr>
<td>Mr PM</td>
<td></td>
</tr>
<tr>
<td>Mrs AD;</td>
<td></td>
</tr>
<tr>
<td>Mrs AD;</td>
<td></td>
</tr>
<tr>
<td>Mr ER</td>
<td></td>
</tr>
<tr>
<td>Mrs QS</td>
<td></td>
</tr>
<tr>
<td>Ms QS</td>
<td></td>
</tr>
<tr>
<td>Mr QA/QC</td>
<td></td>
</tr>
</tbody>
</table>

Procedural analysis is the next technique used in observation. This kind of exercise requires researcher to draw up an agenda, or time plan of a specific event and then plot the actions and interactions within the frame. For example, this researcher wanted to find out who spoke most in a staff meeting. This method allows researcher to identify the number of contributions that individuals made in the meeting and the length of time for they spoke. Illustrate in Table 2.
Table 2: Procedural Analysis

<table>
<thead>
<tr>
<th>Participant</th>
<th>No. of Contributions during meeting</th>
<th>Length of time (m.s)</th>
<th>Total talk time (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr CM</td>
<td>23</td>
<td>9.29</td>
<td>29.5</td>
</tr>
<tr>
<td>Mr PM</td>
<td>18</td>
<td>8.45</td>
<td>26.9</td>
</tr>
<tr>
<td>Mrs AD1</td>
<td>16</td>
<td>2.45</td>
<td>7.8</td>
</tr>
<tr>
<td>Mrs AD2</td>
<td>9</td>
<td>1.28</td>
<td>4.0</td>
</tr>
<tr>
<td>Mrs AD3</td>
<td>7</td>
<td>1.03</td>
<td>3.3</td>
</tr>
<tr>
<td>Mr ER</td>
<td>11</td>
<td>1.45</td>
<td>4.6</td>
</tr>
<tr>
<td>Mrs QS</td>
<td>18</td>
<td>3.15</td>
<td>10.0</td>
</tr>
<tr>
<td>Ms QS</td>
<td>3</td>
<td>0.17</td>
<td>0.5</td>
</tr>
<tr>
<td>Mr QA/QC</td>
<td>19</td>
<td>4.20</td>
<td>13.4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>124</td>
<td>31.45</td>
<td>100</td>
</tr>
</tbody>
</table>

The analysis from the meeting would be meaningful by identifying the total talk time for each participant using the following equation.

\[
\text{Total talk time (\%)} = \frac{\text{Length of time (m.s)}}{\text{Total Length of time (m.s)}} \times 100\%
\]

Interaction process analysis can be used in a variety ways. It can be used to capture the number and type of interpersonal interaction. This technique may be used to capture sophisticated interactions, but is demanding in concentration. This kind of technique may be useful for tracking changes in a variety of situations over time; for example in the relationship between a researcher and a group of people, or among the people themselves.

Table 3: Interaction Process Analysis

<table>
<thead>
<tr>
<th>Categories of behaviour</th>
<th>One-minute Intervals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mrs AD1</td>
</tr>
<tr>
<td>Smiles</td>
<td>✓</td>
</tr>
<tr>
<td>Touches</td>
<td>✓</td>
</tr>
<tr>
<td>Nods</td>
<td></td>
</tr>
<tr>
<td>Initiates conversation</td>
<td></td>
</tr>
<tr>
<td>Listens</td>
<td></td>
</tr>
<tr>
<td>Is empathic</td>
<td>✓</td>
</tr>
</tbody>
</table>

D. Phase 4: Reflect

From the previous observation analysis, it is important for a researcher to identify any issue that can be raised up for the next cycle of PAR. This is the main focus in this fourth phase of PAR. If a researcher has satisfied upon the output, he can continue with documenting all the output on the focus area. For this research, a researcher decided to stop at Cycle 1 of PAR since the data gathered satisfying the research questions. Here, researcher gets advantage to cut time and continue to analyse the output. Figure 3 shows the flow chart for the overall activities involve in Phase 4. If any issue occur, researcher can continue the next cycle and evaluates the effectiveness of the new strategies.

**IV RESULT AND DISCUSSION**

Based on the result from the implementation of PAR approach in construction environment, this research found the difference output between normal approach and PAR approach. PAR approach gave several advantages in order to capture the business process and capture the requirements among multiple roles from various knowledge domains in local construction industry. PAR is an approach that researcher is closed to the participants and appreciate their opinion. Findings from this research found that there are several roles missing in the chart. By using normal approach, this research identified there are several construction players have been missing. Using conventional method such as interview, this research recognized the player for consultant involved in one construction project. However, the detail of stakeholder involved under consulting firm did not captured. Using PAR, this research acknowledged the missing stakeholders as illustrated in Figure 4. In short some information recorded in document (explicit knowledge) may differ time to time as from this research, we found out the updated version of construction players (tacit).

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A. Two-Dimensional Business Process Model Requirement For Construction Management

i. Vertical Overview

Using normal approach, gives such difficulties to understand the business processes involves with the multiple role players in construction-based company. For example, a developer needs to interview with the related stakeholder and from several sessions of interviewed, developer can defined the functional and non-functional requirements for the application system. However, based on the interview session with the experience developer, using this approach gave difficulties to understand the integration among players. The requirements gathered from system analyst were isolating and had no integration. Because of this issue, they need to re-confirm the requirements before proceed to the development of the system. Using this approach also gives some point of overview where the developer or researcher is looking into the stakeholder business process in vertical overview. Figure 5 shows the vertical overview of business processes involved in this research.

![Figure 5: The Vertical Overview of Business Processes using normal Approach](image1)

Figure 5: The Vertical Overview of Business Processes using normal Approach [9]

ii. Horizontal Overview

By using PAR, researcher is able to see the business process as well as the integration of multiple role-players in construction environment in horizontal view. Horizontal view means that a researcher can see the integration with cross departmental. Apart from that, a researcher has the ability to get better understanding of business process for construction management which resulted in reducing the iterative process as occurred using normal approach. Figure 6 shows the horizontal overview of business processes involved in this research.

![Figure 6: The Horizontal Overview of Business Processes using PAR method](image2)

Figure 6: The Horizontal Overview of Business Processes using PAR method [9]

B. Repetitive Process

PAR reduces repetitive process for gathering the requirements as a researcher participate with their daily activities. An arrow in Figure 7 illustrated the process of gathering from the functional and non-functional requirements, core process as well as supporting process from one stage to another stage by using normal approach compared with PAR. This arrow indicates the repetitive process involve to capture and re-ensure the requirements with the stakeholders. Using PAR method, a researcher can identifies the functional and non-functional, the core process and supporting process in single event. This is because PAR proposes a researcher to participate alongside with the stakeholder and observe their business process in daily activities. However, using normal approach such as formal interview may occur in several repetitive processes as a researcher needs to clarify from one section to another section of requirement. Furthermore, PAR method gives advantage for researcher to look into the integration between the stakeholders. The integration among these multiple roles of stakeholders is crucial in development of application system. Repetitive process may lead to increase the cost of project’s budget, time consuming, lack of motivation and cause delay and difficult to maintain. Refer to Figure 7.

![Figure 7: The Repetitive Process](image3)
Every participant is of value and has ideas to contribute to service development. The ideas and opinions from participants must be appreciated. Using PAR, a researcher can keep track those participants who play an important role to the organization, the relationship among participants and their contribution towards the project. Whilst for those passive participants who less contributes can be motivated by the respected authority. As a result of this case study, PAR has identified requirements based on explicit and tacit knowledge of the stakeholders and argued to be more accurate and comprehensive to manage cross functional and multiple roles requirements.

VI ACKNOWLEDGEMENT

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VII REFERENCES


Figure 7: Repetitive Process using normal approach and PAR approach [9]